Natural Law: The Dynamics of Syntactic Representations in MP*

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This work concentrates on the requirements of the computational system of HL, by developing the idea that Natural Law applies to universal syntactic principles. The systems of efficient growth are for the continuation of motion and maximal distance between the elements. The condition of maximization accounts for the properties of syntactic trees - binary branching, labeling, and the EPP. NL justifies the basic principle of organization in *Merge*: it provides a functional explanation of phase formation and thematic domains. In Optimality Theory, it accounts for the selection of a particular word order in languages. A comprehensive and definitive understanding of the principles underlying MP will eventually lead to a more advanced design of OT.

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1 Introduction

Minimalist Program and Optimality Theory are complementary approaches. Their implementation exemplifies a natural tendency to

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proceed from descriptive methods toward a more generalized, explanatory adequate theory.

At this point, OT- system should be reformulated in such a way that the operations of the computational system of human language CHL can provide an account for the syntactic constraints. So far, proposals of how to go about this incorporation are lacking. The present state of disjunction leaves both MP and OT with certain flaws. It is not clear what basic operations underlie CHL, and how these operations relate to the output of the system.This inconsistency can be cancelled by incorporating the insights of MP and OT into a larger, highly desirable comprehensive scheme. A question that remains unanswered is the implication of the crucial difference between OT (static) and MP (dynamic) models - OT does not involve movement, and MP does. While MP is concerned with structural aspects and derivational procedures of the generator, OT is designed to assess the resulting syntactic representations. According to the view expressed in this paper, the proposals of what rules apply on the generator should precede an adequate formulation of interface/ output conditions that follow from more basic assumptions.

Natural Law (NL) exemplified in the growth of organisms as the Fibonacci (Fib) sequence has serious consequences for the theory of syntax. Similar to other structures that comply with NL, tree structures are maximized. The principle of maximization applied to the sequence of nodes in syntactic trees provides a functional explanation of binary branching, labeling, and the Extended Projection Principle (EPP) – the requirement for a sentence to have a subject. This explains why languages tend to have filled specifiers and complements, and why the number of arguments found in natural languages is limited the way it is.

The maximization requirement that every head must have an XP complement creates a problem at the bottom-most layer of a syntactic tree: it eliminates a line in a tree with only terminals. The solution to this problem lies in redefining binarity to include *level 0*, which follows directly from the functional pressure of cyclic derivation: each successive element combines with two already merged elements, not with one. For example, merging 1 with 2 (which is a sum of 1 and 1) yields a new element 3. However, merging two elements none of which is a sum – such as 0 and 2 – will not yield a new element. 'Zero'-branching is exemplified e.g. as X-labeled elements in conjunctions. Furthermore, determining whether a node is an XP or an X in terms of a Fib sequence depends on whether the element is a result of Merge or not. In addition, a node has to be immediately dominated by a node bearing a different label. This clarifies the notion of labeling, and answers the question of what labels can be disposed of in syntax.

Redefining syntactic representations in terms of NL leads to the discussion of phasal properties of xPs, in Chomsky's sense (2001, 2004, 2005). A 'maximal thematic domain' requires a single pair of dyadic structures: the lower part constitutes a relation between individuals, and the upper part relates individuals to events. It is shown that passives of double object constructions (with obligatory arguments) and Applicative constructions (with optional arguments) follow the same pattern of derivation. NL explains why XP should be a well-defined space in a derivation, and argument representations are constructed a certain way. The cross-linguistic analysis offered in this paper leads toward the definition of both minimal and maximal syntactic domains.

This paper offers new ideas concerning minimal requirements imposed by CHL, and represents movement as a crucial part of the dynamic model of MP. The proposals of what rules apply in the process of generation of syntactic structures will allow OT to evaluate the resulting syntactic representations, and adequately formulate the output conditions.

1.1 Natural Law

The Fibonacci series is one of the most interesting mathematical curiosities that pervade the natural world. The series was invented around 1200 by Leonardo Fibonacci. In the series, each new term is the sum of the two that precede it: X(n) = X(n–1) +X(n–2), 0,1,1,2,3,5,8,13,21,…The limit ratio between the terms is an irrational number .618034..., ‘Golden Ratio’ (GR). For centuries, it has been recognized that e.g. plants have a fixed number of leaves and petals. Early approaches to FS in nature were purely descriptive; they just sorted out the geometry of patterns. Recently, a theory of plant growth (phyllotaxis) explained the observed arrangements as following from space filling (Douady & Couder, 1992).[1] This system follows from simple dynamics that impose constraints on the arrangement of elements to satisfy conditions on efficient packing. Fib numbers are evident in the growth of every living organism.[2]

1 The Fib sequence is related to maximizing space. As a consequence of simple dynamics, successive elements form at equally spaced intervals of time on the edge of a small circle, representing the apex. The repulsion between elements ensures that the radial motion continues and that each new element appears as far as possible from its immediate successors.

2 In humans, Golden Ratio appears e.g. in the geometry of the DNA molecule . On a cellular level, the ‘13’ Fib-number present in the structure of microtubules (cytoskeletons and conveyer belts inside the cells) may be useful in signal transmission and processing. The brain and nervous systems have the same type of

1.2 The discrete infinity of language

The faculty of language (FL) in the broad sense (FLB) includes a sensory-motor system, a conceptual-intentional system, and the computational mechanisms for recursion; FL in the narrow sense (FLN) only includes recursion (Hauser et al, 2002). A highly specific property of the *discrete infinity* makes FLN crucially different from other discrete systems found in nature.[3] This is the most elementary rule of syntax; there are neither n-and-a-half words nor n-and-a half-word sentences. Furthermore, there is no limit to the length of a meaningful string of words; there are ten-word sentences, twenty-word sentences and so on indefinitely. This property is exemplified e.g. in a well-known nursery rhyme where each sentence Xk with a number of words **n** is succeeded by a sentence Xk+1 with a number of words **n**+*m*: Xk+1 (n) = Xk (n+*m*).[4] In contrast, the Fib sequence in other biological systems exhibits *discrete finiteness*. Discretely infinite syntactic recursion is a species-specific property of the human mind. Consequently, finding out more about the principles underlying recursion will provide us with the clue to the structure of mental representations. Hauser et al. argues that FLN may have evolved for reasons other than language. In this article, rather than trying to identify the driving force

cellular building units, so the response curve of the central nervous system may also have the Fib sequence at its base.

