

DERIVING COORDINATE NOUNS WITH MERGE AND PRINCIPLES OF EFFICIENT COMPUTATION*

DERIVANDO NOMES COORDENADOS COM MERGE E PRINCÍPIOS DE COMPUTAÇÃO EFICIENTE

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ABSTRACT

We analyze coordinate nouns in English and derive their properties from Merge and Principles of efficient computation. The proposed analysis relies on extended projections for the coordinate conjunction and provides derivations to the interfaces with consequences for the externalization of the coordinator and the semantic interpretation of the coordinate nouns. The proposed analysis challenges associative theories of learning. It also challenges the view that apparently simplex forms, two-words expressions, are remnants of a previous stage in the evolution of language.

KEYWORDS: simplest Merge, principles of efficient computation, binominals, co-compounds, conjunctions, extended projections, operator features, externalization, language learning, language evolution

RESUMO

Analisamos nomes coordenados em inglês e derivamos suas propriedades a partir de Merge e de Princípios de computação eficiente. A análise proposta baseia-se em projeções estendidas para as conjunções coordenadas e fornece derivações para as interfaces com consequências para a externalização do coordenador e a interpretação semântica dos nomes coordenados. A análise proposta desafia as teorias associativas de aprendizagem. Também desafia a visão de que formas aparentemente simples, expressões de duas palavras, são resquícios de um estágio anterior na evolução da linguagem.

PALAVRAS-CHAVE: merge mais simples, princípios de computação eficiente, binômios, co-compostos, conjunções, projeções estendidas, traços de operador, externalização, aprendizagem de língua, evolução de linguagem.

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1. The puzzle

Coordinate nouns pose an interesting puzzle to any explanatory theory of their form, interpretation and externalization of their parts. We focus on coordinate nouns in English, which are puzzling with respect to the externalisation of the coordinator. In some cases it is externalized e.g. *mother and child*, and not in others, e.g. *lion leopard*. According to the literature, coordinate nouns with an overt coordinator are labelled “binominals”, while coordinate nouns without the coordinator are labelled “co-compound”.² For Wälchli (2004), bare binominals and “co-compounds” “typically express natural coordination, which implies that a close lexico-semantic relationship exists between the coordinands”. Coordinate nouns are also puzzling with respect to their semantic interpretation. For example *mother and child* has a group reading, which is not the case for *lion leopard*.

We address the following questions. Why the coordinator silent in co-compounds and externalized in bare binominals? Why do co-compounds and binominals differ in semantic interpretation? Is their semantics related to the externalization of the coordinator or lack there of?

We proposed elsewhere, (Di Sciullo 2017a), a derivation of multiple DP conjunctions, such as *John, Paul and Mary*, according to which the pronunciation/silence of the coordinator follows from DP movement to the Specifier of a higher phase in conjunction with principles of efficient computation. In this paper, we detail this analysis for coordinate nouns.

The paper unfolds as follows. We describe our theoretical framework. We discuss certain properties of coordinate nouns, focussing on English binominals and co-compounds. We provide derivations for these expressions. Lastly, we point to consequences of our analysis for language learnability and evolvability.

² Co-compounds and bare binominals are found in several language families and have been studied in different perspectives, including typological (e.g. Bower 2008, Wälchli 2004, Arcodia *et al.* 2009), statistical (e.g. Wälchli 2005, Benor and Levy 2006, Renner 2014), and descriptive (e.g. Withney 1889, Di Sciullo 2005b, Scalise and Bisetto 2009, Bawer 2017). We will not discuss the lexical semantic properties of these expressions and their conventional interpretation in some cases.

2. Current minimalist theorizing

Linguistic theory aims to provide the simplest explanation for the basic property of language. The computations of the mind (Universal Grammar) generate an infinite array of hierarchical structures underlying linguistic expressions, which are ultimately interpreted by the conceptual-intentional and the sensori(motor) system. The derivations of Narrow Syntax (NS) lead to Spell-Out, the point where the derivations split into further computations leading to the semantic interface (SEM) on the one hand, and to the phonetic interface (PHON) on the other. This language design embodies the view that the language of thoughts is primary and the externalisation of language is secondary.

