Language design and parametric interaction.

Approaching the emergence of Clitic Doubling from below.

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A Lucio y Emilio

por su inocente paciencia

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Doctoral dissertations are not the opus of a single person but the result of the efforts of many people around the author. Curiously, this aspect of a doctoral thesis is in line with the main topic of this study: the nature of the properties that, interacting with each other, give rise to the emergence of parameters. In this sense, this work wouldn't have been possible without the contribution of many people. For this reason, I would like to thank all of them, especially my thesis directors, Susann Fischer, for her infinite trust and patience, and Kleanthes K. Grohmann, who received the first draft of my project with great interest, encouraging me to continue to work on it these past years. I'm also must thank Roberta D'Alessandro for her interest and predisposition for the reading and third evaluation of this thesis, and Wolfgang J. Meyer for his attentive participation in the evaluation committee of the final defense.

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M.N.

ABSTRACT

According to the biological nature of human language, the language genotype or Universal Grammar (UG) has to be sufficiently stable to ensure its genetic replication. Contrarily, the language phenotype would not have developed across our species. From this perspective, one of the major challenges of the biolinguistic program is how to explain linguistic diversity despite the stability of the genetic endowment. One of the central proposals to resolve this dilemma has been to assume that UG consists of a set of general "principles with certain possibilities of parametric variation" (Chomsky 1981:6). This theory, however, is associated with a strong genetic-centrist perspective, and, despite its descriptive success regarding linguistic diversity, the vast number of parameters identified have led to an overspecified conception of UG (Newmeyer 2005).

Thus, the aim of this dissertation is to explore the nature of parameters from a minimalist/biolinguistic perspective, arguing that they are emergent properties, that is, not specified in UG. In addition, based on new empirical data, I propose a new parameter taxonomy, also supporting the epigenetic approach assumed in this study.

The "overspecified" UG clearly challenges the design properties assumed by the minimalist program (Chomsky 1995). Moreover, genetic-centrism is not currently accepted by most biological development theories, which focus instead on the interaction of a complex set of developmental properties (Lorenzo & Longa 2009). Finally, this overspecified UG is also incompatible with current theories regarding language evolution (Hornstein 2009, Boeckx 2009), which agree that the rise of human language is a recent change in Homo sapiens, necessarily implying that UG has to be as simple as possible (Chomsky 2007, 2010).

In this dissertation, I will therefore try to solve the "overspecification problem" by arguing that parameters are actually emergent, hierarchically-organized properties that are not specified in UG. To this end, I will address Roberts' (2012) current proposal of parameter emergence as a consequence of the interaction of Chomsky's (2005) three factors in language design. However, I will also argue that Roberts's interactional approach is too strong, ignoring certain kinds of parameters. In this sense, and based on new data provided by the Clitic Doubling Parameter in Romance Languages project (see, e.g., Navarro et al. 2017), I will propose an extended theory of the interactional nature of parameter emergence.

To show this, I will discuss the emergence of the Clitic Doubling Parameter, whose

interactional scenario involves the clitic items and the pre-specification of the Verb Movement Parameter. Since the verb movement correlation is empirically justified by affecting the availability for the object of A'-positions, I will thus argue that the loss of verb movement in Romance languages is directly related to the emergence of clitic doubling constructions. Specifically, assuming that clitic doubling is related to the accessibility interpretation of objects (see Fischer & Rinke 2013), the loss of the information encoded in the different preverbal A'-positions can be recovered by clitic doubling constructions (see Navarro et al. 2017 and Fischer et al. 2019). In other words, the clitic doubling phenomenon has emerged as a "recovery mechanism" to repair the accessibility interpretation affected by the pre-specifications of the Verb Movement Parameter.

In addition, by analyzing the grammatical effects associated with both parameters, I also identify a crucial difference between them: whereas the Verb Movement Parameter involves only formal features in the interactional scenario, thus affecting core properties of grammar, the Clitic Doubling Parameter, by contrast, encompasses a wider set of features, which seem to be associated to grammatical interfaces. This difference can also be related to different interactional properties, which, in turn, define different emergence scenarios. All this allows us to identify two kinds of parameters: (i) *Core-parameters*, whose emergence is exclusively subject to the three factors in language design; and (ii) *Peripheral-parameters*, whose emergence depends on pre-specified Core-parameters and certain pre-stored items in the lexicon. Finally, since both kinds of parameters are defined in epigenetic terms, I propose adopting a perspective from below with respect to UG in keeping with Chomsky.

ZUSAMMENFASSUNG

Der biologischen Natur der menschlichen Sprache entsprechend, muss der sprachliche Genotyp oder UG ausreichend stabil sein, so dass seine genetische Replikation sichergestellt ist. Andernfalls könnte sich der sprachliche Phänotyp nicht innerhalb unserer Spezies entwickelt haben. Von diesem Standpunkt ausgehend besteht eine der größten Herausforderungen des biolinguistischen Programms in der Erklärung der linguistischen Vielfalt trotz der Stabilitätsbedingung der genetischen Ausstattung. Einer der zentralen Ansätze zur Erklärung dieses Problems war die Annahme, dass UG aus einem Set von generellen "*principles with certain possibilities of parametric variation*" besteht (Chomsky 1981:6). Allerdings ist diese Theorie mit einer starken genetisch-zentristischen Perspektive assoziiert, und trotz des deskriptiven Erfolges im Hinblick auf linguistische Diversität, führte die große Zahl an identifizierten Parametern zu einer über-spezifizierten Auffassung der UG (Newmeyer 2005).

Ziel dieser Dissertation ist es daher, die Natur der Parameter aus einer minimalistischen/biolinguistischen Perspektive zu betrachten, unter der Annahme, dass es sich um emergente Eigenschaften handelt, die nicht spezifiziert in UG sind. Zusätzlich stelle ich, neuen empirischen Daten folgend, eine neue Parameter-Taxonomie auf, welche den in dieser Untersuchung vorausgesetzten epigenetischen Ansatz ebenfalls stützt.

Die "überspezifizierte" UG steht eindeutig den Designeigenschaften gegenüber, die das minimalistische Programm (Chomsky 1995) annimmt. Hinzu kommt, dass der genetische Zentrismus gegenwärtig von den meisten biologischen Entwicklungstheorien nicht akzeptiert wird, diese sind stattdessen auf die Interaktion eines komplexen Sets von Entwicklungseigenschaften fokussiert (Lorenzo & Longa 2009). Schließlich ist eine überspezifizierte UG auch nicht mit den aktuellen Theorien zur Spracheevolution kompatibel (Hornstein 2009, Boeckx 2009), die darin übereinstimmen, dass der Aufstieg der menschlichen Sprache eine kürzliche Veränderung in der Gattung Homo Sapiens darstellt, was zu der Idee führt, dass UG so einfach wie möglich sein muss (Chomsky 2007, 2010).

In dieser Dissertation werde ich daher versuchen, "das Überspezifikationsproblem" zu lösen, indem ich argumentiere, dass Parameter tatsächlich emergente Eigenschaften sind, hierarchisch organisiert, jedoch nicht in der UG spezifiziert. Um dies zu tun, spreche ich Roberts (2010) derzeitige Annahme der Emergenz der Parameter als

Konsequenz der Interaktion von Chomskys (2005) drei Faktoren des Sprachendesigns an. Nichtsdestoweniger lege ich dar, dass Roberts interaktionaler Ansatz zu eingeschränkt ist und bestimmte Parameter außen vorlässt. In diesem Sinne und entsprechend neuer, aus der klitischen Dopplung der romanischen Sprachen stammender Daten (siehe z.B. Navarro et al. 2017), stelle ich eine erweiterte Theorie der interaktionalen Natur von der Emergenz der Parameter auf.

Um dies zu zeigen, diskutiere ich das Auftauchen von klitischen Dopplung-Parametern, deren interaktionales Szenario die klitischen Elemente sowie die Präspezifikation des Verbbewegung-Parameters beinhaltet. Da die Korrelation der Verbbewegung empirisch gerechtfertigt ist durch den Einfluss auf die Verfügbarkeit des Objekts für A′-Positionen, lege ich dementsprechend dar, dass der Verlust der Verbbewegung in romanischen Sprachen direkt mit dem Auftauchen von klitischen Dopplung-Konstruktionen verbunden ist.

Genauer gesagt, da klitische Dopplung verbunden ist mit der „*Accessibility interpretation*“ von Objekten (siehe Fischer & Rinke 2013), kann der Verlust an Informationen codiert in den präverbalen A′-Positionen durch klitischen Dopplung Konstruktionen zurückgewonnen werden (siehe Navarro et al. 2017 und Fischer et al. 2019). In anderen Worten tritt das Phänomen der klitischen Dopplung als „recovery mechanism“ auf, um die durch Präspezifikationen der Verbbewegung Parameter beeinträchtigte „*Accessibility interpretation*“ zu reparieren. Indem die mit beiden Parametern assoziierten grammatikalischen Effekte analysiert werden, ist es zusätzlich auch möglich, einen entscheidenden Unterschied zwischen diesen zu identifizieren: Das Verbbewegung-Parameter nur formale Merkmale im interaktionalen Szenario und beeinflusst somit Kerneigenschaften von Grammatik. Im Gegensatz dazu umfasst das klitische Dopplungs-Parameter eine breitere Reihe von Eigenschaften, die mit grammatikalischen Schnittstellen im Zusammenhang zu stehen scheinen. Dieser Unterschied kann auch in Verbindung zu unterschiedlichen interaktionalen Merkmalen gesetzt werden, welche wiederum verschiedene Emergenzszenarien definieren: (i) *Core-parameters*, deren Erscheinung ausschließlich den drei Faktoren des Sprachendesigns unterliegt; und (ii) *Peripheral-parameter*, deren Erscheinung von spezifizierten *Core-parameter* und bestimmten, im Lexikon vorgespeicherten Elementen abhängig ist. Da beide Parameter in epigenetischen Begriffen definiert sind, kann schließlich eine „*perspective from below*“ (Chomsky 2007) bezüglich UG aufrechterhalten werden.

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LIST OF ABBREVIATIONS AND SYMBOLS

A	Adjective
ACC	Accusative
anim	Animate
Aux	Auxiliary Verb
BCC	Borer-Chomsky Conjecture
C	Category
C	Complementizer
CI	Conceptual-Intentional System
Cl	Clitic
CLD	Clitic Doubling
CS	Computational System
D	Determiner
DAT	Dative
def	Definite
DM	Distributed Morphology
DNA	Deoxyribonucleic Acid
DO	Direct Object
DP	Determiner Phrase
D-S	Deep Structure
F	Feature
FE	Feature Economy
FF	Formal Feature
G_1	Grammar 1
G_2	Grammar 2
GB	Government & Binding Program
h	Functional Heads
H	Head
IG	Input Generalization
IO	Indirect Object
$_k$	Sub-index for Case
LAD	Language Acquisition Device
LF	Logical Form
L*p*	Language Phenotype
MHL	Modern Human Language
MP	Minimalist Program
MS	Motor System
N	Noun
n=	Quantity of Features
Neg	Negation
NP	Noun Phrase
p	Parameter
P	Parameter Hierarchy
p	Phenotype
PF	Phonetic Form
PHON	Phonetic Interface
Pl.	Plural
PLD	Primary Linguistic Data
PP	Prepositional Phrase

PRO	Pronominal Empty Category
pro	Pronominal Empty Category
Q	Quantifier
R	Representation
RNA	Ribonucleic Acid
SEM	Semantic Interface
sg.	Singular
SMT	Strong Minimalist Thesis
spec	Specific
S-S	Surface Structure
SUT	Strong Uniformity Thesis
t	Trace
T°	Tense Head
UG	Universal Grammar
v	light verb
V	Verb
v_i	Value
VM	Verb Movement
*v*P	Light Verb Phrase
VP	Verb Phrase
Wh	Question words
X	Any Category
x	Variable
XP	Any Phrase
ZP	Any Complement
ϕ	Phi-Features
ΣP	Sigma Phrase
S	Subject
O	Object
∀	All Quantifier
∃	Existential Quantifier
∈	It belongs to…
Σ°	Sigma Head
(A)	Adenine Acid
(C)	Cytosine Acid
(G)	Guanine Acid
(T)	Thymine Acid
*	Diacritic for Strong/Overt
|F|	Set of Features
|G|	Set of Grammars
|P|	Set of Binary Choices in of a Parameter
°	Diacritic for Head
1, 2, 3,	Grammatical Person
∅	Cero/Null

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1. INTRODUCTION

The nature of human language capacity is determined by universal principles that are genetically specified in the human language genotype or Universal Grammar (UG). From this, it follows that the structural composition of this cognitive organ should be relatively stable. In this sense, any theory of the human language has to capture the architecture of a general computational/linguistic system which needs to be biologically invariable. If not, its biological replication properties (through genetic inheritance) and ontogenetic development as well as its speciation history could never have taken place during the phylogenesis of Homo sapiens.

Nevertheless, the "stability condition" seems to contradict the fact that, at least superficially, there is a wide variety of languages. Assuming that the human language faculty has the same kind of properties as any other biological system, how is it possible that such a "mental organ", subject to invariable principles, enables the wide range of attested languages?

During the 1980s, in order to solve this problem, a parametric framework was defined, enabling the development of numerous generative approaches that focused on identifying principles that should be subject to variation (i.e.,

parameters). In other words, the parametric theory has been invaluable, attributing a set of general "principles with certain possibilities of parametric variation" to UG (Chomsky 1981a: 6).

However, minimalist assumptions on human language properties (Chomsky 1995, 2000, 2005) and the problems associated to its evolution raised in the last years (e.g., Berwick 1997; Hauser et al. 2002; Hornstein 2009; Boeckx 2009, 2011a; Berwick et al. 2013a; Tattersall 2014; Berwick & Chomsky 2016; Martins & Boeckx 2016) directly confront the conception of language faculty assumed within the principles and parameters theory (Chomsky 1981a, 1981c, 1986).

The increasing number of parameters identified as part of human language has led to an overspecified conception of its genotype or UG (see Newmeyer 2005, 2017; Boeckx 2009, 2011b). From a biolinguistic perspective, this is no minor problem (Boeckx 2011b, 2014a, 2014b, 2016). Even though many evolutionary language theories seem to be quite speculative, most authors agree that its emergence has to be the result of a recent change in Homo species. Hence, a theory advocating a UG constituted by an innate set of computational properties driven by invariant principles, plus several principles or parameters open to different settings during language acquisition, is not an adequate approach to explain, for example, the origin of the language phenotype. In evolutionary terms, the language genotype has to be as simple as possible to emerge during the short history of human cognition (Chomsky 2007, 2010). In this context, since variability and, consequently, change are not an exclusive matter of linguistics but also biological evolution, the aim of this thesis is to explore the nature of parametric variation from a biolinguistic perspective. The central question will thus be how to eliminate the tension between a minimalist (and strictly biolinguistic) perspective of human language and the traditional parametric explanation of linguistic variation and, consequently, of the attested structural diversity.

1.1. Hypothesis and Theoretical Proposals

From a minimalist perspective, the internal design of human language constitutes a computational system, whose architecture is capable of connecting syntactic structures with sound and meaning in an optimal way

(Chomsky 2000). Thus, the (narrow) syntax system has been reduced to a simple computational operation (MERGE) that, alongside different formal mechanisms (e.g., AGREE, checking, copy, labelling, transfer) and probably accessible to the semantic interface as well (see, e.g., Hinzen 2006), works optimally, providing interpretable structures to the respective interfaces, i.e., at the phonological (PHON) and semantic (SEM) representational levels. Once the structure is transferred to the corresponding interface, it can be interpreted by the conceptual/intentional and the sensory-motor systems, respectively. In other words, in order to meet the PHON and SEM conditions, human syntax is optimally designed to derive interpretable structures for sound and thought systems. Otherwise, the structural derivation will "crash". As I will show later on, this hypothesis has been defended under the so-called Strong Minimalist Thesis (Chomsky 2000).

In addition to this internal function, Chomsky (2005) postulated that the design of human language is constrained by the following factors: (i) the genetic endowment or UG; (ii) the linguistic experience or primary linguistic data; and (iii) the general principles of cognition or computational efficiency which are not exclusive to human language. Based on these properties, we can conclude that, even though the first and the third factors are not subject to variation, the second factor should be a good candidate for that variation (Chomsky 2007, 2010, 2016). Therefore, the locus of variation has to be a matter of the interface related to the externalization system (sensory-motor system) (Chomsky 2007), where the relation between the externalization system and intricate communication processes and historical pressures, for example, leads to the conclusion that parametrization can only be localized in PHON —and perhaps as well in the lexicon, a component directly related to language acquisition processes and the linguistic experience.

Thus, putting the variation debate within a minimalist context, I will try to solve "the overspecification problem" by arguing that parameters are actually emergent properties not specified in UG (see also Roberts 2012). Following Holmberg and Roberts (2014), I adopt a parametric theory of language variation, where any parameter and its hierarchically-organized instances — from macro- to micro-variation— constitute an epiphenomenon emerging from the interaction of Chomsky's (2005) language design factors (see also

Roberts 2012). However, I will argue that the interaction of Chomsky's factors of language design is a necessary but insufficient condition for the emergence of all kinds of parameters. Specifically, I will show that the emergence of certain kinds of parameters is constrained not only by design factors but also by the interaction of pre-specified parameters and certain grammatical categories (e.g., lexical availability). In this sense, the parameters' emergence is defined by a set of components that are not always the same. The nature of these components thus defines different interactional scenarios, which, in epigenetic terms, are responsible for the emergence of two kinds of parameters: (i) Core-parameters, which are subject to the third factors exclusively; and (ii) Peripheral-parameters, which emerge as a consequence of a more complex scenario, where the pre-specification of Core-parameters together with certain lexical specifications constitute two crucial conditions for their emergence.

Furthermore, since the set of factors of language design demands a conception of the UG from below (Chomsky 2007), language variation can be considered an epigenetic phenomenon that should also be observable in language change. Accordingly, the nature of parameters cannot be considered part of the language genotype or the genetic endowment but as an epiphenomenon of different interactional scenarios. Since this emergentist approach is an empirical matter, this thesis will focus on investigating a widespread phenomenon in Romance languages, namely, clitic doubling (CLD).

Taking into account that CLD constructions do not only imply a complex interaction between different grammar components but also represent a structural mosaic within which different behaviors are manifested inter- and intra-linguistically, this thesis will address the following two aspects: (i) the internal organization of the clitic doubling parameter (henceforth, "CLD-parameter") and its consequences for the attested variation; and (ii) the emergence and development of the parameter itself. I will thus argue that both the structural organization of the CLD-parameter and its emergence are consequences of interactional factors. Thus, the first aspect implies that the variational nature of CLD constructions can be captured as a parametric hierarchy (see, e.g., Fischer & Rinke 2013). We can therefore assume that the

linguistic contexts in which CLD constructions are allowed are subject to the specification provided by the parametric hierarchy itself. However, the hierarchy's structural organization depends on general requirements as well as the interaction of other factors of language design.

With respect to the second aspect, I will show that the interaction between pre-established parameters and specific categories (pre-stored in the lexicon) are two conditions for the emergence of the CLD-parameter (see, e.g., Navarro et al. 2017; Fischer et al. 2019). In this sense, I will argue that certain kinds of parameters are subject not only to the interaction of the three factors of language design —seemingly affecting the structural parametric hierarchy's organization— but also subject to a specific constellation of linguistic aspects and other parameters. Evidence for this comes from a diachronic analysis of the CLD phenomenon across Romance languages.

As Navarro et al. (2017) show, the emergence of the CLD-parameter seems to be subject to the grammaticalization of the clitic item and how specified the Verb Movement Parameter is in each Romance language variety. I propose that the CLD-parameter is the function of a macro-interaction between the effects of the verb movement specification, the availability of clitic items and the three factors of language design. I argue that this complex scenario is justified because of the nature of the CLD construction itself, which, in turn, affects peripheral aspects of the grammar and its interfaces. By contrast, the Verb Movement Parameter (henceforth, "VM-parameter") is subject to a specific set of formal features that, interacting with the primary linguistic data (PLD) and general learning strategies, affects the hierarchy's internal organization.

Both kinds of parameters are defined in epigenetic terms as emergent human language properties. In keeping with this view, assuming a pre-specified UG is not necessary. Moreover, since the emergence and the interactional scenario are defined by a set of factors that are not exclusively part of UG, there is no reason to maintain a pre-specified network where implicational conditions affect different kinds of parameters. Thus, the macro- and micro-parameter distinction is nothing more than a descriptive approach to the parameter hierarchies' internal organization. Accordingly, we can define language diversity by the set of Core- and Peripheral-parameters that

emerges as a consequence of different epigenetic scenarios but not as a consequence of implicational networks between parameters.

1.2. THESIS STRUCTURE

This dissertation consists of the following three key sections. Chapter 2 addresses the main problem that gives rise to the study treated here: the biolinguistic problem of linguistic diversity. For this, I revisit two different models of human language architecture. In section 2.1, I focus on the top-down approach proposed by the Government & Binding Program, which gave rise to principle and parameters theory, a model that centers on a parametrized UG in order to solve the problem of linguistic diversity. In section 2.2, I examine the bottom-up approach emerging from the minimalist/biolinguistic program, a model that reduces complex human language architecture and demands a simple (biological) UG. The UG from below perspective, discussed in 2.2, is justified by three strict and interrelated biological definitions: first, the evolutionary concept of modern human language (section 2.2.1); second, the strict definition of UG as a language genotype (section 2.2.2); and, third, the developmental process determining the language phenotype (section 2.2.3). Since these three biological notions cannot be ignored, a parametrized UG for linguistic diversity must be reconsidered, an issue referred to as the "overspecification problem" (section 2.3).

Chapter 3 discusses two central aspects of the nature of parameters: their hierarchical organization and their emergent properties. I explore the parameters' hierarchical organization from a typological perspective in section 3.1. This view focuses on two further notions of the typological description of linguistic diversity, namely, macro- and micro-parameters (sections 3.1.1. and 3.1.2 respectively). Consequently, both notions are not entirely devoid of problems from an explanatory point of view, requiring the integration of a new perspective. Thus, section 3.2 addresses the emergent theory of parameters proposed by Roberts (2012), which, according to the epigenetic factors discussed in Chapter 2, seems to reach explanatory adequacy regarding the overspecification problem (section 3.2.1). This theory of parameters is not only interesting from the epigenetic perspective but also from the formal point of view, since parametric variation is also captured in terms of hierarchical organization (section 3.2.2).

Chapter 4 focuses on the properties involved in the emergence of parameter hierarchies, providing evidence that not only forces us to extend the theory of the nature of parameter emergence but also requires a new taxonomical approach in biolinguistic terms. This chapter thus offers a broad discussion on the CLD phenomenon. Section 4.1 addresses the formal complexity of CLD configurations. In section 4.2, I discuss the variational nature of such sentences in Romance languages, showing that a CLD-parameter hierarchy can fully capture the complex picture. However, since the CLD-parameter's emergence conditions are not at all clear, section 4.3 addresses the interactional scenario giving rise to the CLD-parameter, focusing, in turn, on verb movement specifications which are instances of the VM-parameter. Section 4.4 then explains the differences regarding the interactional properties involved in both scenarios, which, in turn, define both kinds of parameters.

Finally, Chapter 5 presents the conclusions of this study and open remarks.

2. THE BIOLINGUISTIC PROBLEM OF LINGUISTIC DIVERSITY

The aim of this chapter is to explain the kinds of problem we face when talking about linguistic variation within the biolinguistic program.[1] As is well known, one of the major problems to be solved in modern linguistics is the tension between linguistic variation and biological stability. Since linguistic variation is an intrinsic property of language, a theory of human language architecture should provide an adequate explanation both in theoretical and biological terms (Chomsky 1986). During the 1970s and 1980s, the explanation focused on how much should be attributed to human language structure when explaining the acquisition process in spite of the poverty of stimulus argument. The top-down perspective was thus consolidated under the main theory of parameters which formally addresses acquisition and structural

[1] Even though generative efforts have assumed a biological perspective (Chomsky 1957, 1959, 1965, 1967), in this thesis, I refer to biolinguistics as the discipline which has recently emerged according to Boeckx and Grohmann (2007: 2): "The strong sense of the term 'biolinguistics' refers to attempts to provide explicit answers to questions that necessarily require the combination of linguistic insights and insights from related disciplines (evolutionary biology, genetics, neurology, psychology, etc.)." Biolinguistics serves here to refer to strict biological factors and not only with respect to theoretical abstraction justifying the innate hypothesis (see, e.g., Martins & Boeckx 2016).

diversity problems. In the early 1990s, however, the minimalist program appeared on the generative scene and, with it, intensive interdisciplinary work under the 'biolinguistics' label for the following decades (Boeckx & Grohmann 2007; Martins et al. 2016). During that time, the theoretical explanation was driven by a bottom-up perspective (Chomsky 2007). The main question to be answered, therefore, is how little should be attributed to human language structure. In this context, parametric theory does not fit with the developmental and evolutionary conditions that have been attributed to human language in the last decade. Insisting on a parametrizable structure, for instance, leads to an overspecified conception of human language. Thus, a reconciliation between biological unity and linguistic diversity has not yet been achieved. On the contrary, even more biological inconsistencies with respect to human language have appeared, issues which need to be resolved.

The discussion in this chapter is organized as follows: in section 2.1, I describe the top-down perspective which guides parametric theory development in order to resolve the problem of language acquisition and structural diversity. In this section, I present the generative concept of UG and modular human language architecture. In section 2.2., I present the bottom-up perspective or the minimalistic approach to UG that gives rise to the strict biological conception of human language defended in this work. To this end, I discuss and clarify three major aspects of human language: its evolution, the genetic conception of UG and the phenotypic notion of the faculty of language. In section 2.3., I show that a parametrized UG is not compatible with the bottom-up approach, for this taking into account both the specific minimalistic assumptions and the biological properties as discussed in section 2.2. Thus, I show that the overspecification problem is more relevant from a biolinguistic perspective if parametric theory is not re-considered in terms of biological adequacy. Finally, section 2.4. summarizes all the points addressed before presenting and discussing some conclusions that will be relevant for the next chapter.

2.1. THE TOP-DOWN APPROACH: MAXIMIZING UG

In the second half of the 20th century, the naturalistic approach to studying human cognition led by Noam Chomsky began to take center stage in

linguistic studies.[2] Leaving aside the conception of language as a social object (Saussure 1916) and focusing on the individual knowledge which a speaker/listener possesses to master and use a language, Chomsky defined language capacity as a natural object. Very early on, Chomsky's innateness hypothesis drove attempts to characterize the linguistic component of the human mind (Chomsky 1957). A well-known piece summarizing this idea is Chomsky's (1959) review of Skinner's (1957) *Verbal Behavior,* a paper that not only represents an attempt to change the empirical paradigm but also appeals for the demolition of the behaviorist dogma.

> […] It is easy to show that the new events that we accept and understand as sentences are not related to those with which we are familiar […]. It appears that we recognize a new item as a sentence not because it matches some familiar item in any simple way, but because it is generated by the grammar that each individual has somehow and in some form internalized. And we understand a new sentence, in part, because we are somehow capable of determining the process by which this sentence is derived in this grammar. (Chomsky 1959: 58)

Against the behaviorist paradigm's argument, which sees the language capacity as a "tabula rasa" that will be filled as children interact with their linguistic communities, Chomsky argued that language capacity should be seen as a mental component, whose development in the human mind is dictated by specific structural constraints which are biologically determined.

> […] The grammar must be regarded as a component in the behavior of the speaker and listener which can only be inferred […] from the resulting physical acts. The fact that all normal children acquire essentially comparable grammars of great complexity with remarkable rapidity suggests that human beings are somehow specially designed to do this, with data-handling or "hypothesis formulating" ability of unknown character and complexity. (Chomsky 1959: 57)

As Chomsky explained, the most important argument of an innate hypothesis arises from the question of language acquisition itself: if language represents

[2] Chomsky has often pointed that his contribution to cognitive sciences does not constitute a new revolution but, rather, a renewal of many classical ideas (see e.g., Chomsky 1964).

complex knowledge, how is it possible to explain the fact that its acquisition is a systematic, rapid and effortless process, successfully achieved despite the fragmented linguistic data to which children are exposed? The question has later been referred to as "Plato's Problem" and constitutes one of the major questions that the innateness theory of human language aims to answer (Chomsky 1986).

The central problem refers to the empirical fact that linguistic evidence is actually a limited but sufficient input from which the learner has to deduce the grammatical information to successfully become a competent speaker within her linguistic community.[3]

> […] the child has an innate theory of potential structural descriptions that is sufficiently rich and fully developed so that he is able to determine, from a real situation in which a signal occurs, which structural descriptions may be appropriate to this signal, and also that he is able to do this in part in advance of any assumption as to the linguistic structure of this signal. […] Let us, in any event, assume tentatively that the primary linguistic data consist of signals classified as sentences and non-sentences, and a partial and tentative pairing of signals with structural descriptions […] A language-acquisition device […] is capable of utilizing such primary linguistic data as the empirical basis for language learning. This device must search through the set of possible hypotheses G1, G2…, which are available to it […], and must select grammars that are compatible with the primary linguistic data.
>
> (Chomsky 1965: 32)

Nonetheless, because the exploration of the organic/genetic aspects of human language was technically limited and distanced from most linguistic works in the late 1960s,[4] Chomsky developed his research program to provide the study of human language with a formal model sufficiently strict to determine those aspects that should be part of innate knowledge (Chomsky 1957). Taking into account the "creative" (or recursive) property of the syntactic component, Chomsky (1957, 1965) suggested that language capacity could be a generative

[3] An aspect that has been called the poverty of stimulus argument (Chomsky 1986). For a discussion on the contemporaneity of the argument in current generativism, see Berwick et al. (2013).
[4] An important exception is the work of Eric Lenneberg (see Lenneberg 1967).

grammar device, a kind of computational competence to generate any natural grammar. From the beginning, Chomsky's linguistics represented an attempt to abstractly justify the fact that the cognitive capacity for language had to be hosted "somewhere" within the brain, and that, therefore, it should "somehow" be the expression of a genetic specification (Chomsky 1967, 1976). Thus, the abstraction of many formal aspects of natural languages was fundamental to later develop the whole conceptualization of UG, that is, a plausible biological theory of human language (Chomsky 1965, 1967, 1975, 1976).[5]

Chomsky continually stressed the fact that the success of theory depended on how it reached both descriptive and explanatory adequacy (Chomsky 1964, 1965). In other words, the model should be able to adequately describe an individual's tacit knowledge and, at the same time, also explain the language acquisition process. From this point of view, it becomes clear that the empirical solution to the language acquisition problem depends, firstly, on the kind of innate mechanism hypothesized and, secondly, on how to explain the interaction of this mechanism with the primary linguistic data that is available. In terms of this mechanism, Chomsky (1965) suggested the existence of a Language Acquisition Device (LAD), a kind of processor to convert "the experience into a system of knowledge attained" (Chomsky 1986:3). This mechanism should indeed be responsible for the acquisition process' success.

During the 1950s and 1960s, the research program focused on the description of generative rules.[6] This descriptive phase was characterized by a formal account within which the representations of a phrase structure was, for

[5] Despite the fact that the term *universal grammar* has suffered many conceptual changes throughout the generative enterprise (see also Leivada 2020), I have tried to maintain a correlation between the UG concept and the historical development of the program itself. For instance, at this point, UG is sometimes viewed as an abstract component of human mind and sometimes as a theory of itself. For Chomsky (1965), the UG concept is associated with an acquisition mechanism, and, at the same, he interprets this as the language faculty itself: "The language-acquisition device is only one component of the total system of intellectual structures that can be applied to problem solving and concept formation; in other words, the *faculte de langage* is only one of the faculties of the mind" (Chomsky 1965:56). Interestingly, Chomsky seems to distance himself from the concept: "What many linguists call "universal grammar" may be regarded as a theory of innate mechanisms, an underlying biological matrix that provides a framework within which the growth of language proceeds" (Chomsky 1975: 2). These constant changes between core concepts seem to me to be one of the most important causes of the actual misinterpretations of UG's biological status or the faculty of language within the generative framework.

[6] This theoretical stage is known as the "standard theory" period (Lasnik & Lohndal 2013).

instance, subject to rewriting rules such that X → …Y…, and this, in turn, defined a set of possible structures of any particular language (Chomsky 1957). These kinds of rules capture three specific properties of syntactic knowledge: (i) the categorial nature of words and phrases that is manifested through a kind of lexical insertion-rule, giving rise to S → NP VP; (ii) the linear order of its combination; and (iii) the resulting hierarchical structure. These rules have been applied specifically to particular structures in particular languages, and we might expect that natural languages are made up of such rules. Therefore, we can argue that an individual speaker's/listener's linguistic knowledge and their faculty to use/understand a natural language implies a set of generative rules of this kind as well.

Rewrite rules and their description of phrase structures are not enough to capture the many generative properties of grammatical knowledge. Chomsky (1965) thus appealed to two technical notions: competence and performance. Both terms not only distinguish 'language knowledge' and 'language use', respectively, but also correlate with "deep" and "surface" structures as part of the grammatical component (Chomsky 1965: 18ff.).[7] For example, the fact that a phrase can be interpreted at different positions of the sentence through the "displacement" mechanism shows that there must be a relation between two forms of a sentence as part of the grammatical competence where the rule applies:

(1) a. The American government spies on its citizens.
b. The American government spies on *whom*.
c. Whom$_i$ does the American government spy on *whom*$_i$?

In this early account of generative grammar, the movement of syntactic elements has been subject to transformational rules. For example, taking the rule 'movement of Wh-words to the front of the sentence', the grammar system "transforms" a sentence from the deep structure (1b) and produces a surface expression (1c) with the constituent (Wh-word) in another position. One prior assumption with respect to this property is that, since transformational rules are specific for each system, we can argue that

[7] This new stage of the standard theory is known as "the extended standard theory" phase (Lasnik & Lohndal 2013).

grammars differ from each other in terms of the "transformations" that they apply.

The descriptive approach of the standard theory does not however simplify the idea of the language acquisition process. For example, the specificity of many rules —e.g., the displacement of a Wh-phrase to generate interrogative sentences is not part of Japanese grammar—, as well as the speculative nature of some rules —where they can be optional in some cases and obligatory in others—, does not seem to be clearly accessible to children. Moreover, as many a priori rules generate non-grammatical sentences, this seems to be sufficient evidence that such a set of rules does not seem to be part of the speaker's/listener's internal language knowledge; neither can they be acquired successfully. We have to assume that children learn a considerable number of rules applicable to many specific structures both rapidly and effortlessly and that, in turn, this will be different from language to language or, simply, an *ad hoc* stipulation for specific structural phenomena. Indeed, within the rule-system approach, UG constitutes the biological substrate for the language acquisition device that provides children with a certain number of formal universals to which they can compare their linguistic experience and filter out the rules of the language to acquire. The acquisition process had been seen as an "evaluation activity", where children acquire grammatical knowledge that will be compatible with the set of rules and lexical items attributed to their linguistic environments. In addition, while most generative works were originally based on the English language,[8] the linguistic community promptly observed the explanatory potential of the model from a typological point of view, and generative inquiries soon expanded towards other languages. This expansion, however, implied an increase in the number of generative architecture components, as well as introducing new tools for the generative analysis, which, as a result, considerably enriched the whole theory's descriptive level. At the end of the 1970s, it became clear that it was impossible to assume a successful acquisition process with the set of generative rules and structural conditions proposed by the transformational framework (Hornstein & Lightfoot 1981).

[8] See, however, Newmeyer (1996).

Technically speaking, such an approach could no longer satisfy the explanatory adequacy condition (Chomsky 1981b). The scenario proposed by the standard theory was incompatible with the success of language acquisition and the poverty of stimulus argument. A reconciliation between descriptive and explanatory adequacy became one of the major tasks addressed throughout the generative enterprise, but it was not until the Government & Binding model was developed that a robust theory to tackle this tension was formulated. For the generative program, it was clear that only a theory capable of formalizing principles for different constraints and rules would be able to solve the question of language acquisition in terms of explanatory adequacy (Chomsky 1981a, 1981c, 1986). The generative enterprise then systematically rejected the rule-system approach and has since focused on the development of a theory which was directly driven by a top-down perspective. The program has been organized around the question of how much structure can be attributed to UG in order to achieve the appropriate balance between descriptive and explanatory adequacy.

2.1.1. MODULAR ARCHITECTURE AND PARAMETRIZED UG

Excessive proliferation and the over-generation of structures are the most obvious formal aspects where the descriptive model of the standard theory has failed (Chomsky 1970). This led to a lot of work and generated great interest in the structural conditions which could translate specific rules into more general principles (see, e.g., Ross 1970, Perlmutter 1971; Emonds 1976; Chomsky & Lasnik 1977; Freidin 1978, for early approaches). The program rapidly eliminated the rule system as part of an individual's grammatical knowledge; and, with the latter, the evaluation mechanisms that were proposed automatically disappeared as well.

The new human language perspective assumed a highly structured UG in which formal universals were replaced by universal principles constraining the generative derivation.[9] Thus, the X-Bar Theory for phrase structure (Chomsky

[9] In truth, the nature of the derivational mechanisms was not deeply explored at that time. What the application of the different constraints and principles as proposed actually achieved were representations of the assumed generative device. This representational model provided the human language architecture with a more complex structure, and the descriptive nature was not questioned.

1970; Jackendoff 1977), the Theta-Criterion for the assignment of semantic roles to arguments, the Case-Filter for the distribution of nominal phrases at the superficial structure (Chomsky 1981a), the Subjacency Condition for displacement restrictions (Chomsky 1973), and the Binding Theory concerned with the relations of anaphors and pronouns to their antecedents (Chomsky 1981a) all emerged as general UG principles or conditions.[10] Consequently, sentences like interrogatives or passives were considered structural epiphenomena, subject to the interaction of these grammatical properties. Rewrite rules were completely abandoned, while transformational rules were replaced by a single syntactic operation, Move-α, conditioned by different modules. Categorial features and the argument structure of predicates were now, in the same way, projected from the lexicon onto the syntactic structure through general principles affecting natural languages.

