Asymmetries in Long-Distance Dependencies: A View from Gradient Harmonic Grammar

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1. Introduction

Claim:
Gradient Harmonic Grammar (Smolensky & Goldrick (2016)) offers a new perspective on how to derive three different types of asymmetries as they can be observed with long-distance dependencies in the world's languages:

- asymmetries between movement types
- asymmetries between types of moved items
- asymmetries between types of local domain

Background assumptions:
(i) Harmonic Grammar
(ii) Gradient Representations
(iii) Harmonic Serialism

1.1. Harmonic Grammar

Harmonic Grammar (Smolensky & Legendre (2006), Pater (2016)): A version of optimality theory that abandons the strict domination property and replaces harmony evaluation by constraint ranking with harmony evaluation based on different weights assigned to these constraints. This makes it possible to derive some (but not all) kinds of cumulative effects in syntax (Murphy (2017), Müller (2017a)).

(1) *Harmony* (Pater (2009)):

$$H = \sum_{k=1}^{K} s_k \, w_k$$

w_k = weight of a constraint
s_k = violation score of a candidate

Assumption (simplified):
Constraints assign negative scores, and weights are nonnegative.

(2) *Optimality*:
An output qualifies as optimal if it is the candidate with maximal harmony in its candidate set.
A candidate has maximal harmony if it has the value closest to zero (i.e., the lowest penalty).

1.2. Gradient Harmonic Grammar

Basic assumption (Gradient Harmonic Grammar; GHG; Smolensky & Goldrick (2016)):
It is not just the constraints that are assigned weights. Symbols in linguistic expressions are also assigned weights; they are not categorical either.

Predecessor:
Squishy Grammar (Ross (1973a;b; 1975)) is a direct predecessor of GHG. Ross argues that there is

constituent class membership to a degree, and presupposes that instead of standard category symbols like [X], there are weighted category symbols like [αX] (where α ranges over the real numbers in [0,1]). Rules, filters, and other syntactic building blocks are given upper and lower threshold values of α between which they operate.

Note:
This way, the concept of varying *strength* of syntactic categories (see Chomsky (2015) for a recent reappraisal) can be formally implemented in the grammar.

Observation:
So far, most of the work on GHG has been in phonology (e.g., Zimmermann (2017), Faust & Smolensky (2017), Kushnir (2018)); but cf. Smolensky (2017), Müller (2017b), Lee (2018) for syntactic applications.

1.3. Harmonic Serialism

Note:
Harmonic serialism is a strictly derivational version of optimality theory.

(3) *Harmonic serialism* (McCarthy (2008), Heck & Müller (2013)):

a. Given some input I_i, the candidate set $CS_i = \{O_{i1}, O_{i2}, ... O_{in}\}$ is generated by applying at most *one operation* to I_i.
b. The output O_{ij} with the best constraint profile is selected as optimal.
c. O_{ij} forms the input I_{ij} for the next generation step producing a new candidate set $CS_j = \{O_{ij1}, O_{ij2}, ... O_{ijn}\}$.
d. The output O_{ijk} with the best constraint profile is selected as optimal.
e. Candidate set generation stops (i.e., the derivation converges) when the output of an optimization procedure is identical to the input (i.e., when the constraint profile cannot be improved anymore).

Note:
From the very beginning (see Prince & Smolensky (1993; 2004)), it has been identified as a possible alternative to standard parallel optimization:

> Much of the analysis given in this book will be in the parallel mode, and some of the results will absolutely require it. But it is important to keep in mind that the serial/parallel distinction pertains to Gen and not to the issue of harmonic evaluation *per se*. It is an empirical question [...] Many different theories [...] can be equally well accommodated in Gen, and the framework of Optimality Theory *per se* involves no commmitment to any set of such assumptions.
>
> Prince & Smolensky (2004, 95-96)

- *Phonology*: McCarthy (2008; 2010; 2016), McCarthy, Kimper & Mullin (2012), Kimper (2016), Pruitt (2012), Torres-Tamarit (2016), Elfner (2016), Hauser & Hughto (2018), Marquardt (2018), etc..
- *Morphology*: Müller (2018)
- *Syntax*: Heck & Müller (2013; 2016), Lahne (2008; 2009), Georgi (2012), Assmann, Georgi, Heck, Müller & Weisser (2015), and Murphy (2016; 2017)).

Observation:
Harmonic serialism in syntax ('Extremely Local Optimization') is a version of minimalist, phase-based syntax (Chomsky (1995; 2001; 2014)) that explicitly incorporates optimization procedures (like Merge over Move; see Chomsky (2000), Hornstein (2009), Weisser (2015), among many others).

Note:
Taken together, this gives rise to a concept of *Serial Gradient Harmonic Grammar*.

2. Proposal

2.1. Constraints and Weights

Assumptions:
(i) The Phase Impenetrability Condition is an inviolable constraint (e.g., part of *Gen*).
(ii) The Merge Condition and the Antilocality Condition are violable constraints.

(4) PIC (Phase Impenetrability Condition; Chomsky (2001)):
For all heads Y: *Y that c-commands α_i of a dependency Δ but does not m-command α_{i-1} of Δ.

(5) a. MC (Merge Condition; Chomsky (1995; 2001),Heck & Müller (2013)):
For all structure-building features [•F•] and XPs with a matching F: [•F•] triggers Merge of XP.
b. AL (Antilocality Condition; Bošković (1997), Abels (2003), Grohmann (2003), Pesetsky (2016), Erlewine (2016)):
For all heads Y: *Y that (minimally) c-commands α_i of a dependency Δ and m-commands α_{i-1} of Δ.