Like other biological organisms, language is genetically based. The combinatorial operation of the language faculty, Merge, is the landmark of humans' genetic capacity for language. As it is the case for any biological organisms, language presents growth and diversity within certain limits. Language acquisition and languages in contact give rise to variation. As for all biological organisms, language is subject to natural laws. Principles of efficient computation, external to the language faculty, apply in syntactic derivations, characteristically overriding efficient communication (Chomsky 2005, Berwick and Chomsky 2016, Di Sciullo and Jenkins 2017).

In recent Minimalist theorizing, (Chomsky 2013; Chomsky, Gallego & Ott 2017, 2019) Merge is reduced to its simplest form.³ It applies freely, recursively combining two syntactic objects that have not been combined previously in the derivation (External Merge) as well as objects previously merged (Internal Merge). Merge builds the underlying hierarchical structures of linguistic expressions. It applies to two syntactic objects x and y and forms a set: Merge (x,y): $\{x,y\}$. It reapplies to its own output and forms larger sets by merging another syntactic object z to the one previously derived: Merge ($z,\{x,y\}$): $\{z\{x,y\}$. Merge is recursively unbounded and generates the discrete infinity of language. While Set Merge generates unordered sets of syntactic objects, Pair Merge generates adjunctions.

³ Simplest Merge is not sensitive to c -selection features, which restricted the insertions of lexical items in phrase structures in previous models, including the Standard Theory (Chomsky 1965) and the Government and Binding Theory (Chomsky 1981). Simplest Merge is not sensitive to features driving the displacement of syntactic constituents, including the EPP and the Edge features. Simplest Merge contrasts with Crash-free syntax (Frampton and Gutman 2000), where Merge derives grammatical sentences only. Merge applies freely and derivations are cancelled for example when problems of labelling arise. See Chomsky (2013).

While Merge generates hierarchical structures, feature sharing between linguistic constituents is subject to AGREE.⁴ This operation is asymmetrical, and relates unvalued features on a Probe ([uF]) to an inherently valued feature ([F]) on a Goal located in the Probe's structural sister. Unvalued feature must be valued before the interfaces in order to satisfy Full Interpretation. We proposed elsewhere (Di Sciullo 2015, 2017a) to reduce principles of efficient computation to two overarching principles: Maximizing Asymmetry and Minimizing Externalization, each one subsuming specific principles. Derivation-by-Phases and AGREE is part of the principles of Maximizing Asymmetry.⁵ Minimize Externalization includes conditions such as Pronounce the Minimum (Chomsky 2001), according to which copies of displaced constituents are generally not pronounced, as well as Collins's (2007) economy condition on Spell-Out, according to which either the Specifier or the edge of a phase is pronounced, but not both.⁶ According to our hypothesis, principles enforcing efficient computation would be reduced to the ones relevant to language design, basically Merge and the two interfaces.

We provide derivations for coordinate nouns in the framework outlined above. Before doing so, we discuss some properties of coordinate nouns in English.

3. Coordinate nouns

Coordinate nouns in English are interesting on several counts, including the distributional properties of their constitutive nouns, their structure and their interfaces. We will discuss them in the following paragraphs.

⁴ See Chomsky (1995), (2000a), (2001), (2008). See also Di Sciullo (2005a) and Di Sciullo And Isac (2008) for the asymmetry of AGREE.

⁵ Derivation by phases and AGREE rely on asymmetrical relations. For example, according to the Phase Impenetrability Condition, only the edge of a phase, the head and the Specifier, are accessible to AGREE and Merge.

⁶ The condition on Spell-Out is a more general version of the Doubly-Filled Comp Filter (Chomsky and Lasnik 1987, Koopman and Szabolcsi 2000) requiring that one or the other constituent of a phase edge must be pronounced, but not both.

Condition on Spell-Out

- a. Edge(x) must be phonetically overt.
- b. The condition in (a) applies in a minimal way so that either the Head or the Specifier, but not both, are spelled-out overtly. (Collins 2007:3)

3.1 Nouns in coordinate nouns

Based on distributional properties the constituents of binominals and co-compounds are not regular nouns.

