Optimality Theory and the Minimalist Program

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1 Introduction

The Minimalist Program (Chomsky 1995, 2000) and Optimality Theory (Prince and Smolensky 1993, 2004) are not alternative theories logically inconsistent with each other. Optimality Theory is a theory of how universal constraints of grammar interact (Prince and Smolensky 1993, Grimshaw 2005). Minimalism, as Chomsky notes (2000:41), is a research *program* –not a theory– investigating to what extent the language faculty provides an optimal design for the satisfaction of conditions at the interface with the sensory-motor system (PF) and the system of thought (LF). It is thus possible to pursue an OT-perspective of human grammar while maintaining minimalist goals, a fact highlighted by many contributors to the DEAL 2005 conference at ZAS (Berlin) on the relation between OT and Minimalism and also explicitly pointed out by Chomsky (2000:141). In this paper I argue that an OT-approach to grammar is actually essential to minimalist investigations, because it dramatically widens the set of linguistic properties potentially reducible to interface conditions while at the same time dispensing with interface-external language specific provisos. The discussion will hopefully also dispel some common misconceptions about OT.

2 Crosslinguistic Variation

One of the most evident empirical properties of human language is its crosslinguistic variation. Current minimalist theorizing –e.g. Chomsky (1995, 2000)–

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excludes crosslinguistic variation from the set of properties and imperfections that call for a minimalist explanation. Variation is instead assumed to follow from differentiations in the feature-bundles associated with lexical items in each language's lexicon, allowing for parametric variation in feature strength (weak vs strong) and/or variation in feature distribution (presence of EPP-features, presence of dislocating features).

Some important consequences follow from this assumption: to begin with, variation is left unrelated to interface conditions. Interface conditions might possibly motivate the existence of interpretable and even uninterpretable features as part of the optimal design of grammar, but they cannot derive the differences in strength and distribution associated with crosslinguistic variation. It follows that variation is also modelled as accidental. The parametric properties of features could be eliminated with no consequences on the optimal design of C_{HL}. The very existence of variation is thus unexpected: since a relation with interface conditions is excluded a priori, the parametric properties responsible for it are left with no linguistic motivation. It is unclear why variation occurs at all.

This state of affairs appears at odds with minimalist goals. In its strictest possible interpretation a minimalist approach to language should see a pervasive property like crosslinguistic variation emerge naturally from interface conditions. Whether this ambitious goal can be achieved or not depends on our initial assumptions about the nature of grammar constraints and their interaction. If the universal constraints of grammar never conflict with each others, then grammatical status inevitably coincides with their simultaneous satisfaction, and since the set of structures satisfying this condition is necessarily invariant across all languages unless something else is added to differentiate them, it becomes inevitable to account for crosslinguistic variation via language-specific parametric properties.

If on the other hand universal constraints are allowed to conflict with one another, as maintained in OT, crosslinguistic variation becomes a predicted out-

come, merely reflecting all the possible alternative resolutions of the conflicts among UG constraints.[1] Under this view, crosslinguistic variation is no longer accidental. Rather, it is entailed by the universal constraints of grammar themselves, which directly determine (i) *whether* variation occurs: it only occurs whenever two or more constraints conflict, never when constraints do not conflict; (ii) *where* it occurs: it occurs only with respect to those structures and properties on which the constraints conflict; (iii) *how* it occurs: the different structural aspects and properties found across distinct languages are themselves entirely determined by UG constraints, not by language-specific provisos.[2]

Deriving crosslinguistic variation as an inevitable consequence of constraint interaction is highly desirable also because it deepens the explicative power of our generative models. As concisely but effectively stated by Edwin Williams in his DEAL 2005 contribution, "*deepening explanation [. . .] arises when previously unrelated parts of a theory become predictively interrelated – the 'constants' of the theory are thereby reduced, making the correct theory more inevitable [. . .]*" (Williams 2005). By making crosslinguistic variation a predicted property, OT relates it to UG constraints in the strictest possible way, reducing the need for unnecessary theoretical constants such as language specific devices and provisos.

The explicative power of constraint conflict also emerges when considering

[1] Variation is of course contingent on the assumption that conflicting constraints can re-rank freely. Free re-ranking follows from the null hypothesis that no ranking is superior to any other.