3 The only other system of this kind - arithmetical capacity – can also be a part of FLN (Chomsky 2000).

4 (i) The discrete infinity of language / 'The House That Jack Built' X_k +1 (n) = X_k (n+*m*): X_2 (n) = X_1 (n+4),…, X_5 (n) = X_4 (n+4), X_6 (n) = X_5 (n+8), …

(ii) Various kinds of flowers have a fixed number of petals. For each kind K of a flower (a, b, c, d, e,…), there is a fixed number of petals X that corresponds to a Fib number, e.g. K_a=X(3), K_b=X(5), K_c=X(8), K_d=X(13), K_e=X(21), K_f=X(34), K_g=X(56).

behind the evolvement of FLN, we will approach FLN as a part of a more general system.

2 Maximization of syntactic trees

Recently, it was shown that syntactic structures exhibit certain mathematical properties (Carnie et al. 2005). Similar to other systems that comply with NL, tree structures are maximized in such a way that they result in a sequence of categories that corresponds to FS.

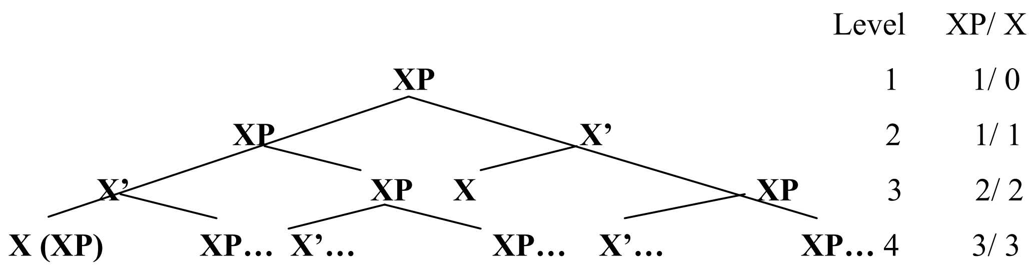

Fig. 1

The tree is generated by merging two elements; the next operation adds a newly introduced element to the already formed pair. Each item is merged only once; every subject/specifier and every object/complement position is filled. In the traditional sense of Chomskyan X-bar theory, a label immediately dominated by the projection of another category is an XP(hrase).[5] Other non-terminal nodes are annotated as X'. For example,

5 The Fib-sequence in a tree is related to the fact that each node dominates exactly one maximal projection. Possibly, hierarchical structures created by pair-Merge (adjunction) comply with NL as well. This gives rise to the following question. It is not clear how the Narrow Syntax can determine that pair-Merge is required, rather than the default set-Merge. Rubin (2003) proposes the (obligatory) existence of a functional category, Mod, in the structure of adjuncts ([Mod [[YP]Adjunct]]) that is parallel in nature to functional categories in clauses.

Adam loves Eve may have a representation [$_{XP}$ [$_{XP}$Adam] [$_{X}$ loves $_{X'}$ [$_{XP}$Eve]]] where XPs are phrases, X's are intermediate projections, and Xs are 'heads'. Count XPs in each line of this derivation, and you will receive a partial FS (1, 1, 2, 3,…). If XP(n) is the number of XPs in the nth level, then XP(n) = Fib(n). This property is true of all trees that are maximized by having specifiers and complements filled.

What is the reason behind compositionality that motivates combining exactly two terms in a set? The requirement to achieve tree maximization explains why the trees are constructed out of binary units. If Merge were allowed to optionally select three terms and combine them into a ternary structure, then FS of maximal categories would disappear. The sequence where each term A_n combines with the two that precede it is 1, 1, 1, 3, 5, 9, 17, 31, 57,... The ternary branching system shows a Fib-like sequence; however, the arrangement of elements displays a ratio different from GR, which fails to meet the condition of optimization. As a result, ternary branching or any operation that merges more than two syntactic elements is disallowed.[6]

NL provides an external motivation for Merge to distinguish between syntactic labels in a particular way. Determining whether a node is XP or X follows directly from the functional pressure of cyclic derivation. The Fib-based system distinguishes between *a sum of terms* and *a single term* (XP/ X), rather than XP/ X' or X'/ X. For example, level 4 has three XPs and three non-XPs: two X's and one X (cf. Level 3 – 1 X', 1 X, 2 XPs; Level 2 – 1 X', 1 XP). The assumption that syntactic structures have an

6 Chomsky (2006) asserts that "Merge cannot create objects in which some object W is shared by the merged elements X, Y. It has been argued that such objects exist. If so, that is a departure from SMT, hence a complication of UG."

intermediate X’ projection is a stipulation: basic syntactic representations are *monadic* (cf. the *dyadic* model of X-bar theory).[7]

2.1 Zero-Merge

The requirement to have specifier and complement positions filled faces a problem: it creates a ‘bottomless’ tree by eliminating a line with only terminal Xs. However, real sentences always have an ending point. The solution to this problem lies in redefining syntactic binarity to include zero-branching – in other words, to start FS with 0 instead of 1. This follows directly from the requirement of NL: each successive element is combined with a sum of already merged elements, not with one: merging 2 with 1{1, 0} yields a new element 3, while merging two elements one of which is not a sum (2+0) does not. In the present system, singleton sets are indispensable for recursion.

The newly introduced type of merge, Zero-merge (Ø-M) distinguishes between *entities* {1}/X and *singleton sets* {1, 0}/XP at the bottom of the tree. New terms are created in the process of merging *sums* with *entities* to ensure continuation of motion; in (fig. 2), (i) and (ii) are the instances of Merge while (iii) is not. When the sum of terms is present at each step, it provides the ‘bottom level’’ in the syntactic tree.

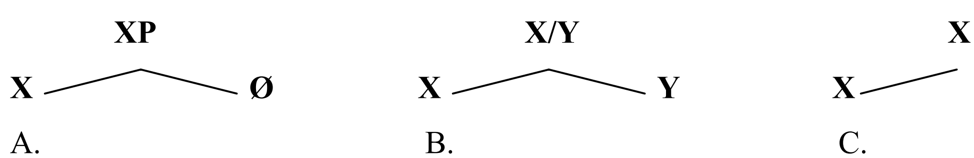

Fig. 2

[7] See also Collins (2002).

The suggestion to regard an empty element as functional in Merge has serious consequences for the theory of binary branching. The minimal building block that enters into linguistic computation is re-evaluated to include Ø-Merge, and identified as the product of Ø-Merge.[8] As a result, binarity is preserved, while there is no problem caused by the requirement to have specifier and complement positions filled. XPs and Xs can be disambiguated, which eliminates the necessity to proceed with further branching below the bottom level. Furthermore, labels X and XP are not syntactic primitives.[9] There exist numerous instances of label-switching between X and XP; for example, *that* may behave as X and XP in the same sentence.[10] The analysis along the lines of NL clarifies the notion of labeling, and answers the question of why labels can be disposed of in syntax. The idea that constituent structures are labeled appears to be a stipulation - this part of Merge should be abandoned in favor of a more explanatory adequate rule. As the grammar evolves toward a more generalized syntactic representation, the only necessary mechanism is not the one that determines which node is XP and which is X or X', but the one that determines whether a node is a result of Merge or not. Thus,

- *Determining whether a bottom node is XP or X depends on whether the element undergoes Ø-Merge.*
- *Determining whether a node is XP or X depends on whether the element is the result of Merge.*

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8 For the discussion of zero-branching constructions (bare nouns in conjunctions) see Roodenburg (2004).