Note:
(i) (4) is a strengthened version of Chomsky's original PIC since it acknowledges a potential barrier status of *all* XPs (see Müller (2011) and references cited there); in this respect, it implements related concepts proposed in Riemsdijk (1978), Koster (1978), Sportiche (1989), Koster (1987). Legendre et al. (1998): Assuming constraints to be violable makes it possible to maintain such general statements without introducing ad hoc exceptions (as in Chomsky (1986)).
(ii) Given the PIC, *all* movement violates AL (movement originates either in the complement position of some head Y, or in the specifier position of Y's complement).
(iii) Unlike a general economy constraint blocking movement (e.g., *TRACE, as in Grimshaw (1997), Legendre et al. (1998; 2006)), AL has different effects depending on the nature of the head crossed in the course of movement.

Features for intermediate movement steps:
Intermediate movement steps are triggered by duplicates of criterial features (see Abels (2012)), which can freely be assigned to any head Y. E.g., [•wh•] can show up on C, T, V, v, etc.

Note:
Weight (relative strength) plays a role for three different items in (5-ab).

1. Y: Some Y heads give rise to stronger violations of AL than other Y heads if movement takes place across them.

⇝ asymmetries between XP barriers.

2. [•F•] in MC: Some movement-related features give rise to stronger violations of MC (i.e., are stronger triggers for movement) than other movement-related features.

⇝ asymmetries between movement types

3. XP: Some XPs give rise to stronger violations of MC than other XPs if they do not undergo movement.

⇝ asymmetries between moved items

3. Three Extraction Asymmetries in German

3.1. Asymmetries between XP Barriers

(6) *Local vs. long-distance scrambling in German – VP vs. CP*:

a. dass sie [$_{VP}$ [$_{DP_2}$ das Buch] [$_{V'}$ [$_{DP_1}$ dem Karl] [$_{V'}$ t_2 [$_{V}$ gegeben hat]]]]
that she the book$_{acc}$ the Karl$_{dat}$ given has

b. dass [$_{vP}$ [$_{DP_2}$ das Buch] [$_{v'}$ [$_{DP_1}$ keiner] [$_{v'}$ [$_{VP}$ t'_2 [$_{V'}$ t_2 gelesen hat] v]]]
that the book$_{acc}$ no-one$_{nom}$ read has

c. *dass sie [$_{DP_2}$ das Buch] gesagt hat [$_{CP}$ t_2 [$_{C'}$ dass] [$_{TP}$ sie gelesen hat]]
that she the book$_{acc}$ said has that she read has

Observation:
In the clausal spine, the weight increases from bottom to top. VP typically permits extraction from it; CP often does not. Similar considerations hold for the features that trigger movement, and for the moved items: The relative position in the tree is decisive.

(7) *Weight assignments for German*:

a. Strength of Y:
(i) V: [0.3]
(ii) $C_{[-wh,+fin]}$: [0.8]
(iii) $C_{[+wh,+fin]}$: [1.0]
(iv) $C_{[+restr,-fin]}$: [0.6]
b. Strength of [•F•]:
(i) [•scr•]: [0.2]
(ii) [•wh•]: [0.5]
(iii) [•top•]: [0.65]
c. Strength of XP:
(i) DP_{obj}: [0.9]
(ii) DP_{subj}: [0.8]

(8) *Object scrambling via VP*:

I: [$_{VP}$ ... $DP_{obj:[0.9]}$ $V_{[0.3]}$,[•scr•]:[0.2]]	MC *w = 2.0*	AL *w = 3.0*	*H*
O_1: [$_{VP}$ ... $DP_{obj:[0.9]}$ $V_{[0.3]}$,[•scr•]:[0.2]]	-1.1		-2.2
☞O_2: [$_{VP}$ $DP_{obj:[0.9]}$ [$_{V'}$ ... t_{obj} $V_{[0.3]}$,[•scr•]:[0.2]]]		-0.3	-0.9

(9) *Object scrambling via finite declarative CP*:

I: $[_{CP}\ C_{[0.8],[\bullet scr\bullet]:[0.2]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
☞O_1: $[_{CP}\ C_{[0.8],[\bullet scr\bullet]:[0.2]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	-1.1		-2.2
O_2: $[_{CP}\ DP_{obj:[0.9]}\ [_{C'}\ C_{[0.8],[\bullet scr\bullet]:[0.2]}\ [_{TP}\ t_2\ [_{T'}\ ...\ T\ ]]]]$		-0.8	-2.4

Note:
The CP output that leaves DP_{obj} in SpecT is optimal; consequently, the PIC is fatally violated on a subsequent cycle.

Observation:
If different kinds of Cs ([±finite], [±restructuring], [±operator], [±overt], etc.) can have different weights, one and the same movement type (e.g., scrambling) may leave CPs with a weak C head (restructuring infinitives) but not others.