Differences between regular nouns, bare nouns and light nouns have been discussed in several works, including Carlson (1977), Stvan (1998), Kishimoto (2000, 2004), and Barry and Yoo (2017). In English, contrary to regular nouns, bare nouns cannot be preceded by an article, e.g. **I stayed at the school*, they do not permit adjectival modification e.g. **I stayed at nice school*, and they do not allow plurals, e.g. **I stayed at schools*. Contrary to bare nouns, light nouns, can be quantified, e.g. *someplace, something, somebody*; attributive adjectives must follow them, e.g. *someplace nice, something nice, someone nice*, they do not combine with demonstratives, e.g. **this body, *that body*, and they do not allow plurals, e.g. **someplaces nice, *somethings nice, *some bodies nice*. The nouns in binominal and co-compounds cannot be preceded by a determiner, be quantified or modified by an attributive adjective that would follow them, or combine with a demonstrative. See (1)-(2).

- (1) a. This [lion (**the/*this/*one*) leopard] is interesting.
b. This [lion (**every/*one*) leopard] is interesting.

- (2) a. This [mother and (**the/*this/*one*) child] is impressive
b. This [mother (**nice*) and child] is impressive.

Collins (2007:16) proposed that in English, the different kinds of nouns differ in their extended projections. Only regular nouns project the full DP structure, (3a). Bare nouns do not project intermediate functional structure between NP and DP, (3b). As for light nouns, they can project QP but not DP, (3c). They are NP with no Case feature. Furthermore, as illustrated in (3), the same lexical item, for example *home*, can be used as a regular noun, a bare noun or a light noun, and project full or impoverished functional structure accordingly.

- (3) a. regular nouns: cat, dog, house, home (e.g. stay at the nice home)
 [DP D [FP ADJ [NUMP NUM NP]]]
- b. bare nouns: school, work, church, home (e.g. stay at home)
 [DP NP [D' D <NP>]]
- c. light nouns: thing, body, one (non locational)
 [QP Q NP] home, place, PLACE (locational) (e.g. stay home)
 NP (no DP, no Case feature)⁷

Collins (2007:16)

The nouns in binominals and co-compounds project no more than NP structure. They cannot combine with categories above NP in the nominal extended projection, including determiners, quantifiers, demonstratives, and numerals. Their internal structure is opaque to agreement, including number agreement and anaphora, see (4)-(5), where ≠ stands for difference in interpretation.⁸

- (4) a. There several/twenty [lion (*s) leopards] on the shore.
 b. ≠There were several/twenty [mother (*s) and child] on the shore.

- (5) a. The [[lion] leopard] saw itself in the pond.

^-----/-----|

- b. The [[mother] and child] saw themselves in the pond.

^-----/-----|

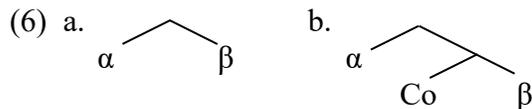
⁷ There is language variation with respect to the syntactic distribution and the semantic interpretation of bare nouns. In English, bare nouns are used more freely than in Italian (Longobardi 2001). For example, nouns like *home* in English can be used as a regular noun, e.g. *stay at the nice home*, as a bare noun, e.g. *stay at home*, or as a light noun, e.g. as *stay home*, whereas this is not the case for Italian, e.g. *stare a casa* “stay at home”, **stare casa* “stay home”.

⁸ Di Sciullo and Williams (1987) refer to this property in terms of syntactic and semantic opacity, which is characteristic of morphological objects, such as compounds in English. In these expressions, the stress pattern does not follow the Nuclear Stress Rule (Chomsky and Halle 1968), but falls on the non-head of the compound. These expressions are opaque to extractions and their interpretation is non strictly compositional. See Di Sciullo and Williams (1987) for discussion.

We will take the nouns in binominals and co-compounds to be used as light nouns, that is, nouns without any functional structure between DP and NP.

