Generalized Complementizer-Trace Effects in Gradient Harmonic Grammar: Deriving Extraction Asymmetries

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1 Overview

Subject/Object Extraction Asymmetries ('that'-trace effects) in English

(1)　　a.　[$_{CP}$ Who(m)$_i$ did you think [$_{CP}$ t$_i$ [$_{C'}$ ∅] John saw t$_i$]]?

　　　　b.　[$_{CP}$ Who$_i$ did you think [$_{CP}$ t$_i$ [$_{C'}$ ∅] 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]]?

Subject/Object Extraction Asymmetries in Korean

(2)　　a.　[$_{CP}$[$_{CP}$ Yusu-ka　　t$_i$ man-ass-**ta**] Cini-lul$_i$]
　　　　　　　　Yusu-NOM　　meet-PST-C　Cini-ACC
　　　　'Yusu met Cini. '

　　　　b.　[$_{CP}$[$_{CP}$ t$_i$ Cini-lul　man-ass-**ta**] Yusu-ka$_i$]
　　　　　　　　　　　Cini-ACC　meet-PST-C　Yusu-NOM

　　　　c.　[$_{CP}$ Suci-ka　　t$_j$ anta　[$_{CP}$[$_{CP}$ Yusu-ka　　t$_i$ man-ass-**ta-ko**]$_j$　Cini-lul$_i$]]
　　　　　　　　Suci-NOM　　knows　　　　Yusu-NOM　　meet-PST-DECL-C Cini-ACC
　　　　'Suci knows that Yusu met Cini. '

　　　　d.　*[$_{CP}$ Suci-ka　　t$_j$ anta　[$_{CP}$[$_{CP}$ t$_i$ Cini-lul$_i$　man-ass-**ta-ko**]$_j$　Yusu-ka$_i$]]
　　　　　　　　Suci-NOM　　knows　　　　　　Cini-ACC meet-PST-DECL-C Yusu-NOM

Outlook on Data

- Both English and Korean exhibit extraction asymmetries between the subject and the object depending on C items.

(3)

| *English*: | Covert C | Overt C |
Korean:	C in root clauses	C in extraposed clauses
Object	✓(a)	✓(c)
Subject	✓(b)	✗(d)

- How can we capture this parallelism between two domains from two different languages?

Claim of this talk:

> Gradient Harmonic Grammar (GHG; Smolensky & Goldrick, 2016, Müller 2017, Zimmermann 2017) can derive extraction asymmetries with generalized complementizer-trace effects:
>
> (i) Asymmetries between *movement types*: strength of C items and triggers
>
> (ii) Asymmetries between *moved items*: strength of DPs

Roadmap:

- Provide an overview of what Gradient Harmonic Gramamar is and how it works.

- Show how asymmetries are directly incorporated into the grammar by assigning different strengths to Cs and DPs.

- Show that GHG analysis can give a reanalysis of 'that'-trace effects in English without encountering a look-ahead problem.

- Show that the same logic can be applied for two more generalized complementizer-trace effects in head-final languages like Korean.

2 Gradient Symbolic Representation

- In Harmonic Grammar (Legendre 1999; Pater 2016; Prince & Smolensky 2008), constraints are neither categorical nor ranked, but they are associated with *weights*.

- The output of the Harmonic Grammar is the representation with maximal Harmony[1] (i.e. the optimal candidate).

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[1]In GHG, the Harmony of a representation r is the weighted sum of the violations by r of the constraints $\mathbb{C}$ that constitute the grammar:

$H(r) = \sum_k w_k \mathbb{C}_k(r)$

A constraint $\mathbb{C}_j$ with a weight w_j penalizes the Harmony of r in proportion to $\mathbb{C}_j(r)$, the degree to which r violates $\mathbb{C}_j$.

- In GHG, both linguistic expressions (LEs) and constraints are *gradient*, not discrete, with strengths varying from 0 to 1.[2]
- Ross (1973a,b) proposes Squishy Grammar, which is highly similar to GHG, based on the concepts of "nouniness" and "clausematiness" to capture variation with passive and reconstruction constructions.

e.g., LE $x_{[0.7]}$ may be *active* enough to trigger a certain operation by interacting with weighted constraints, whereas LE $y_{[0.3]}$ may be too *weak* to trigger the same operation.

Sketch of a GHG analysis

- Recall the data in (1-c) and (1-d).
- Suppose that DPs have a different strength (i.e. a degree of activity). DP_{Obj} is assumed to have more strength than DP_{Subj}.