(10) *Restructuring vs. non-restructuring infinitives in German*:

a. dass $[_{DP_{obj}}$ das Buch] keiner $[_{CP}\ t'_2\ [_{C'}\ C\ [_{TP}\ t_2$ zu lesen]]] versucht hat
that the $book_{acc}$ no-one$_{nom}$ to read tried has

b. *dass $[_{DP_{obj}}$ das Buch] keiner $[_{CP}\ t'_2\ [_{C'}\ C\ [_{TP}\ t_2$ zu lesen]]] abgelehnt hat
that the $book_{acc}$ no-one$_{nom}$ to read rejected has

(11) *Object scrambling via restructuring infinitive CP*:

I: $[_{CP}\ C_{[0.6],[\bullet scr\bullet]:[0.2]}\ [_{TP}\ DP_{obj:[0.90]}\ [_{T'}\ ...\ T\ ]]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
O_1: $[_{CP}\ C_{[0.6],[\bullet scr\bullet]:[0.2]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	-1.1		-2.2
☞O_2: $[_{CP}\ DP_{obj:[0.9]}\ [_{C'}\ C_{[0.6],[\bullet scr\bullet]:[0.2]}\ [_{TP}\ t_{obj}\ [_{T'}\ ...\ T\ ]]]]$		-0.6	-1.8

Note:
A weight of [0.8] for non-restructuring infinitival C ensures that scrambling from the infinitive is blocked.

Independent evidence for CP projections in German restructuring infinitives:
Baker (1988), Sternefeld (1990), Müller & Sternefeld (1995), Sabel (1996), Koopman & Szabolcsi (2000), Müller (2016)

(12) *Local unstressed pronoun fronting indicates the presence of a CP*:

a. *dass sie mir$_1$ schon letzte Woche $[_{VP}\ t_1$ es$_2$ gegeben] hat
that she$_{nom}$ me$_{dat}$ already last week it$_{acc}$ given has

b. *dass sie mir schon letzte Woche $[_{VP}$ es$_2$ zu lesen] schien
that she$_{nom}$ me$_{dat}$ already last week it$_{acc}$ to read seemed

c. dass sie mir$_1$ schon letzte Woche $[_{CP}\ t_1$ es$_2$ zu geben] versucht hat
that she$_{nom}$ me$_{dat}$ already last week it$_{acc}$ to give tried has

d. dass sie mir$_1$ schon letzte Woche versucht hat $[_{CP}\ t_1$ es$_2$ zu geben]
that she$_{nom}$ me$_{dat}$ already last week tried has it$_{acc}$ to give

Implicational universal I:
If an XP α can undergo Σ-movement across a Y head δ_1, and δ_1 has more weight than another Y head δ_2, then α can ceteris paribus undergo Σ-movement across δ_2.

3.2. Asymmetries between Movement Types

(13) *Object wh-movement vs. object scrambling in German – [•wh•] vs. [•scr•]*:

a. (Ich weiß nicht) $[_{CP}\ [_{DP_{obj}}$ welches Buch] sie gesagt hat $[_{CP}\ t_{obj}\ [_{C'}$ dass] $[_{TP}$ sie
I know not which $book_{acc}$ she said has that she
gelesen hat]]
read has

b. *dass sie $[_{DP_{obj}}$ das Buch] gesagt hat $[_{CP}\ t_{obj}\ [_{C'}$ dass] $[_{TP}$ sie gelesen hat]]
that she the $book_{acc}$ said has that she read has

(14) *Object wh-movement via VP*:

I: $[_{VP}\ ...\ DP_{obj:[0.9]}\ V_{[0.3],[\bullet wh\bullet]:[0.5]}]$	MC *w = 2.0*	AL *w = 3.0*	*H*
O_1: $[_{VP}\ ...\ DP_{obj:[0.9]}\ V_{[0.3],[\bullet wh\bullet]:[0.5]}]$	-1.4		-2.8
☞O_2: $[_{VP}\ DP_{obj:[0.9]}\ [_{V'}\ ...\ t_{obj}\ V_{[0.3],[\bullet wh\bullet]:[0.5]}]]$		-0.3	-0.9

(15) *Object wh-movement via finite declarative CP*:

I: $[_{CP}\ C_{[0.8],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
O_1: $[_{CP}\ C_{[0.8],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	-1.4		-2.8
☞O_2: $[_{CP}\ DP_{obj:[0.9]}\ [_{C'}\ C_{[0.8],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ t_{obj}\ [_{T'}\ ...\ T\ ]]]]$		-0.8	-2.4

Implicational universal II:
If an XP α can undergo Σ_1-movement across a Y head δ, and Σ_1 has less weight than another movement type Σ_2, then α can ceteris paribus undergo Σ_2-movement across δ.

3.3. Asymmetries between Moved Items

Note:
In some environments, there are no asymmetries between subject and object extraction in German. E.g., there are no complementizer-trace effects with subject extraction in standard contexts.

(16) *Subject and object wh-movement via finite declarative CP* (Haider (2010)):

a. (Ich weiß nicht) $[_{CP}\ [_{DP_{obj}}$ welches Buch] sie gesagt hat $[_{CP}\ t_{obj}\ [_{C'}$ dass] $[_{TP}$ sie
I know not which $book_{acc}$ she said has that she
gelesen hat]]
read has

b. (Ich weiß nicht) $[_{CP}\ [_{DP_{subj}}$ welches Buch] sie gesagt hat $[_{CP}\ t_{subj}\ [_{C'}$ dass] $[_{TP}$ sie
I know not which $book_{nom}$ she said has that she
beeindruckt hat]]
impressed has

(17) *Subject wh-movement via finite declarative CP*:

I: $[_{CP}\ C_{[0.8],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ DP_{subj:[0.8]}\ [_{T'}\ ...\ T\ ]]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
O_1: $[_{CP}\ C_{[0.8],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ DP_{subj:[0.8]}\ [_{T'}\ ...\ T\ ]]]$	-1.3		-2.6
☞O_2: $[_{CP}\ DP_{subj:[0.8]}\ [_{C'}\ C_{[0.8],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ t_{obj}\ [_{T'}\ ...\ T\ ]]]]$		-0.8	-2.4

Observation:
Subject and object wh-movement from interrogative CPs also does not show any asymmetries; it is uniformly impossible.