The discovery of such conditions and principles was entirely compatible with a modular conception of human language within which its architecture was conceived as a highly specified system (see Figure 1) in which different subsystems were assumed.

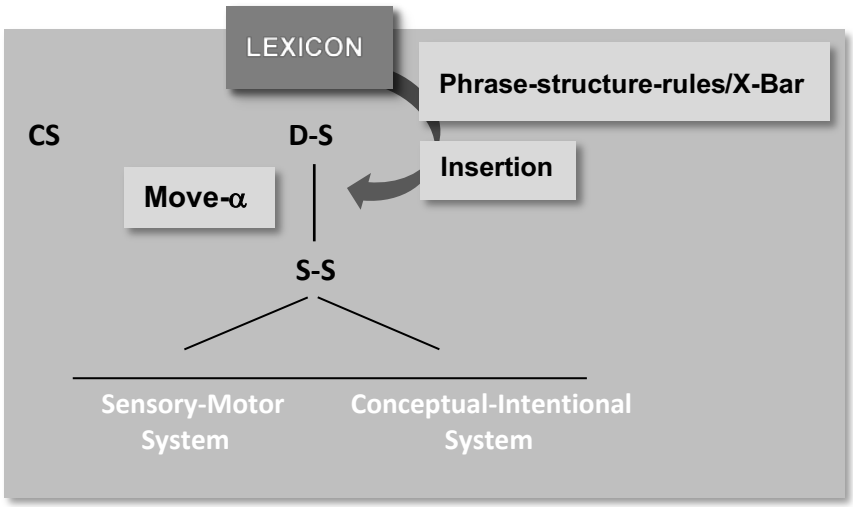


Figure 1. The GB model of human language

Later, with the advent of the minimalist program (Chomsky 1993), the nature of the derivational mechanisms became the focus of inquiry. The representational model was completely replaced by a strict derivational model (Chomsky 1995), thus reducing the complexity of the language design.

[10] The binding "principle C" also captures the fact that referential expressions are free with respect to their antecedent.

The model of human language proposed by Government & Binding theory (GB) (Chomsky 1981a) constitutes a complex architecture, where different components and computational requirements are represented. The D-S (deep-structure) and S-S (surface-structure) of grammatical computation come into play as two specific levels of structural representation. In addition, syntactic operations like Move-α or filter-constraints (e.g., Theta Theory, Case Theory, Binding Theory, Control Theory, etc.) are presented as modular systems interacting with both structural levels.

Another central component of the GB model is the lexicon, i.e., the store-component of the speaker's mind that constitutes the "mass" of lexical entries that will be available for the computational system (CS). Thus, the CS selects lexical items, driving the syntactic representation to possible and non-possible structures. For example, to generate the sentence, *The American government spies on its citizens* (1a), the CS takes the verb, *spies*, which has to include an object, *citizens*; if CS selects (a definite) noun, it needs a determiner, *the citizens*, and so on. The GB model includes two further computational notions to formalize this aspect: insertion that fulfils the structural composition of a sentence at D-S (specified by the X-bar module and related to its argumentative and semantic requirements, too); and a displacement operation or Move-α, that takes any D-S element and moves it to another position of S-S (see the examples represented in 1b-c, above). Finally, it is assumed that S-S has to satisfy interpretable requirements imposed by other modules localized outside the CS (Chomsky 1981a, 1981b, 1986). To achieve this, syntax splits at S-S into two representations: a Phonetic Form (PF) and a Logical Form (LF), respectively. PF constitutes a phonological representation with all the phonetic information available to the Sensory-Motor system (MS), that is, a module linked to the perception and production of sound. LF conforms to a representation with all the necessary semantic information available to the Conceptual-Intentional system (CI), a module directly linked to thought and meaning. Both performance systems are external to the CS module, but, while SM is linked to the externalization of FL, CI is related to its internalization.

One of the basic theoretical assumptions within the GB model is that different modules interact between different levels of representation

(Chomsky 1981a: 5). It is assumed, for example, that Control Theory (a constraint module related to the reference and the empty category, PRO) and Theta Theory (a θ-role assignment module) are applied at D-S; or, in turn, Binding Theory (a distance restriction with respect to the displacement of syntactic objects) is applied in order to derive S-S from the D-S (i.e., a grammar module that restricts the operation Move-α). Moreover, whereas Case Theory (a distributional module restricted to Case positions in the structure) is applied at S-S, the Empty Category Principle (a condition of proper government of traces) is applied at LF.

The leading assumption of the theory is a principled UG. The GB program consists of deducing these general principles which have been part of UG. By increasing the UG's structure, a more adequate solution was expected for the acquisition problem. In other words, if the UG consisted of well-structured and restricted innate knowledge about what a possible grammar could be, the acquisition task was greatly reducible (Hornstein & Lightfoot 1981).

A crucial aspect of the principled perspective of UG to meet descriptive and explanatory conditions has been the development of intensive work on different languages. Indeed, despite Chomsky's efforts to draw the attention of inquiry to the deep structural aspects of syntax, initial discussions on more general constraints in the 1970s arose in the traditional linguistic typology perspective, leading to this new generative make-up (see Newmeyer 2005: Ch. 2, for a review on this change). This comparative analysis initiated within the generative framework provided the theory with many general conditions and a set of variational phenomena which, years later, consolidated into the parametric approach of linguistic diversity (see, e.g., Kayne 1975; Rizzi 1976; Aissen & Perlmutter 1976, for Romance languages). In this sense, together with the highly articulated structure of human language, it was assumed that UG not only contains "pre-fixed" principles but also principles that should be adjusted during language acquisition.

Following this conception of UG, the acquisition process was reduced to a "discovery" task, where children should establish in a particular way (i.e., according to primary linguistic data) those principles that were not specified by UG. In other words, the learner only needs to acquire lexical items with their formal, semantic and phonetic properties; the rest is a question of how

to determine the principles, which are subject to variation. The theory thus gives the UG component a major role at the explanatory level: linguistic diversity can be explained by the different adjustments attributed to the unfixed principles during acquisition. From this perspective, UG is the initial state of grammar or G_i, composed of general principles shared by all languages and parameters, that is, their parametrizable versions (Chomsky 1981a, 1981b, 1986). Thus, the learner goes from state G_i to state G_f, the final function of the interaction between the LAD and the primary linguistic data available from the linguistic environment.

At the end of the 1970s and in the early 1980s the conception of a parametric architecture of UG definitively crystalized under one of the most important developments within generative frameworks: Principles & Parameters Theory (Chomsky 1986), a theory that not only sought to explain the problem of language acquisition but also aimed to provide an adequate explanation for structural diversity.

2.1.2. LANGUAGE DIVERSITY IN A PARAMETRIC WORLD

Variation patterns of structural types depend on "principles with certain possibilities of parametric variation" (Chomsky 1981a: 6). The early assumption was that parameters imply a restricted degree of variation (i.e., in a 1-0 format, as proposed by Chomsky (1986)), providing the possibility to set them in a specific manner. Grammatical differences between languages would thus be the outcome of the interaction of a finite number of "discrete factors" or parameters (Baker 2001:158).

The 'parameter' notion appears within the generative framework as a heuristic tool. For instance, consider the following example (2).

(2) The government received the members of the G20 summit.

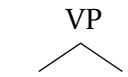
This sentence shows how the formal notion 'head' appears as a core element of the phrase structure. The sentence contains a VP [*received the members of the G20 summit*] headed by the verb *receive*. In addition, the NP (or DP) [*the member*s], as well as the NP [*the government*] are headed by N-heads[11] and the

[11] The same analysis can be made for the functional DP and TP categories with respect to the verb, etc.

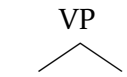
PP [*of the G20 summit*] is headed too by the preposition, *of*.

Note that such empirical observation allows generalizing about a specific organization of the phrase structures, regardless of which kind of category the phrase projects: all languages build their phrase structures with a common linearization pattern, that is, a head-complement relation of the kind [X° + ZP]. Furthermore, a comparative observation immediately shows that a head can appear to the left of a complement or to its right, depending on the linguistic variety analyzed. A classic example of this kind of patterns is represented by the following VP structures for Spanish and Japanese.

(3) a. Spanish



b. Japanese



The structures in (3) account for the order of constituents: there are two structural possibilities, (3a) or (3b).[12] The theoretical suggestion of the parametric proposal becomes clear: we can hypothesize the existence of a so-called Head-Parameter (4). The hypothesis (head-complement linearization) can be extended to other phrases (e.g., NPs, PPs, etc.), suggesting that the Head-Parameter must be specified only once for a particular phrase; the generalization can then be extended to all phrases in a given language.[13] Such a min-max criterion ensures that, instead of an exhaustive specification of each rule, establishing a single generalization during the acquisition process would be enough for children.

(4) **Head-Parameter:**
Complements are consistently to the left or to the right of the head.

Based on little evidence, the 'parameter' notion could potentially capture the empirical fact that languages vary according to the specifications that children make during language acquisition. The new theory assumes that the set of principles and parameters provided by UG guides LAD. The variation problem is, in this sense, transferred to the language acquisition process, where

[12] This simple explanation should help only as a link to further discussions about the nature of parameters. As we will see, the nature of variation represents a more complicated scenario which cannot simply be captured by a 1-0 setting model.
[13] See, however, Fukui (1993), Baker (2001) and Newmeyer (2004), among others.

parameters must be determined in a specific way.

Since the internal constraints assumed as part of UG determine which kinds of structures are possible (Newmeyer 2005; Moro 2009), the variational property of languages can also be considered a natural function of language capacity. From this point of view, principles and parameters theory not only provides a theoretical basis to explain the acquisition problem (see Pinker 1984; Hyams 1986; Williams 1987); it also represents a substantial attempt to resolve the problem of structural diversity. If language acquisition, for example, can be understood as a scanning process (see, e.g., Lightfoot 1991) in which children attempt to match the relevant linguistic information (through the PLD) to those conditions already pre-fixed by UG, languages may differ in the specific values of their parameter setting. In other words, assuming the view of principles and parameters theory that language acquisition is about how children establish parameters as influenced by their linguistic environments (Chomsky 1981c; Pinker 1984; Borer 1984; Hyams 1986; Lightfoot 1991), the diversity of languages must thus be a consequence of the parametric adjustments carried out during the acquisition of a particular language (Hyams 1986: 149). In addition, because structural varieties represent different states of particular languages, they must also be subject to processes of change (observable throughout the history of a particular language, as Lightfoot (1999) argues). In this sense, languages remain susceptible to linguistic changes as a function of time, where several (external and internal) factors establish the "proper" context in which a particular language goes from one state to another. Accordingly, language acquisition, linguistic variation and language change are three inseparable issues, which have to be resolved by a common theoretical explanation involving parametric approaches (Lightfoot 1991; Clark & Roberts 1993; Yang 2002; and Roberts & Roussou 2003, among others).

While the parameter's dependency on settings with respect to language acquisition has been maintained, the notion of parameters has changed. The assumption that changes in a single parameter could have "clustering effects" which determine the parametric organization of a particular language appeared early on (see Chomsky 1981a for a clustering description of the Null Subject-Parameter).

> In a tightly integrated theory with fairly rich internal structure, change in a single parameter may have complex effects, with proliferating consequences in various parts of the grammar. Ideally, we hope to find that complexes of properties differentiating otherwise similar languages are reducible to a single parameter, fixed in one or another way.
>
> (Chomsky 1981a: 6)

From a typological point of view, Baker's (1996, 2001) Parameter Hierarchy represents an important attempt to capture parameters' 'cascade-effects', laying the groundwork for a hierarchical conception of parameters. In this sense, Huang and Roberts (2017) point out that "one advantage of parameter hierarchies is that they reduce the space of possible grammars created by parameters by making certain parameter values interdependent" (Huang & Roberts 2017: 73). Specifically, "parameter hierarchies can restrict the space of possible grammars, and hence reduce the predicted amount of typological variation and simplify the task for a search-based learner" (Huang & Roberts 2017: 74).

In addition, as linguistic diversity inquiries have progressed within the parametric approach, two main research streams have developed. On the one hand, some have advocated major parameters or macro-parameters which have consequences for grammars at a typological level, and, on the other, some scholars have been more interested in the small differences of specific (or familiar related) grammars or microparameters[14] (for a discussion on the theoretical consequences of this distinction, see Baker (2008)). The distinction between both parameters has led to the assumption that there must be parameters strongly related to syntax (as seems to be the case for classic parameters like the head-parameter or the Null-Subject parameter), while others are related to properties of the lexical items of a particular language. The latter has given rise to a number of particular specifications that the UG has to conserve within its own structural design (a highly specified system, in accordance with a top-down perspective). The micro-parametric conceptualization could, in turn, justify the idea that all parameters are attributable to differences in the features of particular items or functional

[14] The major exponent of the micro-parametric approach is Richard Kayne (see Kayne 2000, 2005).

heads in the lexicon, an idea that was originally proposed by Borer (1984) and later adopted by Chomsky (1995) (the so-called Borer-Chomsky Conjecture, see Baker 2008). At the same time, this idea allows for a more fine-grained description of syntactic structures, as has been the case for the cartographic approaches to human language (see Belletti 2004).

As I will discuss in detail in Chapter 2, the early idea of parameters having effects on the internal organization of a natural language, as well as the size-distinction and its effects on linguistic diversity, is the basis for an even more technical perspective concerning the structure and nature of parameters. We can summarize the properties of parametrizable principles as follows:

(5) **Properties of parameters** (Gallego 2011: 529):
(a) principles of UG with a degree of variation;
(b) its setting-dependent on the linguistic input;
(c) effects on other syntactic structures.

In the following section, I address the minimalist concept of human language, which, in turn, challenges early assumptions about parameters and the parametric theory of UG. Specifically, minimalist assumptions (Chomsky 1993, 1995, 2000 and seq.) and stricter biological conceptions of human language led to more rigorous treatment as the tension between the biological unit attributed to UG and the attested linguistic diversity grew. That is, the advent of the biolinguistic program completely changed the theoretical question about the complexity of UG, demanding a more underspecified UG architecture.

2.2. THE BOTTOM-UP APPROACH: MINIMALIZING UG

From the 1980s onwards, the abstraction of the UG properties has acquired maximum importance. The principles and parameters theory conceives a more complex and richer UG structure (Chomsky 1981). The more parametrizable principles children possess, the less effort they need to acquire a language —this is the top-down perspective. However, it is fair to say that the theory's elegance as well as its explanatory potential has contributed to ignoring the growing biological advances made with respect to linguistic capacity. Principles and parameters theory seems to solve this problem adequately, and, in some sense, the empirical question about how a

biologically specified UG should be seems to have been neglected. This aspect of the generative enterprise becomes evident, as is clear with the growing number of language acquisition inquiries during the early years of the minimalist program (Chomsky 1993, 1995) which were later heightened under the guidelines proposed by the Strong Minimalist Thesis (SMT) (Chomsky 2000). The language acquisition explanation maintains a parametrized perspective of UG without modifying much more of the UG's well-established apparatus. New perspectives of language acquisition adopting minimalist assumptions only started to appear after several years (Yang 2002, 2004, 2011; Longa & Lorenzo 2008; Yang & Roeper 2011; Yang et al. 2017).

The minimalist program arose during the 1990s, providing some methodological adequacies in the generative program. It constituted a radical change for the research agenda, replacing some of the traditional concepts and formal tools adopted by prior inquiries, even by the principles and parameters theory itself. Previous models had, for instance, conceived the grammatical description as a representational system, which does not quite fit with formal economic criteria common to any scientific research (Occam's razor). The minimalist account defends a derivational approach,[15] leading the generative analysis through formal aspects of "good" design (Chomsky 2000). Indeed, the theoretical architecture of human language, which the program describes, should now be seen as a natural consequence of general and simple economic conditions, avoiding any redundant explanation to each particular case manifested by any natural language as much as possible.

The aim of inquiry is now to show a set of computational mechanisms and cognitive interrelations, subject to the operative optimality of the whole system (Chomsky 1995: 171). Specifically, the reduction of the formal and descriptive apparatus and the optimization of the language architecture constituted two central criteria for the research program. On the one hand, the program requires a methodological minimalism or "weak" thesis, which assumes a radical position by reviewing, eliminating and amending theoretical postulates. The methodological approach demands reformulating general UG principles by other principles, which would not necessarily be specified for the

[15] See note 9.

language capacity. On the other, the program also demands an ontological minimalism or "strong" thesis, which leads to a complete change in the theoretical conception related to language capacity (Martin & Uriagereka 2000): the reformulation of grammar's modular characterization in which the system design's optimal criterion has to be guaranteed (Chomsky 2000). Specifically, the SMT imposes conditions of "good" design onto language capacity. In other words, because human language represents an interactional module, in which the syntactic system fulfils an operative function (Chomsky 2007), the derivational process has to maximize the computational resources in order to provide each interface with an interpretable representation.

Thus, within the minimalist program, the CS is reduced to only derivational properties. This means that just two representational structures, PF and LF, are subject to the legibility conditions imposed by external systems (i.e., the Full Interpretation Condition). Altogether, language design imposes two conditions on CS: (i) general economic principles and (ii) interpretability conditions.

Such a design then shows that, if a sentence's derivation fails, that is, the syntactic operation does not respect economy or infringes on a condition of the external systems, the interpretation at the interfaces would not be possible, and the outcome would be an ungrammatical sentence. In other words, the violation of such conditions leads to the crash of the derivation (Chomsky 1993: 5).

Although many changes were required to make language design compatible with the SMT, the so-called T/Y-model adopted in the GB model (see Figure 1 in section 1.1.1 above) has been maintained (see Figure 2 below). Nonetheless, the minimalist program now argues that language capacity is divided exclusively into two "specific cognitive systems" (Chomsky & Lasnik 1995: 20: (i) an encyclopedic storage unit or LEXICON and (ii) a computational component, which applies the derivational operations to PF and LF interfaces. As occurred with the previous model, the entire language architecture is also linked to two "general cognitive systems", SM and the CI.

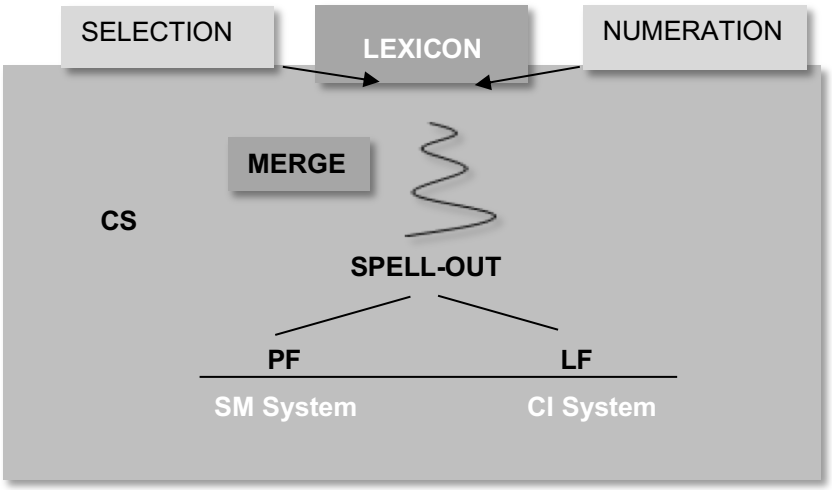


Figure 2. The minimalist grammatical model

However, note that Figure 2 shows four computational operations: (i) SELECTION, which takes units from LEXICON; (ii) NUMERATION, or lexical array, which determines the number of candidates that can enter a syntactic derivation; (iii) MERGE, which allows combining the elements selected and, at the same time, builds syntactic objects in a structured and uniform manner; and (iv) SPELL-OUT, which splits the derivation to PF and LF.

One of the minimalist program's most important formal introductions has been characterizing the set of features that lexical entries possess: phonological, semantic and formal features (Chomsky & Lasnik 1995: 26). Each language specifies LEXICON's content from putatively universal feature domains. Accordingly, children's learning tasks include internalizing items into LEXICON. Since the phonological and semantic features are related to interface conditions of pronunciation or interpretation, an important question is whether these features are available to syntax. A standard position is that they are not (see Halle & Marantz 1993; Chomsky 1995, 2000; and Marantz 1995, among others).

The syntactic module can only access formal features (Chomsky 1995), and these can be either interpretable and uninterpretable features. I-features encompass categorial features, the number of nouns and the semantic-selection feature of predicates. They are legible at LF and PF, i.e., they are subject to the interpretable conditions of both external modules, respectively. By contrast, u-features, like the structural case of nouns or the number of

verbs, are not interpretable at LF and must therefore be eliminated during the derivation to converge.

As mentioned, the derivation of sentences depends on the application of successive operations. Thus, if we consider a sentence such as (6a), the first computational steps will be SELECTION and NUMERATION. Both operations determine the set of categories (6b) to be derived by the syntax module:

(6) a. The American government spies on its people.
b. {(D 2; A 1; N 2); (V 1; T 1)}

The derivation then starts the lexical array represented in (4b):

(7) … →← {V {D, N}}
↑
{V} →← {D, N}
↑
{D →← N}

The combinatorial process requires only one computational operation called MERGE (Chomsky 1995), that is, a mechanism which melds two objects {α,β}, to form a new syntactic object {δ{α,β}. The minimalist program assumes that the label, δ, identifies the properties of the set, {α,β}. Moreover, during the derivation, δ maintains the formal properties of one of its components (i.e., δ^{α}), containing all the necessary information to be interpreted at LF. In this sense, MERGE characterizes all the computational properties needed to build syntactic structures. The motivation for MERGE defended within the minimalist program is the optimization concept, which, in turn, justifies the minimalist computation's functioning: MERGE would be motivated by a proof-checking operation[16] for uninterpretable features at LF. That is, since LF cannot interpret certain formal features, CS eliminates them by a mechanism that triggers the application of MERGE. In other words, the system itself optimizes the derivation in such a way that any uninterpretable structure can

[16] I take the term "proof" to refer to the relation probe/goal-checking proposed by Chomsky (2000). However, for the moment, I will not discuss the lexicalist approach (see Chomsky 1993, 1995) through movement or a non-lexicalist approach through AGREE (Chomsky 2000, 2001, 2004). For pertinent discussions, see, e.g., Hornstein (2009).

be derived (see, e.g., Chomsky 1995; Epstein et al. 1998).[17]

The minimalist program thus provides two important descriptive characterizations of language design that are highly interrelated. Firstly, since CS is considered a derivational system of cognitive interaction, the early idea of a "substantially" autonomous system can be abandoned (Chomsky 2007). Secondly, CS suggests a syntactic component, whose internal functionality can be explained as an attempt to derive structural representations that must be interpretable for the performance systems (Chomsky 2007). From this perspective, the compositional architecture of human language can be understood as the outcome of a set of principles and properties optimally designed to interact with general cognitive systems (Chomsky 2002, 2005). The "optimal" interaction between all components turns the model defended by SMT into a formal expression of language capacity's biological design.

Nonetheless, while this cognitive property of our species has been exhaustively characterized by contemporary linguistics, a further level which has to be characterized corresponds to neurophysiological properties. At this level of analysis, the interaction between genes, brain and language is fundamental to explain the ontogenetic and phylogenetic nature of human language. This perspective represents the robust biological element to be developed by the generative enterprise. In this sense, the minimalist program contributes to reduce the complexity of human language architecture, eliminating specific modules and representational instances of the computational derivation. In addition, since most principles are now deductible from general computational design aspects, the question about UG content arises again. In other words, as the minimalist program has advanced, the top-down perspective is no longer compatible with the minimalist design of human language. A new explanatory discrepancy thus arises, whereby the program has to be re-oriented due to how little structure can be attributed to UG in order to achieve the optimal design supported by SMT and the attested linguistic diversity. Specifically, minimalist assumptions and biological investigations not only offer a deeper characterization of language capacity in

[17] Chomsky (2004) proposes that MERGE comes consists of two structural versions: External MERGE and Internal MERGE.

biological terms; they also challenge many proposals maintained until today, suggesting that the biolinguistic approach should be seen from a bottom-up perspective (Chomsky 2007).

2.2.1. DEFINING MODERN HUMAN LANGUAGE

One central thought that comes to mind when we talk about language is the idea of a specific language capacity that has emerged only recently during the genus Homo's evolution (Berwick & Chomsky 2016). A first assumption of this claim refers to the nature of this cognitive capacity: language is a biological property of the human mind. I will address this assertion further below. However, for the time idea, I want to briefly discuss a second assumption embedded in this thought, which will also be important for the discussion on linguistic variation addressed in this thesis.

Phylogenetically speaking, language capacity is an exclusive human trait. That is, no other species possesses this cognitive specification; this is a claim that, in turn, acquires significant importance in language evolution studies. In keeping with a traditional evolutionary perspective, many approaches focus on establishing a continuum between language and some hypothetical cognitive capacities found in diverse, already extinct hominid generations (see, e.g., Mithen 1996; Davidson 2003; Pelegrin 2009; and Wood & Bauernfeind 2012, among others). Given the difficulties of reconstructing language fossils (Davidson 2003; Tattersall 2009; Wynn 2009; Fitch 2010; Botha 2012; Balari et al. 2013; and Benítez-Burraco & Dab Dediu 2018, among others), many researchers have tried to establish a relation between human communication systems and those of other non-human primate species (see, e.g., Tomasello 2008; Gibson & Tallerman 2012; and Lemasson et al. 2013, among others). Such attempts however, have not provided convincing evidence: it seems a fact that no primate species possesses a communication system in which any of the distinctive formal language properties appears to be a part (Hauser et al. 2002). Moreover, I should note that much of the interdisciplinary research on the nature of language has yielded important results in the last few years, reducing the speculative margins of some comparative proposals (Martins et al. 2016; Pagel 2017). Evidence from current archaeological, paleoanthropological and paleo-molecular research indicate, for instance, that the emergence of the modern cognitive behavior is not more

than 150,000 years old (see, e.g., Tattersall 2009, 2010; Wynn 2009; Coolidge & Wynn. 2009; Beaudet 2017; Pagel 2017; and Benítez-Burraco & Dab Dediu 2018, among many others).

Whatever the conditions constraining the emergence of language, most of the evidence suggests a saltationist scenario (see, e.g., Berwick 1997, 2011; Lorenzo 2006, 2012). Language emerged as a one-time event in genus Homo's history —regardless of whether any of the other systems with which language interacts were present or not in their ancestors.[18] Specifically, because of the Homo species' short history, the evolutionary nature of language was subject to specific internal and organizational constraints that are unrelated to traditional Neo-Darwinism interpretations. That is, instead of speculating about a gradual continuum, where a selective mechanism is applied to some kind of proto-forms of language (for which there is absolutely no evidence), we have to assume that there are emergent conditions which affect the human mind exclusively (see Lorenzo (2006) for further discussion).[19] Therefore, taking into account these assumptions on language evolution, I will use the term Modern Human Language (MHL) instead of simply using 'Language' not only because MHL refers to a specific property of our species but also because it pinpoints the discussion of its evolution to early Homo sapiens' origins, specifically, the rise of modern humans.[20]

Returning to our first assumption that MHL is a biological specification of our mind, we can argue that its scientific study should be addressed through a specific research program that is, in turn, designed on the basis of three traditional questions found in Biology (see, e.g., Mayr 2001): (i) the organic composition of the biological object being studied; (ii) how this object develops within the organism itself; and (iii) how and why this property evolves within a determined species at all. From this perspective, the biolinguistic program can be divided into three interrelated levels of study:

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[18] See Reboul (2017: ch.1) for an excellent discussion on gradual and punctuated issues for language evolution.

[19] Separating out other species from the phenotypical space, we can avoid addressing its evolution through a comparative analysis which, as we will see, is not relevant for the aim of this thesis.

[20] See Lorenzo (2006) for an evolutionary explanation reducing language's emergence from 250,000 years of Homo sapiens history to the 60,000 years of Modern Humans. See also Tattersall (2009) for more general aspects of the evolution of cognition and the phylogenesis of the genus Homo.

(8) **Explanation levels of the biolinguistic program** (Lorenzo & Longa 2003):

a. Identifying the properties expressed by MHL, examining the conditions that constrain the architectural design.
b. Understanding MHL's developmental mechanism through the diverse genetic, neurological, and environmental factors that constitute the basis of its ontogenesis.
c. Explaining the origin and evolution of MHL, addressing those phylogenetic aspects that characterize these.

The first axis should provide a structure of MHL's compositional properties in order to answer the question about what MHL is. The second axis, or the ontogenetic level, is related to the question of how this structure develops in individuals. In line with Chomsky (2005), we can argue that the success of ontogenetic research will depend on its identification of three architectural design conditions or factors: (a) the genetic endowment (or first factor) allowing for the interpretation and transformation of the environment into linguistic experience; (b) the linguistic experience (or second factor) that leads to the linguistic variation "within a fairly narrow range"; and (c) the principles of neurobiological (or physical) computational design (or third factor) that are not exclusive to the linguistic specification. In addition, these three factors in language design are also related to the third axis of explanation or phylogenetic level, attempting to explain the biological and paleoanthropological aspects of how and why this cognitive property evolved in the human species the way in which it did. Therefore, although all the biolinguistic program levels are so highly interrelated, making it difficult to easily focus on just one without neglecting important aspects of the other(s) (Jenkins 2000), I will start only with the first level.

A key aspect is that, structurally speaking, MHL can be understood as a cognitive compound based on two additional components: *Universal Grammar* and *Faculty of Language*. As I will show, there are crucial biological properties distinguishing the nature of both components. However, during the early decades of the generative enterprise, the definition of both components focused on the theoretical perspective adopted at the time (see section 1.1). Many technical concepts and idealizations have since been added

to achieve the explanatory adequacy that such a highly abstract description supposes. The biological status of both components has often been misinterpreted because of this (Boxell 2016; Mendívil-Giró 2018), leading to some confusion with respect to these terms and their specific properties. There is no doubt, for example, that UG is definitely the term which has had the most impact on the scientific study of language. But what exactly does 'universal grammar' mean?

Throughout the generative enterprise, much has been said about what this biological specification actually is, though much more has been discussed about how its theory architecture should be in order to explain it. Due to this, the main idea of UG oscillates between different conceptions. It sometimes appears as a 'theory of' an 'innate capacity' (to acquire a particular language) (Chomsky 1965) or, at the same time, as a 'theory of an internal grammar knowledge' (Chomsky 1986). Even, 'universal grammar' has been interpreted as a 'theory of itself' (Chomsky 1965, 1975, 1980); and only recently has it been described as an undiscussable genetic factor of MHL (see, e.g., Chomsky 2005) —albeit not defined with enough biological strictness. The conceptual confusion is clear: if 'universal grammar' is a theory of the 'language capacity', why do we talk about 'universal grammar' sometimes as 'a theory of…' or as 'a mental organ', and, at the same time, as a 'genetic component'? This is not a trivial question and affects both concepts alike (for further discussion, see Trettenbrein 2015; Boxell 2016; Ueda 2016; Balari & Lorenzo 2018; Mendivíl-Giró 2018).

To be fair, however, the intensive interdisciplinary work carried out in recent years provides a more detailed description of MHL's genetic, neuroanatomic and cognitive properties (see, e.g., Benítez-Burraco (2009) and Friederici (2017), respectively). Moreover, it is no less true that MHL's molecular and organic has been explored more in recent years than its theoretical construction (Ueda 2016). This shift is not only attributable to the technical development of many disciplines but also to the "programmatic" turn performed by the integration of minimalist assumptions.

Nowadays, it seems to be clear that only strict biological aspects can help us define both molecular and physiological components in a unified manner, showing us, in turn, how important they are to explain the development and

evolution of MHL. In the next sections, I will try to adequately integrate the biological notions that define MHL.

2.2.2. THE LANGUAGE GENOTYPE

The generative enterprise's launch implied opening a new era within linguistic studies. After Chomsky's (1959) review of B. F. Skinner's (1957) *Verbal Behavior*, the generative agenda deployed a battery of theoretical and empirical arguments in favor of MHL's innate nature.[21] These ideas not only aroused the interest of a growing group of linguists but also found an echo with many other researchers working on the biological foundations of language (Lenneberg 1967).

A central assumption of this biological perspective has always been that, whereas the formal properties characterizing MHL are coherent with the biological conception thereof, it would not be surprising to consider both its cognitive design as well as its development in the brain as a specification of the human genome (Chomsky 1980).[22] In other words, since inherited traits are transmitted in part through the genetic information encoded in the molecular structure of a gene passed on from parents to their offspring, it has always been clear for generativists that there must be a genetic factor ensuring MHL's ontogenetic and phylogenetic properties in our species. In this sense, a definition of the genetic factor is a necessary condition for our discussion.

However, while the entire language capacity developmental process is highly complex and not solely circumscribed to genetic inheritance, a narrow description of the molecular structure of genes and the transfer of genetic

[21] For many scientists at the time, it was clear that the development of this hypothesis would later allow for a more specific approach to solve the so-called "unification problem", that is, the integration of nativist considerations. Therefore, the growth of such arguments has been what ensured the foundational lines of biolinguistics as a discipline today (Piattelli-Palmarini 2013).

[22] What exactly is attributed to genes regarding the general development of human language has not yet been answered (Benítez-Burraco 2006, 2009). However, within the generative framework, we can observe a displacement regarding the interpretation of the genetic role in human language (Lorenzo & Longa 2009). This change, which spans from the GB theory to current minimalist assumptions, correlates with the growing criticism of Modern Synthesis genocentrism and gives foundation to developmentalism in the form defended by Evo-Devo biology (Hall 1992). As we will see, a minimalist conception of human language avoids a radical pre-programmatic geneticism with respect to the developmental of human language. Numerous biolinguistic research is currently reinforcing this fact, which highlights, as well as in modern developmental biology, the importance assigned to epigenetic and environmental constraints by the maturation process of biological organs (see Lorenzo & Longa 2009; Longa & Lorenzo 2012; Balari & Lorenzo 2013; and Boeckx & Leivada 2013, among others).

information should be enough to delimit the role of genes in MHL (Martins et. al. 2016).

Despite the multiple uses of the term, 'gene' (Pierce 2012), we can simply define it as a heredity unit, encoding what has traditionally been called the genetic blueprint of a biological and/or behavioral character.[23] Structurally speaking, genes are arranged in a lineal order along a microscopic chromosome. From a molecular point of view, genes comprise two main classes of nucleic acids, that is, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Both acids are "polymers" or molecules with a complex structure of subunits called nucleotides. Most organisms —including humans— carry their genetic information in the DNA molecule, consisting of a sugar, a phosphate and a nitrogenous base. DNA's nitrogenous base is composed, in turn, of four amino acids: adenine (A), cytosine (C), guanine (G) and thymine (T). A sequence of these chemical amino acids is structured in a double chain,[24] encoding the genetic information to develop a specific protein, which is the fundamental organic piece of any cellular structure (Griffiths et al. 2010; Brooker 2012; Pierce 2012; Weaver 2012). Nevertheless, whatever the biological property expressed through physiological or cognitive functions, it must rest on a cellular base (Oyama 2000). Therefore, since proteins are the organic base of any cellular structure, what ensures the development of organic components is the developmental specification of proteins, something which is encoded in the RNA. Thus, the RNA molecule, which is chemically similar to the DNA,[25] is what actually drives the synthesis of highly specific proteins (Weaver 2012). The whole process is what geneticists refer to as bio-synthesis and begins with DNA transcription and the translation of DNA sequences into RNA molecules. The transcription and translation of a DNA sequence consist of doubling the strands of the original DNA molecule. The original strand is

[23] The blueprint metaphor arose in the context of Modern Synthesis Biology (Huxley 1942), a genocentric perspective on development and evolution which influenced a large part of biological theories in the 20th century and is recognized as the basis of the new-Darwinists movement (Mayr 1982). (See, however, note 22 above and Lewontin 2000; Gould 2002, and West-Eberhard 2003 for foundational criticisms, as well as Pigliucci 2010 for a recent critic on the metaphor.)

[24] Any chemical sequence of {(A)(C)(G)(T)} is hosted in a long chain structure, known as a "double helix" (Pierce 2012).

[25] However, both molecules are different in some chemical aspects: RNA has a ribose acid instead of deoxyribose as a sugar base and a uracil nitrogen instead of thymine. Furthermore, in contrast to DNA, the RNA molecule is a simple chain structurally, and this is important to conform complementary structures to one of the DNA's chains during the replication of DNA.

separated into two individual strands or templates, which serve as patterns to be complemented by the addition of successive nucleotides. Each complementary structure or m(essenger)RNA molecule constitutes a transcription of the DNA molecule's chemical information. The replicated molecule links the sequence of amino acids {(A)(C)(G)(T)} with a ribosome or ribonucleic acid which, in turn, reads the mRNA sequence. Basically, what the mRNA sequence represents is a building instruction to be translated into a specific protein structure (Griffiths et al. 2010; Weaver 2012).

The bio-synthesis process is thus a fundamental part of the development of organic or cellular structures. At a first level of description, the developmental path looks as follows:

(9) DNA > RNA > protein > cellular structure

Despite the fact that (9) constitutes only a small portion of the any biological organ's full developmental path, the bio-synthesis process is currently a primordial aspect of genetic and neurolinguistic approaches to language (Benítez-Burraco 2009; Kemmerer 2015). One reason for this is that such cells, or neuronal structures, constitute, for example, different organic tissues, "hosting" a great number of neuronal networks (Sporns 2011). As many studies show, these neuronal structures are linked to the activity of specific linguistic functions (see. e.g., Pulvermüller 2002; Kemmerer 2003; Bornkessel-Schlesewsky & Schlesewsky 2009; Friederici et al. 2011; Bornkessel-Schlesewsky & Schlesewsky 2013; Westerlund & Pylkkänen 2014; and Matthews 2015, among many others).