(4)   *If $DP_{[1]}$ is strong enough,*

I: [$DP_{[wh]}$:[1] . . . C]	WH w= 2	DEP w= 1.5	H
☞ O_1: [DP_i:[1][t_i . . . C]]		-1	**-1.5**
O_2: [$DP_{[wh]}$:[1] . . . C]	**-1**		-2

T_1. Wh-Movement of DP_{Obj}: [0.8]

(5)   *If $DP_{[0.5]}$ is too weak,*

I: [$DP_{[wh]}$:[0.5] . . . C]	WH w= 2	DEP w= 1.5	H
O_1: [DP_i:[0.5][t_i . . . C]]		-1	-1.5
☞ O_2: [$DP_{[wh]}$:[0.5] . . . C]	**-0.5**		-1

T_2. Wh-Movement of DP_{Subj}: [0.5]

-**WH** (Wh-Criterion): *XP$_{[wh]}$, if it is not in [Spec, CP].   ❝ *Carry out wh-movement!* ❞
-**DEP**: All material that shows up in the output is present in the input.   ❝ *Do not move!* ❞

- Let's look at *wh*-movement. If the strong DP in (4) does not undergo *wh*-movement, it will induce a fatal violation. The optimal output will therefore be O_1 which have a better harmony score than O_2.

- However, if a weak DP does not undergo wh-movement (see (5)), it results in getting only half of the penalty, so the in situ candidate O_2 will be optimal.

- Different strengths discriminate the two opposite derivations, and this is a way to derive subject/object asymmetries.

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[2]Symbols are discrete but their degree of presence in a given linguistic representation is continuously gradient (Smolensky and Goldrick, 2016, p.2).

3 Assumptions

This section summarizes which constraints are required and how much strength is assigned to LEs.

3.1 Constraints

- **WH** (Wh-Criterion): *$XP_{[wh]}$ if $XP_{[wh]}$ is not in [Spec, CP].
- **SCR** (Scrambling): *$XP_{[scr]}$ if $XP_{[scr]}$ is not in [Spec, CP].
- **EXTR** (Extraposition): *$XP_{[ext]}$ if $XP_{[ext]}$ is not right-adjoined to CP.
- **MIN** (Minimality Condition):
  *C if
  (i) C linearly intervenes between α_i and α_{i+1} of a chain link $<\alpha_i, \alpha_{i+1}>$, and
  (ii) C c-commands α_{i+1} but does not c-command α_i.

  > ❝ *Do not cross a C node!* ❞

  (6)   a. $[_{CP} XP_i [_{C'} \textbf{that} \cdots t_i]]$ b. $[[_{CP} t_i \cdots \textbf{C}]XP_i]$

- **DEP**: All material that shows up in the output is present in the input.

3.2 Strength

- DP_{Obj}: 0.8, DP_{Subj}: 0.4

- In English,
  - $C_{0.5}$ - realized as a zero morpheme at PF
  - C_1 - realized overtly (e.g. *that*) at PF

- In Korean,
  - $C_{0.2}$ - if there is no C that c-commands it.
  - $C_{0.5}$ - if C is not c-commanded by another C, but is m-commanded by another C.
  - C_1 - if C is c-commanded by another C.

Question: What determines strength?

- ❧ In the case of English phonological realization may depend on strength of LEs.

- ❧ Strength may correlate with depth of embeddeding. In a minimal phase, an object is more deeply embedded than a subject is.

- ❧ A similar intuition underlies ECP-based approaches (Chomsky 1981, Aoun et al. 1987): An object is lexically governed by a verb and thereby circumvents the that-trace effect, but a subject is not.

4 Complementizer-trace effects: Deriving an extraction asymmetry

4.1 Reanalysis of *that*-trace effects in English

Data

- English *wh*-movement exhibits an extraction asymmetry between subject and object that interacts with the presence or absence of the complementizer (Perlmutter 1968, Chomsky 1981, Pesetsky 1982, Grimshaw 1997).

(7)   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]]?

- The standard approach to complementizer-trace effects relies on the presence or absence of *'that'* in narrow syntax.
- ECP-violations[3] give rise to the *that*-trace effect in English (Chomsky 1981, Aoun et al. 1987).
- If the realization of C is *post-syntactic* (e.g., vocabulary insertion as in Distributed Morphology), how can it determine the *syntactic* complementizer-trace effects?

Analysis

Every phase is cyclically evaluated and optimized (Ackema & Neelman 1998, Fanselow & Ćavar 2001, Heck & Müller 2003).