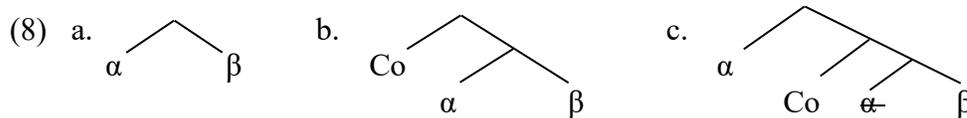
3.2 Structure

In a model where the operations of the language faculty generate hierarchical structures, and where syntactic operations are structure-dependent, coordinate structures cannot be reduced to a flat structure, as in (6a), where α and β , two nominal categories, are sisters. Coordinate structure have been analysed as being asymmetrical with respect to dominance relations, as we illustrate in (6b) (Munn 1992, Thiersch 1993, Kayne 1994).



The question arises whether the derivation starts by combining α and β , combining the coordinator (Co) to the previously derived constituent, as suggested in Chomsky (2013), see (7)-(8), or whether the coordinator is first merged with one of the conjuncts, and the resulting structure is then externally merged with the other conjunct, see (9)-(10).⁹ Given simplest Merge, both derivations are possible.

- (7) 1. ExtM (α, β) : { α, β }
 2. ExtM (Co, { α, β }) : {Co { α, β }}
 3. IntM ($\alpha, \{Co, \{\alpha, \beta\}\}$) : { $\alpha \{Co \{\alpha, \beta\}\}$ }

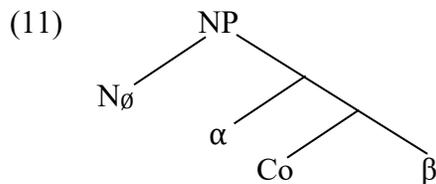


⁹ Yet another possibility would be to analyse coordinate structure as adjunction structures and derive them with External Pair Merge. We will not discuss this third option here. However, it is worth noting that there is no modification relation relating the conjuncts in co-compounds such as *lion leopard*, as it is the case with *toy-gun* (fake gun), *mushroom soup* (soup with mushrooms) or *children hospital* (hospital for children).

- (9) 1. $\text{ExtM}(\text{Co}, \beta) : \{\text{Co}, \beta\}$
 2. $\text{ExtM}(\alpha, \{\text{Co}, \beta\}) : \{\alpha \{\text{Co}, \beta\}\}$



In previous work, (Di Sciullo 2005b) we analysed the structure of co-compounds as being exocentric. That is, the categorial and semantic head of the compound is external to their constituent structure.¹⁰ According to this analysis, a functional head, a conjunction or a disjunction asymmetrically relates the two conjuncts, (11).



As expected, the categories of the conjuncts can be different from the category of their conjoined constituents, e.g. *mother-and-child* vs. *up-and-down* and *hit-and-run*. We propose in section 3 that binominals and co-compounds have additional internal structure.

3.3 Interface properties

We observe that the order of the nominal constituents with respect to one another can be altered while preserving semantic interpretation. In co-compounds, both order are generally possible, as it is the case with *lion leopard* and *leopard lion*. In both cases, their reading is that of a single complex entity with intersecting semantic properties of the first and of the second nominal

¹⁰ This is in accord with Chomsky's (2013) view according to which certain categories, including conjunctions, do not project their label.

constituent. Similarly, nominal constituents in binominals can be reorder without altering their semantic interpretation. This is the case for *salt and pepper* and *pepper and salt* for example. This is also the case with *mother and child*; whereas, *child and mother* is not the preferred order.

Languages vary in the form of coordinate nouns. For example, in the case of co-compounds in Italian *sale e pepe* (salt and pepper) is preferred to *pepe e sale* (pepper e sale). In French, the order of the modifier with respect to the head in root compounds is not the one observed in English, as it is the case for *poisson chat* (cat fish) and *homme elephant* (elephant man). This suggests that the order the constituents is not derived in narrow syntax, but rather in the phonological component of the grammar. Simplest merge derives unordered sets of constituents, which are interpreted at the semantic interface; whereas linear order is derived in the phonological component and interpreted at the phonetic interface. Given that language of thoughts is primary and externalization is secondary, we expect the derivations of coordinate nouns to include structural dependencies between the nouns and a coordinator, even if the latter is not externalized.