From this perspective, the biological study of MHL requires identifying two aspects: (i) the neuroanatomical or neurophysiological substrate of the whole brain, which ensures, for example, the optimal functioning of the computational mechanisms of grammar (Schnelle 2010); and (ii) the mental or cognitive mechanism, which allows the acquisition of linguistic knowledge and which actually constitutes a substrate of the whole mind (Bever 1970). Though both aspects could be studied separately, they are, however, specified on the basis of a unique organic structure or biological substance. This organic body results from a complex replication and development process that begins, as I will explain, with the genetic material encoded in DNA.

In other words, genes only provide a specific building-pattern that is synthesized in proteins (Moss 2003). Proteins are later constrained by epigenetic and environmental factors, which in turn determine the course that the physiological development should take, later assuming a specific biological function (Oyama 2000). In the case of language, the physiological base is, thus, basically a complex neuroanatomical structure, which allows implementing a computational system and developing linguistic specifications (grammars) at the cognitive level.[26] Beyond the developmental constraints that affect the path from the molecular to the organic structure, or from the physiological to the cognitive function, MHL's genetic specification is encoded in a particular portion of the DNA sequence. This specific locus of genetic information is what geneticists call 'genotype', or the set of gene(s), which provides the molecular biochemical information that an individual organism possesses to develop, in part, a biological/behavioral character (Oyama 2000).

Taking into account the biological notions discussed so far, I will refer to *Universal Grammar* (UG) as the "genetic endowment for language" or language genotype that constitutes a central piece for the development of the computational system and the language acquisition device in the human mind (Chomsky 2005). Therefore, leaving aside any reference to "a theory of" UG, the language genotype can simply be reduced to the generative notion of the developmental path's "initial state".

UG thus provides the genetic building pattern to develop the physiological structure within the organism, which will be necessary, in turn, for the optimal functioning of the computational principles that characterize MHL. Nevertheless, as genotypes cannot lead *per se* to the specification of a biological trait during the developmental process, other factors such as epigenetic aspects and environmental effects should be considered in the ontogenesis of language, too.[27] In this sense, UG is a necessary condition in

[26] In keeping with Chomsky (2016) and previous work, I have focused on language capacity "as a language of thought" (Berwick & Chomsky 2016), that is, on an exclusive capacity of internal representations and computations in the generative sense and not on "language as speech" or the externalist perspective (e.g., Fisher & Vernes 2015).

[27] This is the case, for example, with the genotype for human height, which can be affected by nutritional deficits during an individual's development (Perkins et al. 2016).

MHL's development, though it is insufficient on its own.

As I will show, in our picture of concepts, not everything in biology is genetically determined. The notion of 'epigenetic' development, or the function of the interaction between genes and the environment, is also important to understand the limits of UG's mapping functionality with respect to MHL (see Lorenzo & Longa 2009).

2.2.3. MAPPING THE LANGUAGE PHENOTYPE

One of the most important concepts in genetics has been the distinction between genes and biological traits (Pierce 2012). While genes transmit genetic information through sexual reproduction, biological traits constitute specific properties that are developed in part from the genotype itself. Geneticists thus define genes as directly inherited factors in biological organisms, reserving the term, phenotype, for all the biological expressions encoded in the genotype's molecular structure (Weaver 2012).

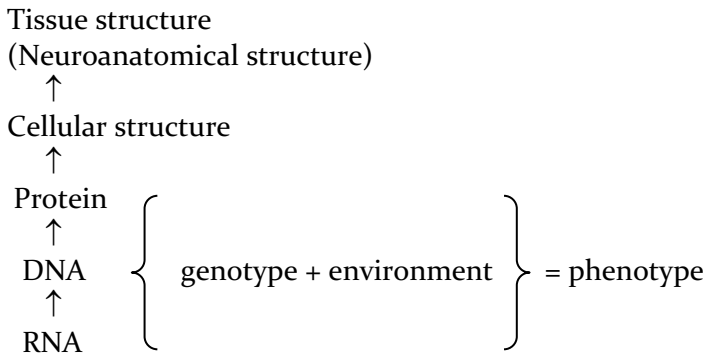
In this sense, from a biolinguistic perspective, I will use the "faculty of language" (FL) or "language phenotype" terms to refer to our species' linguistic specification that characterizes the human mind. Specifically, UG fulfils an important biological function with respect to the linguistic phenotype: through the replication process, UG ensures the transmission of the genetic information necessary to create the basic organic structure that will enable the development of FL.

Taking into account both biological concepts, another aspect that should be explained is the nature of the relation between both components. According to the Modern Synthesis perspective (Huxley 1942), genes determine phenotypes directly, thus reserving a deterministic function for the genotype with respect to the phenotype (Jacob & Monod 1961). However, since there actually is no one-to-one relation between genotype-phenotype, a "blueprint" metaphor can apply (Pigliucci 2010). Such a simplistic explanation leaves aside many other factors that are directly related to the mapping of phenotypes.

Strictly speaking, a biological trait results from a complex interactive process between the genotype, epigenetic development constraints and different environmental scenarios (Moss 2003). In this sense, we can

schematically extend (9) by restructuring the developmental or mapping path as follows:

(10) **Developmental path**



The hierarchy on the left-hand side of the developmental path in (10) has increased the number of components with respect to (9), adding the tissue structure —or a neuroanatomical structure in the case of brain-based organs (e.g., for cognitive functions)—. In turn, the hierarchy's elements are distributed into two levels. The lower level contains the genotype's biochemical path, including the bio-synthesis process (DNA>RNA>proteins), whereas the higher level contains more complex structures that are developed through the bio-synthesis process (Allis et al. 2007; Brooker 2012; Pierce 2012; Maderspacher 2013). Despite the fact that the interaction with the environment is not too strong at the lower level, the genotype constantly interacts with environmental factors at both levels, though, at higher levels, the interaction with the environment tends to be directly involved into the development of the final character or phenotype (Lewontin 2000). This interactional difference between both levels of the developmental path characterizes the "affectedness" degree of epigenetic factors on the genotype and the phenotype, where the environmental factors do not have as much of an effect on the first steps of the developmental path (Allis et al. 2007; Goldberg et. 2007; Hallgrímsson & Hall 2011; Maderspacher 2013; De la Peña & Loyola 2017).

A further distinction between genes and biological traits —which may also be related to differences on the levels of interaction described above— is that genes are "conservative" by nature. This means that genotypes, as a set of genes, maintain a set molecular structure throughout their replication history. Genotypes, therefore, do not essentially change because of environmental

factors. Phenotypes, however, cannot only differ from each other regarding the nature of a specific character —whether a physiological (e.g., wing length or brain size), behavioral (e.g., gregarious instinct or sexual monogamy) or mental property (e.g., perception or learning)— but also with respect to the same property: while a biological trait is essentially maintained within organisms of the same species, differences in shape can appear as well, without implying major qualitative changes within (Lewontin 2000). In other words, organisms of the same species simply have the same genotype because they possess the same set of genes, thus conserving the molecular structure that should in part ensure a phenotype's development (Allis et al. 2007; Goldberg et. 2007; Hallgrímsson & Hall 2011; Brooker 2012; Pierce 2012; Maderspacher 2013; De la Peña & Loyola 2017). On the contrary, organisms of the same species will possess a common phenotype if they look or function alike, regardless of the particular differences expressed by the same phenotype (Griffiths et al. 2010).

In this sense, since organisms interact with environments which are constantly changing, most biological traits can change with respect to a specific sequence of environments. Specifically, during the development of a phenotype p_0, particular environmental changes can affect the growing pattern of p_0, giving rise to changes in some part of the body structure and, consequently, to the emergence of p_1, that is, a modified phenotype that will interact with a new environmental state. This is the case, for example, with the fruit fly during its pupal stage, when sudden and strong temperature fluctuations can affect the normal growing pattern of the vein structures on its wings (or p_0): this, in turn, gives rise to the emergence of a new wing structure or the modified phenotype (or p_1) (Griffiths et al. 2010: 18). Chomsky does not ignore this natural property of phenotypes, repeatedly insisting on the need to consider linguistic variations as a crucial factor to understand the nature and evolution of this biological property (Chomsky 2016). For instance, the term, I-language ('internal language'), which refers to the individual language knowledge developed by speakers during the acquisition process (Chomsky 1986), can be correctly associated with the nature of phenotypes described above: whereas FL appears as a common cognitive character throughout the human species, the I-language develops in each individual as

a particular form of the linguistic phenotype due the interaction between UG and different environmental factors (see Lorenzo & Longa 2009; Yang et al. 2017).

As explained above and in keeping with the "blueprint" view, where genes determine the development of specific phenotypes directly, we tend to simplify the natural complexity of the mapping function, leaving aside many epigenetic factors which also play a crucial, if not central role in the developmental path (Allis et al. 2007; De la Peña & Loyola 2017). However, a phenotype must be understood as an indirectly inhered function of the interaction between both the invariable building-pattern or genetic information and the variety of environmental factors that interact with it. Accordingly, since the genotype alone does not determine developmental processes, any metaphor of a genetic blueprint dictating the ontogenetic unfolding of a particular phenotype does not tell us the whole story (see Pigliucci 2010 for recent criticism).[28] In modern biology, a direct mapping-function between both biological components cannot be maintained. Beyond environmental factors, mapping a phenotype implies both genetic and epigenetic factors, and the latter should also play a central role by determining the stability of phenotype in a species.

As I explained in the introduction to this chapter, the biological notions examined so far are central for our discussion about linguistic variation and the biological nature of MHL. Assuming a strict biological perspective, the function of the genotype regarding the development of a specific phenotype can therefore only be restricted to the molecular level, where UG would actually have limited effects on the mapping function of FL. In other words, UG ensures the transfer of genetic information to be synthetized as proteins, which are at least necessary for the development of neuronal structures. However, from a developmental point of view, UG does not provide any developmental instruction per se. Therefore, while UG plays an important role in the replication mechanism, maintaining a stable system that is, in turn, the

[28] Contrary to Dawkins's (1982) claim that the replication mechanism is a property of ADN, numerous scholars assume that the replication property is a complex process, within which many other factors beyond ADN are involved (Griffiths et al. 2012). See García Azkonobieta (2005) for a criticism of the gene-centric perspective.

optimal way to make the transcriptional process effective, UG does not determine how the mapping function for FL should work. However, this does not imply that UG does not fulfil a crucial function in the specification of what can be developed at all, a core argument of minimalist assumptions (Boeckx 2006).

2.3. THE OVERSPECIFICATION PROBLEM

In this section, we will turn our discussion to two additional genotype properties: stability and variation. On the one hand, the stable nature of genes with respect to the heritage of genetic information allows for a certain degree of conservativism, which is manifested in the replication mechanism's success, a crucial factor for genotypic stability. On the other, the combinatorial nature of the ADN structure ensures a variation margin that, depending on other factors, has evolutionary consequences for phenotypes.

As mentioned in section 2.2.2, genes play a central role in the transmission of genetic information. This process is ensured through the replication mechanism, a biological inheritance property. Although the replication mechanism constitutes a complex process that implies not only bio-chemical aspects but also a set of multiple developmental resources (e.g., basal bodies, cytoplasmic chemical gradients, patterns of DNA methylation, cell membranes and organelles, in addition to DNA itself (Oyama 2000; Moss 2003; Robert 2004)), the structural stability and chemical inactivity properties of the genetic material allow genes to maintain a central role in the inheritance of traits (García Azkonobieta 2005; Brooker 2012; Pierce 2012).

Moreover, as also explained in previous sections, genes are more conservative at a low level of the developmental path (9), with the unique function of stably transmitting the molecular resources for proteins structures (Moss 2003). In this sense, genotype stability is a clear property of genes in the first development steps. However, as the ontogenetic process of an organism unfolds, epigenetic and environmental factors become increasingly active throughout the whole process (Robert 2004). That is, at higher levels of the developmental path, the mapping function can be affected in such a way that alternative structures can emerge as a function of the interaction between internal or organizational constraints and different environmental factors

(Lewontin 2000).[29] Depending on the "degree" of these structural "deviations", they can affect qualitative aspects of the phenotype itself; if they do not, some argue that the phenotype maintains a stable position within a particular morpho-space (see Mittroecker & Hutteger 2009 for a conceptual review of morpho-space).[30]

Scholars have used the biological concept of morpho-space to explain the stability of a set of phenotypes {*p*1... *p*n} in evolutionary terms (Raup 1966). The central idea is that different phenotypic states are parameterizable, conserving, however, a position in a range of natural possibilities (spaces).

Despite the variety of morpho-space representational models (see, e.g., Alberch 1980; Kauffman 1993; and Webster & Goodwin 1996, among others), they all assume that the position of the phenotype within the morpho-space can only be altered when substantial mutations drastically affect the ontogenetic process, thus moving the position of the phenotype to another place (Minelli & Fusco 2008). Alberch (1980), for example, describes a morpho-space as a landscape with clear frontiers between one phenotype and another (see Figure 3 below).

[29] The fact that developmental systems theory focuses on the interaction between external and internal factors is also shared by current biolinguistic approaches (Longa & Lorenzo 2012) and it is a highlighted idea within the minimalist program (Chomsky 2005, 2009, 2010 et seq.). Such an approach to human language departs from the already excessively anchored idea of internal forces as the only factors responsible for development as used in Modern Synthesis and traditional generative grammar.
[30] There are many developmental mapping models which moves beyond the traditional programmatic view of Modern Synthesis (see, e.g., Goodwin 1982; Alberch 1991; Kaufmann 1993). Most of these coincide regarding the complexity of the developmental scenario that is basically constrained by internal and external factors (Lewontin 2000). A similar development has occurred with the generative grammar (GG) from the principles and parameters theory to the minimalist program (Longa & Lorenzo 2008).

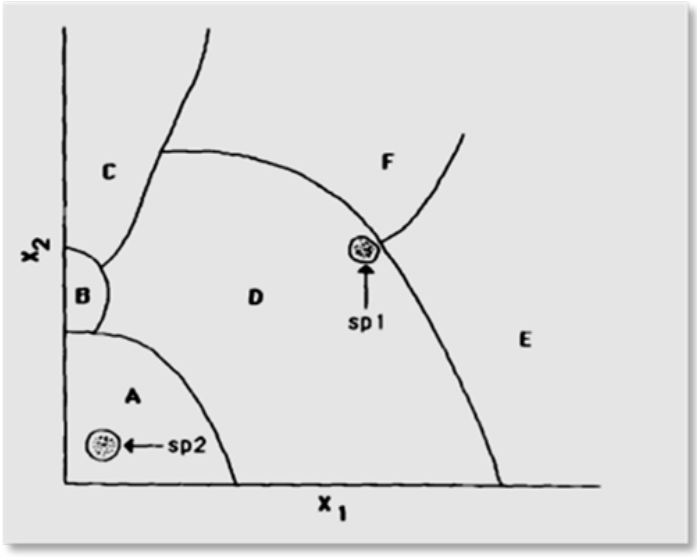


Figure 3. The parameter space (Alberch 1991). This model shows a hypothetical parameterized space composed of six phenotypes: A, B, C, D, E and F which are functions of the interaction of two parameters (Axes x_1 and x_2) during the development process. The stability of a particular phenotype is directly related to the area of its domain in the parameter space: a larger domain implies that a broader range of parameter values will result in an identical phenotype (Alberch 1991: 7). For example, phenotype B, which has a relatively small domain, should, ontogenetically and phylogenetically, be less stable than, say, phenotype D.

In Alberch's model, the landscape is defined as a parameter-space, where different developmental parameters are set along the ontogeny of an organism. Different parameter-setting might not affect the phenotype's basic properties, thus maintaining a positive distance with respect to the frontiers that delimit its morpho-space. In this case, the phenotype maintains a stable position within the phenotypic space. But, if the developmental changes affect the phenotype in such a way that the phenotypic position in the space is close to a frontier, it is said that the phenotype is in an unstable position within the morpho-space, and its developmental instability can have strong evolutionary consequences for the phenotype in question.

This developmental perspective coincides with the fact that, in addition to the genetic material's stability property, another essential characteristic of genes is their combinatorial nature. From a molecular perspective, any combinatorial change at a specific position in the DNA sequence might produce a divergence during protein biosynthesis. It is this DNA mutational

property which allows variation at the bases of the molecular structure,[31] being more sensible to alterations in its organic structure during its development.

The degree of these combinatorial changes, together with standard environmental factors involved in the interaction between these factors and genotypes, can have drastic consequences for the complete organic structure. Specifically, a simple combinatorial change can affect, in certain environmental scenarios, the development of an organism. Considering Alberch's model, if a phenotype occupies an unstable position in the morpho-space, a simple genetic change can then move the phenotype to the other side of the frontier, falling thus into a new morpho-space (Alberch 1980; 1982; 1991). This model is also compatible with Waddington (1957)'s landscape (Figure 3).

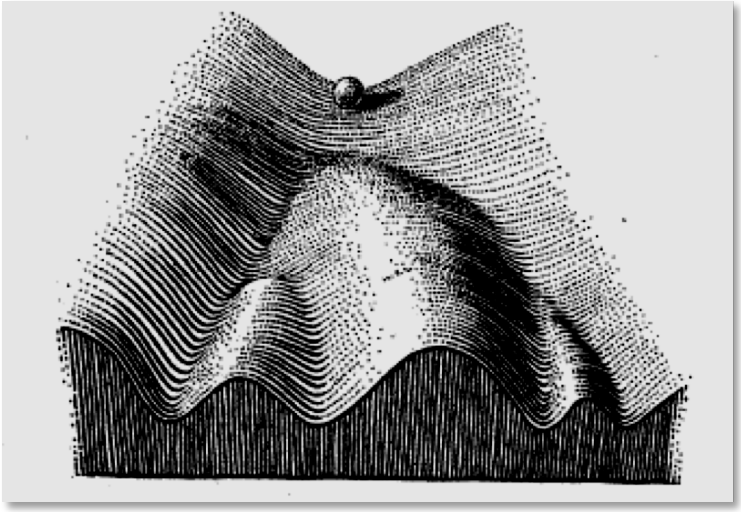


Figure 4. Waddington's (1957) epigenetic landscape. This model represents the tendency of species (the ball) to follow specific developmental paths instead of those that could be more accessible because of the deeper grooves (i.e., wells of attraction). However, developmental tendency can be altered by small perturbations at a critical point (i.e., a bifurcation) that phenotypes can suffer, allowing the 'ball' to find different paths. See Merrill Squier (2017) for discussions on the representational model of Waddington's landscape.

A change from a phenotype to another depends on the 'domains of attraction' of the area where the phenotype is located in the parameter-space (i.e., ranges in parameter values[32]). That is, in keeping with Waddington's landscapes, each

[31] Differences in a phenotype —but not different phenotypes— occur as changes within a gene's nucleotide sequence. They are called 'gene mutations' and are the result of a rare chemical deviation. That is, 'mutations' are the result of genetic variation in which a gene is found in two or more alleles. Hence, 'allele(s)' is an alternative form of a specific gene (Brooker 2012).

[32] This is an idea that, as we will see, is also quite similar to parameter hierarchy theory.

area is a well of attraction. Arguably, a small perturbation in the controlling parameters can produce a qualitative change in the outcome if the domain of attraction is too strong. In other words, qualitative changes in a phenotype depend on its position in the well of attraction (Figure 4). This phenotype will occupy a new morpho-space and can be subject to selective pressure. If natural selection acts positively with respect to the new morpho-space, the new genotype's replication mechanism will be "successful" again. Without this stability and the variational properties of the genetic information, replication and evolution cannot be conceived at all. DNA's stability and mutability, on the one hand, ensures the replication of the organic material to be developed, and, on the other hand, guarantees the relentless nature of evolution (Thompson 2013).

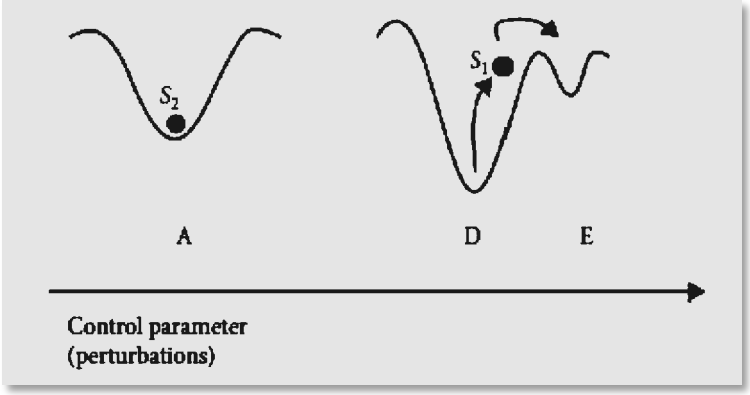


Figure 5. Domain of attraction in morpho-spaces (Balari & Lorenzo 2013). S_1 and S_2 are different traits of a species that are determined by the A, D, E phenotypes. Perturbations are represented by arrows in D. Since S_1 is at the edge of the well of attraction, a minimal perturbation can affect the developmental path tendency of S_1. By contrast, the domain of attraction by phenotype A is deeper at D, and, therefore, any minor perturbation will not cause a change in the S_2 domain.

As has been suggested before, the inheritance system should be seen as a complex system, where many other factors and conditions, aside from the genetic traits, should be taken into account (Lewontin 2000). However, at the first level of the developmental path (9), the replication mechanism is chemically supported by the genetic component; and it is a fact that this mechanism is essentially subject to how high the fidelity of the copy transferred by the replicator is. In this sense, from a stable transmission of genetic information, the phenotype's stability will largely be ensured over many generations (Sterelny 2001).

Thus, from a biolinguistic perspective, any biological approach to language has to conform to the description of a cognitive system, which will be genetically replicable and, despite the variational properties of its shape, will possess a stable design in phylogenetic terms. I refer to this condition as the stability criterion:

(11) **Stability Criterion**

The biological composition of MHL —as any biological organ— should be relatively stable.

We can thus assume the stability criterion for the biological conception of MHL. In other words, the language genotype, or UG, should be stable, otherwise both its biological replication properties (through genetic inheritance) and its speciation history would never have taken place during the Homo sapiens' phylogenesis.[33]

Nevertheless, since variability and, consequently, change, fall not only within the linguistics domain but also biology, one of the major challenges from a biolinguistic perspective is how to explain the attested linguistic variation. Returning to the biological perspective, phenotypes vary subtly, thus giving rise to individual/final states of language knowledge (equivalent to Chomsky's (1986) I-language). And, as explained above, this kind of variation is sufficiently stable to not produce any relevant perturbations in the morpho-space, thus preserving the phenotype's properties. As Alberch's model shows (1980; 1982; 1991), if phenotypic stability is broken, we will then have a new phenotype in a new space that would not necessarily be an I-language but another mental organ.

The tension between uniformity and diversity described throughout this chapter appears again: since UG's stability condition ensures FL's replication in our species, how can we explain the fact that, at least superficially, there is a wide variety of languages? If, biologically, we cannot attribute to the

[33] The fact that only Homo sapiens possesses the language faculty is a controversial matter within cognitive evolution (see Barceló-Coblijn & Benítez-Burraco 2013 for discussions). For instance, some archaeological and cranial anatomy research on Neanderthal cognition shows that it would be possible to consider that this species also possessed this capacity. Nevertheless, based on genetic arguments, many other authors reject this thesis (Benítez-Burraco et al. 2008). I will put this topic aside simply using the term, 'Human Language', to refer to the language faculty possessed only by Homo sapiens.

genotype more than its replication function, what then does the variation of structural aspects of I-languages, manifested as linguistic variation, trigger? Taking into account the definition of MHL adopted here, I claim that, whereas both questions are valid, the answers provided through the generative enterprise thus far can only be seen as a consequence of misinterpreting core biological concepts (starting with the confusion regarding UG's and FL's theoretical roles discussed in section 2.2.1) and the genocentric conception of biological development that has dominated the biology field for more than eighty years (see Lorenzo & Longa 2009).

Posing the problem another way, I will argue that the answers given by principles and parameters theory achieve explanatory adequacy only if we ignore UG's biological definition as a relatively stable component of the human genome, with clear biological limitations with respect to the FL-mapping function. In other words, the solid explanatory adequacy achieved by parametric theory can only work if we increase UG's properties, attributing it many parameterizable components that should unfold throughout the whole development process. I presented this perspective in section 2.1 above and identified it as a top-down perspective. Such an approach to UG clearly attributes it a central role in the phenotype's development —which in modern evolutionary and developmental approaches to biological systems is not possible. Taking into account a strict biological conception of UG together with core minimalist assumptions and current evolutionary approaches to MHL, we are forced to avoid a hyper-structured conception of UG.

The overspecification conception of UG presents a similar problem, one which arose during the development of rule-systems. Indeed, in the biolinguistic perspective, a parametrized UG does not respond to the bottom-up perspective, leaving the tension discussed unresolved. Instead, if we assume that UG can only be responsible for the replication of genetic information with respect to FL, there is no reason to claim that any variation related to I-language and structural changes at the superficial level should be constrained by parametric properties localized, exclusively, in the language genotype. In other words, if the stability condition is maintained and the biolinguistic problem of linguistic variation can be solved by adopting an emergent model where parameters are epigenetic specifications related to

factors of the developmental system and their interactional nature, MHL properties can be addressed from below (see Chomsky 2007).

2.4. SUMMARY

Focusing on the fact that linguistic variation is part of the biological nature of human language, this chapter addressed the adequacy problem arising from a parametrized UG theory with respect to current biological and evolutionary constraints assumed within biolinguistic research.

In order to show this, I traced the transitional development from an early generative ruled-syntax to a high-specified syntax, which some have described as a computational system constrained by a complex architecture of innate modules and grammar principles (Newmeyer 1996).

As described, from an explanatory point of view, maximizing UG was the first logical attempt to solve the language acquisition problem (Chomsky 1986). Hence, as I discussed, in the early 1980s such a high-modularized system was compatible with a gene-centric perspective. That is, the language genotype or UG was seen as the crucial component of language development, and, hence, the "richness" of a highly specified UG was not questioned (Jerne 1985). In other words, the gene-centrist view supported the parametric theory for language acquisition and linguistic diversity, and, thus, the theory was, at that time, able to meet the explanatory adequacy requirement.

Later on, I examined the core aspects of the minimalist architecture of language, which have remained a part of the biolinguistic perspective in the last few decades. I have shown that language should be seen as an optimal system, which responds to an internal and functional organization and where a simple recursive computational mechanism interacts with two additional systems (i.e., the S-M and I-C systems) (Chomsky 1995). In this sense, reducing the computational components, in turn, leads us to have to reject the heavy genetic burden attributed to UG during the 1980s. In this sense and according to current developmental biology theories, I have assumed a strict biological conception of human language to redefine UG's status. From this point of view, the language phenotype emerges as the result of the interaction between genetic, epigenetic and structural constraints as well as environmental factors. Accordingly, a first conclusion arises: the minimalist architecture of human

language is compatible with current advances in modern biological theories, where, like most biological organisms, the genetic component does not play a central role in development (Lorenzo & Longa 2009). Hence, if we maintain a gene-centrist perspective, the adequacy problem appears again, since minimalist constraints and modern evo-devo approaches are not compatible with an overspecified UG (Boeckx 2014).

Since this issue is also manifested by assuming current theories of language evolution, I have briefly shown that the minimalist language design together with current perspectives on its evolution define the computational system as an exclusive and modern capacity of the human mind or MHL. In this sense, I discussed the fact that new findings obtained through archaeological research and the study of genetic fossils related to the human brain and language development in our species suggest that there has not been enough evolutionary time to allow for an overspecified composition of the MHL genotype (Hornstein 2009).

In sum, UG should be as simple as possible, that is, a genetic component sufficiently underspecified to give rise to the epigenetic interaction needed for the biological development of MHL. Therefore, the parametrized nature of UG should to be rethought, minimalizing the genetic burden attributed by parametric theory, in order to finally meet the explanatory adequacy requirement of biolinguistic research in the positive sense (Boeckx & Grohmann 2007).

The aim of the next chapter is, therefore, to redefine the nature of these parameters from a strict biolinguistic perspective, exploring the parametric theory of linguistic diversity.

3. THE NATURE OF PARAMETERS

As shown in Chapter 1, the principles and parameters approach has been described as a promising theory, capable of achieving an adequate balance between the descriptive and explanatory conditions necessary to address language acquisition and linguistic diversity problems. The arguments can be summarized as follows: whereas the grammar knowledge of an individual is subject to the universal principles of UG in part (i.e., the genetic specification for MHL), the set of parameters (or unfixed principles) should restrict the number of specifications to be selected by learners according to their linguistic experience (Piattelli-Palmarini 1989). Since children are not exposed to the same input during the language acquisition process, they do not necessarily set the same parametric choices; consequently, linguistic variation arises (see Lightfoot 1991). At the structural level, parameters therefore constrain the possible languages that an individual can develop. That is, the principles and parameters theory assume that a finite set of parametric choices (universally specified) gives rise to a specific set of structural possibilities but not to other sets. As Moro (2009: 32) suggests, "we can even think of modern linguistics as

a theory of the limits of experience in language acquisition". On the one hand, the principles and parameters theory provide a logical explanation for the problem of language acquisition and, on the other, it emphasizes the fact that languages do not vary in unlimited forms, ending the misconception of linguistic variation as a random phenomenon (see Biberauer 2008 for discussion).

Nonetheless, different aspects related to the nature of parameters do not seem to be at all clear. Some empirical facts have been simply ignored from a theoretical point of view, even though the parametric framework eventually became the standard approach for language acquisition and generative typological studies. Scholars soon noted, for example, that not all the parameters were associated with the same modules or components of the GB architecture. Indeed, whereas some parameters affect different internal levels (D-structure and S-structure) of the syntactic domain —as has been the case with the Wh-parameter—, others have been associated with specific grammar architecture modules. The Head-parameter and the Wh-parameter, for example, were originally linked to the phrase-structure component (or X-bar module) and to the bounding module, respectively. Other parameters, however, were related to mixed domains —as was the case of the Null-Subject parameter, whose setting choice is twofold: the availability of a phonological null-pronoun *pro* in the lexicon and the availability of the functional category T-head in the syntactic structure. Accordingly, from a taxonomical point of view, some stipulated early on that there had to be a distinction between parameters and that such distinction should perhaps be linked to the "degree of association" of each parameter to some grammar principles and components (Biberauer 2008: 20).

This complex scenario of course changed with the advent of the minimalist conception of grammar: since modules and representational levels of grammar have been radically reduced, there is no longer place for an association between parameters and these modules. However, as I discuss below, the minimalist architecture has implied rethinking an old question: where does variation be localized?

In addition, the binary-choice character, which has traditionally been assumed for parametric settings, did not hold up cross-linguistically. For example, the setting effects of the Head-parameter elegantly describe and explain a "harmonic" word order, failing, however, when extended to other languages with "disharmonic" specifications (Biberauer & Sheehan 2013). Early formulations of the Null-Subject parameter have likewise failed as many languages (e.g., Icelandic and Russian) were found to show rich agreement morphology systems but did not exhibit null-subject constructions (see Gilligan 1987). Moreover, many languages with "poor" agreement morphology do show null-subject constructions (e.g., Chinese and Cheke Holo). In this sense, the binary-choice system does not seem to be empirically sustainable, at least in the simple manner formulated during the 1980s. We are thus forced to assume a more complex parameter schema.

As comparative studies advanced, not all proposed parameters from the principles and parameters theory era have fulfilled the descriptive condition expected (Pica 2001; Newmeyer 2005). Following the path between principles and parameters theory and recently-developed minimalist assumptions, the aim of this chapter is to examine the nature of parameters. In this context, I will firstly address the implicational nature of parametric relations and linguistic diversity (section 2.1). To this end, I will discuss the early perspective adopted within principles and parameters theory to explain the notion of 'parametric-setting' and 'clustering effects' and the "typological" distribution of hierarchical networks (sections 2.1.1 and 2.1.2). As I will show, both aspects are the pre-conceptions of the current assumption regarding the internal organization of parametric hierarchies. Secondly, and considering the overspecification problem that arose as the biolinguistic program advanced, I will address the nature of parameters from an emergentist point of view (section 2.2). In order to do this, I will adopt an epigenetic conception of parametric hierarchies, discussing the minimalist and evolutionary constraints that force us to assume an underspecified UG, a concept that is supported by third factors recently introduced in MHL linguistic theory (section 2.2.1). Finally, I will explain the epigenetic conception of parametric hierarchies, which, in turn, will allow us to find the balance between the descriptive and explanatory conditions and to resolve the overspecification

problem from a biolinguistic perspective (section 2.2.2). Section 2.3. presents a summary of the previous chapter.

3.1. A HIERARCHICAL APPROACH TO IMPLICATIONAL NETWORKS

When principles and parameters were still assumed to be part of innate UG components, the explanation for language acquisition was very easy: equipped with an innate set of fixed principles and parameters, children navigate through a space of linguistic experience that triggers the set of parametric options one way or another. Even though research on parameters' internal format was not central to the development of principles and parameters theory, it was taken for granted that they were a kind of switch with two options (Chomsky 1986: 146). The learning process was automatically reduced to parametric settings, and, accordingly, language variation (Chomsky 1981a, 1981c) and language change (Lightfoot 1979) were hypothesized to be the consequence of (re)setting parametric values.[34]

Nonetheless, from outset, scholars have noted that changes in a single parameter can have complex effects on the grammatical expressions of the entire system (Chomsky 1981a).

> Note that a change in the value of a single parameter may have complex consequences, as its effects filter through the system. A single change of value may lead to a collection of consequences that appear, on the surface, to be unrelated. Thus, even languages that have separated only recently may differ in a cluster of properties, something that has been observed in comparative studies. (Chomsky 1986a: 126)

Associating a change in a single setting to a cluster of effects in grammar would contribute not only to simplify the language acquisition process but also to unify the attested linguistic variation superficially. In order to capture the effects of the parameter setting, many parameters were proposed throughout the principles and parameters theory's development, and, with them, different clustering networks were identified (see Newmeyer 2005 for a review and exhaustive discussion on these formulations). However, what the

[34] We should note that 'parametric setting' is an exclusive property of language acquisition, while parametric re-setting is a property of language change (and, possibly, second language acquisition).

organization of clustering effects looks like has not yet been fully captured within the parametric approach. Furthermore, this question was not taken seriously until the advent of the minimalist program.

The first attempt during the GB era to relate parameters to a cluster of grammatical effects was carried out by Rizzi (1982). In his classic work on the Null-Subject parameter, Rizzi observed that Perlmutter's Generalization — i.e., the property of Null subject languages to move Wh-subjects from a finite embedded clause across the complementizer (Perlmutter 1971)— can, for instance, be linked to the ability of so-called "free inversion" in null-subject languages. In addition to this observation, further grammatical effects were associated, leading, in turn, to capture the following cluster effects of the Null-Subject setting:

(12) **Clustering properties of the Null-Subject parameter** (Roberts & Holmberg 2010):
   a. The possibility of a silent, referential and definite subject of finite clauses
   b. Free subject inversion
   c. The apparent absence of complementizer-trace effects
   d. Rich agreement inflection on finite verbs

Rizzi's typological claim was that, whereas Italian (a null-subject language) manifests this cluster in its system, English (a non-null-subject language) lacks all the specified properties.

Nonetheless, one of the clearest formulations of clustering effects within the parametric approach was proposed by Baker (1996). Specifically, reviewing similarities between English and Mohawk, he showed that crucial typological differences between both systems depended on how a system specifies the following condition:

(13) Every argument of a head element must be related to a morpheme in the word containing that head (Baker: 1996: 14).

As this morphological condition[35] is met in English but it is in Mohawk, Baker (1996: 14) claimed that (13) should be considered a standard case of a parametrizable principle, which he calls the 'Polysynthesis-parameter'. From a comparative point of view, a first distinction between languages is whether they fulfil this condition or not. Thus, the Polysynthesis-parameter allows us to distinguish between typological distanced languages (Baker 2001: 111). In addition, Baker's parameter also distinguishes between languages according to the kind of morphological strategies that they use to satisfy the condition: whereas some languages fulfil this condition by applying overt agreement with the main predicate (e.g., Navajo), others additionally use an incorporated root (i.e., noun-incorporation). Thus, some languages apply both strategies to meet this requirement (e.g., Mohawk). Since no language uses noun-incorporation without fully generalized agreement morphology to satisfy the Polysynthesis' condition, Baker suggested a universal implication, in which generalized agreement morphology is a necessary condition for noun-incorporation (Baker 1996: 18).

Baker's Polysynthesis-parameter can be linked to a set of properties characteristic of polysynthetic languages (see Baker 1996: 498-499 for an extended range of properties):

(14) **Clustering Properties of the Polysynthesis-parameter** (Baker 1996).
a. Syntactic noun-incorporation
b. Obligatory object agreement
c. Free prop-drop
d. Free word order

In sum, like other parameters that have been proposed before —e.g., the Null Subject parameter (Rizzi 1992), the Compounding parameter (Snyder 1995)

[35] To specify the condition formulated in (13), Baker proposed that languages can be distinguished according to a "visibility factor" of the system for θ-role assignment (Baker 1996: 17):
(i) The Morphological Visibility Condition:
A phrase X is visible for θ-role assignment from a head Y only if it is co-indexed with a morpheme in the word containing Y via: (a) an agreement relationship or (b) a movement relationship.
Languages that comply: Mohawk, Nahuatl, Mayali, etc.
Languages that do not: English, French, Chichewa, etc.

and the Wh-Movement-parameter (Huang 1982)—, the Polysynthesis-parameter has been argued to show a whole set of clustering effects.

Baker's proposal went even further as the first attempt to formalize the implicational interrelations between parameters which arise as a consequence of setting different parametric choices cross-linguistically. In other words, he applied the parametric approach to capture the typological distribution of languages along a complex network of parametric specifications. From a language acquisition perspective, Baker (1996, 2001) assumed that the Polysynthesis-parameter should be the most basic setting choice which the learner has to specify.