[2] Under OT, individual grammars coincide with specific rankings of UG-constraints. The structure selected as grammatical by each grammar is the one that best satisfies UG-constraints under the corresponding ranking. More precisely, it is that structure A that beats any conceivable alternative B on the ranking at hand, i.e. such that for any B, A beats B on the highest constraint on which the two perform differently (Prince and Smolensky 1993, 2004; Grimshaw 2005). When two or more constraints conflict, their possible rankings determine all the available conflict resolutions, with each distinct ranking selecting a distinct optimal structure. The properties of the optimal structure remain shaped by the UG-constraints that selected it.

the number of distinct languages derived by a set of N conditions. With N binary parameters we may at most derive 2^N distinct languages, whereas N conflicting constraints may give rise to N! languages.[3] As N increases, N! rapidly becomes a vastly larger number than 2^N. For example 6 conditions determine 2^6=64 languages with binary parameters against 6!=720 potential languages with conflicting constraints. With 8 conditions the numbers become 256 vs. 40,320. It follows that on purely logical grounds an OT approach to constraint interaction potentially reduces the variation manifested across human languages to a far more restricted number of grammar conditions than allowed by parametric devices, providing a clear measure of their explicative power.[4]

The arguments just examined provide compelling theoretical motivation for investigating an OT approach to constraint interaction. They hold independently of minimalist goals, yet they appear essential to a minimalist perspective given their potential for reducing all aspects of human grammar, crosslinguistic variation included, to the conflicting interaction of constraints at the PF and LF

[3] The above figures presuppose N constraints conflicting with each others. Distinct languages only arise when constraints conflict. When they do not conflict their ranking is irrelevant, since it no longer affects the choice of optimal form. It is therefore incorrect to assume that N constraints always predict a cross-linguistic typology of N! languages. The overall size of the typology depends on the number of conflicts and the number of constraints involved in each conflict. This does not affect the explicative power of constraint conflict, since it remains true that a set of M crosslinguistic variants will potentially be reducible to a smaller set of conflicting constraints than binary parameters.

[4] The striking differences between 2^N and N! should also dispel the misconception that reranked constraints are parameters in disguise. On the non-equivalence between parameters and pairs of opposite constraints see also Grimshaw (1997), and Samek-Lodovici (1998).

interfaces.[5]

3 Constraint Conflict

Having considered the above theoretical motivations favoring an OT perspective, we may ask whether they are supported by the empirical evidence available to us. Obviously, the very existence of crosslinguistic variation provides a first important piece of empirical support since as we saw variation is expected if constraints conflict and unexpected if they do not. There is also a great variety of highly complex linguistic paradigms that find a simple and principled explanation once examined in terms of constraint conflict. See for example the numerous OT-syntax analyses downloadable at the Rutgers Optimality Archives at `roa.rutgers.edu`. Several analyses are also available in the following volumes: Legendre, Grimshaw, and Vikner (2001); Fanselow and Féry (2002); Samek-Lodovici (forthcoming); Barbosa, Fox, Hagstrom, McGinnis, Pesetsky (1998); and Beckman, Walsh Dickey, Urbanczyk (1995).

Here, I will only consider two specific cases that I find particularly significant for the kind of constraint conflicts involved.

3.1 Conflict between Prosody and Syntax

Verb movement aside, the syntactic and prosodic properties of simple clauses with overt subjects in Italian and English are very similar. When the entire clause constitutes new information focus we observe SVO order with rightmost prosodic prominence in both languages, as shown in (1) (focused phrases are subscripted by ‘f’. Prosodic prominence is marked as ‘*’. The word marked by

[5] An even more ambitious project is pursued in Smolensky and Geraldine (2006), where the OT articulation of human grammar is viewed as directly emerging from the connectionist architecture of the human brain.

‘*’ also constitutes the head of the intonational phrase ‘IP’ that encompasses the entire clause).

(1) a. (∗) IP
[Gianni ha cantato]$_f$ (focusing context: Any news?)
John has sung
“John has sung”

b. (∗) IP
[John has sung]$_f$ (focusing context: Any news?)