Constraints

- **Wh** (Wh-Criterion): *XP$_{[wh]}$ if XP$_{[wh]}$ is not in [Spec, CP].

      ❝Carry out wh-movement!❞

- **Min** (Minimality Condition):
  *C if
  (i) C linearly intervenes between α_i and α_{i+1} of a chain link $<\alpha_i, \alpha_{i+1}>$, and
  (ii) C c-commands α_{i+1} but does not c-command α_i. ❝ *Do not cross a C node!*❞

- **Dep**: All material that shows up in the output is present in the input. (I.e., traces and copies violate **Dep**.) ❝ *Do not move!*❞

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[3]Formally, the ECP states that (Haegeman 1994, p. 442):
  Traces must be properly governed:
  A properly governs B iff A theta-governs B or A antecedent-governs B
  - A theta-governs B iff A governs B and A theta-marks B
  - A-antecedent governs B iff A governs B and A is coindexed with B.

Optimization

The following tableaux show the optimization, when an embedded CP is built up.

- If C:[0.5] is selected (→ and it will realize as ∅),

T_3. *Wh-Movement of DP_{Obj}: [0.8]*

I: [_{CP} C:[0.5] … DP_{[wh]}:[0.8]]	WH $w=6$	MIN $w=2$	DEP $w=1$	H
☞ O_1: [_{CP} DP:[0.8] [_{C'} C:[0.5] t_{DP}]]		-0.5	-1	**-2**
O_2: [_{CP} C:[0.5] … DP_{[wh]}:[0.8]]	-0.8			-4.8

T_4. *Wh-Movement of DP_{Subj}: [0.4]*

I: [_{CP} C:[0.5] … DP_{[wh]}:[0.4]]	WH $w=6$	MIN $w=2$	DEP $w=1$	H
☞ O_1: [_{CP} DP:[0.4] [_{C'} C:[0.5] t_{DP}]]		-0.5	-1	**-2**
O_2: [_{CP} C:[0.5] … DP_{[wh]}:[0.4]]	-0.4			-2.4

- ❧ Wh-criterion triggers intermediate steps of wh-movement (Abels 2012).
- ❧ MIN and DEP have to be violable, since every step of movement from CP phases violates MIN.
- ❧ The constraint WH has a larger weight than MIN and DEP.

- If C:[1] is selected (→ and it will realize as 'that'),

T_5. *Wh-Movement of DP_{Obj}: [0.8]*

I: [_{CP} C:[1] … DP_{[wh]}:[0.8]]	WH $w=6$	MIN $w=2$	DEP $w=1$	H
☞ O_1: [_{CP} DP:[0.8] [_{C'} C:[1] t_{DP}]]		-1	-1	**-3**
O_2: [_{CP} C:[1] … DP_{[wh]}:[0.8]]	**-0.8**			-4.8

T_6. *Wh-Movement of DP_{subj}: [0.4]*

I: [_{CP} C:[1] … DP_{[wh]}:[-0.4]]	WH $w=6$	MIN $w=2$	DEP $w=1$	H
O_1: [_{CP} DP:[0.4] [_{C'} C:[1] t_{DP}]]		-1	-1	-3
☞ O_2: [_{CP} C:[1] … DP_{[wh]}:[-0.4]]	**-0.4**			**-2.4**

Note

- The constraint MIN interacts with the strength of Cs, and WH interacts with the strength of DPs.

- DEP checks whether there exists a trace (which is not *gradient*) or not in the output representation.

- DP:[0.8] is strong enough to induce a fatal WH violation, if it does not move across C:[1].
  (i.e., $|0.8 \cdot \text{Wh}| > |1.0 \cdot \text{Min} + 1.0 \cdot \text{Dep}| : T_5$.)

- DP:[0.4] is not strong enough to induce a fatal WH violation, if it does not move across C:[1]; the *gang effect* of MIN and DEP blocks subject movement.
  (i.e., $|0.4 \cdot \text{Wh}| < |1.0 \cdot \text{Min} + 1.0 \cdot \text{Dep}| : T_6$.)

Interim Summary:

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

  (i) If a weak C is selected, both DPs are strong enough to cross the C boundary.

  (ii) If a strong C is selected, only the object is still enough to undergo wh-movement.