9 Heads can behave like Phrases and visa-versa, according to Carnie (2000), Collins (2002), and Chomsky (2004, 2005).

10 (i) $_{XP}$ That $_{X}$ that is, is; $_{XP}$ that $_{X}$ that is not, is not - we all know $_{XP}$ that.

2.2 Argument structure

Why is the number of arguments limited in a certain way? *Eve_1 laughs*, *Eve_1 kissed $Adam_2$*, and *Eve_1 gave $Adam_2$ an $apple_3$* are the only possibilitied. In contrast, sentences *Eve_1 gave $Adam_2$ an $apple_3$ a $pear_4$* and *gave $Adam_1$ an $apple_2$* are ungrammatical: in the former, there is an extra argument; in the latter, one argument is missing. If we agree that syntactic principles follow from more general rules, we can make suggestions as to why thematic domains have a fixed number of nodes.

Merge is operation responsible for the construction of elementary trees and combination of these pieces into larger structures. Strong Minimalist Thesis entails that Merge of α, β is unconstrained. Under External Merge (EM), α and β are separate objects; under Internal Merge (IM), one is part of the other, and Merge yields the property of *displacement* (Chomsky 2001). The argument structure is the product of EM. The pressure for the tree to be maximized justifies the basic principle of organization in both types of Merge. Move is just one of the forms of Merge: EM induces IM by virtue of the fact that already conjoined elements have to be *displaced* to occupy maximally advantageous positions in the tree.

The application of Fib-rule makes some interesting predictions about the constraints on EM. Assume that Ø-Merge (Ø-M) is the operation responsible for constructing elementary argument-centered representations prior to lexical selection.[11] Ø-M is relevant for distinguishing between

[11] Chomsky (2006) specifies that there exist other argument-based constructs such as e.g. Pritchett's (1992) theta-driven model of perception, 'relevant to the use of

entities {1}/X (***single terms***) and singleton sets {1, 0}/XP (***sums***). Determining whether a node is XP or X follows directly from the functional pressure of cyclic derivation to merge terms of *different* types only.

In contrast with what is found in other natural systems of efficient growth, once a syntactic constituent is formed, it cannot be broken up into parts. The Impenetrability Condition IC induces type-shift from *sums* to *entities* at each level in the tree. For example, at the point where 3 is merged with 5, element 5 is the a of 2 and 3, but 3 is a single entity. As is shown in (fig. 3), $\boldsymbol{\alpha}_2$/1 is shifted from *singleton set* {$\boldsymbol{\alpha}_1$, 0} (XP) to *entity* $\boldsymbol{\alpha}_2$ (X) and merged with $\boldsymbol{\alpha}_3$ (XP). The type of $\boldsymbol{\alpha}_3$/1 is shifted from *singleton set* {$\boldsymbol{\alpha}_2$, 0} (XP) to *entity* $\boldsymbol{\alpha}_3$ (X) and merged with $\boldsymbol{\beta}_1$ (XP).[12]

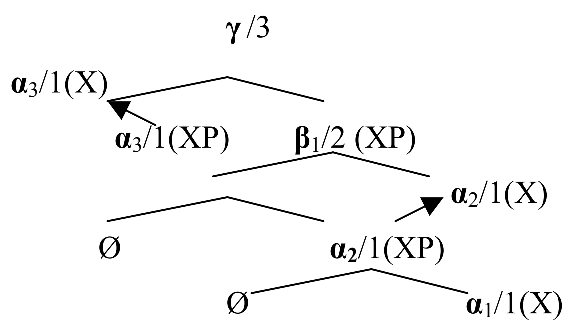


Fig. 3

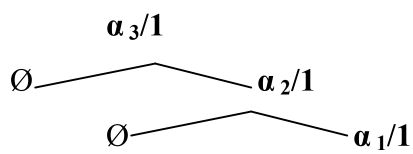
There is a limited array of possibilities for the Fib-like argument tree depending on the number of positions available to a term adjoining the tree. This operation either returns the same value as its input (Ø-Merge), or the cycle results in a new element (N-Merge). The recursively applied rule

language'. In such and similar models, a verb is theta-role assigner. In a Fib-like EM, the only function that matters is the one that identifies arguments.

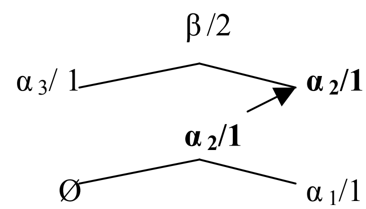
12 Throughout the paper, the author complies with Chomskyan X-bar model to build representations that are not in 'real time'.

adjoins each new element to the one that has a higher ranking in a bottom-up manner, starting with the term that is 'Ø-merged first'.[13]

- Term α_1 can be Ø-merged *ad infinitum*. The function returns the same term as its input. The result is zero-branching structures (fig. 4, A).
- Ø-merged α_1 is type-shifted to α_2 and N-merged with α_3. The process creates a single argument position of intransitive (unergative and unaccusative) verbs, e.g. *Eve*$_1$ *laughs*, *The cup*$_1$ *broke* (fig. 4, B).[14]
- Terms α_2 and α_3 assume positions where each can be merged with a non-empty entity, the result is two positions (fig. 4, C).
- There are three positions to accommodate term 1 (i, ii, and iii). This may explain why in double object constructions the number of arguments is limited to three (*Eve*$_1$ *gave Adam*$_2$ *an apple*$_3$) (fig. 4, D).



A.



B.

[13] Term A may undergo Ø-Merge either first or second. The supporting evidence comes from Japanese that threats the same NP as any of the two. In (i), the argument position of *the girl* is 'Ø-merged second' in the matrix clause and 'Ø-merged first' in the subordinate clause.

(i) Yoko-ga kodomo-o koosaten -de mikaketa onnanoko-ni koe-o kaketa
Yoko-NOM child -ACC intersection-LOC saw girl -DAT called
'Yoko called the girl who saw the child at the intersection'
(Pritchett 1992)

[14] Certain verbs of spatial configuration such as *lean* are unergative with an agentive subject but unaccusative when they take a non-agentive subject (Levin and Rappaport Hovav 1995).

