Intervention in *tough*-constructions revisited

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In this paper, we subject to closer scrutiny one particularly influential recent argument in favour of the long-movement analysis of *tough*-constructions. Hartman (2011, 2012a,b) discovered that experiencer PPs lead to ungrammaticality in *tough*-constructions, but not in expletive constructions. He attributes this ungrammaticality to defective intervention of A-movement, a movement step crucially postulated only in the long-movement analysis. He takes this as evidence that *tough*-constructions are derived via long movement. We make the novel observation that a PP intervention effect analogous to that in *tough*-constructions also arises in constructions that do not involve A-movement, namely pretty-predicate constructions and gapped degree phrases. Consequently, the intervention effect does not provide an argument for an A-movement step in *tough*-constructions or for the long-movement analysis, but rather for the base-generation analysis. We develop a uniform account of the intervention effects as a semantic-type mismatch. In particular, we propose that what unifies *tough*-constructions, pretty-predicate constructions, and gapped degree phrases is that they all have an embedded clause that is a null-operator structure. Introducing an experiencer PP into these constructions creates an irresolvable semantic-type mismatch. As such, we argue for a reassessment of what appears to be a syntactic locality constraint as an incompatibility in the semantic composition.

Keywords: *tough*-constructions, predication, defective intervention, null-operator constructions, gapped degree phrases

1. Introduction

Adjectives like *tough* and *easy* can appear in two syntactic frames that are at least superficially synonymous. In the EXPLETIVE CONSTRUCTION, the adjective takes an infinitival clause as its argument, and the matrix subject position is filled with an expletive (1a). In the *TOUGH*-CONSTRUCTION, the adjective combines with two elements: an infinitival clause containing a gap and a subject DP that is semantically interpreted in the gap position (1b).
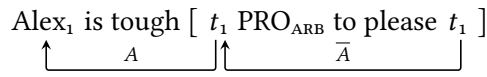
(1) a. *Expletive construction*
    It is tough to please Alex.

   b. *Tough-construction*
    Alex₁ is tough to please ___₁.

The syntactic and semantic relation between the two frames in (1) has been the subject of much debate throughout the history of generative grammar, beginning with Lees (1960) and Chomsky (1964). At this point, there is a common consensus in the literature that $\overline{\text{A}}$-movement takes place within the infinitival clause in *tough*-constructions (1b), but not in expletive constructions (1a). Chomsky (1977, 1982) observes that in *tough*-constructions, (i) the embedded infinitival clause forms a *wh*-island, (ii) no *wh*-islands or NP-islands may intervene between the gap and the left edge of the infinitival clause, and (iii) parasitic

gaps are licensed within the infinitival clause. He concludes that $\overline{\text{A}}$-movement from the gap position to the edge of the infinitival clause must take place in *tough*-constructions, a stance that is shared in the majority of the literature.

More controversial are the questions of (i) what the $\overline{\text{A}}$-moving element is and (ii) how it relates to the surface subject of the *tough*-predicate. Within the theoretically and factually rich literature on *tough*-constructions, two basic families of accounts can be distinguished, which differ in their answers to these two questions. The first family of analyses, which we will refer to as the LONG-MOVEMENT ANALYSIS, proposes that the $\overline{\text{A}}$-moving element is the surface subject itself. Originating in the gap position, this DP first $\overline{\text{A}}$-moves to the edge of the infinitival clause and then A-moves to the matrix subject position. The resulting derivation for (1b) on this account is sketched in (2).
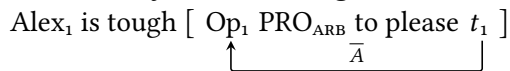
(2) *Derivation of (1b) on a long-movement analysis*
     Alex$_1$ is tough $[\ t_1\ \text{PRO}_{\text{ARB}}\ \text{to please}\ t_1\ ]$
     $\underset{A}{\uparrow\ \ \ \ \ \ \ \ \ }\ \underset{\overline{A}}{\uparrow\ \ \ \ \ \ \ \ \ \ \ \ \ \ }$

Long-movement accounts of *tough*-constructions have been developed by Rosenbaum (1967), Postal (1971), Postal and Ross (1971), Brody (1993), Hornstein (2001), Hicks (2009), Hartman (2011, 2012a,b), Fleisher (2013), and Longenbaugh (2015). On a long-movement account, then, the *tough*-construction is derived from the expletive construction, offering a relatively straightforward account of their apparent synonymy.

The second family of analyses proposes that the matrix subject is base-generated in the matrix clause. Inside the embedded clause, the gap position contains a null operator that is $\overline{\text{A}}$-moved to the edge of the embedded clause. The link between the matrix subject and the null operator, and hence via proxy to the embedded gap, is created semantically. We will refer to this latter family of analyses as the BASE-GENERATION ANALYSIS. The structure of (1b) on this account is schematised in (3).