    (8)   a. $[_{CP} \text{DP}_i^{\text{strong}} [_{C'} \textbf{that}^{\text{strong}} \cdots t_i]]$ b. $[_{CP} \text{DP}_i^{\text{weak}} [_{C'} \textbf{that}^{\text{strong}} \cdots t_i]]$

Side Remarks

- Asymmetric patterns of subject/object extraction are remodelled 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 its PF form of Cs in the syntactic derivation.

Constraints (for post-syntactic optimization):

- **VI**: $*X^0$ if X^0 is not realized by vocabulary insertion.

- **DEP**: All material that shows up in the output is present in the input. (Here, a vocabulary insertion violates DEP.)   ❝ *Do not insert a vocabulary item!* ❞

If C has a fully-activated strength [1],

I: […C:[1]]	VI	DEP	H
	w= 2	*w= 1.5*	
☞ O₁: […*that*]		1	**-1.5**
O₂: […∅]	1		-2

T₇. Vocabulary Insersion of C: [1]

If C has a defective strength [0.5],

I: […C:[0.5]]	VI	DEP	H
	w= 2	*w= 1.5*	
O₁: […*that*]		1	-1.5
☞ O₂: […∅]	0.5		**-1**

T₈. Vocabulary Insersion of C: [0.5]

- 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 2017).

4.2 Scrambling/Extraposition Asymmetries in Korean

Data

- In Korean, arguments are allowed to undergo scrambling and extraposition.

Generalized comp-trace effects with objects in Korean

(9)   In simple clauses

    a.   [$_{CP}$ Cini-lul$_i$ [Yusu-ka t_i man-ass-**ta**]]
           Cini-ACC   Yusu-NOM   meet-PST-C
    'Yusu met Cini. '

    b.   [$_{CP}$[$_{CP}$ Yusu-ka t_i man-ass-**ta**] Cini-lul$_i$]
             Yusu-NOM t meet-PST-C Cini-ACC

(10)   In embedded clauses

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

- Korean exhibits an extraction asymmetry between movement types in embedded clauses. An object can undergo scrambling to a left-peripheral position of C, whereas it cannot be right-adjoined to the embedded C.

- These movement type asymmetries have been analyzed by genuinely different approaches (e.g., cyclic linearization, movement approach, bi-clausal approach (Chung 2009, 2010, 2012, Ko 2007, 2009, Yim 2013)), but there is no a priori reason why this should be so.

Observation

- In simple clauses, the object undergoes scrambling or extraposition freely across the matrix C-boundary.

	Movement Type	[$_{CP}$ *DP* C$_{matrix}$]	[$_{CP}$ *DP* C$_{embedded}$]
(11)	Scrambling (L)	✓(8-a)	✓(9-a)
	Extraposition(R)	✓(8-b)	✗ (9-b)

- Asymmetries are observed depending on the direction of movement in embedded clauses: leftward movement (i.e., scrambling) of the object is still allowed, but rightward movement (i.e., extraposition) is ungrammatical.

Analysis

Constraints

- **SCR** (Scrambling): *XP$_{[scr]}$, if XP$_{[scr]}$ is not in [Spec, CP].

  ❝*Carry out scrambling.*❞

- **EXTR** (Extraposition): *XP$_{[ext]}$ if XP$_{[ext]}$ is not right-adjoined to CP.

  ❝*Carry out extraposition.*❞

- **MIN** (Minimality Condition):
  *C if
  (i) C linearly intervenes between α_i and α_{i+1} of a chain link $<\alpha_i, \alpha_{i+1}>$, and
  (ii) C c-commands α_{i+1} but does not c-command α_i. ❝ *Do not cross a C node!*❞

- **DEP**: All material that shows up in the output is present in the input. (I.e., traces and copies violate DEP.) ❝ *Do not move!*❞

Optimization

T_9. DP$_{Obj}$: *[0.8]- leftward scrambling in simple clause C: [0.2]*

I: [$_{CP}$ ... DP$_{[ext]}$:[0.8] ... C: [0.2]]	SCR $w=5$	MIN $w=4$	DEP $w=1$	H
☞ O$_1$: [$_{CP}$ [$_{CP}$ ... t$_{CP}$ ... C: [0.2]] DP:[0.8]]			-1	**-1**
O$_2$: [$_{CP}$ ... DP$_{[ext]}$:[0.8] ... C: [0.2]]	-0.8			-4

T_{10}. DP$_{Obj}$: *[0.8] -leftward scrambling from embedded clause C:[1]*

I: [$_{CP}$ ... DP$_{[scr]}$:[0.8] ... C: [1]]	SCR $w=5$	MIN $w=4$	DEP $w=1$	H
☞ O$_1$: [$_{CP}$ DP:[0.8] [$_{C'}$ ... t$_{DP}$ ... C:[1]]]			-1	**-1**
O$_2$: [$_{CP}$ ... DP$_{[scr]}$:[0.8] ... C: [1]]	-0.8			-4

- ☙ SCR interacts with the different activity levels of DPs.