(18) *Subject and object wh-movement via finite interrogative CP* (Müller & Sternefeld (1993)):

a. *$[_{DP_{obj}}$ Was] weißt du nicht $[_{CP}$ wie man t_{obj} repariert] ?
what$_{acc}$ know you not how one fixes

b. *$[_{DP_{subj}}$ Wer] weißt du nicht $[_{CP}$ wie t_{subj} das repariert] ?
who$_{nom}$ know you not how that fixes

(19) *Object wh-movement via finite interrogative CP*:

I: $[_{CP}\ C_{[1.0],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
☞O_1: $[_{CP}\ C_{[1.0],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	-1.4		-2.8
O_2: $[_{CP}\ DP_{obj:[0.9]}\ [_{C'}\ C_{[1.0],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ t_{obj}\ [_{T'}\ ...\ T\ ]]]]$		-1.0	-3.0

(20) *Subject wh-movement via finite interrogative CP*:

I: $[_{CP}\ C_{[1.0],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ DP_{subj:[0.8]}\ [_{T'}\ ...\ T\ ]]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
☞O_1: $[_{CP}\ C_{[1.0],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ DP_{subj:[0.8]}\ [_{T'}\ ...\ T\ ]]]$	-1.3		-2.6
O_2: $[_{CP}\ DP_{subj:[0.8]}\ [_{C'}\ C_{[1.0],[\bullet wh\bullet]:[0.5]}\ [_{TP}\ t_{obj}\ [_{T'}\ ...\ T\ ]]]]$		-1.0	-3.0

Question:
Wh-islands have often been derived by assuming that a moved wh-phrase blocks a single escape hatch (Chomsky (1977; 1986)). Isn't it therefore a step backwards to postulate that wh-islands simply go back to increased strength of C?

Answer: No.

- Embedded *polar questions* are also wh-islands even though it is not obvious why SpecC should be unavailable if C is headed by a *whether* or *if* clause.
- Minimalist analyses typically rely on the assumption that *multiple specifiers* are freely available (Chomsky (2001; 2014)). For instance, otherwise there would be *no* extraction from a vP containing an external argument DP, given the PIC.
- As shown below, wh-islands can in fact *be circumvented* under certain conditions in German. Given a constraint like the PIC (or the Subjacency Condition), this implies that SpecC must be available in principle in embedded interrogative CPs.

Observation:
With topicalization from interrogative CPs, there *is* an asymmetry between subjects and objects.

(21) *Subject and object topicalization via finite interrogative CP* (Fanselow (1987), Müller & Sternefeld (1993)):

a. $[_{DP_{obj}}$ Radios] weiß ich nicht $[_{CP}$ wie man t_{obj} repariert]
radios$_{acc}$ know I not how one fixes

b. *$[_{DP_{subj}}$ Linguisten] weiß ich nicht $[_{CP}$ wie t_{subj} das reparieren]
linguists$_{nom}$ know I not how that fix

(22) *Object topicalization via finite interrogative CP*:

I: $[_{CP}\ C_{[1.0],[\bullet top\bullet]:[0.65]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
O_1: $[_{CP}\ C_{[1.0],[\bullet top\bullet]:[0.65]}\ [_{TP}\ DP_{obj:[0.9]}\ [_{T'}\ ...\ T\ ]]]$	-1.55		-3.1
☞O_2: $[_{CP}\ DP_{obj:[0.9]}\ [_{C'}\ C_{[1.0],[\bullet top\bullet]:[0.65]}\ [_{TP}\ t_{obj}\ [_{T'}\ ...\ T\ ]]]]$		-1.0	-3.0

(23) *Subject topicalization via finite interrogative CP*:

I: $[_{CP}\ C_{[1.0],[\bullet top\bullet]:[0.65]}\ [_{TP}\ DP_{subj:[0.8]}\ [_{T'}\ ...\ T\ ]]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
☞O_1: $[_{CP}\ C_{[1.0],[\bullet top\bullet]:[0.65]}\ [_{TP}\ DP_{subj:[0.8]}\ [_{T'}\ ...\ T\ ]]]$	-1.45		-2.9
O_2: $[_{CP}\ DP_{subj:[0.8]}\ [_{C'}\ C_{[1.0],[\bullet top\bullet]:[0.65]}\ [_{TP}\ t_{obj}\ [_{T'}\ ...\ T\ ]]]]$		-1.0	-3.0

Implicational universal III:
If an XP α_1 can undergo Σ-movement across a Y head δ, and α_1 has less weight than another XP α_2, then α_2 can ceteris paribus undergo Σ-movement across δ.

4. Extraction from DP in French

Observation (Mensching, Müller, Werner & Winckel (2018), Kolliakou (1999), Sportiche (1981), and references cited there):
Dont-relativization from DP in French does not apply to the highest θ-role within DP. Rather, at most one DP-internal *de*-phrase can be different from the others, e.g., by qualifying as a (genitive-marked) KP, not as a PP. Only such an item can be extracted from DP.