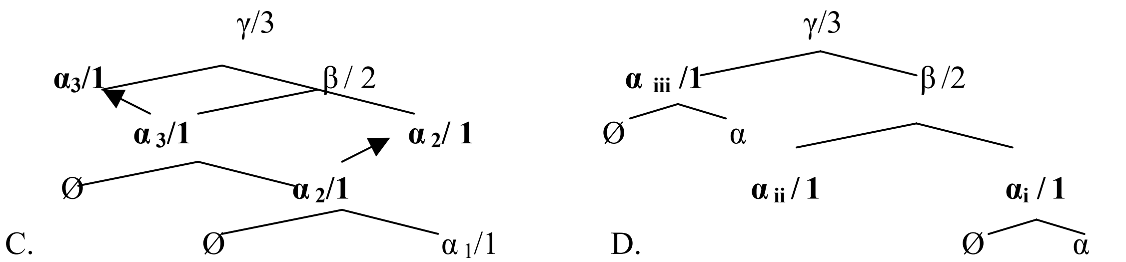


Fig. 4

2.3 Maximal thematic domains

We have shown so far that the NL-logic can be applied to the analysis of EM to provide an account for the number of argument positions. The argument structure is built upon *hierarchical* relations. Hierarchy is assumed to be automatic for recursive operations (Chomsky 2005).

The applicative and double object constructions of the kind *John baked Mary a cake* and *John gave Mary a cake* are essential for the analysis of maximal thematic domains.[15] Recent research on argument structure has resulted in a complex representation that consists of two levels: one involves two individuals, and another expresses an individual-event relation. Sentences *John baked/ gave* [*Mary*] *individual* [*a cake*] *individual* are the first type, and [*John baked a cake*] *event* [*for Mary*] *individual* / [*John gave a cake*] *event* [*to Mary*] *individual* are the second. It was suggested that a relation between individuals is established by means of the Individual Appl

[15] See Marantz (2003), McGinnis (2001), Pylkkänen (2001, 2003).

Head I-ApplH in I-ApplP, and by means of the Event Appl Head E-ApplH in E-ApplP (fig. 5). [16]

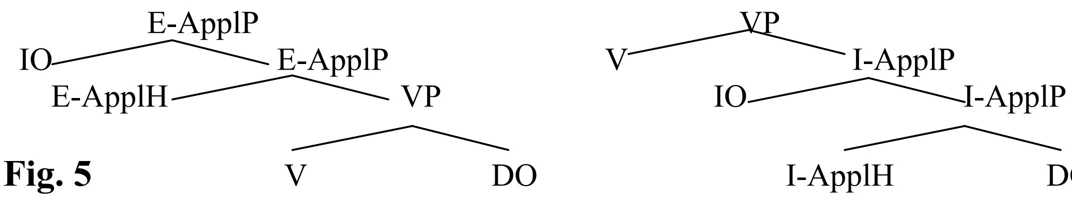


Fig. 5

When the trees are maximized and all positions are filled, the sum of heads, specifiers, and complements yields a maximal space of 13 (the Fib-number):

(1) [XP Y_EP [Y_E Y_E’ [XP *v*P [*v v*’ [XP VP [V V’ XP]]]]]] Y_E E-Appl H

(2) [XP *v*P [*v* *v*’ [XP VP [V V’ [XP Y_IP [Y_I Y_I’ XP]]]]]] Y_I I-ApplH

In theory, there is a strong possibility that maximal thematic domains are constructed to accommodate all possible argument configurations represented in (fig. 6). There does not seem to be any intrinsic reason semantically or morpho-phonologically as to why thematic domains of this kind should be maximal spaces with a particular number of nodes. However, from a broader perspective, there is a sense in which the domains under discussion are maximal (see Part 1).

16 This classification is viewed as necessary to provide an account for the difference in semantic interpretation. See e.g. Erteshik-Shir (1979) and Snyder (2003) on the semantics of the English to-dative and double object constructions with ‘give’.

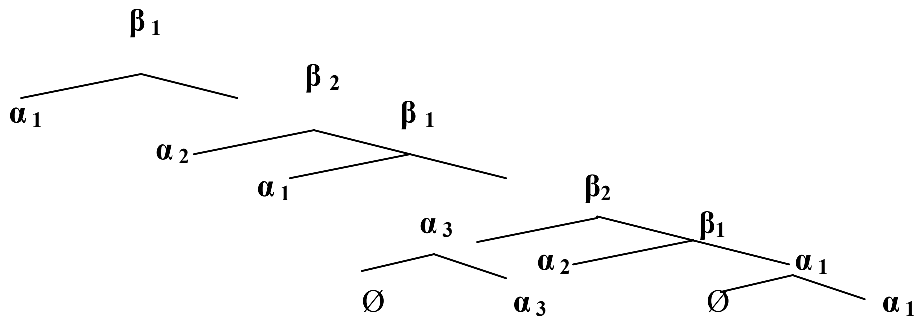


Fig. 6

3. Merge and displacement in syntax

Syntactic representations are characterized by two operations: *Merge* and *Displacement*. As was already shown, EM creates a hierarchical structure with a maximal number 3 as the number of arguments. Application of NL not only makes interesting predictions about the constraints on EM but also explains the properties of IM. *Displacement*, which is relevant at the point of pronunciation, assigns the order to lexical items LIs. It is possible that maximization requirement exemplified as the Fib-law justifies the principle of organization in IM replacing *hierarchy* with *dependency* relation between sisters that invariably involve an antecedent and a dependent.

The explanation of IM is very straightforward if we assume that derivations proceed by phases and movement depends on the qualification of phrases as phases.[17] According to Chomsky's Phase Impenetrability Condition PIC, only the Edge and the Head of a phase are visible to later syntactic operations; the domain is opaque. At the end of each phase, derivations are sent off to PF (Spell-Out) and LF (Interpretation). Are phases propositional? According to Chomsky (who suggests that *v*P and CP

[17] See Chomsky (1995, 2004, 2006) for the discussion of phase formation. See also Boskovic (2002), Epstein and Seely (2002), Legate (2003), Müller (2004), Suranyi (2004), and Wexler (2004).

are phases, while VP and TP are not) the answer is most probably *yes*. Only a fully fledged phrase can qualify as a phase. *Bill likes Mary* is possible because there is an additional position x in Spec, *v*P to accommodate NP *Bill*. This position is projected by a phasal Head *v* in [x_{Bill} *v*P *v* *v'* [$_{VP}$ loves Mary]]. In contrast, *likes Mary* is not a phase as no position x is available to accommodate NP *Bill*: representations of the kind $_{VP}$[x loves Mary] is not feasible. As was already discussed, ternary branching or any operation that merges more than two syntactic elements is disallowed in syntax. In this paper, phases are primarily characterized by their ability to induce a cycle by projecting extra Spec positions, to ensure continuation of movement in derivations. Syntactic phase formation is regarded as language-specific in this article: phases are redefined as *maximal* (propositional) and *minimal* (non-propositional) constituents. It follows then that any X can in principle head a phase.