This similarity is disrupted as soon as non-final phrasal constituents are focused. In this case, Italian can preserve rightmost prosodic prominence by re-arranging the syntactic structure so as to let focus occur rightmost in its clause; see for example the postverbal focused subject in (2a) below. English instead leaves the syntactic structure unaffected, but it retracts prosodic prominence onto the focused constituent; see for example the stressed clause-initial focused subject in (2b).

(2) a. (∗) IP
Ha cantato [Gianni]$_f$ (focusing context: Who has sung?)
has sung John
“John$_f$ has sung”

b. (∗) IP
[John]$_f$ has sung (focusing context: Who has sung?)

The challenge is to derive the divergence in (2a) and (2b) from the same constraints that determine the convergence in (1a) and (1b). Note the minimalist nature of this challenge, which aims at analyzing all above sentences as optimal solutions dictated by a single set of universal constraints rather than resorting to language-specific stipulations on the syntax and prosody of focus to derive the divergence in (2).

The crucial insight to meet this challenge was provided by Zubizarreta (1998), who analyzed rightmost focus in Romance as arising from the need to keep prosodic prominence rightmost and focus stressed. Armed with this insight and constraint conflict, we may account for the entire paradigm in terms of three simple constraints: (i) the syntactic constraint EPP forcing subject to raise to specTP (Grimshaw 1997, Chomsky 1982); (ii) the prosodic constraint H-I requiring the prosodic head of the intonational phrase IP to align with the IP's right boundary (Selkirk 1995, Truckenbrodt 1995); and (iii) the constraint Stress-Focus requiring focused phrases to carry the highest prominence in their domain (Jackendoff 1972, Truckenbrodt 1995, Zubizarreta 1998. In (1) and (2) the focus domain coincides with the entire clause).

When the entire clause is focused Stress-Focus is trivially satisfied independently of the position of the prosodic peak '*'. Consequently EPP and H-I can be satisfied independently of one another, giving rise to the preverbal subjects and rightmost stress of sentences (1a) and (1b). When focus applies to the subject, however, the need to satisfy Stress-Focus –here ranked highest– unleashes a conflict between EPP and H-I. Grammars ranking H-I higher than EPP, like Italian, strand the subject in rightmost position as in (2a) to satisfy H-I, even if this forces a violation of the lower ranked EPP. Grammars ranking EPP higher than H-I, like English, raise the subject to specTP as in (2b) to satisfy EPP, even if this forces a misaligned prosodic peak in the intonational phrase IP which violates the lower ranked H-I.[6]

[6] An extended and more detailed analysis consistent with the simpler version provided here is provided in Samek-Lodovici (2005). The analysis employs finer grained prosodic and syntactic structures and derives a wider range of empirical data from Italian, English, German, French, and Bantu languages. A reduction of Italian clause-initial and clause-internal focus to prosodically induced clause-final focus is available in Samek-Lodovici (2006), showing how aside for the marginalization cases examined by Cardinaletti (2000, 2001), focus is always clause-final in Italian while post-focus phrases are always right-dislocated and clause-external. Even clause-initial focus is actually formed by clause-final focus followed by an entire dislocated clause.

The conflict between EPP and H-I thus properly predicts where the above focus patterns converge and diverge, while its resolutions accurately determine how the structures diverge when they diverge. All these predictions follow with no appeal to language specific properties and devices. The relevant constraints remain invariant in both languages and are fairly non-controversial, rooted in a long tradition of generative analyses. They are also clearly active in both languages, since they are necessary in both to determine the location of subjects and stress under clause-wide focus.

These desirable properties of the analysis are tightly linked with constraint conflict. As soon as we stipulate that constraints do not conflict we immediately lose the potential for a unified analysis rooted in UG-constraints alone. Since EPP and H-I remain necessary to derive the preverbal subject and rightmost stress of (1a) and (1b), the consequences of our stipulation emerge in the accounts for (2a) and (2b), which must now be made consistent with the satisfaction of both constraints despite clear evidence of the contrary. This is exactly the problem faced by the analysis in Zubizarreta (1998), where the lack of a theory of constraint conflict forces the introduction of two parametric devices. The first makes unfocused phrases prosodically invisible in English (but not in Italian, where their visibility is crucial for the analysis of rightmost focus). This reduces the IP in (2b) to the size of the focused subject alone, thus ensuring that stress is assessed as rightmost even in this case and satisfying the conditions equivalent to H-I in Zubizarreta's analysis. The second parametric device occurs in the grammar of Italian, where it ensures that the conflict between the conditions equivalent to EPP and H-I unleashed by focusing of non-final constituents is detected and resolved via the necessary syntactic re-arrangements.