(24) *Extraction from DP in French*:

a. *Le Corbusier dont$_1$ $[_{DP}$ la maison t_1 de M. X] n' est guère confortable
Le Corbusier of whom the house of Mr. X NEG is hardly comfortable

b. M. X dont$_1$ $[_{DP}$ la maison de Le Corbusier t_1] n' est guère confortable
Mr. X of whom the house of Le Corbusier NEG is hardly comfortable

c. la symphonie dont$_1$ j' aime $[_{DP}$ l' interprétation de Karajan t_1]
the symphony of which I love the interpretation of Karajan

Reanalyis:
The sole designated DP-internal argument that can undergo extraction need not have a different categorial status; it can simply have more weight. (Alternatively, different categorial status correlates with different strength.)

(25) *Extraction of designated argument from DP*:

I: $[_{DP}\ [_{D'}\ D_{[1.0],[\bullet rel\bullet]:[0.6]}\ PP_2\ PP_{1\,[rel]:[1.0]}\ ]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
O_1: $[_{DP}\ [_{D'}\ D_{[1.0],[\bullet rel\bullet]:[0.6]}\ PP_2\ PP_{1\,[rel]:[1.0]}\ ]]$	-1.6		-3.2
☞O_2: $[_{DP}\ PP_{1\,[rel]:[1.0]}\ [_{D'}\ D_{[1.0],[\bullet rel\bullet]:[0.6]}\ PP_2\ t_1\ ]]$		-1.0	-3.0

(26) *Extraction of other argument from DP*:

I: $[_{DP}\ [_{D'}\ D_{[1.0],[\bullet rel\bullet]:[0.6]}\ PP_{2\,[rel]:[0.5]}\ PP_1\ ]]$	MC *w = 2.0*	AL *w = 3.0*	*H*
☞O_1: $[_{DP}\ [_{D'}\ D_{[1.0],[\bullet rel\bullet]:[0.6]}\ PP_{2\,[rel]:[0.5]}\ PP_1\ ]]$	-1.1		-2.2
O_2: $[_{DP}\ PP_{2\,[rel]:[0.5]}\ [_{D'}\ D_{[1.0],[\bullet rel\bullet]:[0.6]}\ t_2\ PP_1\ ]]$		-1.0	-3.0

5. Complementizer-Trace Effects in English

(27) *The That-Trace Effect*

a. $[_{CP}$ Who(m)$_i$ did you think $[_{CP}\ t_i\ [_{C'}\ \varnothing]$ John saw $t_i]]$?
b. $[_{CP}$ Who$_i$ did you think $[_{CP}\ t_i\ [_{C'}\ \varnothing]\ t_i$ saw John?$]]$
c. $[_{CP}$ Who(m)$_i$ did you think $[_{CP}\ t_i\ [_{C'}$ **that**$]$ John saw $t_i]]$?
d. *$[_{CP}$ Who$_i$ did you think $[_{CP}\ t_i\ [_{C'}$ **that**$]\ t_i$saw John$]]$?

Observation:

- The standard approach to complementizer-trace effects relies on the presence or absence of *'that'* in narrow syntax.
- ECP-violations give rise to the *that*-trace effect in English (Aoun et al. (1981); Chomsky (1981); Aoun et al. (1987)).

Question:
If the realization of C is *post-syntactic* (e.g., vocabulary insertion as in Distributed Morphology), how can it determine *syntactic* complementizer-trace effects?

Reanalysis:
GHG derives subject/object extraction asymmetries on the basis of the interaction between different strengths of Cs (weak *vs.* strong) and different levels of activity of DPs (subject *vs.* object).

(28) *Wh-Movement of $DP_{Obj:[0.8]}$ via weak C:[0.5]*

I: $[_{CP}\ C_{[0.5],[\bullet wh\bullet]:[0.8]}\ [_{TP}\ DP_{[0.8],\,[wh]}\ [_{T'}\ \ldots T]]]$	MC *w=2*	AL *w=3*	*H*
☞ O_1: $[_{CP}\ DP_{[0.8]}\ [_{C'}\ C_{[0.5]}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]]$		-0.5	-1.5
O_2: $[_{CP}\ C_{[0.5],[\bullet wh\bullet]:[0.8]}\ [_{TP}\ DP_{[0.8],\,[wh]}\ [_{T'}\ \ldots T]]]$	-1.6		-3.2

(29) *Wh-Movement of $DP_{Subj:[0.4]}$ via weak C:[0.5]*

I: $[_{CP}\ C_{[0.5],[\bullet wh\bullet]:[0.8]}\ [_{TP}\ DP_{[0.4],\,[wh]}\ [_{T'}\ \ldots T]]]$	MC *w=2*	AL *w=3*	*H*
☞ O_1: $[_{CP}\ DP_{[0.4]}\ [_{C'}\ C_{[0.5]}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]]$		-0.5	-1.5
O_2: $[_{CP}\ C_{[0.5],[\bullet wh\bullet]:[0.8]}\ [_{TP}\ DP_{[0.4],\,[wh]}\ [_{T'}\ \ldots T]]]$	-1.2		-2.4