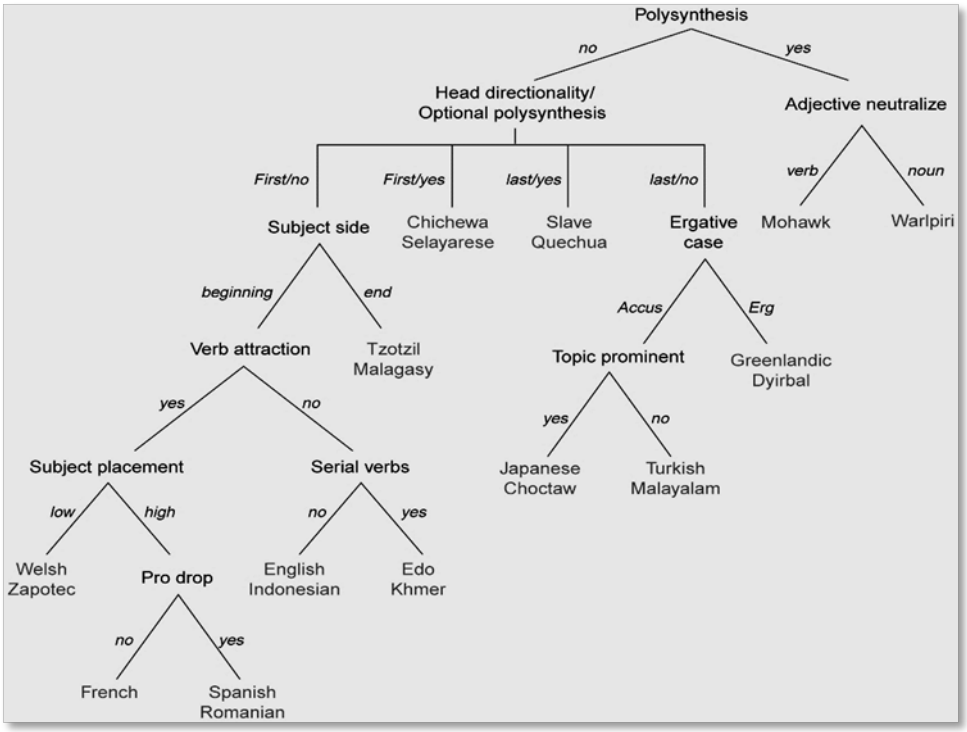


Figure 6. The hierarchical organization of the Polysynthesis-parameter (adapted from Baker 2001: 183).

From a structural point of view, parametric choices are hierarchically organized. That is, each parametric node contains a setting-choice format that splits into branches containing, in turn, new parametric nodes or subordinated parameters with new setting choices.[36]

[36] Each branch has a binary-choice structure with the exception of the Head-directionality parameter and Optional Polysynthesis (see Figure 6) which split into four possible specifications.

The implicational network of the Polysynthesis-parameter not only describes dependencies between parameters which hand not been related up to then; it also captures the hierarchical organization that such dependencies build (Baker 1996, 2001). This represents a crucial moment for the development of parametric theory.

Baker's hierarchical organization established a structural constraint that simply affected the distribution of linguistic types: assuming the implicational network represented in Figure 6, if a system specified the Verb Attraction-parameter positively, such a language would need to establish a further specification at the next level down that would be either "low" or "high" for the subordinated Subject Placement-parameter. If the system specified "high", the following implicational setting-choice would arise: the Null Subject-parameter "yes" or "no". Consequently, the Spanish system would, for example, set "yes" for the Null Subject-parameter but it would not be able to specify those possible parametric specifications implicated within the opposite options along the hierarchy. In other words, the system cannot "climb up" within the hierarchy and specify parameters that do not have the same implicational dependency. Therefore, parameters from another implicational cluster will be naturally excluded as possible properties of a particular system. Typologically speaking, the hierarchy groups those languages that follow the same setting "route", that is, languages that are implicated within the same network along the hierarchy (e.g., Spanish, Italian, etc., for the Null Subject-parameter).

Baker's proposal represented a great step forward within the generative framework, applying a parametric model to capture linguistic diversity. It represents an empirical model that, if sufficient evidence were to support it, could not only be an important advance towards a theory of parameter setting but also of parameters' connections with the different components of language faculty and its development. In this sense, we can consider the model to be the first formal attempt to explain the interactional nature of parameters.

Nonetheless, as I discuss in the following section, the empirical evidence obtained thus far poses many problems concerning the feasibility of the structural organization of Baker's hierarchy. Additionally, it raises a general

question about the existence of clustering effects in the way they have been formulated within principles and parameters theory (Biberauer 2008; Roberts & Holmberg 2010). Therefore, the main empirical problem which needs to be answered is whether the predictions made by a structure like the one represented in Figure 6 really arise cross-linguistically. Specifically, are there any structural limitations within the hierarchy that do not capture the typological distribution of possible languages?

Newmeyer (2005) discussed the general question about the existence of clustering effects at length. He warned about a range of structural inconveniences with respect to Baker's hierarchy. For instance, assigning a positive value to the Polysynthesis Parameter, Mohawk and Warlpiri should be grouped along the corresponding implications despite considerable structural differences. As a matter of fact, Mohawk adopts a strong incorporation strategy and has no overt case marking, while Warlpiri has rich case marking. In this sense, Newmeyer criticized Baker directly by arguing that "the problem with distinguishing the two languages by means of a case-marking parameter is that Baker wants case marking to fall out from the Head Directionality-parameter, since most head final languages have case marking" (Newmeyer 2005: 85). In addition, Siewierska and Bakker (1996) presented evidence that a considerable percentage of head-first languages had case marking, with no more than 35% of head-last languages lacking this trait.

Focusing only on the predictions established by the Polysynthesis-parameter, Newmeyer also discussed different typological limitations associated with the null-subject cluster (Newmeyer 2005: 88-92). He correctly reminded us of Gilligan's (1987) correlation tests between the clustering effects of the Null-Subject parameter formulated by Rizzi (1982, 1986). Many null-subject languages fail in many of the predicted specifications. As Newmeyer mentioned, such evidence should be enough to lead us to the unfortunate conclusion that the clustering specifications traditionally assumed for the Null Subject parameter are not borne out cross-linguistically (see Roberts & Holmberg 2006 for a response to Newmeyer's criticism).

Baker's implicational network also fails in other empirical aspects. The Ergative-Case parameter arises as a setting-choice if the system is specified as

a head-final language without optional polysynthesis. That means that only languages that possess such implicational specifications can be considered ergative systems. However, as Newmeyer noted, a consequence of the hierarchy would be to assume that speakers should know that their systems are accusative even though the respected hierarchies do not show any "information that accusativity is, in essence, the 'default'" option (Newmeyer 2005: 85).[37]

Finally, Baker's hierarchy also assumes that the number of specifications constrained by the implicational route correlates with the number of languages belonging to a given type. In other words, the more specifications a system has, the rarer it will be from a typological point of view. As Newmeyer (2005) pointed out, this cannot be true, since, for instance, there are more non-polysynthetic languages than polysynthetic ones, or, as noted above, Gilligan shows that there are more null-subject than non-null-subject languages. Hence, "none of these languages would appear to have any place in the PH [parameter hierarchy]" (Newmeyer 2005: 85).

In sum and despite the merit of being the first attempt to capture parameter interrelations, there is enough evidence showing that, empirically speaking, the idea of clustering effects presents many difficulties. Newmeyer's final conclusion is pessimistic: "the typological evidence argues against a model of parametric choice with properties remotely that simple" (Newmeyer 2005: 85). Furthermore, Newmeyer adopts a radical perspective, claiming to completely abandon the general proposal of clustering effects associated with parameters as a feasible approach for language typology.[38]

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[37] The same can be said about the typological property of ergative languages having serial verbs as well as topic prominent languages allowing for null subjects (Newmeyer 2005: 85).

[38] The most radical and controversial claim in Newmeyer's (2005) monograph (see also Newmeyer 2004) is that all these problems should not only be enough to reject traditional assumptions about clustering effects or more ambitious models of implicational networks; they are also enough to completely eschew parametric theory. This would not be so controversial if there were evidence for another model solving Plato's Problem and the linguistic diversity problem addressed in this thesis. The central problem with Newmeyer's argument is that he argues in favor of returning to a rule-system approach. I will not discuss Newmeyer's radical argument in this thesis. What is interesting for us is the discussion considering the problems that parametric clusters pose. For a discussion on Newmeyer's rule-hypothesis, see Roberts and Holmberg's (2006) reply as well as Roberts and Holmberg (2010) and Holmberg (2010) for the Null-Subject parameter specifically.

Baker's parameter hierarchy, however, not only opened up a new conception of parametric diversity but also formalized two further notions: macro- and micro-parameters. However, while both concepts seem to be structurally justified, they also are controversial empirically.

3.1.1. MACRO-PARAMETERS: CONSTRAINING TYPOLOGICAL DISTRIBUTION

Taking into account parametric theory's traditional view, the hierarchy approach represents a step forward towards the explanatory condition in two main ways: firstly, the implicational structure is considered to be a robust and structured parametric system, which should form part of the innate properties attributed to MHL (in accordance with early parametric approaches). Secondly, Baker's proposal allows us to abandon the early GB perspective of an "inordinate" list of independent parameters given by the UG, replacing it with an interrelated network that in fact includes all possible human languages.

Thus, from a language acquisition perspective, the learning task should be considerably reduced, since children equipped with such a hierarchical specification would not randomly navigate through the parametric space. That would indeed force us to adopt a highly selective perspective on the acquisition process (see Piattelli-Palmarini 1989 for a criticism on this problem and Yang 2002, 2004, 2013 for a selective approach from a minimalist point of view). In fact, the navigation will be constrained by the hierarchy itself. Baker's view of language acquisition is, however, traditional, based on an extreme simplification of the setting process: "an efficient learner should learn in a structured way in which some parameters are entertained first and others later" Baker (2005: 95). This simple way of seeing the setting process is naturally justified by the logic of the organization of the implications themselves. In this sense, Baker (1996, 2001) associated the typological relevance of certain parameters not only with the course of development of an I-language but also with the natural setting-process. In this context, Baker's hierarchy aimed to formalize two taxonomical conceptions: 'macro-parameters' and 'micro-parameters'.

From the structural point of view discussed above, macro-parameters are localized at the top of the hierarchy and will hence be able to split downwards

into ever more fine-grained parametric choices. In keeping with Baker's view, 'macro-parameters' should have major impacts on a system's entire grammatical structure,[39] whereas micro-parameters will consequently be less typologically relevant. Thus, Baker's proposal is that parametric choices at the top of the hierarchy are directly associated to UG principles, being by nature more salient than lower ones during the grammar acquisition process (Baker 1996, 2001, 2008). Therefore, macro-parameters will first be accessible for the setting-process. In other words, the implication logic demands that typological parameters are set earlier than parameters lower down in the structure (see Wexler 1998 for a similar conclusion). Micro-parameters are expected to be at the bottom of the hierarchy and, as the hierarchy splits into increasingly fine-grained specifications, parametric variation is expected to be at an intra-linguistic level (Kayne 2000). Hence, from the acquisition point of view, parameters of this sort should be acquired later than specifications localized at the top of the hierarchy (Baker 2001: 192-195). As noted before, a further characterization of the hierarchy model of parametric setting is that, although children may not specify a setting-choice, they are not expected to develop structural properties in their I-language that are attested in typologically different languages. Once again, typologically speaking, language learners can set the properties of their own languages and properties that are potentially higher up with respect to the same networks or linguistic family.

Despite the model's simplicity and logic, it is important to note that Baker assumes that such parametric networks are simply given in UG. That is, he never explains how and why they emerge, which is the most interesting question from a biological point of view. The macro-parameter setting is not sufficiently justified in Baker's theory, since the concept merely captures the structural distribution of parametric clusters that, as seen above, are subject to many empirical problems. As I have explained, the hierarchy constrains the distribution of linguistic diversity and, therefore, the path of parameter-setting. Since the distribution of linguistic diversity assumed in this hierarchy

[39] In the same vein, see, for example, Stowell's (1981) Head-parameter, Chierchia's (1998) Nominal-parameter and Bošković's (2008) DP/NP-parameter, among others, which have all been considered pervasive parameters, typologically speaking.

has not been empirically supported, there remains the question about the feasibility of the acquisition process proposed by such a model. The parameter-setting process represents systematic linear development, but nothing indicates that this path is constrained by the parameter hierarchy proposed. It clearly seems to adopt a hierarchical organization but not necessarily the implicational network defended by Baker (2001).

Nevertheless, both macro- and micro-parameters have become the most relevant and controversial notions for typological description within the generative framework (*cf.* Kayne 2000, 2005; Pica 2001; Roberts & Holmberg 2010; Boeckx 2011b; and Baker 2008, for a recent conciliatory justification). For instance, if macro-parameters are subject to grammar principles, their locus should be formulated in terms of a GB architecture. As shown in Chapter 1, the components of such a complex architecture disappear with the minimalist methodology and, with them, the possibility of an association with any parameter.

In this sense, the locus of variation arises as one of the most important questions within principles and parameters theory (Biberauer 2008). And, an interesting proposal within the minimalist framework is to justify the parametric variation from a lexical point of view, thus returning to Borer's (1984) old proposal (*cf.* Chomsky 1995). This new view forces parametric theory to put aside the notion of macro-parameters and seriously consider the language system's minimal variational properties (Kayne 2005). The micro-parameter approach of language variation thus arose and, with it, new models of linguistic diversity in the minimalist scenario (see Gallego 2011, for a review on this historical development).

3.1.2. MICRO-PARAMETERS: THE FINE-GRAINED EFFECT

Despite the difficulties establishing correlations between parametric specifications and the typological distribution of languages that Baker's model proposes, we know that (macro-)parameters of this kind construct implicational networks, which means, in some sense, that the theory of parameters has to explain its hierarchical organization. Some have also argued that the setting-choices which each parameter encodes are not pre-established by UG; that is, the parameter hierarchy should not be understood as a

primitive of the MHL. However, Baker's proposal lacks one main theoretical explanation, namely, the question of what causes the emergence of such parametric hierarchies. This question can only be answered if the theory implements a formal model to capture the nature of parameters and explains why and how they are hierarchically organized.

Many proposals emerged during the principles and parameters theory era, taking up the question of variation (see Biberauer 2008, for an exhaustive introduction to this topic). However, parameters at that time were assumed to be associated with UG principles, and, therefore, the variational options were proposed to be parametrizable within the different modules integrated in the complex architecture of grammar (Chomsky & Lasnik 1995). The "syntax-centrism" which characterized the 1980s did not allow for more alternatives by not asking about the "where". There was only one exception, which was the beginning of the most important variation hypotheses within the minimalist program (*see* Chomsky 1995). In 1984, Hagit Borer published *Parametric Syntax*, where she took the question of the locus of variation more seriously. She claimed that "there is no a priori reason for excluding parametrization over every aspect of UG. The question of which aspects of UG are subject to parametrization and which are not is an empirical issue" (Borer 1984: 253).

Indeed, Borer (1984) argued that parameters were not exclusively associated with the grammar modules that characterized the GB model. Therefore, they should not be associated with particular languages or grammars, but with particular lexical items. Thus, Borer (1984) (see also Fukui 1986 for a similar theory) proposed that the distribution of typological diversity could be captured by the diversity of inflectional morphology. This hypothesis was linked to the problem concerning positive evidence (i.e., enough positive evidence in form, for example, of inflectional forms), which children's linguistic environment should provide to allow for parametric setting.

> When a child is exposed to input data, she/he has available to her/him a preliminary grammar constructed of the principles of UG. These principles, however, are too general. The narrowing-down of the possibilities offered by UG is accomplished by learning the inflectional properties of different formatives and the inventory of inflectional rules operating in the input grammar. (Borer 1984: 3)

The lexical parametrization hypothesis to linguistic variation referred, however, not to all possible lexical items that can be integrated in the lexicon but to a set of specific items: for example, functional categories (*see* Fukui 1986). In this sense, if parametric variation was circumscribed by the functional items stored in the lexicon, languages would not differ from each other with respect to universal computations and principles (what would be expected from a biological point of view); instead, variation would be restricted to the idiosyncratic properties of lexical items at an inter-linguistic level (Borer 1984: 2). In 1995, Chomsky pointed out that the idea of variation as formal features or functional categories associated with them is what he had in mind in his Minimalist Program.

> A major research problem is to determine just what these options [the parameters] are, and in what components of language they are to be found. One proposal is that parameters are restricted to formal features with no interpretation at the interface. A still stronger one is that they are restricted to formal features of functional categories (see Borer 1984, Fukui 1986, 1988). [...] I will assume that something of the sort is correct [...] (Chomsky 1995: 6)

Explicitly, in keeping with Chomsky (1995), such an idea should be correct in a theoretical sense.

> If these ideas prove to be on the right track, there is a single computational system C_{HL} for human language and only limited lexical variety. Variation of language is essentially morphological in character, including the critical question of which parts of a computation are overtly realized [...] (Chomsky 1995: 7)

Baker (2008) labeled the lexical parametrization hypothesis as the Borer-Chomsky Conjecture (BCC) (Baker 2008) as follows:

(15) **Borer-Chomsky Conjecture** (Baker 2008: 353):

All parameters of variation are attributable to differences in the features of particular items (e.g., the functional heads) in the lexicon.

Addressing the long-standing debate on the macro- and micro-parameter concepts (see Piattelli-Palmarini et al. 2009 for discussions), Baker argued that the BCC represented a hypothesis that was only valid for the latter, claiming that this hypothesis could not be valid for all parameters: "There are some parameters within the statements of the general principles that shape natural language syntax" (Baker 2008: 354). In other words, he maintained the old idea that only typological relevant parameters should be associated with UG principles. However, it is not clear at all that such a radical distinction is empirically testable or theoretically "profitable" (Boeckx 2011a). In this sense, many authors have since suggested that they are perhaps formally combinable (see, e.g., Uriagereka 1995) or naturally depending on each other (see, e.g., Roberts & Holmberg 2010). Furthermore, if macro-parameters should be associated with UG principles, one problem is in fact that many of them (e.g., Principle C of the Binding Theory) are not parametrizable at all, and we have to assume the same for core computational mechanisms (e.g., MERGE) (Boeckx 2009). Finally, as Gallego (2011) explained, from a methodological point of view, micro-parameters are in a much better position to approach the study of language acquisition because "variation was restricted to the lexicon, where the assembling of simple and limited features holds the key to acquiring a language" (Gallego 2011: 533).

Taking BCC seriously means that one central aspect of the investigation will be to determine the nature of the functional categories associated with linguistic variation (*cf.* Fukui 1986; Abney 1987; and Pollock 1989, among others). In the 1990s, such an attempt gave rise to a central project within the generative framework: the cartographic project (see Rizzi 1997; Cinque 1999; Belletti 2004 for a review on this research program). The cartographic approach to functional projections was, in a broad sense, a fine-grained description of several features associated with functional categories, hierarchically organized in a universal manner (Cinque 1999). This project, however, has been rejected by many linguists since the fine-grained description of the different functional categories proposed certainly moved

away from the minimalist methodology, avoiding, in turn, a response to how and why such hierarchy would be universally constrained (Boeckx 2008; Gallego 2011).

Despite the logical intuition that parameters should be located in the lexicon, the idea of micro-parameters as a key to determine the nature of linguistic variation faces as many problems as the macro-parameter concept. For instance, the fine-grained number of categories proposed within the lines of the cartography (*cf.* Cinque 1999) seems to take the investigation to the question of the limits of variation again: nothing in the BCC prevents languages from unlimited variation.

Kayne (2005) examined the problem concerning the number of (micro-) parameters formally: if we suppose that each formal feature encodes a binary setting-choice (i.e., a parameter per feature) (Kayne 2005: 15) and defines the quantity of the set of formal features as $n=|F|$, then the quantity of the set of binary setting-choices will be $|P| = 2n$ and the quantity of the set of grammar systems will be $|G| = 2^n$. Accordingly, if the set of formal features is $|F| = 30$, then the quantity of parameters values will be $|P| = 60$. Therefore, the number of possible grammars will be $|G| = 2^{30}$ or 1,073,741,824. Kayne (2005) takes the quantity of the set of formal features to be $|F| = 100$. In this case, the number of possible grammars is exorbitant.

Despite the fact that it is unnecessary to study all these possible languages, another problem remains unsolved: the LAD must be able to navigate through this huge parametric space, otherwise acquisition will fail, or, in Kayne's words:

> There is no problem here (except, perhaps, for those who think that linguists must study every possible language), since neither the language learner nor the linguist is obliged to work directly with the set of possible grammars. The learner needs only to be able to manage the task of setting the 100 parameters (or whatever the number is), and the linguist needs only to figure out what they are (and what the accompanying principles are, and why they are as they are). (Kayne 2005: 14)

However, the "amount" problem is appropriately one of the central obstacles to overcome the tension between descriptive and explanatory adequacy. Roberts (2016) summarized this by confronting a central argument in the diachronic perspective with one of the current assumptions with respect to the evolution of language (see Boeckx 2009; Hornstein 2009). On the one hand, he took Croft's (2003) "uniformitarianism principle" which states that all languages of the past conform to the same UG as those of the present (see also Roberts 2007).[40] On the other, the MHL, as a specific phenotype of our species, cannot be older than the Homo sapiens' emergence; that is, it cannot be more than 200,000 years old. Moreover, because our knowledge about the emergence of modern cognition does not extend back beyond 100,000 years, it is very feasible that UG, as our species' genetic component, did not emerge earlier than 70,000 years ago (see section 1.2.1 above and the literature cited therein).

However, let us suppose that 5,000 languages are distributed across the world, and that this has been the case during modern human history (conforming to the "uniformitarianism principle"). Let us also suppose, then, that every language changes at least one parametric setting every generation. Thus, if we have a new generation every 25 years, we will obtain 20,000 languages per century (Roberts 2016: 173). If we apply this calculation to the history of modern cognition, that, stemming back 100,000 years ago, we will have to calculate 1,000 centuries; hence, 20,000,000 languages would have been spoken throughout the history of MHL! The conclusion would be that the evolutionary time assigned to our MHL is insufficient to cover Kayne's calculation —Roberts' quantification of possible languages is 27 times smaller than Kayne's—, turning it into a true challenge for the micro-parametric approach from an evolutionary perspective. Hornstein (2009), considering what Boeckx (2009) referred to as 'Darwin's Problem',[41] pointed out something similar, suggesting that, from a minimalist perspective, it seems that the

[40] Recall that, from a strict biolinguistic point of view, UG is nothing more than the genotype of the language faculty (see Stability Condition in Chapter 2). In this sense, it is phylogenetically impossible for early languages to be different from modern ones. For recent discussions and details related to the "uniformitarianism principle", see Roberts (2017).

[41] The argument of Darwin's Problem is actually based on the same issue raised by the "amount problem".

lexical parametrization model (i.e., the micro-parameter perspective) leads us to an undesirable "language-particular rule" system (Hornstein 2009: 166).[42]

All in all, taking into account the conditions imposed by SMT as well as the whole methodological perspective adopted by the minimalist program with respect to the "size" of the structural complexity of UG (Mobbs 2015), it becomes obvious that macro-parameters do not seem to fit within MHL architecture. In other words, assuming that macro-parameters are an aside-function of the accumulative effect of micro-parameters, there is actually no other parametrizable locus for variation as hypothesized by the BCC. However, as we have seen, the micro-parameter perspective raises questions about its feasibility with respect to Plato's Problem as well as if we take Darwin's Problem seriously —as has been argued by the strict biolinguistic approach. Indeed, the fine-grained intervention encouraged by the comparative micro-parametric perspective has a clear "negative effect" on linguistic theory if the target is indeed to go beyond explanatory adequacy (Chomsky 2004, 2005, 2007; Boeckx 2011b, 2014a, 2014b). The micro-parametric perspective inevitably increases the structure of UG,[43] and, thus, the overspecification problem remains unresolved.

3.2. Towards a Theory of Parameter Emergence

As principles and parameters theory progressed, new structural aspects were necessary to explain the nature of parametric variation. This, in turn, constituted an empirical challenge for the generative program. In this context, the concepts of both macro- and micro-parameters, for example, arose as possible candidates to capture the clustering nature of parameter-setting (Baker 2008). However, strictly speaking, none of these notions truly implied a departure from the gene-centric conception of UG adopted by principles and parameters theory (see Lorenzo & Longa 2003, 2009 for criticism on this aspect). Whether the existence of syntactic macro-parameters is empirically true (Baker 2008) or featural micro-parametric choices are pre-specified by

[42] For discussions on the same line of criticisms, see Rizzi (2014) and Boeckx (2014a, 2014b).
[43] Note that intuition here dictates that the computational system is not completely separate from the lexicon, a crucial view within the early stages of the minimalist program that has not been actually explored (Boeckx 2016) and has mostly been ignored during the last decade.

functional categories within the lexicon (Kayne 2005), both concepts were traditionally subject to the UG's genetic specification, a view that reminds us of the traditional "pre-formative" conception of genetic development (Oyama 2000). In other words, from a genetic point of view, the conception of UG has not yet been freed from a high-structured system that determines the development of I-language. From this point of view, the main reason why principles and parameters theory seemed to find an "equilibrium" between both the descriptive and the explanatory conditions was certainly the gene-centric perspective adopted within the theory. Thus, the idea of an exclusive genetic specification determining the course of language faculty development forced the theory to assign a main role to the language genotype. Indeed, this constitutes the basis of principles and parameters theory, where the deterministic mapping conception of genome (UG) and phenotype (I-language) was simply translated into a one-to-one relation (Lorenzo & Longa 2003, 2009).

Nonetheless, nothing is further away from a developmental explanation than the determinist approach (Oyama 2000; Reid 2007). Focusing on language, it is clear that giving the plasticity property, which characterizes its development (see Vercelli & Piattelli-Palmarini 2009), a gene-centric perspective leaves little room for epigenetic factors. These are crucial, however, to explain the interaction between genetic information, the environmental aspects and the other factors that are not necessarily related to the organism itself (Reich & Blake 2004). In this sense, although the minimalist program maintained a UG-genotype conception with the advent of the SMT, its main role in the developmental explanation began to be questioned: since the biolinguistic program tried to explain a natural object, which is optimally designed to fulfil an internal function —satisfying those conditions imposed by external components at interface levels— in strict developmental terms, it is not necessary for the whole MHL architecture to be exclusively constrained by UG-specifications but, rather, by general conditions that are not necessarily language-specific. Thus, the high-structured genotype and its parametrizable principles were abandoned. This is the of "UG-from-below" approach assumed by Chomsky (2007). Hence, the SMT weakens the "dogmatic" geneticism adopted by principles and

parameters theory and, assuming current perspectives on development biology, opens the door to research on interactional factors, which are essential for the development of any biological organ (see Reid 2007, Chapter 6, for an excellent review of such advances). From this point of view, the development of the MHL complexity would not be genetically specified but epigenetically; that is, the MHL would be the result of the interaction of many factors during the acquisition process, something expected from any developmental context (Lorenzo & Longa 2003, 2009; Longa & Lorenzo 2012).

The interactional perspective has been clearly formulated in minimalist terms in keeping with Chomsky's (2005) three factors in language design (see also Chomsky 2000, 2004). Specifically, Chomsky suggests that the mapping path to an individual speaker's language knowledge is determined by the following three factors in language design:

(16) **Three** factors in language design (Chomsky 2005: 6):
   a. First factor: Genetic endowment, ensuring the stability condition in our species.
   b. Second factor: Linguistic experience, which leads to a constrained variation.
   c. Third factor: Principles not specific to the faculty of language.

The interactional scenario assumed within the three factors in language design is closer to the epigenetic conception of developmental biology, thus reducing UG's key role within the whole design:

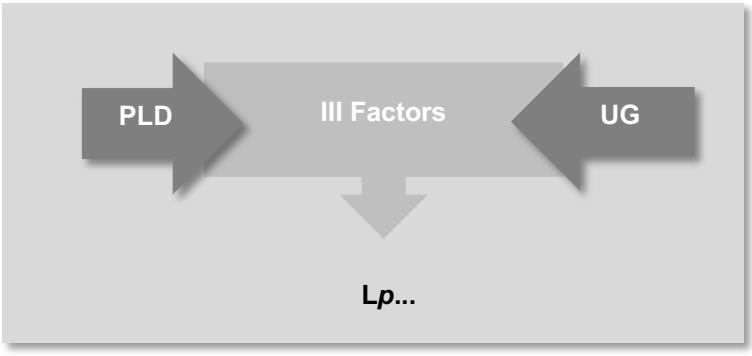


Figure 7. The developmental perspective of *L*p (Language Phenotype): Third factors condition the information of the linguistic experience (second factor) and a small set of properties provided by UG (first factor).

While the first and second factors have served as the basis of the research program from the outset of the generative program and the interaction of both

aspects was heavily explored in the 1980s (Borer 1984; Pinker 1984; Berwick 1985; Hyams 1986; Roeper & Williams 1987, among many others), the third factor is an explanatory component that can not only help to solve some theoretical gaps between the genetic and environmental explanations for language development but, also, overcome the new challenges raised from the SMT as well as the question of the MHL evolution.

Despite the fact that the role of third factors is an idea that Chomsky defended early on (*see* Chomsky 1965, 1975, 1986), it has only recently appeared as the crucial component to explain the developmental process of language (see Chomsky 2004, 2005), occupying a central position within the whole picture of the research program in order to go beyond explanatory adequacy (Chomsky 2007).[44]

> The third factor falls into several subtypes: (a) principles of data analysis that might be used in language acquisition and other domains; (b) principles of structural architecture and developmental constraints that enter into canalization, organic form, and action over a wide range, including principles of efficient computation, which would be expected to be of particular significance for computational systems such as language. It is the second of these subcategories that should be of particular significance in determining the nature of attainable languages.
>
> (Chomsky 2005: 6)

Turning to the nature of linguistic diversity, the scenario for parametric variation has become very narrow with the SMT. Hence, the main question seems to be where the locus of parametric variation is within the whole system. Thus, if the genetic "contribution" of UG (first factor) is reduced to stable genetic information about the computational property, MERGE, whose application is actually subject to third factors (i.e., sub-factors of the kind (a) and (b) described above), then, conceptually speaking, both factors cannot be subject to variation. Boeckx (2011b) explicitly pointed out that the "arity" property of MERGE should be constrained in the simplest possible form by a

[44] The tendency to find an explanation for many language problems in factors that are indeed not specific to the faculty of language has been long addressed in different ways (cf. Lightfoot 1999 for language change; Roberts & Roussou 1999, 2003, and van Gelderen 2004, 2011 for grammaticalization; or Yang 2002, for language acquisition and linguistic variation).

non-domain-specific factor (see the *Minimax Function* argument of Watumull 2010, 2012, 2015). He suggested that the *n*-ary nature of MERGE is subject to general computational performance and not to the genetic specifications of the operation itself. In contrast, cross-linguistic variation of the *n*-ary nature of MERGE would mean that two syntactic objects can be combined in Lp_1 and/or three or more objects in Lp_2, something that is not computationally efficient. Accordingly, 'flat' or non-configurational languages as well as ternary or quaternary branching structures or non-branching structures are excluded in a derivational system constrained by binary MERGE. Therefore, since the variation of MERGE would not be viable in an optimal system, the answer to the question of why the underspecified nature of MERGE is computationally constrained in this way rests in "principles of a more general character that may hold in other domains and for other organisms, and may have deeper explanations" (Chomsky 2008: 135). In sum, a central research issue within the minimalist program would be to explain *how* and *why* third factors affect the nature of the first factor.[45] Answering these questions represents a step forward towards an explanation about the interactional nature of the development of MHL in epigenetic terms.

The "invariability" perspective of UG was already captured by Chomsky (2001: 2) under the Uniformity Principle: "In the absence of compelling evidence to the contrary, assume languages to be uniform, with variety restricted to easily detectable properties of utterances." What Chomsky suggested is that the locus of variation should be located outside FLN; specifically, variation should be restricted to the externalization space: "Parametrization and diversity too would be mostly —maybe entirely— restricted to externalization" (Chomsky 2010: 60) (see also Berwick & Chomsky

[45] Similar arguments have arisen around the set of conditions postulated by the minimalist framework during the last few decades: Inclusiveness (Chomsky 1995); Minimal Link/Relativized Minimality (Chomsky 1995); Phase Impenetrability (Chomsky 2000); Full Interpretation Principle (Chomsky 1995), etc. They seem to be constrained by factor III subtype (b). For instance, the Locality Condition or the Minimality Condition (Rizzi 1982) cannot be present in L*p*1 and be absent in L*p*2. But, even if it is empirically possible to see some kind of cross-linguistic variation, this would imply a conceptual problem because it would directly question the efficiency attributed to the computational device within minimalist terms (see Boeckx 2011 for discussion on this issue).

2011, 2016; Boeckx 2011b, 2014a, 2014b, 2016). This hypothesis was summarized by Boeckx (2016) as follows:

(17) **Locus of variation** (Boeckx 2016: 73):
All "parameters" reduce to realizational options (i.e., PF decisions rendered necessary by the need to externalize structures constructed by an underspecified syntactic component).

Boeckx (2011b) formulated a robust version of the uniformity hypothesis, where the computational properties are seen as a "fully uniform" component, underlying all languages (see also Miyagawa 2006).

(18) **Strong Uniformity Thesis** (Boeckx 2011b):
Principles of narrow syntax are not subject to parametrization; nor are they affected by lexical parameters.

According to Boeckx, the Strong Uniformity Thesis (SUT) seems to be justified by three trends within the development of the minimalist program itself. On the one hand, the SUT is virtually forced by proponents of Distributed Morphology (DM) (see, e.g., Halle & Marantz 1993), who led many of the early pre-syntactic parameters within the lexicon to post-syntactic aspects at the morpho-phonological component (or PF) (see Embick & Noyer 2007). In addition, exhaustive exploration of the nature of features —which motivated the cartography approach (Cinque 1999) or the so-called 'crash-proof syntax' model (Frampton & Gutmann 2002)— led to the development of the idea of a Free-Merge syntax model that is subject to elements bearing "edge features" (Chomsky 2004, 2005, 2008) and interface-internal conditions that filter illegible derivations (Boeckx 2006). Unlike standard features that can vary across lexical items, edge features are a common and necessary specification of lexical items to enter in the computation (Chomsky 2008). In this sense, because they are the only (common) property among lexical items that triggers syntactic operations, both edge features and MERGE can conceptually not be subject to parametric variation (Boeckx 2011b: 212). DM and edge feature specifications are directly related to the nature of the lexicon and the existence of parameters within the lexicon (Borer 1984; Chomsky 1995) —a scenario that was already captured in some way by the BCC (see section 2.1. above).

Finally, as indicated in (17), the SUT is also justified by the growing idea supported by Chomsky's Uniformity Principle. If variation is only associated with PF externalization, the computational system and the LF interface attain a "privileged" status concerning the mapping properties of the whole architecture (Chomsky 2007, 2010). In other words, since the computational system fulfils an internal function because its operations (e.g., elimination of unvalued/uninterpretable features) are motivated to meet the conditions imposed by the C-I (Conceptual-Intentional) system, the language architecture may only be optimized for the interaction between these systems (Chomsky 2010). Contrarily, the PF externalization side would be subject to variation due to the fact that this component is affected by morpho-phonological rules and idiosyncratic aspects of communication, an "intricate" space "subject to accidental historical and cultural events" (Chomsky 2010: 60).

In sum, the plausibility of the SUT is supported by the SMT. Both minimalist hypotheses confine parametric variation outside the (narrow) syntax component. This option does not only seem to satisfy strong minimalist conditions but also evolutionary constraints. We have to assume that the UG is highly underspecified and that the nature of parameter is probably better explained with a deflated UG subject to the interaction of three factors in language design. Such an interactional scenario is close to an epigenetic perspective, where parametric effects arise in the course of language development (Lorenzo & Longa 2009).

3.2.1. THE EPIGENETIC APPROACH. AN INTERACTIONAL SCENARIO

The focus on non-language-specific constraints opens a much wider range of possible explanations towards a theory of UG from below, reducing its contribution to a few computational operations or mechanisms that are, in turn, constrained by third factors and a minimal set of formal features. At the same time, such general constraints imply a different conception of MHL's development: from a strict biological point of view, the development process will not only be subject to genetic endowment and its interaction with the linguistic experience during the acquisition process (*see* Piattelli-Palmarini 1989), but, rather, the development of MHL, as with any biological organism,

will be subject to a complex interactional scenario, where, according to modern biology, other factors also contribute to the design of the language organ. From this point of view, Chomsky's three factors of language design have led researchers to assume an epigenetic conception of MHL's development. Hence, the set of natural properties that constitute the language phenotype (L*p*) should be seen as an emergence object of our species.

Approaching the nature of MHL's development from an interactional perspective not only supports the SMT but it is also in accordance with the recent evolutionary issues addressed by the minimalist program, namely, addressing Darwin's Problem from an explanatory point of view (Boeckx 2009; Hornstein 2009). The epigenetic scenario also implies abandoning the genetic-centric perspective adopted in principles and parameters theory (*cf.* Lorenzo & Longa 2003; Longa & Lorenzo 2012), a view that results in an important shift concerning the theoretical conception of parameters and their theoretical status with respect to the whole system.

The epigenetic or "emergentist" approach has also been assumed in many recent approaches to parameters within the minimalist framework (*cf.* Gianollo, Guardiano & Longobardi 2008; Dresher 2009; Boeckx 2011b; Roberts 2012; Holmberg & Roberts 2014, among others). Indeed, many authors have argued that parameters are the result of the interaction of learning biases, linguistic experience and the underspecification of certain kinds of features that are provided by UG during language development (Newmeyer 2017). In other words, since the bottom-up approach does not allow for a parametrizable UG, parametric variation has to be seen as an emergent phenomenon which is determined by the interaction of the above factors.

As discussed in the previous sections, the minimalist idea of a featural-underspecification property of certain formal features is not totally new. For instance, Holmberg (2010: 8) suggested that "a parameter is what we get when a principle of UG is underdetermined with respect to some property. It is a principle minus something, namely a specification of a feature value, or a movement, or a linear order, etc."