As we have seen previously, in coordinate nouns, the coordinator can be pronounced in some cases and remain silent in other cases. Is there is a relation between the externalization of the coordinator and the semantic interpretation of coordinate nouns? We observe that the semantic interpretation of coordinate nouns differs whether the coordinator is silent as opposed to pronounced. For example, co-compounds such as *lion leopard* and *tent house* are interpreted as complex entities, which interpretation results from an intersection of the interpretation of each nominal conjunct. Thus, a *tent house* is an entity, which shape is that of a tent and which use is that of a house. On the other hand, binominals such as *mother and child* and *salt and pepper* are interpreted as complex entities consisting of the group interpretation of its nominal conjuncts. The examples in (12)-(13), where \neq stands for difference in interpretation, illustrate this difference.

- (12) a. John is looking for a tent house.
b. John is looking for something that is both a tent and a house.
c. \neq John is looking for something that is a tent and for something that is a house.
d. \neq This tent house are often together.

- (13) a. Mary is looking for salt and pepper.
b. ≠Mary is looking for something that is both salt and pepper.
c. Mary is looking for something that is salt and for something that is pepper.
d. This salt and pepper are often together.

There are apparent counterexamples to this generalization. One case is co-compounds such as *friend and colleague*, which interpretation can be intersective: someone, which is both a friend and a colleague. However, such expressions are coordinations of predicate nominals and not of simple nouns. Predicate nominals denote properties and not entities, as the following examples illustrate, *John is a friend and colleague*, vs. # *A friend and colleague is John*.¹¹ Another apparent counterexample is bi-nominals such as *Alsace-Lorraine* and *Austria-Hungary*. These coordinate nouns have neither the intersective nor a group interpretation, but denote a geographical region, which is part of encyclopaedic knowledge, and thus is not derived.

In the core cases, the semantic relation between the nominal constituents of coordinate nouns differs whether the coordinator is externalized or whether is not externalized. When the coordinator is externalized, the semantic operation that determines the interpretation of the coordinate structure is the group operation. When the coordinator is not externalized, the semantic operation is the intersection operation.

Based on cross-linguistic data and on previous work by Winter (1995, 1998), Szabolcsi (2015) argues that in common natural languages, *and* and *or* do not perform Boolean operations or sum up entities themselves but point to the existence of silent operators which actually perform Boolean operations or sum up entities. Zhang (2015) also argues that such operations as set intersection and group forming are not preformed by *and* itself. She proposed that natural language coordinators are essentially markers of data structure list. She argues for a decompositional semantics to account for the syntax and semantics of natural language *and* and *or*, including i) building a list, ii) handling the determinism in the case of *and* and the non-determinism in the case of *or*, and iii) delivering the list for further computation. If the operations of set intersection and

¹¹ See also Heycock and Zamparelli (2004).

group forming are not performed by *and* and *or*, it might be the case that the intersection operator and the group forming operator are part of the extended projection of the conjunction, as we detail in the next section.

The fact that the coordinator is silent in some case is expected, given language design, where the derivations lead to the semantic interface on the one hand and to the phonetic interface on the other, giving rise to interface asymmetries.

The fact that more than one order of the constituent in coordinate nouns is possible follow from simplest Merge, where Merge generate hierarchical structures which are subject to principles of efficient computation, including conditions on Spell-Out.

Based on the properties of nouns in simple coordinate nouns, their possible structures and interface properties, we provide derivations for these expressions in the following paragraphs.