(30) *Wh-Movement of $DP_{Obj:[0.8]}$ via strong C:[1]*

I: $[_{CP}\ C_{[1],[\bullet wh\bullet]:[0.8]}\ [_{TP}\ DP_{[0.8],\,[wh]}\ [_{T'}\ \ldots T]]]$	MC *w=2*	AL *w=3*	*H*
☞ O_1: $[_{CP}\ DP_{[0.8]}\ [_{C'}\ C_{[1]}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]]$		-1	-3
O_2: $[_{CP}\ C_{[1],[\bullet wh\bullet]:[0.8]}\ [_{TP}\ DP_{[0.8],\,[wh]}\ [_{T'}\ \ldots T]]]$	-1.6		-3.2

(31) *Wh-Movement of $DP_{Subj:[0.4]}$ via strong C:[1]*

I: $[_{CP}\ C_{[1],[\bullet wh\bullet]:[0.8]}\ [_{TP}\ DP_{[0.4],\,[wh]}\ [_{T'}\ \ldots T]]]$	MC *w=2*	AL *w=3*	*H*
O_1: $[_{CP}\ DP_{[0.4]}\ [_{C'}\ C_{[1]}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]]$		-1	-3
☞ O_2: $[_{CP}\ C_{[1],[\bullet wh\bullet]:[0.8]}\ [_{TP}\ DP_{[0.4],\,[wh]}\ [_{T'}\ \ldots T]]]$	-1.2		-2.4

Side Remarks

- Asymmetric patterns of subject/object extraction are modelled by assigning different levels of activity.
- As Cs with different strengths are assumed to be selected from the lexicon, the GHG analysis does not encounter a look-ahead problem and it need not refer to the PF form of Cs in the syntactic derivation.
- GHG also gives an insight into *iconicity* between linguistic symbols and their realization. *The more weight a category has, the more likely its lexical realization is* (Müller (2017b)).

(32) *Constraints*

a. VI(VOCABULARY INSERTION): *X^0 if X^0 is not realized by vocabulary insertion.
b. DEP: All material that shows up in the output is present in the input. (Here, an instance of vocabulary insertion violates DEP.)

(33) *Vocabulary Insertion for C: [1]*

I: [. . . C:[1]]	VI *w= 2*	DEP *w= 1.5*	*H*
☞ O_1: [. . . *that*]		1	-1.5
O_2: [. . . ∅]	1		-2

(34) *Vocabulary Insertion for C: [0.5]*

I: [. . . C:[0.5]]	VI *w= 2*	DEP *w= 1.5*	*H*
O_1: [. . . *that*]		1	-1.5
☞ O_2: [. . . ∅]	0.5		-1

6. Three Extraction Asymmetries in Korean

6.1. Asymmetries between XP Barriers

(35) *Object extraposition in simple vs. embedded clauses in Korean*:

a. $[_{CP}[_{CP}$ Yusu-ka t_i man-ass-**ta**$]$ Cini-lul$_i]$
Yusu-NOM t meet-PST-C Cini-ACC
'Yusu met Cini. '
b. *Suci-ka $[_{CP}[_{CP}$ Yusu-ka t_i man-ass-**ta-ko**$]$ Cini-lul$_i]$ sayngkak-han-ta.
Suci-NOM Yusu-NOM t_i meet-PST-DECL-C Cini-ACC think-v-C
'Suci thinks that Yusu met Cini. '

Assumption:
Embedded C in Korean has more strength than root C. (Also see Ross's (1973c) Penthouse Principle.) Therefore, embedded C may block extraposition via antilocality where root C does not, other things being equal. In the case at hand, the combined strength of the moved item (object DP) and the movement type (extraposition) is not sufficient to produce a severe enough violation of MC if movement does not take place.

(36) *DP_{Obj}: [0.8]- rightward extraposition in simple clause C: [0.2]*

I: $[_{CP}\ [_{TP}\ DP_{[0.8],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[0.2],[\bullet ext\bullet]:[0.4]}]$	MC *w=2*	AL *w=3*	*H*
☞ O_1: $[_{CP}\ [_{C'}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]\ C_{[0.2]}]\ DP_{[0.8]}]$		-0.2	-0.6
O_2: $[_{CP}\ [_{TP}\ DP_{[0.8],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[0.2],[\bullet ext\bullet]:[0.4]}]$	-1.2		-2.4

(37) *DP_{Obj}: [0.8] -rightward extraposition from embedded clause C:[1]*

I: $[_{CP}\ [_{TP}\ DP_{[0.8],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[1],[\bullet ext\bullet]:[0.4]}]$	MC *w=2*	AL *w=3*	*H*
O_1: $[_{CP}\ [_{C'}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]\ C_{[1]}]\ DP_{[0.8]}]$		-1	-3
☞ O_2: $[_{CP}\ [_{TP}\ DP_{[0.8],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[1],[\bullet ext\bullet]:[0.4]}]$	-1.2		-2.4

6.2. Asymmetries between Movement Types

Observation:
Asymmetries are observed depending on the direction of movement in embedded clauses: Leftward movement (i.e., scrambling) of the object is allowed, but rightward movement (i.e., extraposition) is ungrammatical, as we have just seen.
These movement type asymmetries have not been analyzed as such. Existing approaches only focus on individual movement types (e.g., cyclic linearization approach and movement approach for scrambling; bi-clausal approach for extraposition; see Chung (2009; 2010; 2012); Ko (2007); Ko & Choi (2009); Yim (2013)).