Such a proposal is, however, not so far from Baker's (2008) BCC, which connects any parameter *P* to formal features (FFs) along the lines of (19):

(19) For some formal feature *F*, *P* = ±*F*

This approach to parametric variation at the UG level relies on the logic of the underspecification schema (20) (see Roberts 2016: 172):

(20) a. For some formal feature *F*, *–F* is the default value of *P*
b. *P* has *+F* when triggered (i.e., under specified conditions), *–F* elsewhere
c. *+F* is the marked value of *P*

The underspecification logic described above represents a reduction of UG according to the following terms:

(21) a. Invariant operation of the narrow syntax (e.g., MERGE, AGREE)
b. A specification of the non-functional lexicon (semantic forms and phonetic forms)
c. A list of FFs with a specification of which FFs are optional and which are not

In (21c), the optional FF specification corresponds to the set of parameters, whereas non-optional FFs correspond to the set of universal principles (Roberts 2019: 69).

There are, however, some theoretical problems with this. Firstly, macro-parameters are not captured in this context. Secondly, while some languages do negatively set certain kind of FFs, other languages show a great variational distribution of specifications for the same feature (see Roberts 2019 for a discussion on ϕ-features/parameters in Japanese and Romance languages). In this sense, the picture described above also does not seem to capture the clustering distribution of parametric variation. Finally, and as discussed in section 3.2, the "amount" problem arises again. That is, despite the fact that it is only applied to UG-optional FFs, the search space imposes a learning problem for children. Furthermore, and as seen in the previous section, the evolutionary constraint has not yet been resolved because the number of

languages that have emerged since the existence of modern human cognition is too large (see Roberts 2016: 172-174).

As Roberts pointed out, these problems could be solved if we succeeded in reducing the set of optional FFs provided by UG, profoundly exploring the epigenetic scenario suggested by the three factors of language design approach, avoiding, in turn, "the addition of further specifications to UG" (Roberts 2019: 71):

> If we can successful[ly] organize the FFs so that they interact just in certain specified ways, then we should be able to address these issues. Allowing only certain types of interactions may cut down the search space, give us a characterization of macro-parameter, and give us a characterization of the kinds of 'sub-options' available. Once again, acquisitional concerns and typological questions come together. The challenge now is to try to organize the FFs without adding to UG. Can we retain the explanatory adequacy of parametric approach while keeping to the general minimalist reduction of UG, thereby facilitating a move 'beyond' explanatory adequacy?
> (Roberts 2019: 71)

Actually, Roberts (2012) and his colleagues (see, e.g., Holmberg & Roberts 2014; Biberauer et al. 2014; Biberauer; Biberauer & Roberts 2015a, 2015b; Biberauer & Roberts 2016; and Huang & Roberts 2017, among others) formalized and explored this idea, understanding that the distinction between macro- and micro-parameters to be central in order to define the epigenetic nature of parametric variation (Newmeyer 2017).

In keeping with Kayne's (2005) and Baker's (2008) hypothesis that macro-parameters are "the result of aggregates of microparameters acting together" as a single parameter (Roberts 2016: 177), Roberts (2012) suggested that, biologically speaking, macro-parameters have to be seen as an epiphenomenon caused by the sum of micro-specifications (see also Roberts & Holmberg 2010). Nonetheless, he has argued that the sum of these micro-parameters is not random but structurally constrained by the interaction of the three factors in language design. Holmberg and Roberts (2014) specifically define these factors as: (i) the UG-genotype, providing a very small set of

underspecified formal features in certain functional heads;[46] (ii) the PLD, ensuring the linguistic input for parametric-setting;[47] and (iii) two learning strategies, which are assumed to be general markedness conditions or third factors.

In order to capture the nature of parameters according to (iii), Roberts and Holmberg (2010) show that there is a direct relation between parameters and a general cognitive property of quantification regarding the underspecification of FFs:

(22) **Quantification over parameters** (Roberts & Holmberg 2010:60):[48]

$Q(f_f \in C)$ [P(f)]

The quantification formulae must be read as 'for some FF, where F belongs to a functional category C, and then a formal operation of P is selected in that system'. Hence, the main idea is that the quantificational relation over underspecified FFs constrains the parametric setting, giving rise to a particular kind of parameters. Specifically, Roberts and Holmberg's (2010) argued that this quantificational relation corresponds to a third-factor property (see also Clark & Roberts 1993) because it "is not given by UG, since we take it that generalized quantification —the ability to compute relations among sets— is an aspect of general human computational abilities not restricted to language" (Roberts & Holmberg 2010: 60).

The interactional scenario proposed here relies on the reduction of the structural content of the genetic endowment according to the SMT and represents a clear epigenetic approach according to current perspectives on variation and biological development processes (*cf.* Reich & Blake 2004; Vercelli & Piattelli-Palmarini 2009; Longa & Lorenzo 2012; Benítez-Burraco & Boeckx 2014). Third factors of the kind represented in (22) interact with the

[46] This is exactly the characterization assumed by Chomsky (1995, 2002, 2004, and 2007) and which, as seen above, Baker (2008) captured under the BCC (see section 3.1.2).

[47] A further assumption compatible with the BCC, as well.

[48] The formal description of quantification of parameters is as follows:
Q = quantification
f = quantifiable formal features provided by UG
C = restriction or functional category
P = nuclear scope or grammatical predicates defining a set of formal operations ("Agree", "has an EPP feature", "attracts a head", etc.)

UG-genotype and linguistic experience, constraining and optimizing learning strategies to reach the final state during language acquisition. In other words, general cognitive resources or computational conservativity principles would support the learner's acquisition process (*see* Mobbs 2008), something that implies the emergence of parametric variation and the necessary setting process (Biberauer & Roberts 2017).

3.2.2. THE INTERNAL STRUCTURE OF PARAMETER HIERARCHIES

Assuming the epigenetic approach and focusing on third factors, Roberts (2012) argued that there are two general learning strategies underlying the quantificational relation in (22):

(23) (i) **Feature Economy** (**FE**) (Roberts & Roussou 2003: 201):
Postulate as few FFs as possible.
(ii) **Input Generalization** (**IG**) (Roberts 2007: 275):
Maximize available features.

The FE constrains the number of FFs to a minimum so that their number is consistent with the input provided by the PLD: given two structural representations R and R' for a substring of input S, R is less marked than R', iff R contains fewer FFs than R'.

The IG relies on the deduction from an existential to a universal generalization of the kind $\exists x\,[F(x)] \rightarrow \forall x\,[F(x)]$: given a set of features F and a given set of functional heads H, given a trigger for feature $f \in F$ of a functional head $h \in H$, the learning device generalizes f to all other functional heads $h_1 \ldots h_n \in H$ (Holmberg & Roberts 2014: 68).

The interaction of FE and IG constrains the learning process in the following formal steps:

(24) **Learning process** (Biberauer & Roberts 2015a, 2015b, 2017):
(i) Assume a default input postulating no functional heads with a given feature,
¬∃h (F(h)), satisfying so the FE and the IG conditions

(ii) Detecting F in the PLD, generalize F to all relevant heads h (IG),
∃h [F(h)] → ∀h [F(h)]

(iii) If a head without F is detected, the learner abandons maximization to postulate that some heads bear F,
∃h ¬[F(h)], and go back to (i)

(iv) If no further F(h) is detected, stop to setting

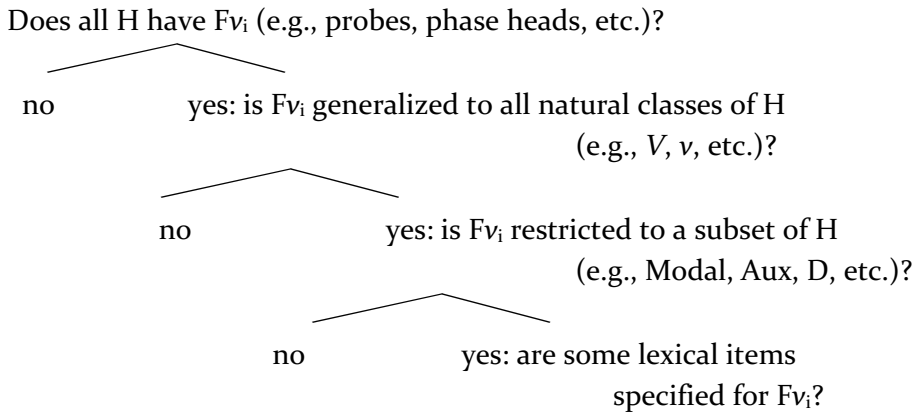
As can be seen, the quantificational relation interacts with the PLD and the underspecified features of UG, giving rise to the emergence of parameters. Along these lines, Roberts (2012) and his colleagues (see Holmberg & Roberts 2014; Biberauer et al. 2014; Biberauer & Roberts 2016; Huang & Roberts 2017 among others) argued that the restrictions on the setting process, NO >ALL > SOME, determine the internal organization of parametric variation in terms of hierarchical structures. In other words, the hierarchical nature of parameters is an emergent phenomenon subject to the interaction of these factors.

Roberts (2012) and his colleagues (Holmberg & Roberts 2014; Biberauer et al. 2014; Biberauer & Roberts 2016; Huang & Roberts 2017 among others) adopted the notions of macro- and micro-parameters, arguing that the former are the sum of the latter. In fact, they did not reject the theoretical value of these parameter distinctions, assuming, however, an underspecified UG in terms of FFs and that the epigenetic notion of interactional factors is necessary for the parameter emergence.

From an empirical point of view, then, since macro-parameters are the result of aggregated micro-parameters, Roberts' conception of macro-parameters implies the internal organization of parameters in hierarchies. Crucial for this hypothesis is that the emergence of these internal hierarchies is subject to the interactional scenario described above in section 3.2.1.

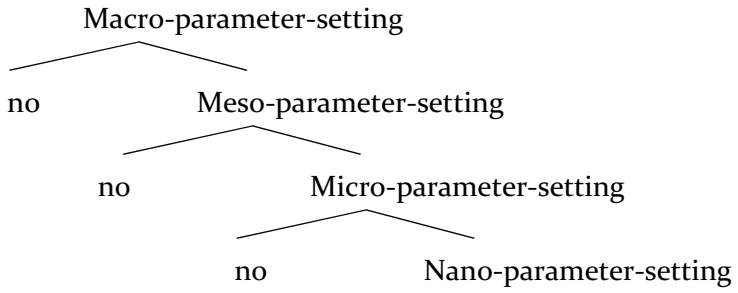
Taking into account all the above, the setting-process, NO F (*p*) > ALL F (*p*) > SOME F (*p*), defines the following hierarchically organized parametric expressions (see Biberauer & Roberts 2015a, 2015b):

(25) For a given value v_i of a parametrically variant feature F:



The parameter hierarchy of (25) can be applied to different variational phenomena, supporting the idea that such hierarchies empirically capture the nature of macro- and micro distinctions at a typological level (Roberts 2017: 341). In order to redefine the nature of the hierarchical organization, Biberauer and Roberts (2015a, 2015b) postulated a conceptually fine-grained taxonomy of the parametric specifications defined through the parametric setting of (25):

(26) **Parameter hierarchy** (Biberauer & Roberts 2015a, 2015b):



The size of the hierarchy can vary according to the complexity of the parametric variation (Biberauer et al. 2014). However, the implicational organization as represented above is invariable,[49] a fact that responds to the

[49] One of the main questions within the minimalist program is why parameters are organized the way they are. A minimalist assumption would be to postulate third factor constraints for that (Moro 2016). In this sense, Susann Fischer (p. c.) reminds me that determining the nature of the implicational organization in terms of implicational conditions would be an attempt to explain structural constraints on parameters beyond explanatory adequacy.

epigenetic conditions to which the setting process, as described in (24), is subject.

Formally, the unmarked specifications at the top of the hierarchy will be set, that is, the macro-parameter —the sum of the properties able to be specified downwards of the hierarchy. If the macro-parameter is set to 'yes', the hierarchy breaks down into the next binary-setting specification, giving rise to a more marked specification. Note that the markedness condition continues throughout the entire hierarchy, determining how marked (or complex) the variational attribute of the specification to be set is. In other words, Roberts' hierarchies are defined by complexity relations: the higher up the specifications are in the hierarchy, the simpler the hierarchy's structure. Moving down the hierarchy, parameters become more complex. Roberts (2012) summarized this aspect as follows:

> [P]arameters become more 'micro' [marked], behaving in a non-uniform, differentiated fashion, which is inherently more complex than the systems higher in the tree (we can suppose that the options move from subsets of the set of formal features F to singleton features of heads f ϵ F, to increasingly context-sensitive environments, ultimately perhaps to single lexical items), and the options have a longer description (the conjunction of all the 'dominating nodes' in the hierarchy).
>
> (Roberts 2012: 321)

In this sense, the consequences for language acquisition theories are clear: during the acquisition process, the LAD scans the hierarchies downward, stopping at the point where there is no "disconfirming PLD" (Roberts 2016: 179). This means that the LAD moves down "only when forced to by PLD incompatible with the current setting" (Roberts 2016: 179). The learning path is defined by the macro-parameter's hierarchical structure, the higher specification being the preferred one by the learner (*cf.* Dresher 1999). As Roberts (2012) pointed out, each hierarchy draws an epigenetic landscape,[50] "defined by incrementally more computationally complex options" as the

[50] For more on the 'epigenetic space' concept, see Waddington (1957).

learner sets the specification down the hierarchical structure (Roberts 2012: 321).

From a diachronic point of view, Biberauer and Roberts (2015a) suggest that, since macro-parameters have more pervasive effects on the grammatical system, they are easily detectable by the PLD, and, accordingly, they are "unlikely to be subject to reanalysis by language acquirers under normal conditions and hence are diachronically stable" (Biberauer & Roberts 2017: 149). Diachronically, the logic of the effects of the markedness conditions established in (23) appears again: the unmarked specifications that are located at higher levels in the hierarchy are more stable than the marked ones. In other words, we can determine an exponential relation diachronically: the more complex a hierarchical structure is, the more unstable the parametric setting. This implies that macro- and meso-parameters are less subject to changes than micro- and nano-parameters:

> If parametric change involves acquisition-mediated reanalysis of PLD, macro-parameters will be set 'easily', hence resisting reanalysis and being strongly conserved; meso- and micro-parameters are correspondingly less salient in the PLD, hence less reanalysis-resistant and less strongly conserved. Nanoparameters are, in principle, still less reanalysis-resistant and thus more unstable, aside from the intervention of frequency effects. (Ledgeway & Roberts 2017: 614)

Assuming Roberts' (2012) hierarchical organization for parameters, the LAD goes through an interactional scenario that is determined by the three factors of language design, thus constraining the development of an I-language and its parametric specifications. In such an epigenetic context, linguistic variation and language change will be restricted to how complex the landscape is at low levels of a macro-parameter. Linguistic variation and language change will be more "active" if the epigenetic landscape is too complex. From this point of view, changes will tend to move up the system to higher positions in the hierarchy: from marked specifications to unmarked ones. In other words, in line with Roberts (2012), the acquisition process and language change seem to react in two opposite directions with respect to the parametric setting along the epigenetic landscape, a topic that I will return to later (see Chapter 4).

From a formal perspective, the hierarchy approach is very interesting because it allows us to maintain theoretical "harmony" with respect to both the descriptive and the explanatory conditions imposed by linguistic diversity and by the problem of language acquisition. In addition, it meets the conditions imposed by the SMT and the evolutionary theory of MHL, representing a theoretical way to solve the overspecification problem. Adopting the emergentist perspective is a way to go beyond explanatory adequacy, which constitutes a step forward within the biolinguistic framework. Indeed, the epigenetic perspective allows us to emphasize the UG's underspecified conception, a crucial condition to describe an interactional scenario as defended by the modern theory of biological development and the three factors of language design advocated by Chomsky's recent works (see Chomsky 2005, 2010).

As have been described in (21) above, the UG-genotype is reduced to two grammatical components: on the one hand, the operation MERGE and a minimal set of syntactic mechanisms that are, in turn, constrained by general factors of computational efficiency —e.g., the binary nature of MERGE discussed above or the DELETE mechanism, which is conditioned by external principles of optimal design— and, on the other hand, the variant set of underspecified FFs that are contained in the lexical entries of functional categories. This last component is crucial for the discussion on the nature of parametric variation. Indeed, as Roberts (2012) and his colleagues (see Holmberg & Roberts 2014; Biberauer et al. 2014; Biberauer & Roberts 2016; Huang & Roberts 2017 among others) have argued, the set of FFs interacts directly with second and third factors: with respect to the former, the underspecified FFs which are encoded within the input, express a substring of the PLD or linguistic experience that, in turn, will trigger the setting process, giving rise to the parametric expressions defined in (25). At the same time, the interaction of the underspecified FFs with the third factor is visualized at the computational efficiency level of the general learning strategies referred to above (i.e., FE and IG). We can calculate the efficiency regarding how conservative they are by ensuring a low level of computational work. In other words, since computation is a costly task, learning strategies are effective if they reduce the "effort" required (Mobbs 2015).

In sum, a central assumption within the biolinguistic program is that the development of I-languages (i.e., linguistic phenotypes in the human mind) is subject to the interaction of Chomsky's (2005) three factors of language design. In this context, it is clear that looking for third factors not only constitutes a way to reduce the role of UG's genetic burden (Lorenzo 2006; Lohndal & Uriagereka 2017; Piattelli-Palmarini & Vitiello 2017) but also automatically implies the assumption that most properties attributed to MHL can be seen as epiphenomena, an idea that has recently been assumed by current perspectives on the nature of parameter emergence (Newmeyer 2017).

However, the interactional perspective must be formally described, empirically justified and biologically compatible with the computational theory of grammar assumed. In this context, the interactional scenario defended by Roberts (2012) and his colleagues (see Holmberg & Roberts 2014; Biberauer et al. 2014; Biberauer & Roberts 2016; and Huang & Roberts 2017, among others) seems to unify all these adequacy aspects, adding, in turn, the notions of macro- and micro-parameters discussed in early works on parametric clusters and typological description (*cf.* Baker 2001; Kayne 2005). Roberts's emergentist approach thus corresponds to the epigenetic scenarios assumed in developmental contexts, where a strict one-to-one relation assumed between the genetic endowment and the parametric nature of I-languages during the GB era completely disappears from the theoretical explanation. Hence, if the emergence approach is on the right track, the perspective of UG from below is strengthened (Huang & Roberts 2017).

Nevertheless, there are some empirical and theoretical aspects that must be rethought. For instance, in keeping with Roberts' proposal, the interaction of the three factors in language design has a universal character. It is assumed that the interaction is a general condition for all parameters (Roberts 2012). However, the interactional scenario assumed by Roberts (2012) and his colleagues (especially Holmberg & Roberts 2014; Biberauer & Roberts 2015a, 2015b; and Huang & Roberts 2017, among many others) does not seem to encompass the emergence of all kinds of parameters. As I will show and discuss in the next chapter, there is evidence that certain kinds of parameter hierarchies emerge as a consequence of a more complex scenario, revealing

that the interaction of the three factors of language design is a necessary but insufficient condition concerning certain kinds of parameters. In other words, empirically speaking, the emergence of parameters is not subject to the interaction of the three factors exclusively.

Indeed, as Navarro et al. (2017) have shown, the rise of the object clitic doubling phenomenon correlates with both the grammaticalization path of the clitic item and the parametric specifications reached by the VM-parameter (see also Fischer et al. 2019). This means that the scenario for the emergence of the object CLD-parameter will only be available once the clitic category reaches a specific grammatical status (see Fischer & Rinke 2013) and the verb movement parameter attains a specific degree of complexity within its hierarchical structure. According to this evidence, the existence of a parameter typology seems to be empirically justified.

The question is, however, how to justify a theoretical explanation for a new parameter taxonomy. Taking into account the epigenetic approach to biological emergence, I will argue (contrary to Roberts' assumption) that the set of factors involved in the emergence of all parameters is not unique. By contrast, I will suggest two main kinds of parameters: on the one hand, those parameters that emerge as a specific set of UG properties subject to core aspects of the computational system —as is the case of FFs for verb movement— and interacting with the second and the third factors; and, on the other, parameters that can only emerge when pre-specified properties in the I-language and, hence, not exclusive to UG, interact together with a set of diverse (formal, semantic and pragmatic) features, consequently affecting diverse interface areas of the grammar component. Accordingly, Roberts' emergence approach, which focuses on the underspecification of FFs of UG exclusively, excludes numerous other parameters. That is, regardless of their typological relevancy or not, such parameters would however be part of the attested linguistic diversity and, therefore, they cannot be excluded from parametric theory.

In addition, according to Biberauer and Roberts (2012) (see also Roberts 2012, 2016), many macro-parameters like head-movement, analyticity, polysynthesis, verb movement or A'-movement, free word order, scrambling,

Wh-movement, etc. are, for said authors, part of the same hierarchy! That is, the hierarchies they proposed are descriptively very close to an implicational network *à la* Baker. Moreover, all these parameters affect core aspects of grammar (i.e., the underspecification of FFs is the crucial factor in the interactional scenario for their emergence). That is, they are all potentially macro-parameters of their own hierarchy. Hence, why do they appear as macro-parametric specifications in lower positions of one "major" hierarchy? Roberts's global picture does not only show a cluster-like organization from macro- to micro-parameters but also from macro- to macro-specifications, in that it is a contradiction from a descriptive point of view. In this context, the theoretical justification of the macro- and micro-parametric description fails. Sometimes, macro-parameters emerge as part of macro-specification branching and sometimes from micro-specification branching!

By contrast, the taxonomy proposed in the next chapter is, as I will show, theoretically justified, since it unifies the emergence approach: firstly, I maintain the macro- and micro-specifications but only as properties of each parameter hierarchy. In other words, it is impossible to be a macro-parameter of any kind and, at the same time, part of the lower branching of another parameter hierarchy. This means that parameter hierarchies are all independent from each other, an aspect that, as we will see, is common to emergent properties. Secondly, parameter hierarchies can establish a relation between other hierarchies, but such relations are justified by the emergent scenarios instead of an implicational network between different macro-parameters. In other words, the relation between different parameter hierarchies is determined by the epigenetic scenarios and not implicational networks. that is, according to the taxonomy that I will propose in the next chapter.

3.3. SUMMARY

The aim of this chapter was to redefine the nature of parameters from a biolinguistic perspective. To this end, I first explored the parametric theory of linguistic diversity. Thus, I addressed the hierarchical conception of parametric structures, which is one of the successful attempts of principles and parameters theory to capture the implicational relation between different

typological properties of linguistic diversity. In this context, I discussed two descriptive perspectives: on the one hand, the macro-parameter approach, which focuses on the typological distribution of languages, and, on the other, the fine-grained description that arises from the micro-parameter concept.

As seen, both approaches present two important problems. The macro- and micro-parameter notion does not work very well in terms of a typological description. That is, despite the fact that many languages are typologically related with respect to some parameters, not all implicational specifications are present in all languages. Furthermore, from a minimalist point of view, both traditional notions of macro- and micro-parameters may capture some clustering effects but they do not solve the biolinguistic problem of linguistic diversity. Both approaches maintain an overspecified UG.

Accordingly, I returned to the discussion on MHL's epigenetic approach addressed in Chapter 2 and explored the current emergent theory of parameters. Thus, I focused on Roberts' and his colleagues' parametric theory, who, based on Chomsky's three factors of language design, provided a biolinguistic approach to the emergent nature of parameters. As shown, these authors assume that parameters are hierarchical structures, which are emergent properties of the interaction of Chomsky's factors. They focus, thus, on two central aspects: a set of underspecified FFs in UG and a set of learning strategies. As demonstrated, these factors, together with the linguistic experience, interact in order to give rise to parameter hierarchies, whose internal structures are also subject to the notions of macro- and micro-parameters. However, both descriptive notions are theoretically justified by the complexity of the hierarchy itself.

Even though Roberts's emergent approach opens a way to think about parameters as emergent MHL properties —maintaining, thus, a bottom-up approach of UG—, I have briefly described some empirical and theoretical problems that must be resolved in order to capture the parametric nature of linguistic diversity as a whole. In this sense, and according to new empirical data, the aim of the next chapter is to redefine the interactional nature of parameter emergence, which will also allow me to propose a new perspective on the parametric theory of MHL.

4. INTERACTIONAL SCENARIOS AND PARAMETER TAXONOMY

The theory of parameter emergence addressed in Chapter 3 represents a strong biolinguistic approach to resolve the problem of linguistic diversity discussed so far. Specifically, since parameters are a consequence of the interaction between different design factors, the conception of UG as a structured and, therefore, parametrized component disappears. In other words, assuming strict minimalist and evolutionary constraints, an interactional approach to parameter emergence rejects the mapping hypothesis —i.e., from genetic information to I-languages— as a unique explanation for language design. This implies not only in terms of modern developmental biology and the SMT but also with respect to evolutionary biology and MHL evolution.

In this context, I have addressed the theory of parameter emergence proposed by Roberts (2012) and his colleagues (especially, Holmberg & Roberts 2014; Biberauer & Roberts 2015a, 2015b; and Huang & Roberts 2017, among many others) who suggest an interactional scenario based on Chomsky's three factors of language design, that is, a set of factors which are epigenetically constrained. In addition, these authors also propose that each parameter is

hierarchically organized from macro- to micro-parameters, assuming, thus, that the interaction of Chomsky's factors not only constrains their emergence but also their internal organization. From this point of view, macro- and micro-specifications can also be captured in terms of developmental properties, covering the attested linguistic diversity.

However, as suggested, the set of factors said authors propose does not seem to capture the emergence of all kinds of parameters. As we will see in this chapter, the interactional scenarios defined by a set of factors are not always unique. In this light, we can argue that the properties involved in the emergence scenario also determine different kinds of parameters. Thus, there is evidence showing that some interactional scenarios are defined by a more complex set of factors than those proposed by Roberts and his colleagues. For instance, in keeping with Navarro et al. (2017) and Fischer et al. (2019), the emergence of the clitic doubling phenomenon in Romance languages suggests that two main aspects have to be involved in the interactional scenario: the grammaticalization path of the clitic item and the parametric specifications reached by the VM-parameter. In other words, the scenario for the emergence of the object CLD-parameter is only possible once the clitic category reaches a specific grammatical status (see Fischer & Rinke 2013) and the VM-parameter attains a specific complexity degree within its hierarchical structure.

From this perspective, two empirical aspects have to be investigated: since the nature of parametric emergence remains subject to different interactional scenarios, the question is to define the kind of conditions that should interact to set certain grammatical specifications in an I-language. As I will argue, the answer to this question is related to the nature of parameters itself. Specifically, I propose that the interactional scenario is able to define two different kinds of parameter hierarchies: on the one hand, there are parameters which are accessible to all possible languages and whose emergence depends exclusively on the interaction of the three factors in language design. On the other, there are other kinds of parameters whose settings depend on how specified the former parameters and the accessibility to particular lexical items are. In both cases, however, the emergence of parameters is not subject to any genetic specification, maintaining the idea of an underspecified UG.

As we will see in this chapter, the empirical evidence suggested by current data leads us to conclude that the three factors proposed by Roberts and his colleagues are a necessary but insufficient condition for the emergence of certain kinds of parameters. In other words, the interactional scenario giving rise to parameters is not the same for all of them. This first conclusion allows us to suggest two important aspects. Firstly, there are different kinds of parameters, and, secondly, their nature can be defined by the components involved within the scenarios that give rise to the parameters themselves. In this sense, the aim of this chapter is to determine those factors and conditions that, interacting with each other, constitute different scenarios for the emergence of different kinds of parameters. Therefore, and following the evidence provided by clitic doubling constructions in Romance languages, I will argue that it is possible to define a novel parameter taxonomy: on the one hand, parameters that are subject to the interaction of Roberts's three factors exclusively (such as the VM-parameter) and, on the other, those parameters, whose emergence is subject to additional conditions, including the pre-specification of the former and the availability of specific categories in the lexicon (as the emergence of the CLD-parameter shows). Moreover, I will argue that only those parameters which emerge as a consequence of the interaction of the three factors of language design are able to adopt a "master" function with respect to the emergence of others. Specifically, I will claim that certain kinds of parameters are characterized by adopting a 'pleiotropic function', a term coined by Williams (1957) in the context of epigenetics to refer to master genes driving the development process of more than one phenotype (see Biberauer & Roberts 2016 for an initial approach). This functional characterization and the nature of the factors involved in their emergence constitute the main distinction with respect to other parameters.

This chapter, then, will address the nature and emergence conditions of these two types of parameters. To this end, in section 4.1, I will discuss the configurational nature of the clitic doubling constructions, focusing on the more important grammatical approaches that address its extreme complexity. In section 4.2, I will examine the variational distribution of such constructions in Romance languages, showing that its variability across languages could be better tackled by assuming a CLD-parameter hierarchy. In section 4.3, I will

discuss new data on the cyclic development of clitic doubling, arguing that its distribution and emergence conditions constitute a complex scenario that goes beyond the grammatical status of the clitic category itself, namely, the verb movement specifications that a particular grammar possesses. In this sense, I will discuss the details of the cyclic pattern of clitic doubling, focusing on the grammaticalization path of the clitics and the VM-parameter (section 4.3.1). Specifically, as I will suggest, verb movement specifications have not only direct effects on the distribution of the objects involved in clitic doubling constructions but also on their semantic and pragmatic interpretations. In this sense, due to the fact that the setting changes along the VM-parameter, specific structural information of the objects is no longer interpretable at A'-positions. Hence, clitic doubling constructions emerge to recover the loss of this information. Accordingly, I will argue that the emergence conditions of the CLD-parameter constitute an interactional scenario, whose nature seems to be different with respect to the VM-parameter itself (section 4.3.2). In section 4.4, I will connect the discussion in previous sections with the emergence theory of parameters discussed in Chapter 3. Thus, I will present a new parameter taxonomy which will be defined by the specific factors that interact together and their functions in the whole system. In section 4.5, I will present a summary of the present chapter.

4.1. THE CLITIC DOUBLING CONFIGURATION

Object clitic doubling constructions (henceforth CLD) are characterized by the duplication of grammatical and semantic information through two different syntactic objects: a clitic pronoun and an associated DP complement in the A-position.

However, although both elements form a discontinuous constituent, the main property of CLD is that these categories share the same grammatical and semantic functions in the same sentence (Jaeggli 1986: 32).[51]

[51] In this sense, they are structurally different with respect to other kinds of duplications, where the clitic is also associated with a DP but in the A'-position. Note that CLD is different from clitic left and right dislocation because the latter necessarily involve a prosodic cue (cf. Jaeggli 1986), whereas this does not need to be the case in CLD (cf. Aoun 1981). Furthermore, clitic left and right dislocations allow for a wide and narrow scope (Torregrossa p.c.), whereas CLD only allows for a wide scope

(27) **Object Clitic Doubling**

… $Cl^{i}_{[\phi, K]}$ … $DP^{i}_{[\phi, K]}$…

In (27), the clitic category doubles the featural information associated with the DP complement in an A-position. This aspect is thus represented by the agreement *φ*-features and the case specification contained in both co-indexed objects.

Cross-linguistically, languages with the pattern represented in (27) share that this pattern is specified in their lexicon with pronominal object clitics of the kind called "special clitics" (see Zwicky 1977, 1985).[52] It is therefore to be expected that those languages that are not specified with this kind of clitics, shall not generate CLD constructions at all (e.g., in English: *__her__ I loved her) (*see* Cardinaletti 1999; Cardinaletti & Starke 1999). Nonetheless, as we will see in section 4.2. below, the availability of clitics in the lexicon is not a sufficient condition to allow for CLD automatically. On the contrary, the distribution and behavior of CLD draw an intricate mosaic, whose structural legitimation seems to be subject to the interaction of different grammar components.

From a typological point of view, the main pattern represented in (27) is common in Hebrew (Borer 1984), in Bulgarian (Franks & King 2000), in Macedonian (Franks & King 2000), in Albanian (Kallulli 2000) and in Greek (Anagnostopoulou 1994), being very widespread in Romance languages, especially in Spanish (Jaeggli 1982; Suñer 1984; Torrego 1994; Uriagereka 1995; Bleam 1999; among many others), in Romanian (Dobrovie-Sorin 1990) and in Catalan (Fischer 2002). The following examples of Spanish should be help to depict the micro-variational complexity reached by some varieties:

interpretation. For a review of the difference between both constructions, see Anagnostopoulos (2006).

[52] Special clitics, despite their reduced phonological weight, have a "special syntax", generally characterized by not bearing a unique placement and order (Spencer & Lluís 2013: 26). Along this chapter, I will refer as clitics to 'special clitics'. If is necessary, I will specify the kind of category.

(28) **Indirect object CLD**

a. **Le** propuse un truco a él.[53] (Sp)[54]
Cl3sg.DAT I proposed a trick to him
'I proposed a trick to him.'

b. (**Le**) propuse un truco a Lucio. (Sp)
Cl3sg.DAT I proposed a trick to Lucio
'I proposed a trick to L.'

c. **Le** propuse un truco a Lucio. (Arg.Sp)[55]
Cl3sg.DAT I proposed a trick to Lucio

(29) **Direct object CLD**

a. **Lo** propuse a él como candidato. (Sp)
Cl3sg.ACC I proposed to him as candidate
'I proposed him as candidate.'

b. *__Lo__ propuse a Emilio/ al muchaho como candidato. (Sp)
Cl3sg.ACC I proposed to Emilio/the boy as candidate
'I proposed him as candidate.'

c. **Lo** propuse a Emilio/al muchaho como candidato. (Arg.Sp)
Cl3sg.ACC I proposed to Emilio/to-the boy as candidate
'I proposed him as candidate.'

Examples (28) and (29) show some interesting differences between intralinguistic varieties. Firstly, if the doubled object is a pronominal DP, CLD is obligatory in all Spanish varieties, regardless of the syntactic function of the complement (28a and 29a). However, if the DP object is not headed by a pronominal category, that is, a full DP, the legitimation of the CLD construction seems to be subject to the syntactic function of the DP itself. Accordingly, indirect object CLD is optional in Standard Spanish (28b)[56] though the most accepted pattern in Argentinian Spanish (28c) (Di Tullio & Zdrojewski 2006; Schroten 2010).[57] Regarding direct object CLD, whereas

[53] The clitic pronouns will be remarked in black-bold and the associated DP will be underlined.
[54] I will simply refer to 'Standard Spanish' as Spanish.
[55] In Argentinian Spanish, I consider that the CLD phenomenon is distributed differently in various areas of Argentina, e.g., the *Rioplatense* region, Córdoba, Patagonia, etc. If necessary for my arguments, I will refer to each region specifically, e.g., *Rioplatense*, *Cordoba* Spanish, Patagonian Spanish, etc.). Otherwise, I will assume that there is no variation in the configuration represented and will hence specify examples as "Arg.Sp".
[56] While it is traditionally assumed that only DP arguments with experiencer, benefactor or possessive theta roles are obligingly doubled, Fischer et al. (2019) suggest that thematic roles marked with the features [+animate; +def; +spec] are more readily doubled than others (2019:58).
[57] See also Dufter & Stark (2008) for Modern Peninsular Spanish and Nishida (2012) for standard Mexican varieties.

Standard Spanish rejects doubling proper nouns and full DPs (29b),[58] Argentinian Spanish seems to legitimize such configurations if the corresponding full DPs are specific and animate entities (see Silvia Corvalán 1981; Jaeggli 1982; Suñer 1988).[59]

Scholars have explained the nature of CLD constructions and their distributional conditions in different ways. Focusing on their syntactic and/or semantic properties, the theoretical success of the proposed analyses has been strongly conditioned by cross-linguistic data, as well as by different diachronic investigations (see Anagnostopoulou 2006 and Fischer & Rinke 2013 for reviews on these perspectives).

4.1.1. BASE-GENERATION VS. CL-MOVEMENT ANALYSES

From a formal point of view, the heterogeneous nature of clitics requires an analysis that involves different grammatical levels and their corresponding interfaces (cf. Perlmutter 1971; Zwicky 1977, 1995; Klavans 1982, 1985; Anderson 1992, 2005; Lluís & Spencer 2012). For instance, Zwicky (1995) pointed out that "[Clitics are] bound elements which in their phonological behavior, resemble inflectional affixes, but in their grammatical function resemble independent words" (Zwicky 1995: 269).

Within the GB framework, for instance, a part of the debate on clitics has concentrated on their status within X-bar Theory and the syntactic mechanism responsible for their derivation. The fact that they behave like words and affixes at the same time has led them to be analyzed as XP (Kayne 1975), and an X-head (Aoun 1981; Borer 1984) or even as elements at an intermediate X′ level (Jaeggli 1982).

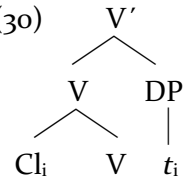
Following the fact that clitics saturate the argument requirement of verbs and that, in some systems, they seem to have a complementary distribution

[58] For explanatory reasons, I will avoid details about certain acceptability values in Standard Spanish attributed in the literature for doubling constructions of proper nouns (e.g., Belloro 2012). The discussion of such details can be reduced to the concept of 'standard' itself, which becomes empirically weak in certain linguistic areas.

[59] I assume, however, that different variants in Argentina have fewer restrictions by doubling direct Full DPs. For the moment, I will set aside the details of the restrictions that affect CLD in Argentinian Spanish (cf. Di Tullio & Zdrowjeski 2006) and other Spanish varieties in the Americas (cf. Zdrowjeski & Sánchez 2014).

with respect to a DP, some authors argue that clitics are free morphemes, subject to a movement operation applied to the canonical position where they are generated (*cf.* Kayne 1975, 1989, 1991; Quícoli 1980; and Madeira 1993, among others). In other words, the Clitic-movement Hypothesis argues that clitics are syntactic units (i.e., free morphemes), generated at the base of the canonical object position. Due to their phonologically weak nature, they later move to an adjoined position in the host-verb (Kayne 1975, 1989, 1991; Quícoli 1982). Thus, Kayne (1975) suggests the following configuration, where the clitic moves and attaches to the right or left of the V:

(30)



This analysis can account for the distribution of clitics with respect to the DP in a simple way:

(31) a. Vi $_{DP}$[los coches]. (Sp)
I saw the cars
'I saw the cars.'

b. Los$_i$ vi $_{DP}$[t$_i$].
Cl3pl.ACC I saw
'I saw them.'

c. *Los$_i$ vi $_{DP}$[los coches]$_i$.