Judging from the analysis of focus alone the benefits of a conflict based analysis are apparent, since it provides a unified analysis of the attested convergent and divergent patterns with no appeal to language-specific provisos. Under a minimalist perspective we may also wish to ask whether the conflict-

based analysis just examined is consistent with the criteria informing minimalist inquiries. These criteria are likely to require further investigation on how constraints like Stress-Focus, EPP, and H-I relate to interface conditions at PF and LF but they do not entail any specific assumption about the possible conflicts holding among these conditions. Since the sensory-motor and conceptual system serve largely independent goals there is no reason to exclude a priori the possibility of conflicting interface requirements. As far as I can see minimalist goals remain here best served by an analysis based on constraint conflict.

Before concluding, note how Zubizarreta's insights on Romance focus also show that PF cannot be insulated in a sub-system of its own external to narrow syntax as proposed in Chomsky (2000:118) because the constraints governing prosodic prominence clearly affect syntactic structures. In my opinion, this is a welcome result for a minimalist perspective, because it ties a type of syntactic dislocation to constraints governing prosodic properties, providing precisely the kind of genuinely non-syntactic requirements impacting syntax that are expected under a strict minimalist interface-based approach. Even in this respect, an analysis based on the conflict between prosodic and syntactic constraints appears to positively contribute to the minimalist enterprise, assigning a more concrete role to PF-interface constraints than originally envisaged.

3.2 Conflict between Economy Principles

A second particularly interesting case of constraint conflict concerns the tension between structural and movement economy discussed by Cardinaletti and Starke (1994, 1999) in their crosslinguistic study of pronominal forms. Using data from a great variety of languages, including Italian, French, Slovak, and Gun (an African language of the Kwa family), they make four important observations: (i) weak pronominal forms are structurally simpler than their strong counterparts, lacking one or more of the top functional projections found in

the structure of strong forms; (ii) weak forms must obtain/check the functional features not already available in their simpler functional shell by raising to appropriate positions of the clause (e.g. spec AgrP to get Case); (iii) there is thus an inverse relation between the richness of a pronominal form's structural representation and the length of its chain, with simpler forms requiring longer chains; (iv) despite their longer chains, weak forms are always preferred to strong forms: strong forms are possible only where weak forms are excluded by independent factors.

On the basis of (iv), Cardinaletti and Starke propose the existence of an 'Economy of Representation' principle requiring minimization of structure. The challenge here concerns how to best model the conflict between Economy of Representation and Economy of Movement highlighted by the inverse relation between structure and chain-length observed in (iii). Under a conflict-based theory of constraint interaction such as OT the solution is straightforward, because economy is always a general property determined by the optimality-theoretic interaction of simple constraints (Grimshaw 1997, 2005; Prince 1997:2; Burzio 2000:209,216; McCarthy 2002:40; Smolensky, Legendre and Tesar 2006:505, 531).

Economy of Movement, for example, need not be stated as such because it follows from the conflict between the constraints that require movement to specific positions of the clause, – henceforth collectively identified as 'Check-F' whether defined in terms of feature checking or not – and the constraint Stay (Grimshaw 1997) violated by any instance of movement. When Stay is ranked lower than Check-F, the structure selected as optimal is the one that best meets Check-F while ensuring the lowest number of Stay violations, effectively minimizing movement.[7]

[7] Interestingly Chomsky (2000:132) describes the concept of 'feature strength' in the model developed in Chomsky (1995) as 'introduced to force violation of Procrastinate', confirming the violable nature of early minimalist economy principles. Optimality accounts like the one sketched above explicitly identify the constraint that is violated and the higher ranked