3.4 Derivations

Coordinate nouns are units of computation and interpretation. We will take their internal structure to be derived by phases (Uriagereka 1999; Chomsky 2001, 2008; Te Velde 2006). While each conjunct cannot be displaced outside of a conjoined NP, displacement may take place in their derivation by phases. The lower phase is headed by a Given simplest Merge, constituents can be displaced from a position in a lower phase to a position in a higher phase. We illustrate (14) displacements in (14), where the conjunction (Co) and one of the conjunct NP are displaced from the lower phase to the next higher phase. Convergent derivations and enforced by principles of maximizing asymmetry and of minimizing externalization.

$$(14) \begin{array}{c} [_{NP} \ NP \ [\ Co \ [_{NP} \ NP \ [\ C\emptyset \ NP \]] \\ \quad \quad \quad \wedge \text{-----} | \\ \quad \quad \quad \wedge \text{-----} | \end{array}$$

Principles of maximizing asymmetry will enforce the merger of categories of different types at the onset of the derivation. Thus, at first Merge, a noun first merges with a coordinator. Another bare noun then merges with the previously derived constituent. The lower Co can be displaced to

Principles of minimizing externalization, including Chomsky's Pronounce the minimum and Collin's condition on Spell Out, ensure that the coordinator will be silent in (15a) and pronounced in (15b).¹³ In (15a), the lower copies of the Co head and the NP are not pronounced, given Pronounce the minimum, and given the Condition of Spell-Out the upper F head is silent, as the DP occupies its Specifier position. In (15b), the copy of the displaced DP in the lower phase is not pronounced given Pronounce the minimum. Since there is no phonetic material in the Specifier of the lower phase, Co phase is pronounced, given the Condition on Spell-Out.

3.5 Summary

In recent Minimalist theorizing, Merge, the core operation of the language faculty, is reduced to its minimum and principles of efficient computation can be reduced to two kinds: principles of maximizing asymmetry and principles of minimizing externalisation. This theory allows for the derivation of apparently simplex coordinate structure, where the coordinates are light nouns, that is, nouns lacking intermediate projections between NP and DP, and where the coordinator is silent in some cases. We analyzed the nominal coordinates as NPs, and we proposed that the coordinator projects an extended projection hosting operator features. Disregarding coordinate nouns with predicate nominal conjuncts or associated with encyclopaedic information, a group reading is derived when the coordinator is silent; whereas an intersective reading is derived when the coordinator is pronounced. The derivations provide the internal structural dependencies and the relevant interpretations for coordinate nouns at the semantic and at the phonetic interfaces.

4. Consequences for the development of language

Our analysis has consequences for language learnability and evolvability, as we point to in the following paragraphs.

¹³ See Di Sciullo (2017a,b) for independent motivation of the proposed analysis, namely that Condition on Spell-Out applies in the derivations of multiple coordinate structures, as well as in the derivation of locative pro-forms in Abruzzi's dialects.

4.1 Learnability

The hypothesis that the extended projection of functional categories such as the coordinate conjunction host operator features that are externalized in some cases and remain silent in other cases has consequences for language learnability. This hypothesis is attuned with naturalistic theories of learning instead of associative theories of learning.

Naturalistic theories of learning (Chomsky 1988, 2008; Gallistel and King 2009, Yang 2010; Yang *et al.* 2017) dominate generative linguistic thinking, as well as computational linguistics. This model is based on the idea that the child is genetically predisposed to learn the grammar of the language (s)he is exposed to on the basis of exposure to partial linguistic evidence. Language is a computational system, which is part of the human genetic endowment, and language learning is a process of computing values of abstract variables. The brain computes a representation of the experienced world, and behavior is informed by that representation.

Associative theories of learning (Pavlov 1928; Hull 1952; Hawkins and Kandel 1984; Rumelhart and McClelland 1986; Smolensky 1986) dominate neurobiological thinking, as well as computer sciences, including Machine learning, a method of data analysis that automates analytical model building. This method is based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention. Associative theories of learning assume that language is not a computational system and that the knowledge of language is not part of human's genetic endowment. The brain rewires itself to make behavior better adapted to the experienced world. It does not compute a representation of that world.

Naturalistic theories of learning predict that the child is capable to compute abstract operations, such as set intersection and group formation without being exposed to massive set of data including overt markers of such operations and their associated patterns. Associative theories of learning however cannot provide an explanation for the fact that while functional categories such as conjunctions are often absent from the data to which the child is exposed, (s)he is nevertheless capable to compute the underlying structure and the interpretation of linguistic expressions, including the interpretation of co-compounds.