In (31b), the clitic surface position is the outcome of applying a clitic-movement at the canonical position.[60] In this position, the clitic receives its θ-role and Case from the verb. Nonetheless, assuming that clitics are adjoined to V (or to the head of a functional category associated to the TP-domain), such a displacement would be restricted to an X-to-X movement. Evidence of clitic climbing suggests, however, that clitics can transcend sentence boundaries, allowing for the possibility that they undergo XP-movement.

(32) a. Lo$_i$ tengo que empezar a poder entender-t_i. (Sp)
Cl3sg.ACC I must Rel.pro to start to be able to understand-t_i

[60] A central assumption in this analysis is that the combination of [CL + X°] constitutes a syntactic atom, allowing us to characterize clitics as syntactic and morphological units.

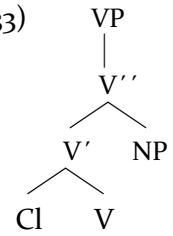
'I have to be able to understand it.' (Ordóñez 2012a: 434)

b. Tengo que empezar-lo$_i$ a poder[-t_i] entender[-t_i]
I must Rel.pro to start-[Cl3sg.ACC] to be able-t_i to understand-t_i
'I must be able to start to understand it.' (Ordóñez 2012b: 110)

The Clitic-movement Hypothesis seems to be reduced to determine whether this displacement corresponds to an XP-movement or X-movement (see Sportiche 1998: Ch.4).

The main theoretical challenge for the movement account for clitics is represented by CLD constructions. Indeed, as seen in (27), assuming that clitics are generated first in the canonical theta-marked position, we are forced to explain the co-occurrence of a full DP in the same clause in accordance with the Theta-criterion and the Case-filter. In line with Strozer's (1976) work on clitics doubling in Spanish (see also Rivas 1977), for instance, many authors have proposed a base-generation analysis for clitics. This analysis assumes that clitics are bound morphemes, therefore generated *in situ* at the surface position, that is, directly adjoined to the verb (see Jaeggli 1982, 1986; and Borer 1984, among others). In this view, clitics are agreement markers with respect to the doubled DP and they do not undergo movement from a canonical argument position (see also Jaeggli 1982, 1986; Borer 1984; and Suñer 1988, among others). According to Jaeggli (1982), for example, CLD constructions assume the following configuration:

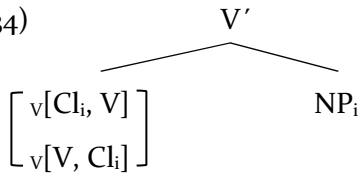
(33)



Configurationally, (33) assumes that the clitic receives Case and its θ-role, but it cannot *c*-command the position within which the NP is generated. A possible solution would be to include a special mechanism into the grammar, stipulating the co-indexation of the Cl and the NP. To avoid this, according to the Projection Principle, Borer (1984) suggested that providing the grammar with external mechanisms allowing for the co-reference between both elements is not necessary. For Borer, clitics are generated as part of V, so that

the resulting complex unit is in line with the *c*-command requirements:

(34)



In (34), the clitic and host-verb constitute a category at the same level of the NP, thus allowing the clitic and the NP to share the same Case and θ-role.

In Romance languages, however, the general property that seems to regulate the legitimization of CLD seems to be that such constructions are only licensed by an additional "special" preposition with Case assigner properties. Jaeggli (1982) referred to this condition as Kayne's Generalization (1982: 20): assuming that clitics "absorb" the Case value assigned by V, only DP objects preceded by such "special" prepositions can be doubled without violating the Case-filter.

For instance, the doubling of accusative full DPs would be possible in certain varieties of Spanish because of the availability of the "a" category (35). By contrast, in French and Italian, where no special prepositions exist, accusative CLD configurations are ruled out with full DPs (e.g., in French **je le vois Jean/*je le vois a Jean/je vois Jean*). Furthermore, with respect to the attested micro-variation in Spanish, Jaeggli stipulates that, in *Rioplatense* Spanish, for example, the accusative full DPs can be doubled due to the preposition "a", which possesses a Case-assignment property. Contrarily, this cannot occur in Standard Spanish, and, consequently, accusative CLD of full DPs are disallowed:

(35) a. **Lo** vi a Lucio. (Rioplatense Sp.)
Cl3sg.ACC I saw to.ACC Lucio
'I saw Lucio.'

b. ***Lo** vi el muchacho.
Cl3sg.ACC I saw the boy
'I saw the boy.'

(36) a. ***Lo** vi a Lucio/al muchacho. (Sp)
Cl3sg.ACC I saw to Lucio/the boy
'I saw Lucio/the boy.'

b. Vi a Lucio/al muchacho.
I saw to Lucio/to.ACC-the boy
'I saw Lucio/the boy.'

In the case of dative CLD where the indirect object DP is always preceded by the preposition *a* in Spanish, French and Italian, Jaeggli (1982) explained that the latter disallowed CLD constructions by assuming that the preposition *a* in these languages was not a Case-assignment category but a Case-marker for dative. Borer (1984) extended the hypothesis on Kayne's Generalization of direct object doubling to include the prepositions *šel* in Hebrew and *pe* in Romanian. Borer's assumption considers that clitics can be elements spelling out Case features of the heads to which they are attached. In this sense, Borer was the first author to suggest that clitics are agreement markers (for discussions, see Anagnostopoulou 2006).

Jaeggli's (1982) proposal suggests, thus, that different specifications for such "special" prepositions could explain the behavior of CLD in Romance varieties, thus constituting a first attempt to capture the distribution of CLD constructions in parametric terms.

Nevertheless, cross-linguistic evidence revealed very early on that Kayne's Generalisation is not enforced in all varieties. Indeed, Suñer's (1988) discussion of Porteño Spanish data[61] showed that CLD in this variety is not subject to the presence of a special "a" preposition but to different semantic constraints associated to the specificity of the doubled DP:

(37) a. [+spec, +anim, +def] (Rioplatense Sp)
La oían a Paca/la niña/la gata.
Cl3sg.ACC they heard to.ACC Paca/the girl/ the cat
'They heard Paca/the girl/the cat.' (Suñer 1988: 396)

b. [+spec, +anim, -def]
La escuchaba a una mujer
Cl3sg.ACC she/he listened to.ACC a woman

[61] Most arguments in Suñer's paper are based on the Spanish variety spoken in Buenos Aires (i.e., Porteño Spanish). However, works on this topic extend the data to Rioplatense Spanish, a wider area that traditionally includes many variants (Donni De Mirande 1996: 209). Nonetheless, with the exception of Berrenechea and Orecchia (1977) and Suñer (1988), it is not clear for me on which specific data these works are based. In the present work, I will maintain the extended terminology, i.e., Rioplatense Spanish, for the variants on both banks of the river including other areas of Argentina, Uruguay and Paraguay (cf. Di Tullio & Zdrojweski 2006).

que cantaba tangos.
who sang tangos
'She/he listened a woman who sang tangos.' (Suñer 1988: 396)

c. [-spec, +anim, +def]
*__Lo__ alabarán al niño que termine primero.
Cl3sg.ACC they will praise to.ACC-the boy who finishes first
'They will praise the boy who finishes first.' (Suñer 1988: 396)

d. [-spec, +anim, -def]
*No **lo** oyeron a ningún ladrón.
Not Cl3sg.ACC they heard to.ACC any thief
'They didn't hear any thief.' (Suñer 1988: 396)

Suñer also provided evidence that accusative CLD in Rioplatense Spanish is not necessarily preceded systematically by the special "a" preposition, as this would suggest two things: (i) the special preposition is not a Case-assignment category but a marker of animacy (37); and (ii) the presence of "a" is not an absolute condition to allow CLD in Rioplatense, explaining why inanimate DPs can also be doubled in this variety (38).

(38) a. Yo **la** tenía prevista esta muerte. (Rioplatense Sp)
I Cl3sg.ACC had foreseen this death.
'I had foreseen this death.' (Suñer 1988: 399)

b. Yo **lo** voy a comprar el diario
I Cl3sg.ACC am going to buy the newspaper
justo antes de subir.
just before coming up
'I am going to buy the newspaper just before coming up.'
(Suñer 1988: 400)

Furthermore, assuming that clitics are agreement markers affixed to the verb, Suñer proposed that they were not only already specified with ϕ-feature in the lexicon but also with the [±specificity] feature.[62]

According to these ideas, the different behavior of dative and accusative clitics would be the result of the fact that the latter seem to be inherently specified as [+specific]. This would explain why CLD of accusative objects are

[62] Suñer (1988) proposed the primacy of specificity over definiteness. This hierarchy is based on her data about the grammatical acceptance of CLD with accusative objects specified as [–definite, +specific] vs. the rejection of CLD with accusative objects that are [–specific, +definite]. However, for critiques based on *Rioplatense* Spanish, see Di Tullio & Zdrowjeski 2006: 26-27). For general discussions on this semantic hierarchy, see Leonetti (2007).

more restrictive in Standard Spanish (37-38) than CLD of dative objects (39).

(39) a. [+spec, +human, +def] (Sp)
Le ofrecí ayuda a la niña/a una estudiante.
Cl3sg.DAT I offered help to the girl/to a student
'I offered help to the girl/a student.' (Suñer 1988: 394)

b. [-spec, +human, -def]
Les ofrecieron queso
Cl3pl.DAT they offered cheese
y leche a familias de pocos medios.
and milk to families of low-income
'They offered cheese and milk to low-income families.' (Suñer 1988: 395)

c. [-spec, +human, +def]
Le dejaré todo mi dinero a los pobres.
Cl3sg.DAT I will leave all my money to the poor
'I will leave all my money to the poor.' (Suñer 1988: 395)

From this point of view, CLD constructions are subject to featural agreement between the clitic marker and the doubled DP. Therefore, if the co-reference direct object DP is marked with a [–specific] feature, the CLD configuration will then be ruled out (e.g., in Rioplatense Spanish **Lo vi un coche* 'I saw a car' vs. ***Lo*** *vi el auto*).[63]

In keeping with Suñer's hypothesis, clitics have a morphological status and, because they are not syntactic units, they will not be subject to the Case-filter and/or the Theta-criterion. In this sense, the standard mechanisms (e.g., the Projection Principle) regulate the configuration of CLD. Thus, the Projection Principle, for example, guarantees that either a phonetic element or the empty category *pro* appears at the object argument position, while the Case-filter and the Theta-criterion assign them Case and the required thematic role (*cf.* Kayne 1989, 1991; Emonds 1999).

4.1.2. COMBINED APPROACHES

The central assumption in the base-generation analysis is that the [CLITIC + V] compound (i.e., a single lexical unit) originates in the lexicon and, as such, cannot undergo movement. However, it should be noted that, as indicated in

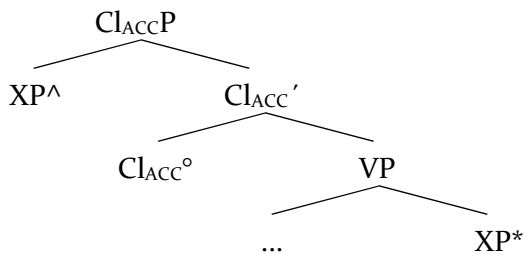
[63] Suñer (1988) referred to this constraint as the Matching Principle (1988: 393). Some consequences of this approach are reviewed by several scholars: see Fernández Soriano (1993) and Franco (1993).

(32), clitics can move away from the host verb. As a result of this paradox, some scholars have argued that it would be possible to propose a combination of both the Cl-movement and the base-generation approaches (Sportiche 1996, 1998; Uriagereka 1988, 1995; Torrego 1988, 1998; and Belletti 1999, among others).

According to the Bare Phrase Structure Theory (Chomsky 1995), certain grammatical items can be simultaneously minimal (heads) and maximal (phrases) categories of the form $X^{min/max}$ (Chomsky 1995: 249). In these terms, clitics could be considered an XP generated in an A-position, involving an X-movement when the clitic is syntactically adjoined to T-head (see Sportiche 1996; and Uriagereka 1995, among others).

Assuming the growing idea of functional projections (Shlonsky 2010), Sportiche (1996, 1998) rejected the assumption that cliticization involves displacement of the clitic (i.e., Cl-movement) (1998: 264), proposing instead that clitics are functional heads of their own projection in the TP-domain. He referred to such a projection as *Clitic Voice* which would be linked to Case and, in turn, associated to nominative, accusative, dative, etc. In Sportiche's proposal, the Cl-DP relation is subject to the general assumption that agreement is always a spec-head relation (Sportiche 1998: 265). Therefore, cliticization is related to XP-movement because this would be required by spec-head licensing, thus involving a doubled DP in CLD constructions or an object *pro* in simple cliticization. Sportiche's configuration for accusative clitics could be represented as follows (adapted from Anagnostopoulou 1999: 779):

(40)



The XP* argument phrase in (40) has a dependent relation with the Cl_{ACC}°. When the XP* is doubled, it undergoes XP-movement to the spec-position of the Cl-domain (i.e., XP* moves to XP^). This movement is possible at some point of the derivation through overt or covert syntax (i.e., at the LF). CLD

differs from simple cliticization in that the XP* is overt in the former and covert in the latter. To explain the trigger for XP-movement, Sportiche proposed the following constraint:

(41) **Clitic Criterion** (Sportiche 1996: 236):
At LF,
(i) A clitic must be in a spec-head relationship with a [+F] XP at LF.
(ii)A [+F] XP must be in a spec-head relationship with a clitic at LF.

Taking into account this filter, clitics license a particular property or feature [+F] in XPs (41 (i)). This property can only be licensed at LF in an appropriate agreement relationship (criterion (ii)). In this sense, the agreement relationship spec-head can be expressed by Case, number, gender and person agreement (at least in most Romance languages). Thus, if a clitic is related to an XP*, this XP* will move in order to satisfy the Clitic Criterion (Sportiche 1996: 27).[64] Finally, the configuration in (40) and the Clitic Criterion (41) allows the formulation of the following parameters:

(42) **Clitic construction parameters** (Sportiche 1996: 237):
a. Movement of XP* to XP^ occurs overtly or covertly.
b. Head is overt or covert.
c. XP* is overt or covert.

If we assume that these parameters are independent, we can predict the following configurations for Romance languages:

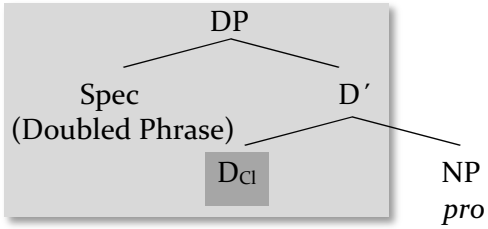
(43) **Configurational possibilities** (Sportiche 1996: 237):
a. A covert XP* moving overtly or covertly to XP^ with Head overt gives rise to undoubled clitic constructions (e.g., in French or Italian).
b. An overt XP* moving covertly with Head overt gives rise to CLD constructions (e.g., in Spanish or Romanian).

In keeping with the combined analysis, Uriagereka (1995) argued that CLD constructions possess a configuration like (44) (see also Torrego 1998). Since

[64] Note that Suñer's (1988) proposal assumes that clitics license direct object [+specific], but indirect object clitics are treated as indirect object agreement markers since they do not have specificity effects.

clitics in Spanish can be analyzed as determiners[65], they will project a DP with a doubled element in the spec-position, moving later and leaving the rest of the structure behind, including the doubled phrase of the spec-DP.

(44)



Within Uriagereka's proposal, clitics, like determiners, can be formally specified as strong or weak categories: strong D-heads are characterized by allowing a new DP (i.e., the doubled phrase) at the spec-position. In languages where clitics are weak, doubled material at the spec-position will not be licensed by the D_{Cl}. In addition, Uriagereka (1995) argued for a functional *F* category at the periphery that would be subject to variation. Thus, the distribution of clitic placement variation in Romance languages would then depend on the parametric setting of *F* being active or not in each particular system. The clitic and the verb are hosted within the FP-domain by independent displacement operations (see Roberts 1991): the verb raises to the F-head through X-movement —note that, from this perspective, the verb must be specified in the lexicon with a strong [*F] feature). Finally, Uriagereka argued that the trigger for Cl-movement would be constrained by a principle at the syntactic-pragmatic interface: only the peripheral material of the TP can be interpreted as [+specific] at the Logical Form. Thus, the surfer position that clitics achieve with respect to the verb depends on the characterization of the functional categories, *F* and *D*, and the lexical V in the lexicon.

4.1.3. FRAGMENTED CLITICS AND THEIR STRUCTURES

The fact that the behavior of indirect or direct object is not subject to the same restrictions cross-linguistically suggests that CLD allows for a fragmented analysis of clitics (see Anagnostopoulou 2003, 2006, Marchis & Alexiadou 2013). For instance, Demonte (1994, 1995) showed that ditransitive constructions in Spanish have different syntactic and semantic properties as

[65] As Uriagereka (1995) pointed out, his analysis was based on Postal's (1969) assumption that pronouns can be analyzed as determiners.

dative CLD configurations. For example, in the absence of the dative clitic, a direct object can bind a reflexive indirect object, while a reflexive indirect object cannot bind a direct object:

(45) a. El tratamiento psicoanalítico reintegró a María (Sp)
the therapy psychoanalytic gave-back to.ACC M(DO)
a sí misma.
to herself(IO)
'The psychoanalytic therapy helped Maria to be herself again.'
(Demonte 1994: 451)

b. *El tratamiento psicoanalítico reintegró a sí misma
the therapy psychoanalytic gave-back to.ACC herself(DO)
a María.
to M(IO) (Demonte 1994: 451)

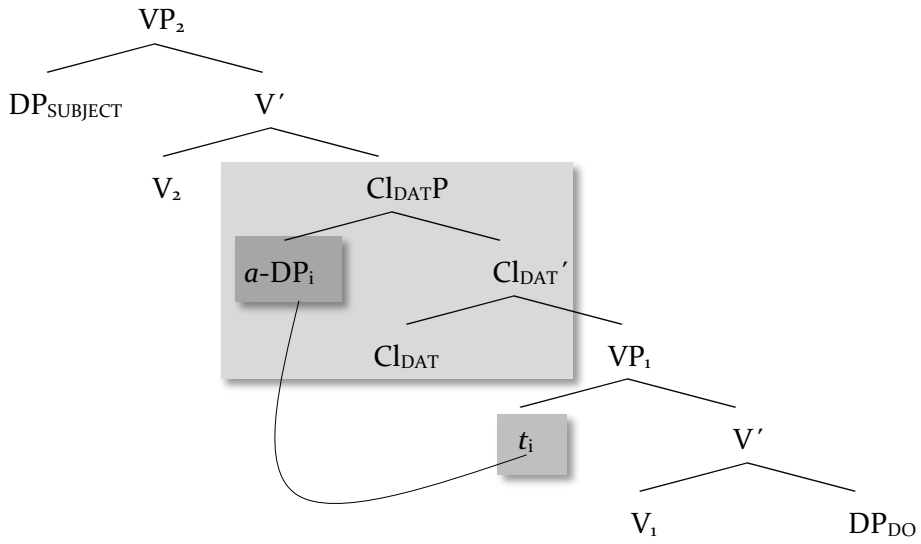
However, when dative clitics are present, indirect objects can bind direct objects, while the inverse is not possible:

(46) a. El tratamiento psicoanalítico **le** devolvió (Sp)
the therapy psychoanalytic Cl3sgDAT gave-back
la autoestima
the self-esteem
de sí misma <u>a la niña</u>.
of herself(DO) to the child(IO)
'The psychoanalytic therapy helped the child to gain back her self-esteem.'
(Demonte 1994: 451)

b. *El tratamiento psicoanalítico **le** devolvió
the therapy psychoanalytic Cl3sg.DAT gave-back
a la niña la autoestima <u>de sí misma</u>.
to.ACC the child(DO) the self-esteem of herself(IO)
(Demonte 1994: 451)

Taking into account these kinds of data, Demonte assumed that the configuration of double objects (Larson 1988) could be extended to dative CLD constructions as follows (adapted from Demonte 1994: 452):

(47)



In this configuration, the dative clitic is heading a dative *Clitic Phrase* ($Cl_{DAT}P$) —following Sportiche's (1996) representation for dative Clitic Voice configurations. Thus, the spec-position in this structure is fulfilled by an indirect object (*a*-DP) which has moved from a base-position, higher than the theme-position (DP_{DO}). In this sense, dative clitics can be subject to the overt or covert properties of the *applicative*-head of doubled constructions (Larson 1988). Such an analysis allows us to conclude that the syntax of dative and accusative doubling cannot be treated uniformly: since direct objects do not manifest alternations like dative-shift, it seems difficult to project the syntax of dative CLD onto accusative CLD (see Anagnostopoulou 2006), which it supports a differentiated treatment of the nature of clitics, and, hence, of the syntactic configurations related to them.

From this point of view, Bleam (1999) argued that dative clitics in Spanish are agreement markers and accusative clitics are determiners (see also Torrego 1988, 1998; Uriagereka 1988, 1995).[66] She focused on the following main facts: (i) the form of direct object clitics in Leísta Spanish (i.e., when the referent is animate, this variant uses the dative clitic form *le* in contrast to Standard Spanish using the accusative form *lo*, e.g., *Le vi* 'I saw him/her' vs. *Lo vi*); (ii) the availability of direct object doubling (i.e., while in all Spanish variants the CLD of direct object pronouns is obligatory, not all varieties allow CLD of a full DP, thus, in Standard Spanish **Lo vi a Lucio* 'I saw Lucio, but in

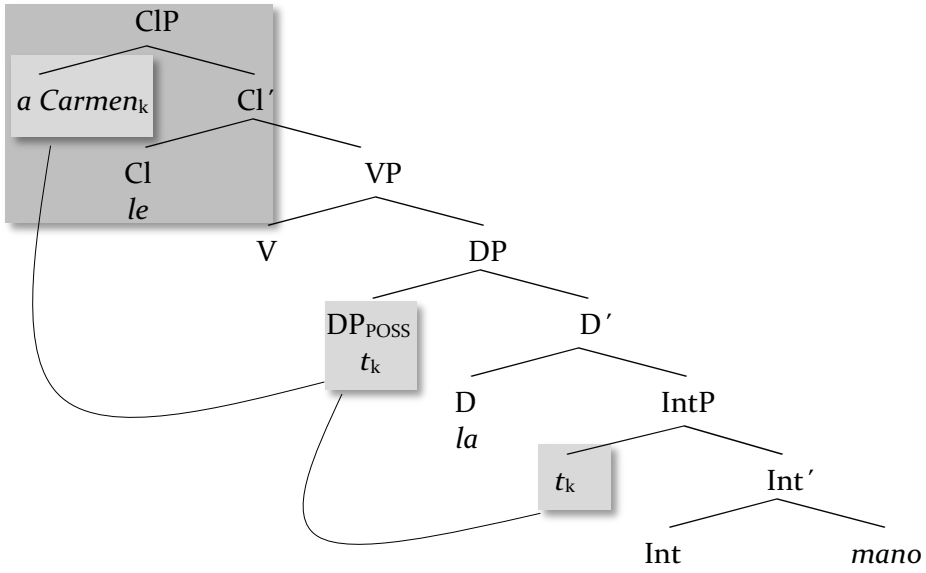
[66] See Anagnostopoulou (2006) for a fragmented approach on CLD in Greek and some contrasts with respect to Spanish variants.

Argentinian Spanish ***Lo*** *vi* <u>*a Lucio*</u>); and (iii) doubling of inanimate direct objects (e.g., while in most varieties of Spanish the doubling of direct objects is limited to animate objects, in Argentinian Spanish this is not the case, e.g., ***La*** llamó <u>*la grúa*</u> nomás 'he called the crane yet'[67]).

Bleam (1999) assumed that accusative clitics have a configuration like (44) above, being D-heads of a complex DP (Uriagereka 1995). However, since "dative clitics do not resemble determiners morphologically" (Bleam 1999: 35), she argued that dative clitics do not have the same configuration as their accusative counterpart. Hence, the lack of specificity in dative clitics is related to the fact that they are not determiners but, rather, agreement makers (*see* Suñer 1988; Sportiche 1996, 1998). Bleam assumed that dative CLD are instances of dative-shift, in which the dative complement moves over the direct object to the specifier of an internal aspect projection (see also Demonte 1995; Ormazábal & Romero 1999). Bleam (1999: Ch.3) adopted the analysis of possessor-raising constructions in Spanish as seen in the sentence, *Le vi la mano a Carmen* 'I saw Carmen's hand', proposed below (Demonte 1994, 1995):

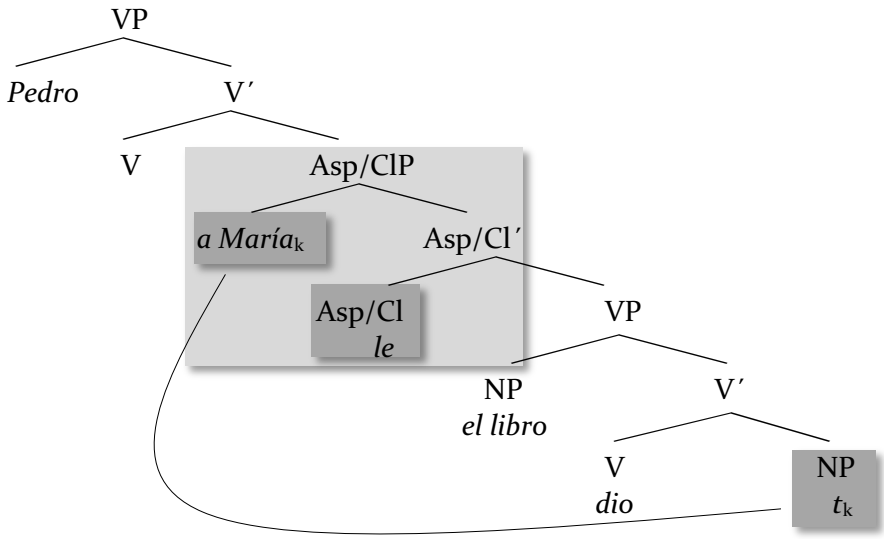
[67] Bleam (1999), based on Schmitt (1996: ch.3), argued that the doubling of inanimate objects without the preposition "a" is limited to *Cordoban* Spanish. To the best of my knowledge, there is no exhaustive documentation on this topic. Even Bleam's work is not based on a corpus at all, and her treatment of this phenomenon refers to a single example of Schmitt's work. As Andrés Saab (p.c.) pointed out, one of the great problems when addressing the accusative CLD of inanimate objects in Argentinian Spanish is the lack of a substantive corpus. I will refer back to this question in the following sections. Taking into account examples like *Lo agarré el mate/al mate* from Patagonian Spanish, I assume that this phenomenon has to be extended to *Rioplatense* Spanish as well. For a discussion on this topic, see Di Tullio *et al*. (2019).

(48)



In such a structure, the possessor (*Carmen*) is generated in the spec-position of an Int(egral)P, moving later to the spec-position of the DP, within which it is associated with the dative marking *a*. From this position, the DP_{POSS} moves to the spec-position of the dative clitic (i.e., in the ClP) to check dative Case and a feature [+A], associated with animacy and affectedness. A dative CLD sentence like *Pedro* ***le*** *dio* *a María* *el libro* 'Pedro gave the book to Maria', would thus have the following configuration:

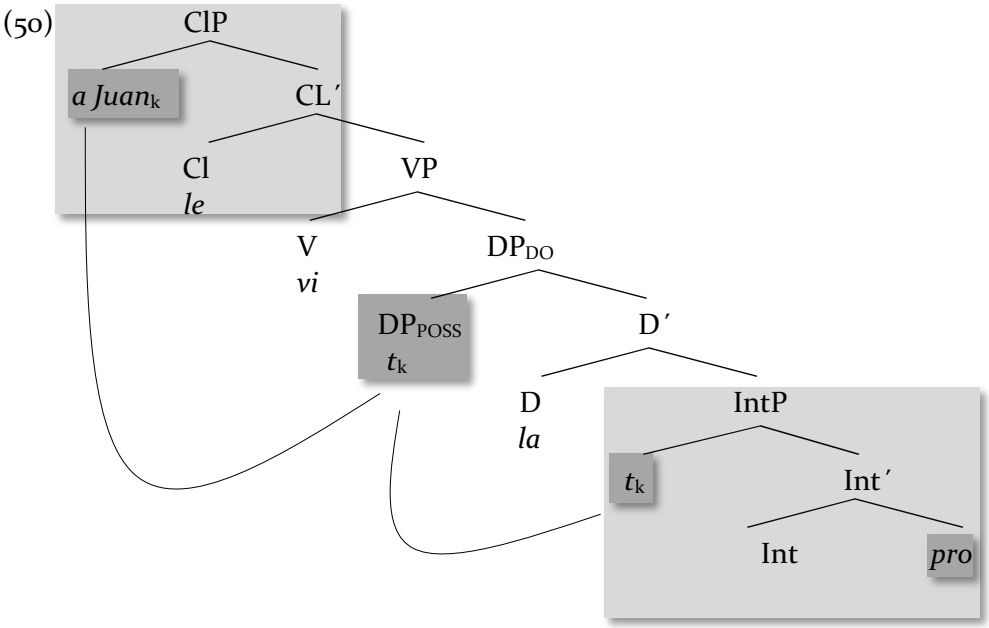
(49)



Finally, for the analysis of CLD of direct objects in Leísta Spanish, Bleam assumed that the doubling configuration is subject to the possessor-raising construction as well, being, in turn, an instance of the integral relation (see Hornstein *et al*. 1994). Thus, the direct object leaves the DP and becomes the

dative argument of V, explaining, hence, the use of the dative clitic form in relation to a direct object (Bleam 1999: 129):

(50)



The analysis proposed by Bleam (1999) shows that it is not possible to maintain a homogenous account for clitics. Instead, their syntax is subject to their fragmented nature (see also Anagnostopoulou 2003): while accusative clitics can be analyzed as determiners, dative clitics must be considered inflections. Therefore, accusative clitics are associated with semantic effects, while dative clitics are associated with syntactic markers. In this sense, the fragmentation of clitics allows identifying *D*-clitics for accusative and ϕ-clitics for dative forms (see Dechaine & Wiltschko 2002; Anagnostopoulou 2003, 2006).

The diversity of analyses reviewed so far shows how complex CLD constructions are.[68] These structures seem to be "resistant" to a uniform analysis, which constitutes, in turn, a great challenge for any explanation of the distributional conditions of CLD and its parametric nature. Because of this complex nature, a diachronic perspective offers reliable data regarding the properties that should constrain both the rise and the development of these constructions. Nonetheless, since most authors have taken for granted that

[68] Furthermore, some aspect of CLD semantics appeals to pragmatic factors or informational structure constraints that also seem to regulate their parametric distribution (see, e.g., Zubizarreta 1998; Leonetti 2007; and Belloro 2007, among others).

CLD constructions became obligatory after the medieval period, few studies have examined the reconstruction of the CLD. Furthermore, since most authors associate the rise of the CLD phenomenon with the categorial status of clitics as a necessary condition, studies dedicated exclusively to the rise of CLD are scant (see, e.g., Gabriel & Rinke 2010 for Spanish; and Fischer & Rinke 2013 for Romance). Even less present is any specific proposal about the emergence nature of the CLD phenomenon (Navarro et al. 2017; Fischer et al. 2019). In this sense, and according to parameter hierarchy discussed in section 2.2., I will address two recent approaches that seem to shed some light on the complex distribution of CLD in Romance languages (Fischer & Rinke 2013) and the factors that seem to constrain the nature of its emergence (Navarro et al. 2017; Fischer et al. 2019).

4.2. TOWARDS A CLD-PARAMETER: EVIDENCE FROM ROMANCE LANGUAGES

In order to explain the development and the distribution of CLD constructions in Romance languages, Fischer and Rinke (2013) defined a parametric perspective that includes many aspects of the grammar that are clearly involved in this phenomenon.

Firstly, they discussed some diachronic data, questioning the fact that many authors have explained the rise of CLD construction by focusing exclusively on the grammaticalization process suffered by the clitics (see, e.g., Rivero 1986; Wanner 1987; Rini 1990; Fontana 1993; Martins 1994). Thus, Fontana (1993) argued, for example, that the rise of CLD in Spanish is related to the loss of the complementary distribution between the clitic and the doubled DP, a loss associated with the reanalysis of clitics from DPs to D-heads categories (Postal 1969).[69] Hence, once clitics acquire the categorial status of a head —i.e., from an X^{max} to X^{min} category—, the complementary distribution definitely disappears in this language, and CLD can occur.

Diachronically, the reanalysis of clitics triggers the following grammaticalization path (see van Gelderen 2004, 2011 for current approaches):

[69] In line with Rini (1990), the complementary distribution of clitics concerning full pronouns finished in the 17th century. See also Wanner (1987) and Fontana (1993).

(51) **Grammaticalization path**

Clitic	>	Clitic	>	Clitic
DPs		D-head		ϕ-features

Fontana's evidence for the reanalysis of clitics stems from the loss of interpolation (52a), enclitics in finite verbs (52b) and the disallowed CLD constructions in early stages (52c):

(52) a. Interpolation (OSp)[70]

…como	a ty	cierto	es que	lo	non hamas…
as	to you	true	is that	Cl3sg.ACC	Neg. loves

'As for you, it is true that you love him.' (*Corbacho*: *VIX*, 13th century)[71]

b. Enclisis in verb finite

…rresçibieron	le	muy bien	en su carneçería…
they welcome	Cl3sg.DAT	very well	in his butchery

'They welcomed him very well in his butchery.' (*LB*: *1183*, 13th century)[72]

c. No doubling of full pronoun DPs

…al	logar	onde dios	mando	ami	salir.
to-the	place	where God	ordered	to.ACC-me	leave

'to the place that God ordered me to leave.' (Fontana 1993: 43)

Nonetheless, Fontana's (1993) one-to-one relation cannot be translated to all doubling Romance languages. Based on Fischer's (2002) data of Old Catalan, Fischer and Rinke (2013) showed that, in the 13th century, clitics in this language —unlike in Old Spanish— invariably followed the pattern [(Neg) + CL + V_{finite}]. This means that clitics did not allow interpolation of negation in Old Catalan (Fischer 2002: 41): they were never separated from the finite verb (Fischer 2002: 34). Nonetheless, and concerning the finite verb, the preverbal pattern could be altered as a consequence of the "Tobler-Mussafia effect", leading to a [V_{finite} + Cl] configuration or enclisis in matrix constructions as in (53a) (Fischer 2002: 37) or in subordinate clauses as in (53b) (Fischer 2003: 264):

[70] Old Spanish.

[71] "Arcipreste de Talavera o Corbacho". Alfonso Martínez de Toledo. Edited by J. González Muela. Madrid: Castalia Ediciones, 1970.

[72] "Libro de Buen Amor". Arcipestre de Hita. Edited by G. B. Gybbon-Monypenny. Madrid: Castalia Ediciones, 1987.

(53) a. E donaren-li muler la dona (OCat)[73]
and theygave-Cl3pl.DAT wife the woman
qui era fila del rey leo.
who was daughter of-the king Leon
'And they gave him as his wife the woman who was the daughter of the king Leo.' (Fischer 2002: 37)

b. …ab lo crestians que volien-los sobtar
against the Christians who wanted-Cl3pl.ACC surprise
'…against the Christians who they wanted to surprise.'
(Fischer 2003: 264)

This evidence suggests that the reanalysis of clitics as D-heads was already concretized during the Old Catalan period. However, as Fischer (2002) demonstrated, in late Old Catalan (14th and 15th), there were still cases of CLD of pronominal DPs (54a), as well as cases without doubling (54b). It would not be until the 18th century when CLD became obligatory in Catalan (Fischer & Rinke 2013: 9).

(54) a. Prec-vos que **m'** ojats tots <u>a mi</u> un poc. OCat
ask-you that Cl2sg.DAT listen all to mea little
'I ask you all to listen to me for a while.' (Fischer 2002: 44)

b. e tan amarg és <u>a mi</u> que…
and so bitter is to me that
'and it is so bitter for me that…' (Fischer 2002: 449)

The "instability" concerning the doubling of full pronouns also appears in Old Spanish and Old Portuguese (Fontana 1993; Martins 1994), leading to the conclusion that a direct relation between the reanalysis of clitics to D-heads and the rise of CLD cannot be maintained for Romance languages. Thus, as Fischer and Rinke (2013) pointed out, "doubling occurs in languages with and without a fixed clitic position and in languages with and without interpolation" (Fischer 2013: 463). For instance, "in Portuguese clitics also occur in post verbal position in main clauses and with sentence initial topics like older varieties of other Romance languages" (Fischer 2013: 463): *vi-**a**$_i$ <u>a ella</u>$_i$* 'I saw her'). Furthermore, Portuguese features interpolation with negation particles [Cl + (Neg) + V_{finite}]: *O João pediu que **o** não acordassem* 'John asked

[73] Old Catalan.

them not to wake him up.'[74] However, the doubling of full pronouns DPs is obligatory:

(55) a. Encontrámo-**las** a elas na feira do livro. (Port)
We find-Cl3pl.ACC to.ACC them in fair of book
'We find them at the book's fair.' (Mateus et al. 2003: 832)

b. *Encontrámo a elas na feira do livro.

In addition to the fact that the correlation between the grammatical status of the clitic and the rise and development of CLD constructions does not coincide cross-linguistically, Fischer and Rinke (2013) also demonstrated that focusing on the nature of doubled DPs alone led to many inconsistencies. For instance, not all variational aspects found in current states of modern CLD varieties correspond with the diachronic path traditionally described. Thus, although Old Romance languages generally considered as CLD modern varieties (e.g., Romanian, Spanish and Catalan) began to double pronominal DPs (which would later become the obligatory configuration), this is not true for all kinds of full pronouns. Note that in Spanish, for example, (***Le***) *agradezco a usted* 'I thank you' is optional, but **Le** *prestaré a ello más atención* 'I will pay more attention to it' disallows doubling (see Fernández Soriano 1993). Therefore, "the characterization of an object as a full pronoun is not a sufficient condition for doubling to be possible/obligatory" (Fischer & Rinke 2013: 463).