(38) *Object scrambling vs. extraposition in Korean – [•scr•] vs. [•ext•]*:

a. Suci-ka $[_{CP}$ Cini-lul_i [Yusu-ka t_i man-ass-**ta-ko**]] sayngkak-han-ta.
Suci-NOM Cini-ACC Yusu-NOM t_i meet-PST-DECL-C think-v-C
'Suci thinks that Yusu met Cini. '

b. *Suci-ka $[_{CP}[_{CP}$ Yusu-ka t_i man-ass-**ta-ko**] Cini-lul_i] sayngkak-han-ta.
Suci-NOM Yusu-NOM t_i meet-PST-DECL-C Cini-ACC think-v-C

Analysis:
Depending on the movement type (scrambling *vs.* extraposition) GHG identifies a locality effect with the object in Korean derived by the constraint MC and the different strengths of [•F•].

(39) *DP_{Obj}: [0.8] -leftward scrambling from embedded clause C:[1]*

I: $[_{CP}\ [_{TP}\ DP_{[0.8],\ [scr]}\ [_{T'}\ \ldots T]]\ C_{[1],[\bullet scr\bullet]:[0.8]}]$	MC *w=2*	AL *w=3*	*H*
☞ O_1: $[_{CP}\ DP_{[0.8]}\ [_{C'}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]\ C_{[1]}]]$		-1	-3
O_2: $[_{CP}\ [_{TP}\ DP_{[0.8],\ [scr]}\ [_{T'}\ \ldots T]]\ C_{[1],[\bullet scr\bullet]:[0.8]}]$	-1.6		-3.2

(40) *DP_{Obj}: [0.8] -rightward extraposition from embedded clause C:[1]* (= (37))

I: $[_{CP}\ [_{TP}\ DP_{[0.8],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[1],[\bullet ext\bullet]:[0.4]}]$	MC *w=2*	AL *w=3*	*H*
O_1: $[_{CP}\ [_{C'}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]\ C_{[1]}]\ DP_{[0.8]}]$		-1	-3
☞ O_2: $[_{CP}\ [_{TP}\ DP_{[0.8],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[1],[\bullet ext\bullet]:[0.4]}]$	-1.2		-2.4

6.3. Asymmetries between Moved Items with Extraposed CPs in Korean

Observation:
Asymmetrical patterns are shown in extraposed CPs: An object can be extraposed after extraposition of the embedded CP, but a subject cannot undergo extraposition in this context.

(41) *A subject/object asymmetry with extraposition from extraposed clauses*

a. $[_{CP}$ Suci-ka t_j sayngkak-han-ta. $[_{CP}[_{CP}$ Yusu-ka t_i man-ass-**ta-ko**$]_j$ Cini-lul_i]]
Suci-NOM said Yusu-NOM meet-PST-DECL-C Cini-ACC
'Suci thinks that Yusu met Cini. '

b. *$[_{CP}$ Suci-ka t_j sayngkak-han-ta. $[_{CP}[_{CP}$ t_i Cini-lul_i man-ass-**ta-ko**$]_j$ Yusu-ka_i]]
Suci-NOM think-v-C Cini-ACC meet-PST-DECL-C Yusu-NOM

Assumptions:

- Extraposed embedded C has less strength than non-extraposed embedded C, but still more strength than root C.
- Objects have more strength than subjects, as in English and German.
- This gives rise to a surprising complementizer-trace effect in Korean (with extraposition).

(42) *DP_{Obj}: [0.8] -rightward extraposition from extraposed clause C:[0.6]*

I: $\ldots[_{CP}\ [_{TP}\ DP_{[0.8],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[0.6],[\bullet ext\bullet]:[0.4]}]$	MC *w=2*	AL *w=3*	*H*
☞ O_1: $\ldots[_{CP}\ [_{C'}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]\ C_{[0.6]}]\ DP_{[0.8]}]$		-0.6	-1.8
O_2: $\ldots[_{CP}\ [_{TP}\ DP_{[0.8],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[0.6],[\bullet ext\bullet]:[0.4]}]$	-1.2		-2.4

(43) *DP_{Subj}: [0.4] -rightward extraposition from extraposed clause C:[0.6]*

I: $\ldots[_{CP}\ [_{TP}\ DP_{[0.4],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[0.6],[\bullet ext\bullet]:[0.4]}]$	MC *w=2*	AL *w=3*	*H*
O_1: $\ldots[_{CP}\ [_{C'}\ [_{TP}\ t_{DP}\ [_{T'}\ \ldots T]]\ C_{[0.6]}]\ DP_{[0.4]}]$		-0.6	-1.8
☞ O_2: $\ldots[_{CP}\ [_{TP}\ DP_{[0.4],\ [ext]}\ [_{T'}\ \ldots T]]\ C_{[0.6],[\bullet ext\bullet]:[0.4]}]$	-0.8		-1.6

7. Idioms

Note:
The new perspective offers surprising accounts of some well-known phenomena. For instance, a ban on even very local movement of parts of semantically opaque idioms follows as a PIC effect, assuming that they have extremely little strength. (This approach to transformational deficiency of

idioms is in fact essentially pursued in Ross (1973a).)

Observation (Fraser (1970), Nunberg et al. (1994), Jackendoff (1997), O'Grady (1998), Burger (1973), Fleischer (1982), Wierzba (2016) for German; but also cf. Fanselow (2015) for a different view):
Idioms resist syntactic transformations that split them up to various degrees.

Implicational generalization:
If an idiom α dominates an idiom β on the opacity scale, and transformation δ can affect α, then δ can also affect β.