4.2. Evolvability

The hypothesis that the extended projection of functional categories such as the coordinate conjunction host operator features has consequences for language evolvability. This hypothesis is attuned with the emergentist theories of language (Berwick and Chomsky (2016) instead of the gradual evolution of language (Hurtford 2001, 2012; Boeckx 2017).

According to the evolutionist view (Bickerton 1990, Hurtford 2001, 2012) proto-syntax is an intermediate state of development: pre-syntactic (one word) stage > proto-syntax (two word) stage > modern syntax.¹⁴ Jackendoff (2002) takes proto-language to be derived by proto-merge, the precursor of full-fledged Merge. Proto-merge would be an n -ary operation that generates flat concatenation/adjunction structures. Progovac and Locke (2009), analyse exocentric VN compounds in English such as *pick-pocket*, as remnants of proto-language on the basis of their apparent simple and irregular form.

According to the emergent view of the evolution of language, the language faculty comprises a distinctive human phenotype that resulted from a small rewiring of the human brain. Language faculty did not evolve. According to the evolutionist view, language evolved gradually from simpler states, under different selection pressures. The inherent difficulty with any evolutionary explanation of human language has been already foreseen previous works. In particular, Lenneberg (1969) points to the fact that it is not possible to reconstruct what the selection pressures were and the targets of the selection.

More recently, Huijbregts (2019) argues that language is a system of discrete infinity, it could not have evolved gradually, as it is a logical impossibility for finite languages, for example from finite proto language, to have evolved into infinite languages gradually. The analysis of VN compounds or coordinate structures as remnants of earlier stages of languages is irrelevant to the problem of the evolution of language, given that language is a system of discrete infinity and that the gradual evolution of a finite language into infinite language is not a logical possibility.¹⁵

¹⁴ For Bickerton (1990) for example, proto-language had a large vocabulary of words, but no internal syntax. For Hurford (2001, 2012), proto-thought had something like predicate calculus, but had no quantifier or logical name

¹⁵ See also Di Sciullo (2013) and Nóbrega and Miyagawa (2015) for discussion.

Moreover, the analysis of co-compounds and binominals, we proposed in section 3, illustrates that extended hierarchical structures, including unpronounced categories, underlie apparently simple forms. Simple Merge in conjunction with principles Maximizing asymmetry and Minimizing Externalization ensures interface legibility, whether the coordinator is externalized or not.

The alleged proto-merge analysis of apparently simple and irregular expressions is a stipulation and is irrelevant to the evolvability of recursive languages. An analysis based on simplest Merge and principles of efficient derivations of apparently simple and in some case irregular expressions offers a deeper explanation for the human capacity for language than evolutionary proto-merge analyses.

5. Summary

We provided an analysis of English coordinate nouns in a framework where Merge and principles of efficient computations are reduced to the minimum. We proposed an extended syntactic projection for conjunctions, where feature sharing relates the categorial features of the lower conjunction head to the operator features of the higher functional head.

We explored the hypothesis that coordinators in natural language are distinct from their logical Boolean and non-Boolean counterparts. We proposed that operator features, namely the intersection feature and the group feature, are part of functional heads in the extended projections of conjunctions. They are interpreted at the semantic interface without being externalized at the phonetic interface in some cases. Given principles maximizing asymmetry on the one hand and principles minimizing externalization on the other, the derivations of coordinate nouns lead to interface representation legible by the external systems and account for the asymmetry between the semantic and phonetic interpretation in cases where the coordinator is not externalized.

The theory of Universal Grammar should meet the criteria of evolvability, i.e. the rapid emergence of language in homosapiens, and the criteria of learnability, i.e. the computational system generating language (Universal Grammar) is not learned. We pointed out that simplest Merge and Principles of efficient computation provide a deeper explanation for the naturalness of

language development, including the development of apparently simplex forms such as coordinate nouns in the child and in the rapid emergence of language.

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