Another aspect that is not clear at all is the idea that some specifications of the CLD variation are subject to how sensible clitics are with respect to the animacy and specificity properties of the doubled DP. As Fischer and Rinke (2013) pointed out, this perspective would force us to explain why there are languages possessing clitics but do not allow doubling of pronominal objects which are inherently specified as specific, definite, and animate categories. Moreover, as Suñer (1988) showed, the presence or absence of the preposition *a* does not determine the rise of CLD configurations in Argentinian Spanish. As seen, Suñer argued that this is so because the Case marker preposition *a* is related to those objects that are [+animate] in nature, while CLD

[74] From Mateus et al. (2003: 866). Cited by Fischer and Rinke (2013: 463).

configurations are related to those DPs that are marked with the [specificity] (and partitiveness) feature (see also Dobrovie-Sorin 1991 for Romanian).[75] Hence, Kayne's Generalization cannot be a sufficient condition for CLD constructions in Argentinian Spanish (see Sánchez & Zdrojewski 2013; Zdrojewski & Sánchez 2014). Nevertheless, by putting both the diachronic and the synchronic data together, a general developmental picture for CLD in Romance languages arises (see Figure 8 below): there is a clear tendency to double full pronominal objects rather than nominal ones; in addition, it seems that doubling dative objects is preferred over accusative objects.

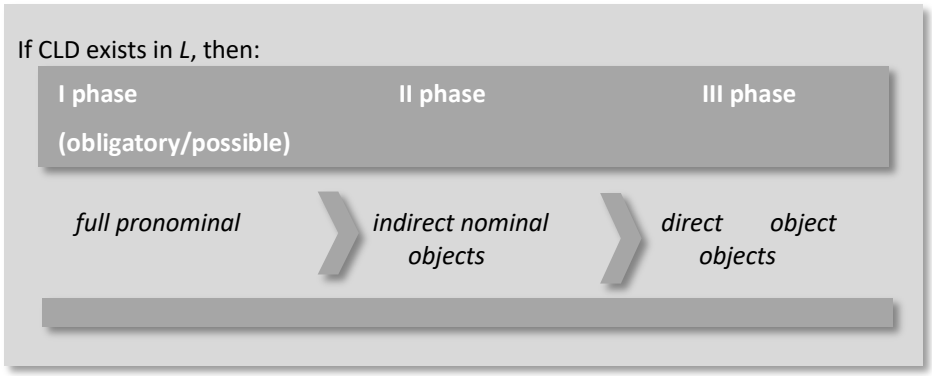


Figure 8. General development of CLD in Romance languages

This general picture allowed Fischer and Rinke (2013) to identify two asymmetries: (i) the accusative vs. dative; and (ii) the pronominal vs. non-pronominal object doubling. However, the distinction between *D*-clitics for accusative and *φ*-clitics for dative (see section 4.1.3) (Bleam 1999; Anagnostopoulou 2003) is not enough to explain the asymmetry in (ii) because, once CLD of pronominal objects appears, there is no attestable difference between dative and accusative pronominal objects (Fischer & Rinke 2013: 466). Accordingly, since no language allows CLD of direct objects without doubling full pronouns and indirect objects as well, it seems that certain semantic aspects like definiteness, specificity and animacy play a central role in their variational distribution (Fischer & Rinke 2013: 466). Pronominal objects, for example, are inherently definite and specific, as opposed to non-pronominal objects which are variable elements with respect

[75] In Romanian there are also exceptions to this generalization concerning DPs preceded by the preposition *pe* (Dobrovie-Sorin 1991; Anagnostopoulou 2006 for a comparison with Spanish).

to these semantic features (*cf.* Leonetti 2007). Thus, Fischer and Rinke (2013) concluded that the difference between dative and accusative objects could be distinguished because the former shows "a tendency to be animate and specific," which is not true of the latter (Fischer & Rinke 2013: 466).

The general conclusion we can reach from the distributional picture provided above does not differ too much from the data described in the previous section: the variational nature of CLD must be explained through the interaction of different grammatical components. And this is exactly what Fischer and Rinke's (2013) parameter proposal attempted to do. Firstly, they captured the heterogeneously data under the following general distribution:

(56) **Implicational Constraint** (Fischer & Rinke 2013):
(i) No language allows doubling accusative objects without also doubling dative objects.
(ii) No language allows doubling dative nouns without also doubling full pronouns.

Secondly, assuming that the elements affected by CLD configurations not only have different categorial status but also inherently semantic specifications (i.e., they are marked with animacy, specificity and definiteness)[76] as well as different pragmatic effects, Fischer and Rinke (2013) argued that the rise of implicational constraint in (56) is subject to the interaction of the following three scales:

(57) a. Grammaticalization scale:
DPs > D-heads > ϕ-features

b. Accessibility scale (Ariel 1988):
Full-pronouns > indirect objects > direct objects

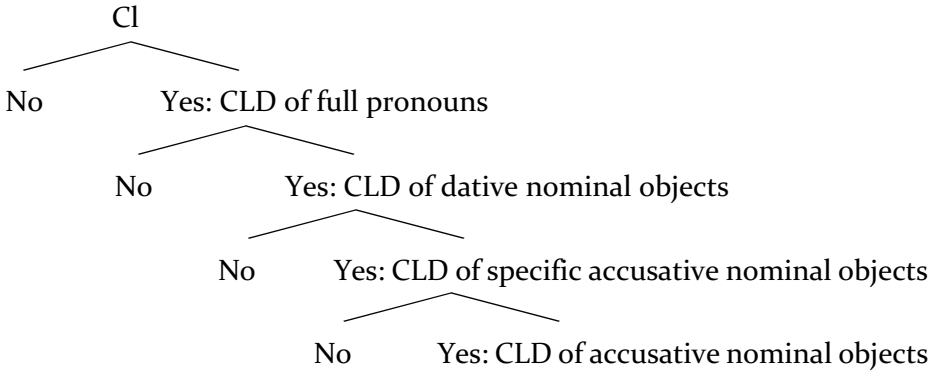
c. Definiteness scale (Leonetti 2007):
Personal pronouns > Definite noun phrases > Specific noun phrases > Non-specific noun phrases

Thus, Fischer and Rinke (2013) assumed that the interaction of the grammatical, semantic and pragmatic nature of object clitics and doubled DPs condition the hierarchical organization of CLD distribution, that is, variational

[76] Whereas full pronoun objects are marked as [+definite; +specific; +animate], indirect nominal objects tend to be [+animate; +specific] and direct nominal objects can be [+/–animate; +/–specific].

specifications that are organized from the general setting or macro-parametric specification to the microparametric instances of variation. In other words, in keeping with Roberts (2012), Fischer and Rinke captured the distribution of CLD across Romance languages in terms of an implicational hierarchy: the CLD-parameter (58).

(58) **Parameter Hierarchy of CLD** (first attempt, Fischer & Rinke 2013):



Although the CLD-parameter proposed by Fischer and Rinke (2013) captured this phenomenon's variational distribution, the question about its emergence still unsolved —note that there is no reference to how the interaction of the three factors design proposed by Roberts' parameter approach should work— . Indeed, while they argued that the rise of the CLD-parameter should be seen as a catastrophic phenomenon within the whole system of a particular language, the emergence of the macro-parameter specification seemed to maintain the traditional one-to-one relation discussed above: the availability of clitic pronouns in order to give rise to the macro-parameter specification (Fischer & Rinke 2013: 468). In other words, once the availability of the functional clitic category is lexically active, the macroparametric specification of CLD can be set. However, although special clitics indeed have to be available in a language to possess CLD configurations, it does not seem to be correct to assume that this is due to a parameter setting effect. The change from a weak pronoun to a simple clitic on the one hand and from a simple clitic to a special clitic on the other is a gradual process, not a categorical one (Navarro et al. 2017; Fischer et al. 2019).

Moreover, the existence of clitics in a language is, of course, a necessary precondition for the emergence of CLD, but it cannot be part of the parameter hierarchy, since the status that a clitic reaches during its grammaticalization

path alone does not trigger CLD (Navarro et al. 2017). Accordingly, not only the "emergence question" has yet be answered; the structure of the hierarchy also has to be rethought.

4.3. THE EMERGENCE OF THE CLD-PARAMETER

By analyzing new data on the grammatical changes affecting CLD constructions across Romance languages, Navarro et al. (2017) and Fischer et al. (2019) were able to stablish two crucial aspects about the nature of this phenomenon. A detailed reconstruction of the development data shows that the CLD phenomenon follows a cyclic pattern (see also Vega Villanova et al. 2018):

(59) **Cycle Process of CLD constructions** (Fischer et. al. 2019: 60):
Stage I → no CLD (Latin/Proto-Romance)
Stage II → optional CLD with full pronouns (OSp/OCat)
Stage III → obligatory CLD with full pronouns
(Early Modern Sp/Decadencia Cat/Sp/Cat)
→ optionally with indirect nominal objects
[+anim/+def/+spec]
Stage IV → obligatory CLD with full pronouns
(*Rioplatense* Sp, Judeo Sp)
→ obligatory CLD with indirect nominal objects
→ spread of CLD to direct nominal objects [+anim/+def/+spec]
Stage V → generalized CLD (with all objects, even inanimate ones)
(Lima Sp, Andean Sp)[77]

As I describe below, the whole cycle corresponds not only to the data discussed by these authors but also to the specifications that are organized along the CLD-parameter proposed by Fischer and Rinke (2013).

Similarly, the diachronic data presented by these authors also reveal a correlation between the emergence of CLD-parameter and the verb movement specifications in a given historical context. Based on this correlation, Navarro et al. (2017) and Fischer et al. (2019) suggested that the specifications of the

[77] Following this process, Fischer et al. (2019) assumed that the last step of the cycle would be the complete loss of the clitic category, giving rise to a stage of the kind represented by the initial one.

VM-parameter seem to play a crucial role in the emergence of the CLD-parameter.

Navarro et al. (2017) and Fischer et al. (2019) based their main argument on the fact that the word order change from Old Romance to Modern Romance languages represented a change from topic-prominent to subject-prominent languages and from discourse-oriented to syntax-oriented languages (Lehmann 1976; Givón 1979; Fischer 2010). This change is constrained by the VM-parameter affecting the A'-positions that could be allowed by the position achieved by the verb itself. In this sense, in topic-prominent languages, highly accessible constituents occupy higher positions in the syntactic structure (i.e., further to the left) because of the verb movement into the C-domain. Hence, Old Romance languages have a seemingly 'freer' word order, where high placement of the verb in the structure gives rise to A'-positions that may host accessible and prominent objects —in addition to subjects. However, when verb movement to the C-domain is "blocked", the A'-position function is lost, and the accessibility information related to objects is no longer possible.

In this sense, assuming that CLD is related to the accessibility scale and definiteness scale of objects (*cf.* Leonetti 2008; Fischer & Rinke 2013), Navarro et al. (2017) and Fischer et al. (2019) argued that the loss in Old Romance languages of the information encoded in the different preverbal A'-positions for accessible objects could be recovered by the CLD constructions. Specifically, since the verb movement configuration of a language could have "negative" effects on the accessibility interpretation of an object, the CLD construction could function as a "recovery mechanism" to repair the interpretation. In other words, since CLD applies first to the most accessible objects —i.e. human and animate (first full pronouns, followed by indirect objects)—, conveying exhaustive/contrastive focus readings, CLD would partially substitute the structural information meaning expressed by historical varieties (Fischer et al. 2019: 54). That is, the emergence of CLD construction would solve this "accessibility deficit" resulting from the impossibility of the verb moving up in the structure.

In order to see the whole scenario, I will explore the clitic doubling cycle described in (58) and its correlation with the verb movement in greater detail.

4.3.1. CLD DEVELOPMENT AND VERB MOVEMENT SPECIFICATIONS

A first approach to the reconstruction of the CLD cycle in Romance languages shows that special clitics were not available in either Latin or in very early stages of Old Romance languages; hence, CLD was not allowed.[78] Accordingly, despite the fact that there is not much evidence regarding Proto-Romance languages, such kinds of constructions must have been disallowed in these varieties, too. Therefore, the first stage in the development of the CLD cycle is a "null" stage, where no construction of this kind can be attested at all (Navarro et al. 2017; Vega Villanova et al. 2018; Fischer et al. 2019).

Nevertheless, this argument can only be founded on the one-to-one relation discussed in section 4.2 above; that is, the traditional correlation stablished between the grammatical status of the clitic and the emergence of CLD (Fontana 1993, among others). However, as shown, although in early stages of Old Spanish and Old Catalan the grammatical status of the clitics was different, CLD was sporadically attested in both languages. This fact clearly weakens the idea that a one-to-one relation is sufficient to explain the emergence of CLD constructions, forcing us to look for an alternative or, rather, assume the possibility of a more complex scenario.

Thus, taking into account that Latin and Proto-Romance languages were discourse-oriented, where anything could appear in front of the verb (see Menge 2000, for Classical Latin; Devine & Stephens 2006, for Vulgar Latin/Proto-Romance) and word order in these languages was clearly dependent on the information structure, we have to analyze the position in front of the verb as an A'-position. In keeping with Ledgeway (2017), there is enough compelling evidence that Late Latin behaved as a V2 language, that is, the verb commonly moved up to C-head. This fact suggests that there was enough place up to the verb for accessibility and prominence information. Hence, according to the correlation proposed by Navarro et al. (2017) and Fischer et al. (2019) and despite the fact that special clitics were not accessible

[78] In Early Old Spanish, for instance, clitics had not yet reached the status of special clitics, being simple clitics —or even weak pronouns in Cardinaletti and Starke's (1999) terms—, that is, the pre-grammatical step that give rise to special clitics (Vincent 1997).

in the lexicon at that time, raising the verb to the C-domain would also block the emergence of CLD.

From the 13th to 15th centuries, object clitics were available in Old Romance languages. However, in stage II, CLD constructions were optional, with full pronouns both in Old Spanish (60) and Old Catalan (61).

(60) a. pusieron a ellos a vna part. (OSp)
they put to.ACC them to one side
'They put them to one side.'

b. yo **les** fiz saber a ellos.
I Cl3pl.DAT made know to them
'I let them know.' (CDAR_HH_Sp_*Fazienda de ultramar*_1210)[79]

(61) a. e tan amarg és a mi que… (OCat)
and so bitter is to me that
'and it is so bitter for me that…' (Fischer 2002: 43)

b. Prec-vos que **m'** ojats tots a mi un poc.
ask-you that Cl2sg.DAT listen all to me a little
'I ask you all to listen to me for a while.' (Fishcer 2002: 44)

Furthermore, even dative CLD with nominal DPs seems to be sporadically attested in this second stage (Fischer et al. 2019), not even in psych-verb constructions (62a,b) as argued by other authors (see Rivero 2010 and Elvira 2014).[80]

(62) a. Plazrie a sus parentes de veerla transida (OSp)
would like to his parents to see.Cl3sACC exhausted
'His parents like to see her exhausted.' (Fischer 2010: 83)

b. Molt plagueren a Fèlix les paraules (OCat)
much like to Fèlix the words
que dix la pastora
that said the shepherdess
'Fèlix liked the words very much that the shepherdess said.'
(Fischer 2010: 76)

With respect to the verb movement correlation, Navarro et al. (2017) pointed out that Old Spanish and Old Catalan show properties of classic V2

[79] The acronym "CDAR_HH" refers to the corpus, "Clitic Doubling Across Romance", written at the University of Hamburg during the project directed by Susann Fischer (www.cliticdoubling.de). This acronym is specified by the language, i.e., "Sp" or "Cat" and the name and year of the text, when necessary. For example, *Fazienda de ultramar*_1210.
[80] See, however, see Fischer et al. (2019: 56) for objections on their analyses.

configurations (63a; 64a) (Salvi 2012; Wolfe 2015; Poole 2017; Fischer 2002; Fischer 2010) next to V3 structures (63b; 64b) and V1 orders (Wolfe 2019; Fischer 2010), as well as stylistic fronting (65) (Fischer 2010), which has been taken as evidence that the verb can move as high as C-head in V2 configurations and as high as Σ-head in V3 structures (Martins 1994; Fischer 2003, 2010; Poole 2017).

(63) a. e entonces le dixo Muget… (OSp)
and then Cl3sg.DAT said Muget
'and then Muget said to him…' (Fontana 1993: 53)

b. E entretanto el hermano de Mahomad llego
and meanwhile the brother of Mahomad arrived
al rrey
to-the king
'and meanwhile the brother of Mahomad came to the king'
(Fontana 1993: 53)

(64) a. Tantost e sens triga vengueren (Ocat)
soon and without haste came.pl
Jacob e Curial
Jacob and Curial
'Jacob and Curial came soon without haste.' (Fischer 2010: 44)

b. E d' aquí avant lo rey féu-li donar tot…
and from there onwards the king made-him give all
'And from there onwards the king made him give all…' (Fischer 2010: 44)

(65) que feita aviets la corona del Emperi, (OCat)
who made had the crown of-the emperor
'who had made the crown of the emperor.' (Fischer 2010: 116)

At the end of this period, there is evidence that the verb still moved to the polarity projection ΣP. This fact also correlates with the loss of available positions upwards Σ-domain (Martins 1994; Fischer 2002).

(66) E diu que lo primer respòs-li hòrreamente. (OCat)
and he said that el primero respondio-le horrendamente
'y dijo que el primero le repondió horrendamente.' (Fischer 2002: 288)

Accordingly, we can suggest that the optionality of CLD in this stage correlated not only with grammatical status that clitics reached during this period but also with the changes undergone by the verb movement specification —i.e., from the CP projection to the ΣP domain— and the consequences for the availability of A'-positions that this implied.

Stage III covers a period that goes from the end of the 16th century up to the 20th century. During this stage the behavior of the CLD constructions of accusative and dative objects began to define itself in different ways. Thus, whereas, in the 16th century, accusative or dative CLD of full pronouns were already obligatory in both Early Modern Spanish (67) and Decadència Catalan (68), doubling with indirect nominal objects (69a) and also with psych-verb sentences (69b) were just beginning to appear.

(67) a. y por amor de mi agüela (EMSp)
and for love of my grandmother Cl2sg.ACC
me llamaron a mí Aldonza.
they called to.ACC me Aldonza
'and for the love of my grandmother they called me Aldonza.'
(CDAR_HH_Sp_*La Lozana Andaluza* 1528)

b. ¿Qué **le** devo a él?
What Cl3sg.DAT I owe to him
'What do I owe him?' (CDAR_ HH_Sp_*La celestina* 1499)

(68) a. que **l'**avia desafiat lo comte a ell. (DCat)
what Cl3sg.ACC-have challanged the earl to.ACC him
'que el conde lo había desafiado a él.'
(CDAR_HH_Cat_*Epistolaris d'Hipólita* 1549)

b. tinga per bé de pagar-**me** a mi lo que m'és degut.
have for good to pay-Cl2sg.DAT to me what me'is owed
'would you please pay me what is owed to me.'
(CDAR_HH_Cat_*Epistolaris d'Hipólita* 1524)

(69) a. y a media noche **les** dije a las camaradas. (EMSp)
and to half night Cl3pl.DAT I said to the companions
'and at midnight I told my companions.'
(CDAR_HH_Sp_*Vida del capitán Alonso Contreras* 1638)

b. que **li** pesa a vostra senyora (DCat)
what her feeling bad to your lady
'what your lady regrets'. (CDAR_HH_Cat_*Epistolaris d'Hipólita* 1549)

From the 18th century onward, doubling with indirect objects seems to have been the common option in both Spanish (70b) and Catalan (71b), becoming obligatory with psych-verbs (70c; 71c).[81]

[81] This specification seems to be attested already in Modern Spanish and Modern Catalan varieties, i.e., during the 17th century. However, as Fischer et al. pointed out, Dative CLD in Spanish and Catalan and their historical varieties are far from clear-cut.

(70) a. Pedro *(**lo**) vio a él. (Sp)
Pedro Cl3sg.ACC saw to.ACC him
'Pedro saw him.'

b. (**Le**) devolví el coche a Pedro.
Cl3sg.DAT I gave back the carto to Pedro
'I gave back the car to Pedro.'

c. *(**Le**) gusta la música clásica a María.
Cl3sgDAT likes the music classical to María
'María likes classical music.'

(71) a. Ahir no *(**el**) vaig veure a ell (Cat)
yesterday not Cl3sg.ACC saw to.ACC him
(sinó només a ella)
(but only to her)
'Yesterday I saw only him (not her).' (CDAR_HH_ Cat_AJT)

b. A la inauguració (**li**) van regalar flors
at the inauguration Cl3sg.DAT they gave flowers
a l'Ada Colau
to the-Ada Colau
'At the inauguration, they gave flowers to A.C.' (CDAR_HH_Cat_AJT)

c. A en Jordi *(**li**) agrada la música clàssica.
to the Jordi Cl3sg.DAT like the music classical
'Jordi likes classical music.' (CDAR_HH_Cat_AJT)

The different behavior of dative doubling of nominal DPs is related to three aspects: i) the kind of sentences where indirect objects appear; (ii) the thematic roles associated to the dative argument; and (iii) the features that intrinsically mark the dative object. Thus, in ditransitive constructions, dative arguments, which possess the thematic roles [goal] or [recipient], permit optional doubling, while dative objects that are specified with the features [+anim, +def, +spec] are, therefore, more readily doubled than others. In addition, experiencer objects in psych-verb constructions, non-argumental benefactors (Gutiérrez Ordóñez 1999) and possessors, are usually marked by the features [+animate, +def, +spec] and, therefore, are obligatorily doubled. Hence, the whole picture of dative CLD of nominal DPs seems not only to involve the nature of the syntactic object but also semantic and pragmatic properties associated to the definiteness scale (Leonetti 2007) and the accessibility hierarchy (Ariel 1989, 1990), respectively (*see* Fischer & Rinke 2013).

With respect to the grammatical status of clitics, since interpolation is not attested in both languages, they can be analyzed as D-heads and, in some cases, perhaps even as φ-heads throughout this period (Bleam 1999).

At this stage, however, word-order showed some discourse function, and, hence, we still find postverbal clitics and postverbal subjects in matrix sentences (72) (Fischer 2002) and quirky subjects (73).

(72) Moríran-hi uns quans capitans d'Espanya. (MCat)
they die-there some few captains of-Spain
'Some captains of Spain died there.' (Fischer 2002: 54)

(73) A Marco parece gustar**le** la música coral. (MSp)
to Marcos seems to like-him the music choral
'Marcos seems to like choral music.' (Masullo 1993: 310)

Accordingly, verb movement in this period might still have been as high as Σ-head. From the 16th to the 19th centuries, however, quirky subjects appeared in the preverbal position. According to Keenan (1976), oblique subjects pass the syntactic tests identifying them as subjects (see Fischer 2010 & Vega Vilanova 2013, for Catalan). Nonetheless, from the 19th century onwards, even though postverbal subjects are attested in many contexts (e.g., Zagona 2002, for Spanish), quirky subjects only pass a few of the syntactic tests. For instance, oblique subjects can still rise to the subject position of control verbs such as *semblar*/*parecer* 'to seem'.

(74) a. A l'autora sembla agradar-**li** especialment (Cat)
to the-author seems to like-Cl3sg.DAT especially
la història de Roma.
the history of Rome
'The author seems to especially like the history of Rome.'

b. A Pedro parece gustar**le** la comida. (Sp)
to Pedro seems to like-Cl3sg.DAT the meal
'Pedro seems to like the meal.'

The fact that quirky subjects still pass some of the syntactic tests has been taken as evidence for the verb movement to T-head and the dual character of SpecTP as an A- and A'-position (e.g., Masullo 1993), whereas others explain the specific properties of quirky subjects by an additional position within TP, which is considered either an A'-position (Gutiérrez Bravo 2006, Tubino-Blanco 2007, Fischer 2010) or an A-position (Fanselow 2002).

In stage IV, the most important aspects of CLD affect the Spanish varieties outside of Europe, specially the Río de la Plata region (Paraguay, Uruguay, Buenos Aires and other provinces along the Paraná and Uruguay rivers) and Argentinian, in general.[82] In this area, for example, the development of this phenomenon shows obligatory dative and accusative CLD with full pronouns as well as dative CLD with nominal objects (Di Tullio & Zdrojewski 2006; Schroten 2010 for dative CLD in Buenos Aires Spanish). Moreover, accusative CLD with animate nominal objects are widespread in Argentinian Spanish (75).

(75) a. **Lo** llevaron al huelguista (Arg.Sp)
Cl3sg.ACC they led to.ACC-the striker
docientos metros…
two hundred meters
'Did you saw my mother.' (CDAR_HH_*La Patagonia Rebelde* 1975)

b. **La** olieron a la mujer
Cl3sg.ACC they smelled to.ACC the woman
'They smelled the woman.' (CDAR_HH_*El beso de la Mujer Araña 1976*)

These properties of accusative CLD have also been confirmed in Judeo Spanish (76) by Vega Vilanova et al. (2018) and Fischer et al. (2019).[83]

(76) a. Yildiz disho ademas ke (JSp)
Yildiz said additionally that
mi tiya Beki la ayudo
my aunt Beki Cl3sg.ACC helped
a parir a su madre.
to give birth to.ACC her mother
'Yildiz also said that my aunt Beki helped her mother to give birth.'
(CDAR_HH_JSp_*eSefarad* 2015)

[82] For other varieties, see Dufter and Stark (2008), Sánchez (2010) and Nishida (2012).
[83] These authors also take Romanian to belong to this stage, even though CLD is not yet obligatory with dative nominals (Diaconescu & Rivero 2007; Cornilescu 2015). Nevertheless, Romanian also allows doubling with accusative nominals that are animate (Dobrovie-Sorin 1990; Anagnostopoulou 2006; Hill & Tasmowski 2008; Fischer & Rinke 2013).

b. La hija hazina **la** yamó (JSp)
the daughter sick Cl3sg.ACC she called
a la madre, después di kuarenta días.
to.ACC the mother, after of forty days
'The sick daughter called her mother after forty days.'
(CDAR_HH_JSp_*eSefarad* 2015)

At this stage, the grammatical status of clitics within the Spanish varieties is clearly differentiated: the accusative category constitutes a D-head, and the dative clitic represents *φ*-features (Bleam 1999; Anagnostopoulou 2006), which is reflected in the fact that doubling dative DPs is possible in many contexts —the dative clitic is realized as an agreement marker with respect to the properties of the object.

With respect to the verb movement specification, it has been noted that, for instance, Argentinian Spanish has a strong preference for SVO (around 90% of the attested data) in contexts where other Spanish varieties such as European Spanish would require a non-canonical word order (e.g., VOS) (Gabriel 2010) —as Fischer et al. (2019) point outed, the same has been shown for Judeo-Spanish (Fischer et al. 2014: 65). Accordingly, word order in these varieties turns most strictly and, therefore, does not codify information-structural meaning. This strictness regarding the word order is a consequence of the verb movement restrictions that these variants have. Specifically, the verb still moves up to T-head; however, the A'-movement of the object might only be into the *v*P-domain. In other words, once the verb movement specification of a CLD language increasingly constrains the accessibility interpretation of all kind of objects, the doubling configuration becomes the most common option. That is, since Argentinean Spanish, for example, shows stricter word order configurations, CLD spreads to a wide variety of objects.

Stage V of the cyclic pattern is represented, again, by other varieties outside European Spanish: Lima Spanish and Andean Spanish, for example. Moreover, as we will see, there are some aspects of CLD constructions at this stage that are also attested in other varieties of Argentina Spanish: Buenos Aires Spanish, Córdoba Spanish, and Patagonian Spanish. Thus, this stage is also characterized by the obligatory CLD of full pronouns and dative objects. But Lima and Argentinian Spanish, for example, do not only show accusative CLD of animate and definite nominal DPs (75); they also double inanimate objects

(77)[84] and indefinite objects (78).

(77) ¿No **lo** viste al libro que compré ayer? (Arg.Sp)
Not Cl3sg.ACC saw to.ACC-the book that I bought yesterday
'Did you saw the book that I both yesterday.'

(78) **Lo** saludé a un estudiante que conozco. (Lima Sp)
Cl3sg.ACC I greeted to.ACC a student that know
'I greeted a student that I know.' (Zdrojewski & Sánchez 2014: 166)

In addition, note that Suñer's (1988) work was the first approach on accusative CLD in Buenos Aires Spanish (see section 4.2) questioning the role of the Case marker "a" with respect to inanimate objects. However, in a comparative experiment between Buenos Aires Spanish and Lima Spanish, Sánchez and Zdrojewski (2013) rejected Suñer's observations for Buenos Aires Spanish, showing that Buenos Aires speakers tend to use double accusative inanimate objects only with the special preposition, while Lima speakers do not.[85]

(79) Después de años de espera, finalmente (Lima Sp)
after of years of waiting finally. . .
la arreglaron la calle de mi mamá.
Cl3sg.ACC they repair the street of my mother
'After years of waiting, they finally fixed my mother's street.'
(Zdrojewski & Sánchez 2014: 167)

Sánchez and Zdrojewski (2013) concluded that Kayne's Generalization was active in Buenos Aires Spanish, while not in Lima Spanish.

Nonetheless, it is very difficult to capture the properties that play an important role by the acceptance, or not, of the tendencies observed (see note 39). Prosodic and pragmatic aspects, for example, could be crucial for the design of acceptability judgements tests, and, in many cases, it is impossible to capture the natural tendency. In a similar audio-test carried out on Patagonian Spanish, researchers found that inanimate accusative CLD

[84] With respect to (72), there is no clear consensus in the literature about this kind of CLD construction. Some authors (see Zdrojweski & Sánchez 2014; Di Tullio et al. 2019), for instance, reject the existence of such constructions without Kayne's Generalization (Suñer 1988; Schmitt 1996). However, there is no exhaustive study about doubling accusative DPs in this area. As a native speaker of such variety, I argue that this kind of doubling is common in Argentina Spanish, but that, in some specific areas (Patagonia and Córdoba), it is also possible without the special preposition associated to Kayne's Generalization. See discussion below.

[85] The test undertaken by these authors seems too vast and only focused on speakers in academic circles. See Fischer and Vega Vilanova (2020) for a discussion on general problems that are present in AJT for CLD constructions.

constructions were also possible without the special preposition "a":[86]

(80) Ahora, **lo** volcaron el auto (Patagonian Sp)
now, Cl3sg.ACC they tipped over the car
camino a Trevelin
on the way to Trevelin.
'They tipped the car over on the way to T.'

With respect to the grammatical status of the clitics in these varieties, one we can argue that, whereas clitics are specified for Case in accusative objects in Buenos Aires Spanish, clitics in Lima Spanish (and probably other varieties such as Patagonian Spanish[87]) are not valued for Case. In addition to these data, Sánchez and Zdrojewski (2013) showed that clitics in Andean Spanish are 'bleached' in so far that they are no longer inflected for number and gender.

(81) a. **Lo** vendo toditos los carros. (Andean Sp)
Cl3Masc.**sg**. sell all.dim.masc.**pl** the car.Masc.**pl**.
'I sell all the cars.'

b. Eso también **lo** mata las plantas.
that too Cl3**Masc.sg**. kill the plant.**Fem**.**pl**
'That too kills the plants.' (Zdrojewski & Sánchez 2014: 165)

Andean Spanish clitics no longer show agreement properties with the doubled object. It looks more like "some kind of agreement, perhaps parallel to subject agreement" (Fischer et al. 2019: 61).

The verb movement specifications in stage V might not be so different from those in stage IV, but there is evidence that there is a tendency for stricter word order in all these varieties (Sánchez & Zdrojewski 2013). Accordingly, verb movement might even stay lower than the T-head (Alexiadou & Anagnostopoulou 1998; Ordóñez 2000), but at least at the *v*-head level, thus allowing object movement to the *vP*-domain in Buenos Aires Spanish and Lima Spanish (and Patagonian Spanish). In contrast, Andean Spanish leaves

[86] This was a pilot test in Patagonia (Esquel, Chubut) carried out in the context of the DFG research project FI 875/3-1 and FI 875/3-2 (University of Hamburg). The test was a simple acceptability judgement task, focusing on fourteen audios/sentences based on a dialog with a short context and a response. That is, the participants were provided with a short context and a response that they could accept or not, as well as having the possibility to realize a comment about the sentences that could be rejected.

[87] There certainly is the possibility of a small line between Patagonian Spanish —similar to Córdoba Spanish (following Schmitt 1996; Bleam 1999)— and Buenos Aires Spanish. However, it is not clear which kind of aspect plays a different role between the behavior of Patagonian Spanish and Buenos Aires Spanish. As Fischer et al. (2018) proposed, contact aspects may play a role.

the object in the initial position, and, hence, there is no verb movement.[88]

In stage V, there is a clear tendency to generalize CLD to all objects. According to the CLD-parameter suggested in section 4.2, the data in this stage indicate that the varieties involved advanced down the hierarchy, with increasingly more micro-specifications. In other words, in the last stage of the cycle pattern, the Spanish varieties described in stage V were more complex than European Spanish. Therefore, they had fewer restrictions on accusative CLD constructions, being more unstable at this point of the hierarchy.

Data analysis can be integrated in the following chart:

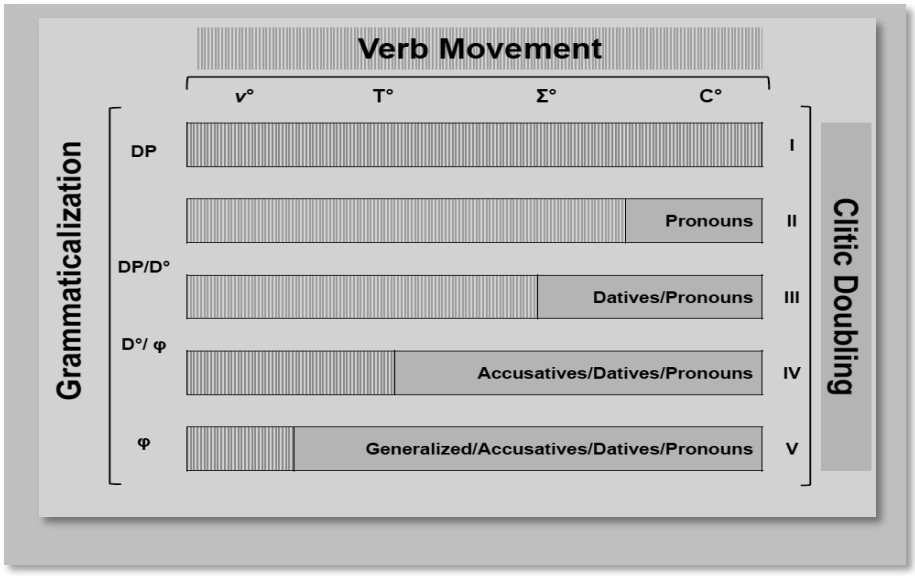


Figure 9. The rise of the CLD configuration (Fischer et al. 2019:66): the interaction of verb movement and the grammatical status of clitic.

The next CLD cycle step is the complete loss of the 'object clitic' category, which will become the starting point of the cycle.

4.3.2. THE CLD-PARAMETER REVISED: STRUCTURE AND INTERACTION

The hierarchical organization of the CLD-parameter assumed in section 4.2 not only complies with the implicational constraint presented in (56), but also shows that each parametric specification represents a cyclic pattern stage described in (59), correlating, in turn, with the attested variational

[88] For example, Muntendam (2008) argued that Andean Spanish often resorts to dislocations in order to express the object's information structure. This can be interpreted as the lack of the relevant object A'-positions within the clause (Fischer et al. 2019: 65).

distribution in Romance languages.

With respect to the rise of CLD configurations, the data in section 4.3.1 also show that the interaction of two conditions contributes to the emergence scenario for the CLD-parameter: (i) the grammaticalization process of clitic items; and (ii) the VM-parameter.

The emergence of CLD constructions is conditioned, thus, by two main factors that, as I have shown, are independent of the CLD-parameter's internal structure. This fact does not only relativize the exclusive character of a one-to-one relation (i.e., clitics items > CLD constructions) for an emergence explanation assumed by some authors but also has consequences for the hierarchical organization of the CLD-parameter presented in (58).

As explained, since the availability of clitic items in the lexicon alone is not an absolute condition to establish a macro-specification like *CLD of full pronouns*, it is not clear which kinds of properties would determine, from a structural point of view, the macro-parameter status of a clitic in the parameter hierarchy represented in (58). If there is no absolute implication associated with the availability of clitics, why should clitics be a macro-parameter specification at the top of the hierarchy? Note that implicational relations are a main condition of a hierarchical structure's internal nature.

Furthermore, according to the data presented in section 4.3.1, the grammatical status of clitic items not only contributes to the emergence of a macro-parameter like *CLD of full pronouns*; it also contributes to micro-specifications down the hierarchy. Hence, if clitics are at the top of the hierarchy, how can we explain the effects of clitics' grammaticalization path that is attested in the micro-specifications? As the data show, clitic status interacts throughout the hierarchy —because clitics are a necessary condition—, but it does not occur at a unique level of specification as would be the case according to the hierarchical organization of parameters in (58). This should be enough evidence to claim that clitic items are not part of the hierarchical organization but of the interactional scenario assumed this far. In addition, and not least, the grammaticalization process of the clitic from a diachronic point of view triggers its own particular cycle change regardless of the CLD cycle. Although the former can affect the development of the latter

—but not the other way around—, both changes are completely independent of each other.