3.1 Minimal and maximal phases

In the linguistic literature, it was maintained that only the relation between individuals and events constitutes a (propositional) phase, to provide an account of passive formation in the Applicative and Double Object constructions (McGinnis, 2001). It was concluded that the absence of an extra Spec-position in I-Appl Phrase disqualifies it from phases, by blocking direct object (DO) movement. Sentences of the kind *A cake was baked* t_{cake} *for Mary* and *A cake was given* t_{cake} *to Mary* are grammatical (DO-movement of NP *a cake* to Spec, E-ApplP), while *A cake was baked Mary* t_{cake} and *A cake was given Mary* t_{cake} are not. However, I-Applicatives behave like phases in other languages, by allowing DO-movement and blocking IO-movement in passives.[18] Synthetic (inflectional) languages such as e.g. Italian and Hebrew I-ApplPs exhibit the properties of *minimal (min)*-phases, analytical languages such as English and Icelandic lack I-ApplP phases, and both groups are characterized by *maximal (max)*-phases such as *v*P and E-ApplP.[19] The absence of *min*-phases is characteristic of languages with fixed word order, where subject and object have to be ordered with respect to the verb. This is in contrast with languages that establish relations between words by means of inflections.

3.2 Phase parallelism and ECM

A certain class of verbs assigns structural case to an embedded subject in Exceptional Case Marking constructions in sentences such as *Eve wanted* $_{Acc}$*Adam to taste an apple* where NP *Adam* is assigned Acc Case by the matrix verb *want.* This fact was accounted for in terms of CP-reduction. If this is a universally accessible rule, it is not clear why many languages – Spanish, Hebrew, and Russian among them - lack ECM. The explanation of this contrast lies in the distribution of the language-specific types of phases.[20]

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18 (i) [VP V [DO I-ApplP [IO I-Appl' [I-Appl' I-Appl $t_{\mathbf{DO}}$]]]] Italian, Russian, Hebrew, Kinyarwanda
I-ApplP minimal phase
(ii) [IO *v*P *v* [VP V [$t_{\mathbf{IO}}$ I-ApplP [I-Appl' I-Appl DO]]]] English, Icelandic
*v*P maximal phase
(iii) [DO E-ApplP [PP E-Appl' [E-Appl' E-Appl [VP V *t*]]]] I/R/H/K/E/I
E-ApplP maximal phase

19 There is further evidence that syntactic structures that express relations between two individuals should be considered more basic than those expressing a relation involving events. In languages with phasal I-ApplPs, sentences such as *A boy tore a girl a skirt*, *My friend broke me glasses*, *She fixed her neighbor a car*, and *A daughter washed her mother the dishes* are regular grammatical structures.

20 Once the lower T_{inf}P-phase is complete, subject NP in Spec, T_{inf}P requires Nominative Case that cannot be assigned in this position due to the properties of

Phrases can be compared along the lines of their configurations if any syntactic phrase may in principle constitute a phase. For example, [CP C [TP T]] is parallel [VP V [I-ApplP I-ApplH]], because both have a no-label dyadic pair [XP X [XP X]] at their base as (Fig. 10). If this is true, one may expect to identify other *min*-phases in languages with I-ApplP phases, such as e.g. TP and VP.[21]

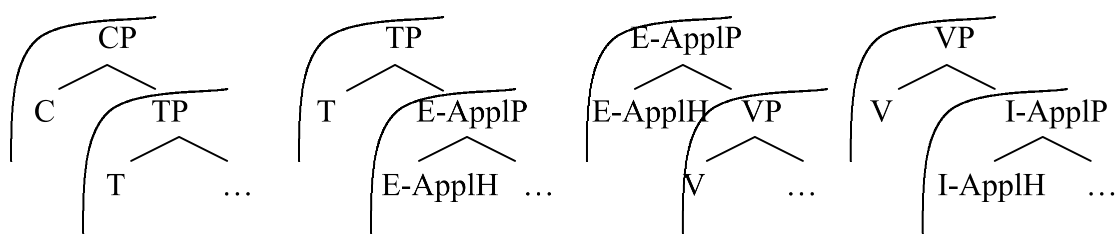


Fig. 7

The absence of ECM can be accounted for if in languages characterized by *min*-phases TPs constitute phases as well. For the same reason, these languages lack Optional Infinitival (OI) Stage.[22] English-speaking children at some stage between 1;10-2;7 on occasion omit TPs by producing sentences such as "Mary like John", while they have no problems forming CPs ("Who Mary like?"). Cross-linguistic data shows that this stage is absent in Polish, Russian, Italian, and Spanish. Evidently, *min*-phases cannot be omitted even at an early stage of language development. The

T_{inf}. The conflict between Case requirements and phasal status of TP cannot be resolved, and derivation crashes. In English, TP is not a phase, and subject moves to object position of matrix verb to receive Accusative Case. When Nominative Case assignment is unnecessary (e.g. in *Eve wanted to taste an apple),* derivation survives in a language with *min*-phases.

21 Recall that in the present system, phases are characterized solely by their capacity to project extra Spec positions.

22 See Wexler (1998) for the discussion of OIs.

cross-linguistic distribution of OIs in child language is consistent with the proposed universal phase parallelism and existence of two types of phases.

3.3 The Strict Cycle Condition

Chomsky (1973) states that 'no rule can apply to a domain dominated by a cyclic node A in such a way as to affect solely a proper subdomain of A dominated by a node B which is also a cyclic node'. This condition is borne out in languages with *min*-phases that allow DO-movement in (3): IO-movement in (4) is blocked.

(3) [VP V [DO I-ApplP [IO I-Appl' [I-Appl' I-Appl $t_{\mathbf{DO}}$]]]]
I-ApplP minimal phase

(4) # [IO *v*P *v* [VP V [$t_{\mathbf{IO}}$ [DO I-ApplP [I-Appl' I-Appl $t_{\mathbf{DO}}$]]]]]
*v*P maximal phase

From a more general perspective, in a system where X(n) = X(n–1) +X(n–2), GR between the terms is preserved only when each term is combined with the one that immediately precedes it. Once a phase is complete, there is no possibility to extract yet another element from its domain. For example, 5 is a sum of 3 and 2. If the sum were formed by adding 1 to 3 etc., sequence would yield (1, 1, 2, 3, 4, 6, 9,…), violating GR.