A similar analysis can be given for Cardinaletti and Starke's Economy of Structure, with a general constraint *Struc (Zoll 1993, Prince and Smolensky 1993/2004) that penalizes any structure not required for the parsing of the initial array of lexical and functional items. Cardinaletti and Starke's observed preference for weaker pronominal forms then simply reflects the ranking Check-F ≫ *Struc ≫ Stay (Check-F outranking *Struc, and *Struc outranking Stay). Under this ranking, weaker pronominal forms with less structure are preferred to more complex ones even at the cost of increased Stay violations, as observed in Cardinaletti and Starke's points (iii) and (iv) above. Such a preference however is subordinated to identical performance on the higher ranked Check-F constraint: whenever the weaker form underperforms the stronger one on Check-F, the stronger form is preferred, completing the account for point (iv).

The same tension between structural and movement complexity is not as readily accounted for in models that disallow constraint conflict. Consider for example Cardinaletti and Starke's analysis, cast in terms of the interaction between feature checking and economy principles in accord with the minimalist model proposed in Chomsky (1995). While they acknowledge the apparent contradictory nature of the two economy principles under discussion, they are also convinced that the tension can be dissolved by letting Economy of Representation (henceforth ER) apply at the point of lexical insertion and therefore prior to Economy of Movement (EM) (Cardinaletti and Starke 1999:202). At first sight, the proposed serialization might appear to deliver the desired result: first ER selects the least structured pronoun and then EM imposes the derivation with the shortest chain among those involving that particular pronoun. Since EM only examines derivations involving the same pronoun, the one selected by ER, the conflict between the two principles appears to have been dissolved.

constraints that force its violation. These accounts, however, have constraint conflict and constraint violability as their prerequisite and thus remain precluded to any theory of grammaticality based on the simultaneous satisfaction of all UG constraints.

The problems emerge when examining the assessment of ER, which cannot occur prior and independently of EM. The choice between a weak and a strong form depends in fact on the availability of a non-crashing derivation for the weak form since only in this case the weak form should be preferred to the strong one by ER. Assessing ER thus requires unfolding the derivation of the weak pronoun, a process that includes the assessment of EM. Consequently, there is no genuine point in the overall derivation where ER is truly assessed prior and independently of EM. On the contrary, EM is an integral part of the assessment of ER, so much so that a final unfolding of the derivation past the assessment of ER becomes redundant. Serialization thus fails as a strategy to avoid the conflict between ER and EM.

A possible alternative conflict-free solution can be provided via an explicit model of ER's assessment along the lines just examined above. This makes it possible to confine EM to derivations that share the same pronominal form, hence preventing the conflict with ER via the explicit subordination of EM to ER. The obvious question raised by this last solution is what determines the subordination of one principle to another. The answer is once again constraint conflict. In OT, conflict is a primitive, and the subordinate status of a constraint relative to another follows from the impossibility of satisfying both. Subordination is encoded via constraint ranking, and assessed in a unified and principled way via optimization. The opposite is true in the non-OT account outlined above, where subordination is an accidental property built-in in the assessment procedure for ER, envisaging a system where different principles are assigned different assessment procedures depending on their relation with each others.

Cardinaletti and Starke's analysis was conceived under the early minimalist system of Chomsky (1995) which allowed for economy principles. The revised crash-proof minimalist model proposed in Chomsky (2000) aims at disposing of economy principles too by a careful design of the operations involved in syntactic derivations, the domain to which they apply, and the order in which they

occur. For example, Move is defined in terms of the Agree and Merge operations plus an additional operation necessary to select the phrase that pied-pipes with the moving head (Chomsky 2000:135). The higher intrinsic complexity of Move relative to Agree and Merge is then assumed to prevent undesired movement. For example, '*a proof'* will not move to specTP in "*there was a proof discovered*" whenever the expletive '*there*' is present in the relevant array because merging of '*there*' only requires Agree and Merge alone and no additional projection selection (Chomsky 2000:138).[8] Even this revised system, however, does not seem to be able to provide an analysis for the subordinate relation between movement and structural economy uncovered by Cardinaletti and Starke while keeping a principled and unified account of economy effects. The problem remains how to account for the ungrammaticality of a strong pronominal form when a weak form is possible. The conceivable solutions appear to contradict significant aspects of the design of C_{HL} proposed in Chomsky (2000). The most obvious one involves a (potentially phase-internal) explicit comparison of distinct derivations, selecting the non-crashing derivation with the least structured pronominal form, thus introducing back in the system transderiva-