- ☙ Scrambling in root and embedded clauses does not violate the constraint MIN, as the item never crosses the C node.

T_{11}. DP$_{Obj}$: *[0.8]- rightward extraposition in simple clause C: [0.2]*

I: [$_{CP}$ ... DP$_{[ext]}$:[0.8] ... C: [0.2]]	EXTR $w=5$	MIN $w=4$	DEP $w=1$	H
☞ O$_1$: [$_{CP}$ [$_{CP}$ ... t$_{CP}$ ... C: [0.2]] DP:[0.8]]		**-0.2**	-1	**-1.8**
O$_2$: [$_{CP}$ ... DP$_{[ext]}$:[0.8] ... C: [0.2]]	-0.8			-4

T_{12}. DP$_{Obj}$: *[0.8] -rightward extraposition from embedded clause C:[1]*

I: [$_{CP}$ ... DP$_{[ext]}$:[0.8] ... C: [1]]	EXTR $w=5$	MIN $w=4$	DEP $w=1$	H
O$_1$: [$_{CP}$ [$_{CP}$ ... t$_{DP}$ ... C:[1]] DP:[0.8]]		**-1**	-1	-5
☞ O$_2$: [$_{CP}$ ... DP$_{[ext]}$:[0.8] ... C: [1]]	-0.8			**-4**

Note

- The Constraint EXTR interacts with the different activity levels of DPs, whereas MIN is gradiently evaluated based on the strengths of Cs.

- Matrix C is too weak [0.2] to induce a fatal violation of the constraint MIN.
  (i.e., $|0.8 \cdot \text{Extr}| > |0.2 \cdot \text{Min} + 1.0 \cdot \text{Dep}|$): T_{11}.

- Asymmetries regarding the directionality of movements are determined by whether or not C is linearly crossed, via MIN.
  (i.e., $|1.0 \cdot \text{Dep}| < |0.8 \cdot \text{Extr}| < |1.0 \cdot \text{Min} + 1.0 \cdot \text{Dep}|$): T_9 & T_{10}. vs. T_{11} & T_{12}

- Different strengths of Cs interact with the constraint MIN. Object DPs are not strong enough to undergo extraposition across C:[1].
  (i.e., $|0.8 \cdot \text{Extr}| < |1.0 \cdot \text{Min} + 1.0 \cdot \text{Dep}|$): T_{12}.

Interim Summary:

> Depending on the movement type (scrambling *vs.* extraposition) GHG identifies a hidden comp-trace effect with the object in Korean derived by the constraint MIN and the different strengths of C items:
>
> (i) Unlike extraposition, scrambling only gives rise to a structural intervention effect.
>
> (12) a. $[[_{\text{CP}} \cdots t_i \cdots \text{C}]\ DP_i]$ b. $[_{\text{CP}} DP_i\ [\cdots t_i \cdots \text{C}]]$
>   extraposition   scrambling
>
> (ii) The object is prohibited from extraposition, when it tries to cross the strong C node.
>
> (13) a. $[[_{\text{CP}} t_i \cdots \text{C}^{\text{weak}}]\ DP_i]$ b. $[[_{\text{CP}} t_i \cdots \text{C}^{\text{strong}}]\ DP_i]$

☛ Note that subject extraposition shows exactly the same pattern, as predicted.

4.3 Subject/Object Asymmetries with Extraposed CPs in Korean

Data

Generalized comp-trace effects with subjects in Korean

(14)   In extraposed clauses

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

   b. *$[_{\text{CP}}$ Suci-ka t_j sayngkak-han-ta. $[_{\text{CP}}[_{\text{CP}}$ t_i Cini-lul$_i$ man-ass-**ta-ko**$]_j$
          Suci-NOM   think-v-C   Cini-ACC meet-PST-DECL-C
       Yusu-ka$_i$]]
       Yusu-NOM   ✗ *Subject Extraposition*

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

Optimization

T_{13}. DP_{Obj}:[0.8] extraposition from extraposed clause C:[0.5]