3.4 Spell-Out and interpretation of phases

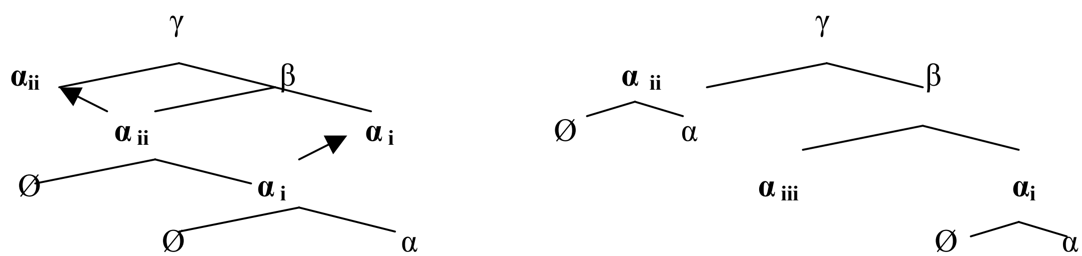
The next important question is how PF (Spell-Out) and LF (Interpretation) are derived in a language system that possesses both types of phases – *max*-/propositional and *min*-/non-propositional. As was already stated, PIC requires that only the Edge and the Head of a phase are visible to later syntactic operations; the domain is opaque. At the end of each phase, it is sent off to PF and LF.

Let us assume that (possibly all) languages have *max*-phases (such as CP, vP, and E-ApplP), while some languages also have *min*-phases (such as TP, VP, and I-ApplP). At the end of derivation, *max*-phases are sent both to PF and LF. One example is 'garden-path' sentences (Gibson 2000). Sentence $_{CP1}$[*The horse raced past the barn*] is interpreted as complete; the resultant derivation is sent to PF and LF. In $_{CP2}$[$_{NP}$[*The horse raced past the barn*] *fell*], CP_1 is reinterpreted as NP and *max*-(CP_2) phase is sent to PF and LF.[23]

According to Epstein and Seely (2002), some features of LIs are illegitimate at one or the other interface. For instance, the pronoun *him* seems synonymous with *he*, even though their PF interpretations are distinct. It was assumed that unvalued lexical features are illegible at both LF and PF; valuation, however, is a necessary but not sufficient condition for LF convergence. The Case feature of a DP/N may be valued by the operation Agree, but a valued Case feature is by hypothesis still not interpretable at LF, and can be interpreted only at PF. Consider *John left his girlfriend with a baby* vs. *John left his girlfriend with a smile on his face*. Such and similar sentences (inspired by Chomsky's examples) exemplify the Case feature valuation of a DP (*his girlfriend*, in this particular case) by Agree; however, the interpretation of the former varies depending on the semantics of matrix V, in contrast with the latter that has

[23] Note that in languages with *min*-phases such reinterpretation is expected to be blocked. By the time *max*-phase CP is complete, *min*-phase NP is already fully incorporated.

only one interpretation. In the EM label-three representation, the distinction between *John left his girlfriend with a smile*) and *John left his girlfriend* (**with a baby*) is obvious: the first has two participants (fig. 8 A) and the second three (fig. 8 B). Possibly, a rule that determines the number of arguments and their hierarchy applies at each step in the derivation including *min*-phases, up till a complete LF is accessed at the level of *max*-phase.



A. B.

Fig. 8

Chomsky (2001) identifies *v*P and CP as fully-fledged phases that are spelled-out cyclically and relatively independent at the interface. Epstein and Seely (2002) find this specification problematic: how do we know they are independent at the interface if Spell-Out applies before the interface is reached? The explanation is as follows. These phases are categories within which all theta roles are discharged, evidence that the underlying argument-based structure is preserved throughout derivations. To conclude,

- Phases can be compared along the lines of their label-free configurations.
- Heads of phases carry *edge-feature* that induces movement.

- All Ls have max-phases; certain (possibly synthetic) Ls also have min-phases.[24]
- At the end of derivation, maximal phases are sent to PF and LF.

4. Argument-centered representations

A relation between individuals may constitute a phase, and induce movement (recursion). This means that ***the core syntactic representations do not necessarily require a verb***. Certain languages have a very restricted number of verbs - for example, Australian language Jingulu has only three verbs: *do*, *go*, and *come*. Igbo (Ibo), a language spoken by approximately 18 million speakers in Nigeria, does not use verbs at all. A hierarchical linearization of arguments in the absence of verbs is exhibited in Igbo clusters. These clusters have the structure -gbá plus a noun: -gbá egwú *dance a dance*, egwú *dance*; -gbá igwè *ride a bicycle*, igwè *bicycle*; -gbá ákụ́/ egbè *shoot*, àkụ́ *arrow*, égbè *gun*; gbá ụkwụ́ *kick*, ụ́kwụ *foot*; -gbá ọsọ *run a race*, ọsọ *race*; -gbá motò *travel with a vehicle*, motò *vehicle*, etc.

The structure termed 'inherent complement verb' (ICV) in Igbo linguistics has always been problematic for the analysis. The first characteristic that differentiates the use of ICV from light verbs in other languages is that it is a regular linguistic means. The second is that these structures do not have any simple verb equivalent. The root *gbá* is the only

[24] For the reasons already specified, Ls with *min*-phases always have *max*-phases, while the *max*-phase group may in principle (but not necessarily) have *min*-phases. The example seems to be Icelandic that has both ECM found in languages with *max*-phases and Dative experiencer constructions DEC such as (lit.) *John-Nom to-me-Dat likes* meaning *I like John*, DEC are characteristic of languages with *min*-phases ($_{\text{I-ApplP}}$[NP_{John} NP_{me}]). English might have DP-phases and possibly PP-phases ($_{\text{PP}}$[*To him*], *science is everything*).

root in Igbo 'devoid of meaning', and the most productive one (Uchechukwu, p.c.). Other roots (e.g. -*tu*, -*kpa*, and –*ma*) check semantic features of the nouns they are combined with, such as 'animacy' and 'shape'.[25] Similarly, the inflected –*gbá* roots are not semantically empty: e.g. -*do* is a suffix that expresses 'fixation of the activity' in –*gbá-do*.