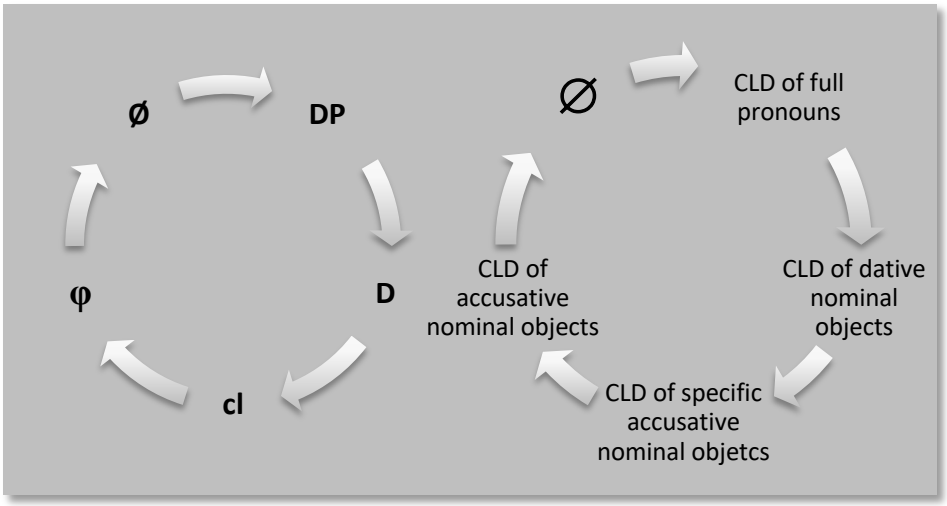
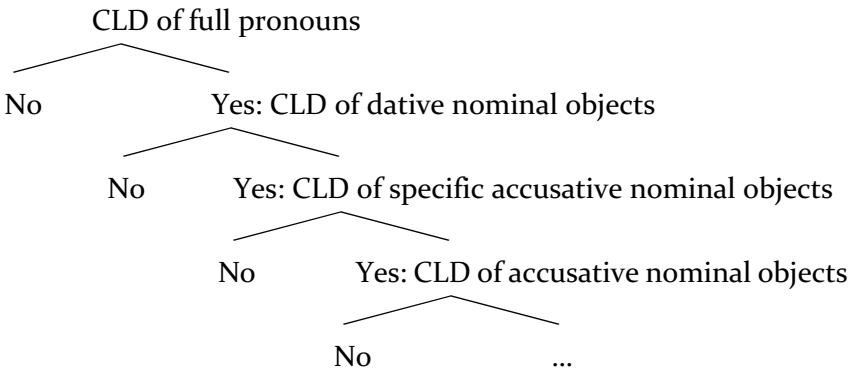


Figure 10. The Clitic Item cycle (left) and the CLD cycle (right).

We are, therefore, forced to rethink the hierarchical organization of the CLD-parameter as follows:

(82) CLD-**Parameter Hierarchy** (revised, Navarro et al. 2017)

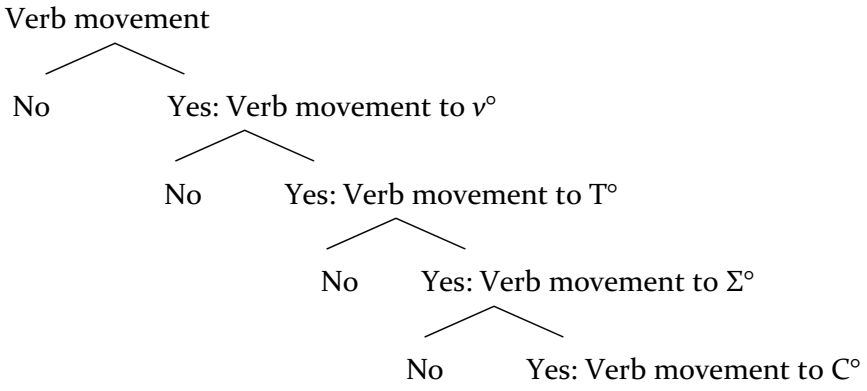


The parameter in (82) removes the clitic item from the hierarchy's internal structure, maintaining, however, a parameter explanation for CLD's distribution and cyclic development according, in turn, to the implicational constraint proposed by Fischer and Rinke (2013). In this sense, the availability of clitics is part of the emergence scenario as a necessary condition but not of the parameter structure itself.

The second condition that contributes to the emergence of the CLD-parameter is the interpretational effects with respect to the accessibility information of the doubled DPs. Since this effect is a direct consequence of

the verb-movement constraints of an I-language, VM-parameter specifications (83) can be seen as the second condition which is necessary and involved in the emergence scenario of the CLD-parameter. The verb-movement constraints are also organized hierarchically as follows:

(83) **The VM-parameter**



Unlike the CLD-parameter, the emergence scenario for the VM-parameter is exclusively conditioned by the interaction of the three factors in language design: a set of underspecified FFs —encoded in each verb category[89]—, which, according to the evidence provided by the PLD, must be evaluated by two conservative learning strategies (Roberts & Roussou 2003; Roberts 2007) that are sensible, in turn, to how marked the hierarchy could be (Roberts 2012). In keeping with Roberts (2010) and Biberauer and Roberts (2015a, 2015b), verb-movement is triggered by the AGREE relationship between the FFs (e.g., T, *v*, V) encoded in the *Head*-probe and the defective features[90] of the *Head*-goal (Roberts 2010: 160); that is, the defective Goal can be incorporated into the host head only after both heads enter into an AGREE relation. From an emergent point of view, the underspecification of a set of FFs is the only part of the language genotype (Biberauer 2016), whereas the other factors are common to each epigenetic development process, in particular, to the emergence of parameter specifications.

Nonetheless, as I have argued, the mere existence of the VM-parameter is

[89] I will not discuss here whether the head-movement of verb categories if part of the PF or the Narrow syntax. For arguments in favor of verb-movement effects at the LF, see Lechner (2005), Matushansky (2006) and Roberts (2010), among others. For an extended discussion of the AGREE mechanism in which verb-movement is proposed as a natural component of narrow syntax, see Roberts (2010).

[90] A goal *G* is defective iff *G*'s formal features are a proper subset of those of *G*'s Probe *P* (Roberts 2010: 62) (cf. Cardinaletti & Starke 1999; Mavrogiorgos 2006).

not involved in the emergence scenario but, rather, a particular specification within this parameter. In this sense, there is no implicational relation between both parameters, but there is a unidirectional side-effect of a particular VM-parameter specification on the emergence scenario of the CLD-parameter. Specifically, a higher degree of specifications along the VM-parameter correlates with the availability of different A'-positions upwards in the syntactic structure. That is, the micro-specifications open A'-positions which can host objects that can receive prominent interpretations, thus contributing to the accessibility information of such object DPs. From the internal structure point of view, the less specified the hierarchy is, the greater the deficit will be with respect to the accessibility interpretation of object DPs. Therefore, if the VM-parameter becomes more complex with respect to the parametric specifications, A'-movement of object DPs would be possible, thus allowing accessibility interpretations at higher positions within the syntactic structure. By contrast, if the VM-parameter stays at the macro-specification level, it would only trigger movement to the *T*-domain (or lower) within the syntactic structure; hence, A'-positions cannot be reached by object DPs. The loss of DPs' accessibility interpretation is, thus, a consequence of the loss of (micro)specifications in the hierarchy, and that is exactly what we find in verb movement development of Romance languages.

Like the availability of clitic items, the VM-parameter specification contributes to the emergence of CLD constructions. However, whereas clitics are used directly in the configuration of CLD constructions, the VM-parameter has an indirect effect on the accessibility interpretation of another element involved in CLD: the object DP. In this sense, CLD configurations compensate the lower accessibility of those object DPs (Ariel 1989, 1995) that, due to language change effects affecting verb-movement, cannot reach higher A'-positions within the syntactic structure.

From an interactional point perspective, then, the emergence of the CLD-parameter is subject to the I-language's resources. Specifically, only when clitics are grammatically available in the lexicon and only when certain specifications of the VM-parameter constrain the availability of A'-positions for accessible and prominent objects do CLD configurations start to appear. In other words, once the interactional scenario is given by both pre-

specifications, the CLD-parameter emerges, co-adapting a new internal function with respect to accessibility interpretation.

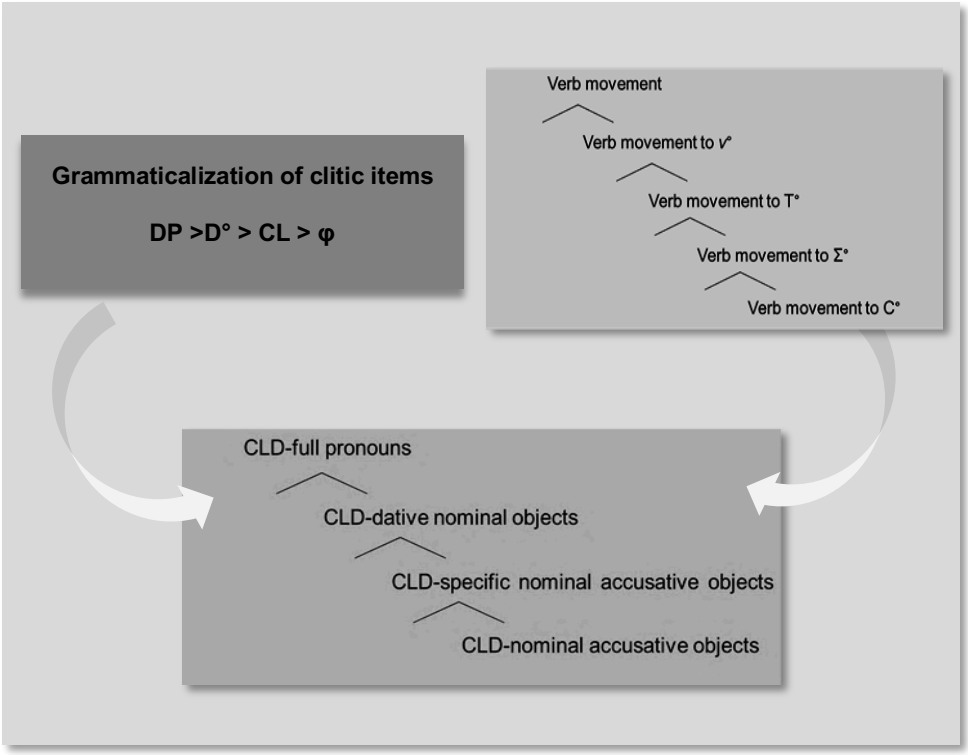


Figure 11. Interactional scenario for the emergence of CLD

As we will see in the following section, this hypothesis has numerous consequences for the general theory of parameter emergence and their classification according to the from-below perspective assumed in this thesis.

4.4. TOWARDS A PARAMETER TAXONOMY

Following the arguments discussed so far, the nature of parameters can be defined in epigenetic terms. That is, parameters are emergent properties of human language that are not specified in the language genotype or UG. Their emergence is defined through the interaction of a set of developmental conditions (e.g., a set of design factors), which in turn determines the appropriated emergence/epigenetic scenario where those parameters can arise.

However, the data analyzed above clearly shows that the conditions involved in the interactional scenario are not always the same for all kinds of parameters. Hence, we can assume that the nature of those factors involved in the emergence of parameters not only defines different interactional scenarios

but also different kinds of parameters. Accordingly, analyzing the emergence scenario and the set of properties interacting within the latter would allow us to establish a new parameter taxonomy. This hypothesis can be formulated as follows:

(84) **Interactional Scenario Hypothesis**:
The taxonomy of parameters is defined by the interaction and nature of the factors involved in the emergent scenario.

In line with (84), the question that remains is what these properties are and which kinds of parameters those properties can define. Focusing on the nature of both the CLD-parameter and VM-parameter, a set of formal and functional properties might be identified. I will first discuss some asymmetries that are identifiable between the parameters analyzed so far.

Taking into account the syntactic structures that are affected by both parameters, we can observe that the verb movement specifications affect, for instance, a single syntactic object: the V-head —and its related functional categories (i.e., *v*-head, *T*-head, Σ-head and *C*-head)—. By contrast, the CLD phenomenon links two syntactic objects: the Cl-head and the doubled DP — note that all kinds of parameters proposed by Roberts (2012) and his colleagues (see Holmberg & Roberts 2014; Biberauer et al. 2014; Biberauer & Roberts 2016; and Huang & Roberts 2017, among others) imply syntactic phenomena affecting only one syntactic object, e.g., the Null-Subject, Wh-movement, Head-directionality, etc. (see Roberts 2019).[91] This asymmetry can be related to a central aspect of the nature of factor I. Assuming that the language genotype encodes the core linguistic properties of language design while PLD and factor III are external components of the language faculty,[92] we will focus on the featural properties which should be part of the expression of UG (Biberauer & Roberts 2016; Biberauer 2016; Huang & Roberts 2017; Roberts 2019).

As explained, the VM-parameter's emergence involves the underspecified

[91] As discussed below, this property of the parameters addressed by Roberts and his colleagues seems to be related to the fact that they involve a specific set of formal features linked to functional categories (cf. Borer 1984; Fukui 1986; Chomsky 1995).
[92] This distinction must not be confused with the "variational" nature of the three factors in language design. Note that the first and third factors are invariant aspects of language design, while the second factor would be subject to variation (Chomsky 2005, 2007).

material of UG, specifically, a set of FFs which should be expressed by the linguistic experience or PLD in order to be valued by a set of learning strategies or FE/IG (Roberts 2012; Roberts 2019). Therefore, the interactional scenario for the VM-parameter's emergence is clearly and exclusively defined by the three factors in language design: simply the interaction between these factors is necessary to develop these kinds of parameters. In the case of the CLD-parameter, however, the set of features involved in the interactional scenario is not restricted to a particular type (i.e., the formal ones) but to the combination of pragmatic, semantic and formal features, which, from a structural point of view, should be linked to different interface levels (Navarro et al. 2017; Vega Vilanova et al. 2018; Fischer et al. 2019). In other words, the set of features given by UG are in both cases different: whereas the featural resources for the VM-parameter emergence scenario are restricted to FFs, the set of features involved in the CLD-parameter is broader. From this perspective, it might be the case that the reason why the set of features involved in the CLD-parameter emergence scenario goes beyond the formal set is due to the accessibility effects causes by the VM-parameter. In other words, since verb movement specifications trigger accessibility constraints on object interpretation, the set of features involved in CLD constructions expands in order to reach language interface levels.

Moreover, as argued above, the conditions involved in the VM-parameter's emergence are totally independent of the CLD-parameter. Nonetheless, this is not the case of the latter, where the VM-parameter is, together with other factors, a necessary condition for its emergence. In this sense, there is a unidirectional relation between both parameters, but this relation does not mean that both parameters are typologically involved in an implicational network (*see* Baker 1996, 2001) (see section 3.1.): nothing in the nature of the VM-parameter implies the emergence of CLD constructions. As I have shown, the CLD-parameter can emerge in the corresponding I-language only when all conditions are given. There is, however, a "side-effect" caused by the VM-parameter's specifications, which, interacting with other factors, triggers the emergence and development of the CLD-parameter. This relation is not an implicational relation like the macro-to-micro specifications subject to the parameter hierarchies' internal structures (Baker 2008), nor an implicational

relation between different parameters of the kind imposed by the traditional principles and parameters theory, where "clustering" effects should be predefined in UG (Baker 1996, 2001). Once again, an epigenetic perspective of the emergence of parameters allows us to maintain an underspecified UG, where no parameter or implicational network between parameters can be part of the genetic endowment. The nature of the interactional scenario is, therefore, the key factor that defines the emergence and the epigenetic relation between parameters during the development of the I-language.

Functionally, whereas the VM-parameter contributes to constrain the emergence scenario of the CLD-parameter, the latter does not have any similar function with respect to any other kind of parameter. Hence, this second asymmetry must also be clarified in some way. The question to be addressed, then, is the nature of the VM-parameter that lets it play such a role with respect to other kinds of parameters. In other words, why can some parametric specifications cause "side-effects" which are later involved in the emergence process of others? The answer to this question can be found, once again, in the expression of the UG discussed above. Indeed, it seems that the nature of the set of underspecified FFs involved in the emergence scenario for the VM-parameter is what determines its functional property. In order to examine this, I will discuss an analogical approach proposed by Biberauer and Roberts (2016) in an unpublished paper —and later treated very superficially in other publications (Ledgeway & Roberts 2017; Huang & Roberts 2017).

From the traditional link assumed between genetics and parameters (*cf.* Chomsky 1980; 1986; Lightfoot 1991; Pinker 1994; Jenkins 2000; Anderson & Lightfoot 2002; Rizzi 2005; and Mendívil-Giró 2006, among many others[93]), Biberauer and Roberts suggest a further analogy based on the genetic notion of "pleiotropy" (Waddington 1957; Wright 1967, 1968; Stearns 2010), which is involved in many emergent processes and, hence, also known as "epigenetic pleiotropy" in the developmental theory of biology (Atchley & Hall 1991; Hall 1992). The term *pleiotropy* denotes a situation within which a particular kind of genes can affect the development of different phenotypic traits (Atchley &

[93] See Lorenzo & Longa (2009) for criticism.

Hall 1991; Hall 1992; Cheverud 1996; Klingenberg 2005)[94]. Genetically speaking, such kind of "master" genes have a multiple driving function within the epigenetic process of different kinds of phenotypes (Stearns 2010). Pleiotropic genes can, therefore, affect the development of different, seemly unrelated phenotypic traits (Atchley & Hall 1991; Hodgkin 1998; Klingenberg 2005). Thus, Biberauer and Roberts (2016) associate this pleiotropic characteristic with the set of FFs discussed above, assuming that, from a functional point of view, some kinds of features are involved in pleiotropic processes with respect to the development of a particular grammar system. In other words, these authors suggest the existence of "pleiotropic FFs" which could explain the emergence of "deep" parameters that profoundly affect the overall shape of different phenotypic traits or I-languages. From this point of view, Biberauer and Roberts' (2016) analogy implicitly suggests that there must also be two main kinds of parameters: those that play a pleiotropic role with respect to the I-language and the other ones, whose emergence is triggered, in part, by the former's pleiotropic effects.

However, Biberauer and Roberts (2016) never address the issue of which kinds of parameters could be affected by the "pleiotropic" parameters. The reason may be due to the fact that, as I have already suggested, the emergence of the kinds of parameters proposed by Roberts (2012) and his colleagues (Holmberg & Roberts 2014; Biberauer et al. 2014; Biberauer & Roberts 2016; and Huang & Roberts 2017, among others) is exclusively subject to the particular set of "master" FFs. Accordingly, all the parameters they proposed have a pleiotropic function, and, as such, they affect core properties of grammar (e.g., verb movement) —which could have side-effects on peripheral areas of that grammar (e.g., accessibility interpretation of DPs). In this sense, it is not clear where the distinction implicitly assumed by these authors can be found: if there is a kind of "deep/pleiotropic" parameters, there must also be other parameters, whose nature should be different. Based on the data presented in this chapter, we can, however, discern a clearer taxonomy of parameters.

On the one hand, the underspecified FFs involved in the emergent scenario

[94] This general developmental process can also be identified through seven different epigenetic proces, which are, in turn, defined by the level of interaction when genes are involved (cf. Hodgkin 1998).

of the VM-parameter could be identified as pleiotropic FFs, since, from the interactional point of view, they only interact with the PLD and the learning strategies. From a functional point of view, this kind of feature affects the movement of verb-heads within the syntactic structure. Accordingly, the VM-parameter affects core properties of grammar, and, therefore, the parametric specifications can cause a range of side-effects on peripheral aspects of the I-language. This is exactly what we observe regarding the accessibility interpretation of DPs, which are affected by the availability of positions within the syntactic structure: since these positions are subject to the specifications of the verb movement, the VM-parameter can be seen as a pleiotropic parameter that affects different peripheral aspects of grammar.

In sum, the set of features affecting the emergent process of the VM-parameter involves pleiotropic FFs, affecting core grammatical properties of language. These kinds of features can also be involved in the emergence scenario of other parameters; that is, the parameter affected by such FFs can have pleiotropic effects on the emergence process of others. In this sense, I refer to this kind of parameters as "Core-parameters".

(85) **Core-parameters:**
The set of emergent parameters defined by:
(a) The exclusive interaction of a set of underspecified FFs, PLD and general learning strategies.
(b) The pleiotropic function of the FFs involved in the interactional scenario defined in (a) with respect to: (i) the development of I-languages, affecting core properties of grammar; and (ii) the peripheral side-effects that should constrain the emergence of other parameters.

On the other hand, and as shown above, the CLD-parameter is exclusively not affected by a set of FFs. This means that there is no set of pleiotropic features but, rather, a set of different features is involved in the emergent scenario of the CLD-parameter. In addition, since there is no exclusive set of FFs, the CLD-parameter does not affect core properties of grammar. Indeed, the CLD-parameter always triggers the same structural configuration —despite the different approaches to capture the structural derivation of the CLD constructions (see section 4.1)—, which implies that the main structure

described in (27) remains unaltered. By contrast, the set of FFs involved in the VM-parameter directly affects the corresponding categories, triggering different syntactic configurations. Moreover, taking into account the pleiotropic function of the VM-parameter, we can argue that its side-effects on the accessibility interpretation of the object DPs can only be solved by the broader set of features involved in CLD configurations operating at different interface levels. Therefore, since the CLD-parameter is not exclusively constrained by underspecified FFs in UG, their grammatical effects will be peripheral with respect to the I-language. That is, the emergence of the CLD-parameter does not affect core properties of grammar but, rather, different interface aspects of that grammar.

From this point of view, the emergent conditions of the CLD-parameter cannot be exclusively reduced to the three factors in language design —as is the case with Core-parameters— but to a more complex scenario, within which the pre-specification of VM-parameter and the availability of clitics items have to be included. Taking into account all these aspects, I refer to these other kinds of parameters as "peripheral".

(86) **Peripheral-parameters:**
The set of emergent parameters defined by:
(a) The interaction of a set of Fs, PLD, general learning strategies and the pre-specification of a Core-parameter.
(b) The set of Fs involved in the interactional scenario defined in (a) with respect to the development of peripheral aspects of I-languages, affecting the interface properties of grammar.

Consequently, the CLD-parameter corresponds to the class of parameters defined in (86). Since they do not possess pleiotropic FFs, they cannot affect the emergence of other kind of parameters or core properties of grammar. The nature of the features involved in the interaction is broader, and, therefore, they do not affect core properties of grammar but, rather, its interface levels. They are parameters which remain at the periphery of an I-language and, hence, they do not affect typological aspects of the phenotype.

4.5. SUMMARY

The aim of this chapter was to redefine the nature of parameter emergence.

To begin, I questioned Roberts' emergent approach, arguing that not all parameters seem to be exclusively subject to the interaction of the three factors in language design (Chomsky 2005). To show this, I discussed the nature of a particular phenomenon of many Romance languages: clitic doubling constructions. These constructions are not only interesting because of their configurational complexity at the structural level (Anagnostopoulou 2006) but also because of their variational nature within particular languages (e.g., Spanish).

As shown and despite the fact that both the phenomenon's complexity as well as its variational nature can be also captured by a parameter hierarchy, illustrating that the conditions involved in its emergence go beyond the interaction of the three factors of language design. Thus, following new synchronic and diachronic data presented in current research (see e.g. Fischer & Rinke 2013; Zdrowjeski & Sánchez 2014; and Navarro et al. 2017), I have addressed the conditions that determine the variational and developmental properties of the CLD-parameter, concluding that the emergence of such constructions is subject to two other main factors: the pre-specification of the VM-parameter and the availability of the object clitic items. Accordingly, the conditions involved in the emergence of the CLD-parameter determine a more complex scenario, which can be associated with the interface character of the phenomenon.

The evidence presented here required redefining the factors and conditions that should interact to give rise to the emergence scenario for parameters. At the same time, it has opened the door to a new perspective to determine two main parameter types: parameters affecting the main aspects of grammar (i.e., core parameters), which are subject to the interaction of the three factors proposed by Roberts and his colleagues; and other parameters, which can affect diverse aspects of grammar associated with interface effects (i.e., peripheral parameters) but which can only emerge when certain conditions are already met.

The parameter taxonomy I present in this chapter could also be justified in terms of epigenetics. As I have shown, both kinds of parameters are emergent properties of language, that is, they are defined by the interaction of a set of factors whose properties are not exclusively encoded in UG. The main

difference, thus, is the nature of the set of interactional properties. In addition, core parameters assume a central developmental function with respect to the others in that, since they affect the main properties of grammar, they must be pre-specified in the I-language, contributing to peripheral parameters' emergence scenario. This pleiotropic property does not seem to be present in the nature of peripheral parameters. However, this functional property of core parameters does not mean that there is a structural implication between both kinds of parameters. Nothing in the nature of the VM-parameter's pleiotropic function implies that the CLD-parameter should arise since, once more, other aspects must also be present.

5. SOLVING THE OVERSPECIFICATION PROBLEM: CONCLUSIONS AND OPEN REMARKS

With this dissertation, my aim has been to rethink the nature of parameters within the biological theory of MHL. I specifically focus on the fact that, since the language faculty is a cognitive property of the human mind, certain "stability" in the genotype has to be ensured for its genetic replication as well as for its ontogenetic and phylogenetic development across our species. However, as I discuss, though the "stability condition" is an intrinsic aspect of any genetic replication mechanism, languages still vary greatly in this respect, at least at the superficial level. In order to resolve this key puzzle in the scientific study of human language —namely, the language acquisition problem and the attested structural diversity—, principles and parameters theory arose as part of the generative enterprise, turning the 'parameter' notion into one of its key concepts from the 1970s onwards.

Nevertheless, despite parametric theory's theoretical success, scholars have questioned the traditional 'parameter' notion over the last few decades, receiving particular attention in the growing multidisciplinary work supported by the minimalist/biolinguistic program.

In this context, current advances on the biological nature of MHL have

shown that a crucial theoretical shift has taken place with respect to how its architecture is conceived and how the properties of those components constraining its development in our species should be determined. As pointed out, a strict biolinguistic perspective requires a minimalized conception of the language genotype, emphasizing, at the same time, its interaction with other factors. Hence, the central role attributed to UG in the early stages of parametric theory failed in terms of important aspects in modern biology theory. The inquiry program, therefore, began to focus on both specific non-language factors and the interactional nature of biological emergence. Since such interaction constitutes the functional basis of any developmental mechanism, it also has to be taken into account to define and answer questions regarding the what, how and why of language design, its acquisition and variational nature, as well as its evolution in our species.

In this sense, I also explain how MHL's development theory, together with the optimal design assumed by the SMT, seem to satisfy current assumptions about the evolution question. However, if current findings supporting the short story of the language phenotype are on the right track, both aspects, that is, MHL development and architecture, do not allow for an overspecified UG. As seen, this issue directly confronts the traditional notion of parameters. Accordingly, a parametrized UG is not compatible with the current minimalist/biolinguistic program. I refer to this central issue of biolinguistics as the "overspecification problem", thus stressing the need to rethink the nature of 'parameter' while maintaining its theoretical relevance.

In sum, since linguistic variation is not a random phenomenon but a constrained one, we are forced to explain the developmental conditions that make this possible. In this sense, the aim of this thesis has been to seek a biological theory of parameters capable of adequately explaining linguistic diversity in order to resolve the problem pointed out above.

Therefore, following early theoretical assumptions of the generative enterprise, I first explore the top-down UG approach, identifying a theoretical framework in which the design of a complex human language architecture comprises a parametrized UG that provides explanatory adequacy. That is, in order to explain both language acquisition and the attested linguistic diversity, the generative program conceives the language genotype as a strong

component with respect to the genetic information it contains. Second, I address the bottom-up approach, which, as I explain, correlates with minimalist constraints of the language architecture and strict biological notions. Taking all this into account, I redefine both the language genotype and the language phenotype, highlighting the importance of epigenetic processes that might affect MHL's biological emergence. Finally, I describe the biolinguistic problem of linguistic diversity with respect to parametric theory.

Based on this context, in Chapter 3 I discuss the nature of parameters in two main senses: on the one hand, the hierarchical structure of parameter relations; and, on the other, the emergent nature of parameters themselves. With respect to the former, it is clear that the motivation for this idea began with crucial evidence from structural variation and its distribution across languages. However, as the typological description has progressed over time, the implicational network seems to have lost its empirical justification. In addition, from a theoretical point of view, neither the macro- nor the micro-specifications provide explanatory adequacy for the overspecification problem. In this sense, the emergent approach to the nature of parameters arises as an evenhanded attempt, since it not only allows us to maintain the 'parameter' notion for linguistic diversity (and language acquisition) but it also provides explanatory adequacy. In other words, an emergent approach to parameters contributes to one of the central aims of the biolinguistic program: minimalizing UG in order to resolve the overspecification problem.

Accordingly, in the second part of Chapter 3, I defend the hypothesis of parameter emergence. Returning to the epigenetic aspects previously discussed in section 2.2, I address the conditions that seem to constrain the development of parameters. Following one of the central proposals in this line, namely Roberts' (2012) theory (see also Holmberg & Roberts 2014) of parameter emergence, I discuss the idea of interaction of Chomsky's three factors in language design as the main condition for the emergence of all kinds of macro- and micro-parametric specifications, that is, parameter hierarchies in Roberts' approach. As seen, Roberts' interactional hypothesis provides a key advantage: in terms of parameter emergence, the interaction of the three factors of language design is conceptually aligned with epigenetic approaches, which implies that the overspecification of UG can be avoided.

As I point out, that interaction is not only responsible for the emergence of parameters but also their hierarchical organization, an important aspect for the formal conceptualization of macro- and micro-parameters. Structurally speaking, a hierarchical configuration will always be organized based on an implicational principle. That is, a parametric specification at a higher level of the structure will imply other specifications at lower levels of the same structure, and vice versa: a lower specification will imply a higher specification. This organizational feature is observable in Baker's (1996, 2000) typological attempts, as well as in Roberts' (2012) minimalist approach. In both cases, the implicational hierarchy provides a formal framework to explain descriptive concepts such as 'macro- and micro-parameters'. From a typological point of view, the differences between both approaches are, however, difficult to identify. Baker's proposal assumes that the implications are external to each parameter, and, therefore, the implicational network discussed in section 3.1 spans across different grammatical phenomena which are assumed to define typological patterns —as I show, however, their predictions are not always empirically borne out. By contrast, Roberts conceived his hierarchies as part of a single formal aspect (i.e., FFs) which triggers the internal organization of different specifications down the hierarchy through the interaction with linguistic evidence and learning factors. This internal organization has been associated with the concepts of macro- and micro-parameters coined during the 1990s by Baker (see especially 2008 for discussions). In other words, Roberts proposed that the hierarchical organization of micro-specifications are internally implicated in a macro-parameter.

There is, however, a conceptual problem related to Roberts' parameter hierarchies, which I have only been able to address briefly. As pointed out in section 3.2.2 and following many empirical attempts led by Roberts and his colleagues, it is not at all clear why the implicational condition associated to a single structure also has structural effects over other macro-parameters (bringing Roberts' proposal very close to Baker's typological description). In other words, some hierarchical structures imply more than one macro-parameter; hence, it seems to be the case that the implicational condition can split different macro-parameters within a single hierarchy. That is, what was

initially assumed to be an independent internal condition of each kind of (macro-) parameter seems to affect many macro-specifications at the same time in a single complex hierarchy. In this view, Roberts' approach seems to be closer to Baker's implicational network. However, the formal problem is clear: conceptually speaking, a macro-parameter should be, by definition, at the top of the hierarchy. Hence, why do Roberts' hierarchies introduce new macro-parameters at different levels of the same hierarchy?

The justification seems to be rooted in (virtual) concepts such as macro-, meso-, micro- and nano-specifications —which Biberauer and Roberts (2012) introduced and Biberauer and Roberts (2015a, 2015b) and Roberts (2016) have only tentatively addressed—. However, it is not at all clear to me what the nature of the FFs involved in each kind of specification is and how FFs work empirically. I thus intuitively suggest that an explanation for this should consider a number of underspecified FFs, which would, once again, question Roberts' theory as a bottom-up approach. In any case, this issue remains open and represents an avenue for future research.

Returning to the main hypothesis, whether the theory is on the right track, or not, is an empirical issue. In this sense, as I have shown, the interactional hypothesis proposed by Roberts and his colleagues (see Holmberg & Roberts 2014) is clearly too strong, since it only takes into account specific kinds of parameters, which, as shown, are affected by underspecified FFs and, therefore, exclusively linked to core aspects of grammar. However, new evidence of parametric variation suggests that the emergent conditions of other kinds of parameters are more complex, since they seem to be affected by a rich set of diverse features. Accordingly, these kinds of parameters affect different aspects of grammar and its interfaces. I therefore maintain the idea of parameters as emergent properties of MHL but I also suggest that not all parameters are subject to a unique interactional scenario regarding the factors involved. Specifically, by exploring the CLD phenomenon and its development across Romance languages, I have been able to establish a new perspective with respect to the interactional nature of parameters. On the one hand, their emergence is defined by the interaction of different sets of factors; that is, the conditions involved in the emergence process seem to determine different interactional/emergent scenarios. Consequently, the interactional scenarios

—which give rise to the emergence of parameters— are definitely not unique for all kinds of parameters. On the other hand, this new step towards a theory of parameter emergence does not only address the complex properties involved in the different interactional scenarios but also allows us to define a new parameter taxonomy. Thus, I present two kind of parameters: (i) those that emerge as a consequence of the interaction of the three factors of language design; and (ii) those whose emergence is defined when other conditions come into play. I illustrate the latter case with the emergent properties of the CLD-parameter, which can only arise if clitic items become available in the lexicon and the VM-parameter is already specified in the I-language. In this scenario, however, there is no implicational condition involved between both the VM-parameter and the CLD-parameter hierarchies. Instead, there is an implicational relation established only by the properties involved in the interactional scenario for the emergence of certain parameters. In this sense, the epigenetic landscape defines the emergence of parameters. From this point of view, the VM-parameter and the CLD-parameter are formally macro-specifications of their own hierarchies, but one does not imply the emergence of the other.

The taxonomy I suggest in this dissertation is not only justified by the emergent properties that take place in each emergent scenario but also by their linguistic effects. Thus, there are interesting correlations that contribute to the definitions of (i) and (ii) above. As explained, parameters of the kind defined in (i) emerge when FFs interact with the linguistic experience and learning factors. Since these FFs are associated to core aspects of grammar, the linguistic effects can only be observable at the computational level. By contrast, the interactional properties involved by those parameters defined in (ii) are more complex and not restricted to FFs. This means that there is a range of features involving formal, semantic and pragmatic specifications. Accordingly, as I have shown, the effects of such parameters are linked to interface aspects of grammar. In this sense, I define the former kind of parameters as "Core-parameters" and the latter as "Peripheral-parameters". Furthermore, as I discuss, the genetic notion of 'pleiotropy' can also contribute to the definition of the taxonomy proposed. Specifically, since pleiotropy attributes a "master" function to Core-parameters with respect to Peripheral-

parameters, the former —like the VM-parameter— assumes a pleiotropic function over the epigenetic landscape, thus contributing to the emergence of peripheral-parameters —like the CLD-parameter.

The taxonomy I propose is empirically justified by the CLD data as I discuss in Chapter 4. This evidence forces us to have to rethink the nature of parameter emergence. Thus, I claim that Core-parameters emerge only when the interactional scenario is exclusively defined by the three factors in language design; since the main properties that interact are FFs, these kinds of parameters affect only core properties of grammar. By contrast, the emergence of Peripheral-parameters implies a more complex scenario. For instance, these parameters are subject to the pre-specification of Core-parameters. Moreover, the interface effects observed by the CLD phenomenon suggest that the interactional scenario of Peripheral-parameters also includes a more complex set of features that should be encoded in particular lexical items, as seems to be the case with clitics. This complexity can also affect differences at the variational level. Thus, whereas Core-parameters can be more resistant to the effects of change, the properties involved in the emergence of Peripheral-parameters seem to be more susceptible to variation through, for example, a contact situation as the CLD-parameter shows and, therefore, more susceptible to abrupt changes. This aspect must be further explored in future studies.

Whether or not the taxonomy I propose here is correct is still an empirical matter, and, consequently, many questions should be addressed. For instance, in assuming that Core-parameters, like the VM-parameter, have functionally pleotropic effects, it cannot be that they only affect a single Peripheral-parameter. In this sense, it would be interesting to see if the VM-parameter is involved in other grammatical phenomena —e.g., clitic climbing (Bok-Bennema 2006), scrambling or object shift (Vikner 2005)—. For instance, as is well-known, object shift is subject to Holmberg's Generalization (Holmberg 1986, 1999) which specifically refers to the fact that verb movement is a necessary condition to give rise to an object shift.

Holmberg (1999: 1) showed, for instance, that if the verb does not abandon the vP, moving at least to T°, in Scandinavian languages (e.g., Swedish), object shift is not allowed. Gallego (2013) convincingly presented arguments for

object shift to be exclusively subject to verb movement as well. The latter analyzed two different generative strategies used in Romance languages to give rise to VOS word order. Leaving details aside, he showed that a typological distribution is possible to be determined, according to both strategies: on the one hand, Central-Eastern Romance languages (Catalan and Italian) derive VOS sentences through VP-fronting (Zubizarreta 1998; Belletti 2004); and, on the other, Western Romance languages (Galician, Portuguese and Spanish) give rise to VOS word order through verb movement (Ordóñez 1997, 2000). Finally, he extensively analyzed the common properties of object shift configurations in both the Western Romance language and Scandinavian groups, empirically demonstrating that the verb-movement dependence is crucial in both cases.

These data could also be applied to the context developed in this dissertation. In keeping with the idea that the VM-parameter is a Core-parameter, it would, therefore, not be surprising if the verb movement specification also affected the emergence of object shift structures in the same way as it affects the CLD-parameter. Such an analysis will also force us to assume that the object shift configuration is a parametric function of the same kind of the CLD-parameter, namely, a Peripheral-parameter. This assumption has to be empirically demonstrated, but it would provide robust support to the interactional theory and the parameter typology defined.

In sum, the extended theory of parameter emergence proposed in this dissertation maintains a bottom-up perspective with respect to UG, thus contributing to resolve the issue of linguistic diversity within the biolinguistic perspective, namely, the overspecification problem. Emergent scenarios are defined by properties interacting in a similar way as organisms' epigenetic development. Since the properties that are part of the interaction are different, they not only define different emergent scenarios but also two key kinds of parameters whose interaction is epigenetically defined and not implicationally related.

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Hamburg, 30.10.2020