(44) *Opacity scale*:
$\text{XP}_{\text{opaque}} > \text{XP}_{\text{semi-opaque}} > \text{XP}_{\text{semi-transparent}} > \text{XP}_{\text{transparent}}$

Variation:

- "Our intuitions in this domain are ... robust and ... consistent across speakers" (Nunberg, Sag & Wasow (1994, 507)).
- "Idioms, more than most aspects of language, vary enormously from speaker to speaker. [...] What is important is that the general claims about idioms ... hold true for each speaker" (Fraser (1970, 23)).
- Data are difficult to judge in many cases (creative use of language, meta-linguistic use, playing with language, ...)

(45) *VP idioms in German* (decreasing semantic opacity):
  a. *opaque*
     Fersengeld geben ('give heel money', 'flee')
  b. *semi-opaque*
     den Stier bei den Hörnern packen ('the bull by the horns grab')
  c. *semi-transparent*
     einen Korb geben ('a basket give', 'turn someone down')
  d. *transparent*
     (i) light verb constructions: zur Aufführung bringen ('to performance bring', 'perform')
     (ii) reanalysis: Buch lesen ('book read') (vs. Buch zerstören, 'book destroy')

(46) *Topicalization*:
  a. ?Fersengeld$_1$ hat der Fritz am Ende t_1 gegeben
     heel money has the Fritz at the end given
  b. Den Stier$_1$ hat sie t_1 bei den Hörnern gepackt
     the bull has she by the horns grabbed
  c. Einen Korb$_1$ hat sie ihm t_1 gegeben
     a basket hsa she him given
  d. Das Buch$_1$ hat keiner t_1 gelesen
     the book has no-one read

(47) *Wh-movement*:
  a. *Was für ein Fersengeld$_1$ hat der Fritz t_1 gegeben ?
     what for a heel money has the Fritz given

  b. *Was für einen Stier$_1$ hat sie t_1 bei den Hörnern gepackt ?
     what for a bull has she by the horns grabbed
  c. ?Was für einen Korb$_1$ hat sie ihm t_1 gegeben ?
     what for a basket has she him given
  d. Was für ein Buch$_1$ hat keiner t_1 gelesen ?
     what for a book has no-one read

(48) *Scrambling*:
  a. *dass der Fritz Fersengeld$_1$ am Ende t_1 gab
     that the Fritz heel money at the end gave
  b. *dass sie bei den Hörnern$_1$ den Stier t_1 packte
     that she by the horns the bull grabbed
  c. ?*dass sie einen Korb$_1$ dem Karl t_1 gab
     that she a basket the Karl gave
  d. dass das Buch$_1$ keiner t_1 gelesen hat
     that the book no-one read has

(49) *Idiom-part object topicalization via VP*:

I: $[_{\text{VP}}$ ... $\text{DP}_{\text{idiom:[0.1]}}$ $\text{V}_{\text{[0.3]},[\bullet\text{top}\bullet]:\text{[0.65]}}]$	MC *w = 2.0*	AL *w = 3.0*	*H*
O_1: $[_{\text{VP}}$ ... $\text{DP}_{\text{idiom:[0.1]}}$ $\text{V}_{\text{[0.3]},[\bullet\text{top}\bullet]:\text{[0.65]}}]$	-0.75		-1.5
☞O_2: $[_{\text{VP}}$ $\text{DP}_{\text{idiom:[0.1]}}$ $[_{\text{V}'}$ ... t_{obj} $\text{V}_{\text{[0.3]},[\bullet\text{top}\bullet]:\text{[0.65]}}]]$		-0.3	-0.9

(50) *Idiom-part object scrambling via VP* (cf. (8)):

I: $[_{\text{VP}}$ ... $\text{DP}_{\text{idiom:[0.1]}}$ $\text{V}_{\text{[0.3]},[\bullet\text{scr}\bullet]:\text{[0.2]}}]$	MC *w = 2.0*	AL *w = 3.0*	*H*
☞O_1: $[_{\text{VP}}$ ... $\text{DP}_{\text{idiom:[0.1]}}$ $\text{V}_{\text{[0.3]},[\bullet\text{scr}\bullet]:\text{[0.2]}}]$	-0.3		-0.6
O_2: $[_{\text{VP}}$ $\text{DP}_{\text{idiom:[0.1]}}$ $[_{\text{V}'}$ ... t_{obj} $\text{V}_{\text{[0.3]},[\bullet\text{scr}\bullet]:\text{[0.2]}}]]$		-0.3	-0.9

8. Outlook

Further issues:

1. How is ineffability (absolute ungrammaticality) eventually derived in cases where first the output without local movement wins, and subsequently the PIC blocks movement on the next cycle? See Müller (2015) for various options.
2. The analysis has been silent so far as regards barriers by lack of L-marking/selection, including subject and adjunct islands (see Chomsky (1986), Cinque (1990); but also Chaves & Dery (2018) and references cited there for arguments against a modelling of these locality effects in the grammar as such). All the evidence presented here involves restrictions on extraction from complements.
3. The features triggering movement via MC have mostly been relevant for *intermediate movement steps*, not so much for *criterial movement steps* (except for the Korean evidence). To model the difference, additional assumptions may be required. (E.g., movement to the specifier of an interrogative C is often ok, movement via an interrogative C sometimes is not.) Possibly, criterial versions of [•F•] are associated with more weight.

4. The approach is categorical as concerns outputs; but it can be combined with MaxEnt grammars (or stochastic OT) yielding non-categorical, gradient output decisions (Hayes (2001)).

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