[8] The definition of Move β in Chomsky (2000), repeated below, has Agree followed by the selection operation (ib), followed by Merge. It remains unclear exactly how the complexity of Move alone can favor merging of the expletive over raising of '*a proof'* in the derivation of '*there was a proof discovered*'. The initial Agree operation, step (ia), is shared by both derivations (Chomsky 2000:123, 135). Once step (ia) has been performed the correct derivation is contingent on proceeding with Merge of the expletive rather than performing the selection operation in step (ib), which would eventually yield the raised subject of '*a proof was discovered*'. The correct choice does not appear entailed by the complexity of Move, but rather by the assumption that Merge of array items always precedes the phrase selection operation in (ib).

(i) Definition of Move β (Chomsky 2000:135).

a. A Probe P in the label L of β locates the closest matching [goal] G in its domain.
b. A feature G' of the label containing G selects a phrase β as a candidate for "pied-piping".
c. β is merged to a category K.

tional comparisons. Another solution, possibly more in tune with the spirit of the proposed system, would have to assume some degree of freedom in the merging of the feature bundles represented by the items in the lexical array. The derivation could then let weak pronominal forms that leave unparsed the feature bundles associated with higher functional layers proceed with their derivation. The derivation would then backtrack to a structurally more complex form that parses those same feature bundles whenever the derivation of the weaker form does not converge. Transderivational comparisons are then avoided at the cost of backtracking. While the details of each solution would have to be further investigated,[9] neither of them accounts in a uniform and principled manner for the property of economy shared by the two principles proposed by Cardinaletti and Starke. Economy of movement is assumed to follow from the relation holding between Move, Agree and Merge, whereas structural economy would have to follow from transderivational comparison or backtracking.

In conclusion, the attempts to model economy while disallowing constraint conflict appear unable to provide a fully general and principled analysis of the various instantiations of economy in human grammar. In contrast, allowing for constraint conflict and defining grammaticality accordingly enables OT to capture the notion of economy in its full generality, letting its specific applications emerge from very simple constraints whose subordination relations are explicitly encoded in a language's constraint ranking. Constraint-specific assumptions and provisos are dispensed with; all constraints are assessed in exactly the same way, examining only the structures at hand with no reference to the evaluation of other constraints. These would appear to be highly desirable properties for a minimalist perspective, making it possible to pursue a view of UG where conflicting universal constraints are dictated by legibility conditions at the PF and

[9] This is particularly true for the second solution, where Merge of array items has to wait past the attempted derivation of the weak pronoun. This contradicts the crucial assumption that Merge preempts Move (Chomsky 2000). See also the above footnote.

LF interfaces, while economy in its various manifestations emerges unstipulated from their interaction.

4 OT and Minimalism

The above sections provided some theoretical and empirical motivation for pursuing the minimalist program while supported by a formally precise theory of constraint conflict and interaction such as OT. Conversely, we may ask what a minimalist perspective would bring to OT-based inquiries.

A minimalist perspective would encourage a deeper understanding of universal constraints with the ultimate goal of linking them directly to interface conditions. OT's fundamental tenet that crosslinguistic variation follows from constraint conflict already forces a better understanding of UG constraints because it makes it impossible to derive variation through the escape hatch of language specific properties and devices. Successive analyses of similar phenomena within the OT-literature show a welcome trend towards ever simpler constraints; this increases the explicative power of the analysis and possibly comes closer to identifying constraints dictated by interface conditions alone as required by Minimalism. A particularly clear example of this trend is provided by Grimshaw's (2001) analysis of structural and movement economy. Rather than viewing them as separate phenomena emerging from the constraints Stay and *Struc introduced above, Grimshaw derives both from a fixed set of five simple constraints: two of them respectively require the presence of specs and heads in phrasal projections while the remaining three require specs, heads, and complements to occur leftmost in their projection. Under this system, every projection is bound to violate some constraints. Consequently, any representation involving structure not required by higher ranked constraints loses against competing representations lacking such unneeded structure, yielding economy of representation. Likewise, since movement operations increase structure by

building additional copies of a constituent they too always violate some of the proposed constraints. It follows that movement operations that are not necessary to meet the demands of higher ranked constraints are suboptimal too, deriving economy of movement. We may still wonder about how to relate Grimshaw's constraints to interface conditions, but the explicative depth of our linguistic analysis has increased because economy of structure and economy of representation are now predicted epiphenomena determined by constraint conflict.