As a matter of fact, *gbá* cannot be considered equal to light verb.[26] The semantic meaning of –gbá-clusters encodes the intrinsic connection between two key arguments, agent and theme, based on the *primary function of the theme with respect to the agent*. For example, the basic function of a car with respect to an agent is to carry passengers. Accordingly, -*gbá motò* means 'travel with a vehicle' – it does not mean 'repair a vehicle', or 'sell a vehicle'. The intrinsic hierarchy of arguments supports the idea that the Relational Rel-(Appl) Head is expressed overtly as -gbá in Igbo. The agent is Ø-merged first *in situ* and then moved to Spec, RelP:

(5) [Spec Rel-ApplP [Rel-Appl' **Rel-ApplH** (-gbá) [[α, Ø], [β, Ø]]]]

(6) [α Rel-ApplP [Rel-Appl' **Rel-ApplH** (-gbá) [t_α, [β, Ø]]]]

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25 This semantic feature checking is similar to SER/ESTAR alternation in Spanish and Portuguese. The choice of a particular (semantically empty) copula is consistent with (+/-) *permanency* feature of the predicate: SER is chosen over ESTAR when 'sourness' is a permanent property of the subject:

(i) a. Os limões são ácidos.'The lemons are [SER] sour.' Portuguese
b.*Os limões estão ácidos. 'The lemons are [ESTAR] sour.'
(ii) a. *As maçãs são ácidas. 'The apples are [SER] sour.'
b. As maçãs estão ácidas. 'The apples are [ESTAR] sour.'
(Costa 1998)

26 In expressions *take a leap*, *take a leak* etc. there is no sharp divide between word and phrasal special meanings (Marantz 1997).

Further evidence for the identification of arguments prior to lexical selection comes from the analysis of verb formation (Hale & Keyser 2002). Conflation of N and V in verbs *to saddle* and *to shelf* is possible only from complement position, which results in *to saddle the horse* and *to shelf the book* (vs. # *to horse the saddle*, # *to book the shelf*). Nouns *saddle* and *shelf* can participate in the N/V conflation, but *horse* and *book* cannot because the hierarchical selection of themes (*horse, book*) precedes lexical formation.

The argument-centered logic of minimal syntactic units relies heavily on the data from language acquisition. It is well known that nouns are acquired first by children who have 'perfect grammar', equipped with the innate principles of universal syntax that allow them to master any language. Deprived of formal linguistic input, children of deaf parents simultaneously invent iconic languages in which the gesture for *give* is associated with three noun phrases, the gesture for *kick* with two, and the gesture for *sleep* with one (Lidz and Glietman 2004). Child language abounds in 'verbless' and 'copulaless' constructions. These structures are preserved in English as e.g. small clauses in *We consider* $_{SC}$ [*Mary a good friend*]. In many languages, copulas such as *is* in *Mary is my friend* are absent. Across language systems, nouns have a special status that ranks them higher than verbs.

The requirement of EM to disregard *order* in favor of *hierarchy* is evident in the following.[27] When asked to complete a sentence, the readers preferred conjuncts with a shared subject over object conjuncts, and both

[27] Kayne's (1994) Linear Correspondence Axiom derives linear order from strict asymmetric c-command. Linearization applies only at the level relevant for pronunciation – the Spell-Out level (Chomsky 2000).

over clause conjuncts (Hoeks & Hendriks 2005). *The model embraced the designer and laughed* was chosen over *The model embraced the designer and the photographer.* Both of those sentences were ranked higher than the one that had conjoined clauses, such as *The model embraced the designer, and the photographer opened a bottle of expensive champagne.* The first type was selected because of the same agent for both verbs; the theme is ranked next. The preference is determined by the structure that identifies arguments first, before a verb is introduced.

In the propositional setting, verbs cannot be disposed of. In the Fib-terms, any two successive elements may be merged to form a part of recursive system. If certain types of phases are defined as non-propositional, IM can be analyzed as an (*edge*-)feature-driven mechanism, while in EM RelApplH establishes hierarchy of arguments α and β in RelApplP, depending on whether α or β is Ø–merged first.

4.1 Word order

Grammatical linguistic expression is the optimal solution - the reason why a particular word order (Subject first) is preferred across languages. The hierarchy of nominal arguments is evident in the word order: SO (subject, object) order remains constant in the majority of languages (96%, Table 1). SOV order (rather than SVO) is the predominant one. The canonical word ordering in optimal terms is SOV, SVO, VSO, VOS, OVS, and OSV. Table 1 shows that the highest preference is given to languages that are either Subject and Object first, or Subject first. Furthermore, it is evident that language systems are symmetrical (SOV/ VSO, SVO/ OVS, VSO/ OSV), which confirms the idea of SO/OS parallelism.

ORDER	NUMBER		PERCENT
(SOV)	497		47
(SVO)	435		41
(VSO)	85		8
(VOS)	26		2
(OVS)	9		.9
(OSV)	4		.4
Lack dominant WO	172		
	total	1228	

Table 1. Word order (Dryer, 2005)

It may be argued that even though S+O (in SO languages) and O+S (in OS languages) display syntactic independence such as moving as a constituent, it is far from being typical or unmarked. This can be explained if movement is re-evaluated as the 'internal' version of Merge, thus not an 'imperfection' of language. Internally merged elements A, B have to be independent to occupy maximally advantageous positions in a syntactic tree. The symmetrical representation of arguments underlying EM assigns an equal status to both, the reason why conjoined Ø-merged elements (such as bare nouns in conjunctions) can move as one constituent only.

The introduction of R-function as a means of hierarchical prioritization is offered as an account for the ranking of word order across languages. The structure α/ β is symmetrical; α and β share an equal chance for movement. The Rel(ational) Head RelH establishes a hierarchy of elements in the Relational Phrase RelP. In the present system, the choice of which element is ranked higher depends on which sum is merged first. If α is *Ø-merged* with first, then α is *displaced* first.

We have assumed that R takes a pair {α, β} where each element has an equal status as its argument. The output of the function is the ordered pair – either <α, β> or < β, α>, depending on whether α or β is zero-merged first. According to Table 1, <α, β> is preferred to < β, α>. In a hierarchical organization of arguments, Subject-Object is preferred to Object-Subject. Further linearization proceeds in the following manner. Once S and O are ordered by RelH, SO undergoes second (Verb)-linearization. It has two options, where the first option is ranked higher than the second:

- The constituent SO is displaced. The resulting order is either <α, β, γ> or <γ, α, β> (γ is V). <α, β, γ> (SO-Verb) is preferred to <γ, α, β> (Verb-SO) (fig. 9, A).
- S is displaced. The resulting word order is <α, γ, β,> (SVO). (fig. 9, B).