I: [$_{CP}$[$_{CP}$ t_{CP} C:[0.2]] [$_{CP}$ . . . DP$_{[ext]}$:[0.8] . . . C:[0.5]]]	EXTR $w=5$	MIN $w=4$	DEP $w=1$	H
☞ O_1: [$_{CP}$[$_{CP}$[$_{CP}$ t_{CP} C:[0.2]] [$_{CP}$ . . . t_{DP} . . . C:[0.5]]] DP:[0.8]]		-0.5	-1	**-3**
O_2: [$_{CP}$[$_{CP}$ t_{CP} C:[0.2]] [$_{CP}$ . . . DP$_{[ext]}$:[0.8] . . . C:[0.5]]]	**-0.8**			-4

T_{14}. DP_{Subj}:[0.4] extraposition from extraposed clause C:[0.5]

I: [$_{CP}$[$_{CP}$ t_{CP} C:[0.2]] [$_{CP}$ . . . DP$_{[ext]}$:[0.4] . . . C:[0.5]]]	EXTR $w=5$	MIN $w=4$	DEP $w=1$	H
O_1: [$_{CP}$[$_{CP}$[$_{CP}$ t_{CP} C:[0.2]] [$_{CP}$ . . . t_{DP} . . . C:[0.5]]] DP:[0.4]]		-0.5	-1	-3
☞ O_2: [$_{CP}$[$_{CP}$ t_{CP} C:[0.2]] [$_{CP}$ . . . DP$_{[ext]}$:[0.4] . . . C:[0.5]]]	**-0.4**			**-2**

Note

(15)   a. [[$_{CP}$ $\cdots t_i \cdots$ **C**] DP_i^{strong}]   b. [[$_{CP}$ $\cdots t_i \cdots$ **C**] DP_i^{weak}]

5 Conclusion

- I have developed a unified approach for generalizing intervention effects of the complementizer within GHG, where the different strengths of linguistic expressions interact with the weights of the constraints.

- GHG appropriately addresses why certain moved items should behave alike, or why they should differ from other moved items, which cannot straightforwardly be accounted for in other grammatical thoeries.

- We have seen that comp-trace effects emerge from both *structural* and *linear* factors. In this way, the mirror types of standard comp-trace effects are identified with rightward movement in OV languages like Korean.

- PF realization may also be sensitive to strength of linguistic items.

6 Open Questions

1. *Empirical Problem 1*:
   The given analysis does not predict the grammaticality of (16-a).

   (16)   a.   [$_{CP}$ Who$_i$ did you think [$_{CP}$ t_i [$_{C'}$ **that**] Mary believed [$_{CP}$ t_i [$_{C'}$ ∅] John met t_i]]]?

   b.   *[$_{CP}$ Who$_i$ did you think [$_{CP}$ t_i [$_{C'}$ ∅] Mary believed [$_{CP}$ t_i [$_{C'}$ **that**] John met t_i]]]?

Alternatively, we can think of derivational assignment of strength of DPs depending on the configuration at each step. The degree of strength of Cs may differ in three ways (i.e., intermediate Cs may gain medial level of activity), and it is not strong enough to induce a fatal violation of MIN.

2. *Empirical Problem 2*:
In Korean long-movement of extraposition with objects from embedded clauses (17-b) is acceptable. But the current analysis predicts that (17-b) is also ungrammatical, since strong C induces a fatal violation of MIN at the early step.

(17) a. *Suci-ka [$_{CP}$[$_{CP}$ Yusu-ka t_i man-ass-**ta-ko**] Cini-lul$_i$]
Suci-NOM   Yusu-NOM t_i meet-PST-DECL-C Cini-ACC
sayngkak-han-ta.
think-v-C
'Suci thinks that Yusu met Cini. '
b. $^{??}$[$_{CP}$[$_{CP}$ Suci-ka [$_{CP}$[$_{CP}$ Yusu-ka t_i man-ass-**ta-ko**] t_i]
Suci-NOM   Yusu-NOM t_i meet-PST-DECL-C
sayngkak-han-ta] Cini-lul$_i$]
think-v-C   Cini-ACC

In (17-b), we might think of the case that the item is moved to the position, where C does not linearly intervene between its chain links at the intermediate step.

3. *Conceptual Problem*:
When MIN and DEP gang-up, they force an item to stay in base-generated position as in the input structure, but still the optimal output is ungrammatical.

(18)   *[$_{CP}$ You think [$_{CP}$ **that** who$_i$ saw John]]?

This may be explained if we assume that a wh-feature in situ will lead to a crash at LF due to uninterpretability (Grimshaw 1997).

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