A minimalist perspective on OT might also lead to investigating how exactly the form selected as optimal by OT-optimization is identified. In this respect many linguists incorrectly believe that OT-optimization requires the human mind to actively generate an infinite number of competing structures, an impossible task in the finite time of linguistic exchanges. The error lies in interpreting optimization tableaux as a procedure to compute the optimal structure (hence contingent on the generation of all suboptimal alternatives) rather than as demonstrations of the optimal status of the selected form, relative to any other conceivable structural alternative hypothetically generable by a maximally unconstrained procedure 'GEN' responsible for structural composition. The issue then becomes whether computing optimal status relative to an infinite set of potential alternatives (mostly left ungenerated) with finite means and within finite time is psychologically feasible. Humans are clearly able to do that. We know that zero is lower than any other positive integer with no need to first enumerate all positive integers. We also know that number 21 is the least common multiple of 3 and 7 despite the infinitely many others available. We even know that even numbers are a subset of all integers despite both sets being infinite. In all these cases, and the infinitely many others that can be easily conceived, our mind appears able to reason in terms of the invariant properties and relations of the objects involved rather than by sheer enumeration and comparison. The identification of grammatical expressions as optimal solutions to possible rankings of UG constraints is likely to follow the same kind of reasoning. For example,

a ranking with Stay placed highest necessarily selects structures lacking movement; this property is sufficient to confine to suboptimal status every possible structure involving movement. There are infinitively many of them, but none of them needs to be actively generated to determine that they are all suboptimal (on the misconception of infinite generation and other common misconceptions see also Prince and Smolensky 1993:197, and Smolensky, Legendre, and Tesar 2006:523).

Misconceptions aside, the issue of how optimal structures are identified is a valid one. Tesar (1995) shows how dynamic programming provides a solution to this problem depending on the complexity of the constraints involved. He also applies this technique to the theory of syllable structure providing an algorithm that correctly computes the optimal structure among an infinite set of potential competitors for any given ranking of five specific constraints. Riggle (2004) goes even further providing a fully general solution to the above issue cast in terms of finite state automata (FSA). FSAs representing specific OT-constraints are combined together into a single larger FSA for which Riggle provides a general algorithm that efficiently computes the optimal forms selected across all possible constraint rankings.

Finally, the properties of OT-optimization themselves provide some useful tools in guiding the identification process. For example, any given set of structures identifies an infinite set of alternatives that are necessarily suboptimal because inevitably beaten by one or more of the original structures on any possible constraint ranking (Samek-Lodovici and Prince 1999, 2002). These alternatives need not be generated since the optimal form cannot be among them.[10]

In conclusion, whether UG constraints conflict or not is an empirical issue.

[10] The above discussion also shows why it is incorrect to view C_{HL} as a possible model for GEN. GEN defines the set of possible linguistic structures among which a constraint ranking selects the grammatical ones; it does not itself identifies the optimal structure. C_{HL} on the other hand is expected to do just that, building the grammatical structure once provided with a suitable array of lexical items.

If they do, and they do appear to do so, a formally precise theory of their interaction becomes necessary for a proper understanding of grammar because simultaneous satisfaction of all constraints ceases to be a viable definition of grammaticality. This reason alone provides a strong motivation for pursuing an OT-perspective of human grammar, while further theoretical and empirical reasons have been offered in the above sections. The pursuit of minimalist goals does not presuppose a specific type of constraint interaction. It is fully consistent with an OT approach to constraint interaction, and as I argued in this paper it can greatly benefit from OT for an appropriate analysis of defining aspects of human language such as crosslinguistic variation, the syntactic impact of prosodic requirements, and economy in all its manifestations.

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