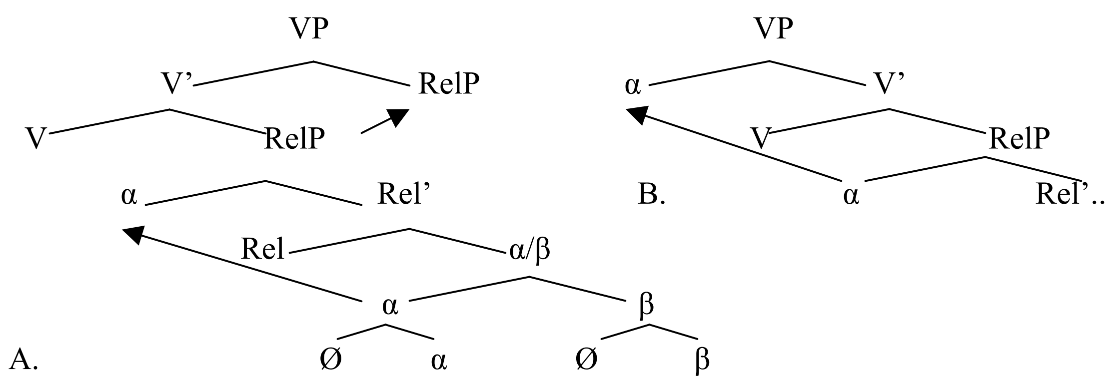

Fig. 9

In Object-first languages, R takes as its complement a pair {α, β} with an output of the ordered pair <β, α> (OS), then verb merges with < β, α >. These are the two options:

- The whole constituent OS is merged with V. The order <γ, β, α > (VOS) is preferred to < β, α, γ> (OSV).
- The first constituent O is merged with V: < β, γ, α > (OVS).

4.2 Symmetrical conjunction

The conclusion we have arrived at is that a minimal syntactic domain (phase) can be defined in non-propositional terms, such as a relation between individuals. The analysis under development shifts the focus from verb to the noun, from propositional to the non-propositional logic of syntactic representations. As was already shown, a lower part [XP X] of [VP V [**XP X**]] represents a phase in certain languages, contrary to what had been previously assumed. In the present system of NL application, there is every reason to believe that in a non-linear representation that involves Merge only, this relation is *symmetrical conjunction* of the basic form {{α, Ø }, {β, Ø}}.[28] Recall that Ø-Merge at the bottom level of the tree is necessitated by the requirement to induce a progressive cycle implemented by sums rather than singe elements; {{α}, {β}} is preferred over {α, β}.

It is well known that conjuncts behave differently from other syntactic structures that can be derived from X-bar schema. Linguistic evidence attests to the fact that certain LIs selected from numeration LEX to participate in conjunctions are Ø-branching (non-maximal) projections such as e.g. prepositional Heads (*up and down the road*) and bare nouns (*cat and dog, knife and fork*). Movement of an entire conjunct out of a coordinate structure and movement of a subpart of a conjunct are prohibited. Conjunctions are syntactic primitives characterized by

[28] See Moro (2000) on the possibility of symmetry at base structure, resolved into asymmetry by Spell-Out. Kratzer's (1996) argumentation that subject should be introduced by a separate predicate opposes the view presented here.

symmetry, while *displacement* obeys the requirement to obtain a linear (asymmetric) order. The key requirement of CHL now includes a non-propositional configuration. As a result, the true structure of language can be characterized within a remarkably weak formalism.

5 Some implications for OT

In OT, variations among languages are attributed to differences in the constraint rankings which restrict linguistic expressions (Prince & Smolensky 1993, 1997). Given an underlying representation, a generator function produces a (potentially infinite) set of realizations, and a process of optimization picks the representation that minimally violates the constraints. Conflicts result in the satisfaction of higher ranked constraints at the expense of their lower ranked adversaries. Optimality Theory gives rise to a variety of specific formal instantiations depending on the types of representations and constraints invoked, but it is a largely unresolved question just what sort of formalism is appropriate for OT syntax.

A grammatical linguistic expression is the optimal solution. However, there has been no account for the preference of a particular word order (SO) in language systems. One possibility is that there are alignment constraints that involve the subject and the object, and the verb and the arguments. If this is the case, then a ranking of these constraints is responsible for the word order. Table 2 shows that the highest preference is given to languages that are either Subject and Object first, or Subject first. Furthermore, it is evident that language systems are symmetrical (SOV/ VSO, SVO/ OVS, VSO/ OSV), which confirms the idea of a parallelism of arguments at the basic level of syntactic representations.

Table 2. SO- and V-linearization

ORDER	SO-linearization		V-linearization					
	SO	OS	(SO)V	V(SO)	(OS)V	V(OS)	(S)V	(O)V
SOV	*		*					
SVO	*						*	
VSO	*			*				
VOS		*				*		
OVS		*						*
OSV		*			*			

6 Summary and conclusions

Both OT and MP attempt to uncover the true structure of language which can be characterized within a remarkably weak formal system. Conjunctivism says that absolutely all relevant syntactic concatenation expresses conjunction; as is further developed to handle an increasingly broad range of constructions and theoretical considerations, it will inevitably become more complex.

The discussion concentrated on the ways to identify minimal requirements imposed by CHL by developing the idea that general physical laws underlie universal syntactic principles. In the present system, the external motivations of UG define the structure of atomic (indispensable) syntactic units. The argument structure was assessed depending on the number of positions available to element(s) adjoining a Fib-like syntactic tree. The minimal building block that enters into linguistic computation was re-evaluated to include Ø-Merge, and identified as the product of Ø-Merge. As a result, binarity was preserved, while labels XPs and X were disambiguated on the bottom line of the tree.

The model outlined in this paper is argument-centered. The idea under development is different from the existing approaches to the analysis of syntactic representations in that it shifts the focus from verb to the noun, from propositional to the non-propositional logic of syntactic representations. Conjunctions are identified as the core syntactic representations characterized by symmetry, and movement as a requirement to obtain a linear ordering. Movement depends on the qualification of phrases as phases, constituents characterized by *edge*-feature, in compliance with Phase Impenetrability Condition. Whether a phase is *maximal* (propositional) or *minimal* (non-propositional) is language-specific. All languages have *maximal* phases; in addition, synthetic (inflected) languages have *minimal* (i.e. Individual Applicative) phases. Label-free phases can be compared along the lines of their configurations, which in its turn provided an account of why languages with *minimal* phases lack ECM.

In sum, this paper offered new ideas concerning the key requirements imposed by CHL, such as minimal syntactic domains where a relation between two elements is established in a non-propositional configuration. In OT terms, grammatical linguistic expression is the optimal solution - the reason why a particular (S>O) word order is preferred in language systems. A better understanding of the general principles underlying CHL will eventually lead to a more advanced design of Optimality Theory.

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