(3) *Derivation of (1b) on a base-generation analysis*
     Alex$_1$ is tough $[\ \text{Op}_1\ \text{PRO}_{\text{ARB}}\ \text{to please}\ t_1\ ]$
     $\underset{\overline{A}}{\uparrow\ \ \ \ \ \ \ \ \ \ \ \ \ \ }$

Base-generation accounts have been proposed by Ross (1967), Akmajian (1972), Lasnik and Fiengo (1974), Chomsky (1977), Chomsky (1981), Williams (1983), Rezac (2006), and Fleisher (2013, 2015), although notably for Rezac (2006) and Fleisher (2013, 2015), the crucial linking between the *tough*-subject and the gap is accomplished by AGREE relations.

In this paper, we subject to closer scrutiny one particularly influential recent argument in favour of the long-movement analysis of *tough*-constructions. Hartman (2011, 2012a,b) discovered that experiencer PPs lead to ungrammaticality in *tough*-constructions, but not in expletive constructions, as illustrated in (4), where the experiencer PP *to Mary* is licit only in the expletive construction (4a), not in the *tough*-construction (4b).

(4) a. It is important **(to Mary)** to avoid cholesterol.
     b. Cholesterol$_1$ is important **(*to Mary)** to avoid ___$_1$.   (Hartman 2012a: 125)

Hartman also observes that there is no general incompatibility between a *tough*-construction and an experiencer PP. For example, if the PP is located above the matrix subject, the sentence is grammatical (5).

(5) **(To Mary)**, cholesterol$_1$ is important to avoid ___$_1$.

Based on a similar type of intervention effect in A-raising constructions in Romance languages, Hartman argues that the ungrammaticality of an experiencer PP in (4b) is due to DEFECTIVE INTERVENTION, whereby an element with inactive syntactic features blocks A-movement over it (Chomsky 2000). Crucially, defective intervention is observed only with A-movement and not with $\overline{\text{A}}$-movement. He concludes from these considerations that the intervention effect in (4b) reveals the presence of an A-movement step over the experiencer PP *to Mary*. Because only the long-movement analysis (2), but not the base-generation analysis (3), postulates such an A-movement step, Hartman concludes that the intervention effect provides a compelling argument in favour of the former.

  We argue in this paper that this argument is not valid and that the intervention effect discovered by Hartman (2011, 2012a,b) in fact provides evidence in favour of the base-generation analysis (3). The core empirical contribution of this paper is the novel observation that a PP intervention effect analogous to that in *tough*-constructions also arises in constructions that do not involve A-movement, namely *pretty*-predicate constructions (e.g. *Marigolds are pretty to look at*) and gapped degree phrases (e.g. *Kittens are too cute to resist*). The fact that these constructions exhibit intervention, yet lack the crucial A-movement step, makes it clear that PP intervention is neither caused by nor a diagnostic of A-movement. Consequently, the intervention effect in (4b) does not provide an argument for an A-movement step in *tough*-constructions or for the long-movement analysis. This conclusion converges with that reached by Bruening (2014) on independent grounds.

  We develop a uniform account of the intervention effects as a semantic-type mismatch. In particular, we propose that what unifies *tough*-constructions, *pretty*-predicate constructions, and gapped degree phrases is that they all have an embedded clause that is a null-operator structure. Introducing an experiencer PP into these constructions creates an *irresolvable semantic-type mismatch*, rooted in the embedded clause being a null-operator structure. Our proposal has a number of consequences. First, it reverses the force of Hartman's observation: the intervention effect provides an argument for the base-generation analysis, not the long-movement analysis. Second, we propose and develop a semantics for *tough*-predicates, an aspect of *tough*-constructions that has been largely ignored in the literature (though see Partee 1977). Third, we argue that the intervention effect is semantic in nature. It emerges as a direct consequence of the compositional semantics associated with null-operator structures. As such, we argue for a reassessment of what appears to be a syntactic locality constraint as an incompatibility in the semantic composition.

  The paper is outlined as follows: Section 2 reviews Hartman's arguments for intervention of an experiencer PP in *tough*-constructions and introduces three novel arguments of our own. The empirical landscape is enriched in section 3, showing that the intervention effect is not due to movement and thus cannot be cast in terms of defective intervention. In section 4, we propose that the intervention effect is semantic in nature, the result of a

type mismatch induced by the experiencer PP and the embedded clause as a null-operator structure. Section 5 concludes.

2. Experiencer intervention in *tough*-constructions

It is well-known since Chomsky (1973) that while two *for*-phrases can occur in the expletive construction (6a), only one *for*-phrase can occur in the *tough*-construction (6b).[1]

(6) a. It is easy [for the rich] [for the poor] to do the work.
    b. The work₁ is easy [for the rich] (*[for the poor]) to do ___₁.

In (6a), *for the rich* is the experiencer PP of the *tough*-predicate *easy*, and *for the poor* is the embedded subject. Surface inspection alone does not reveal which of the two *for*-phrases survives in (6b). In particular, one challenge is that in the absence of an overt embedded subject, an experiencer PP dictates the construal of the embedded PRO subject; see section 4.1 for more details. In short, the *for*-phrase in *tough*-constructions is by default interpreted as *both* the experiencer and the embedded subject. Therefore, it is necessary to look elsewhere for evidence about the status of the surviving *for*-phrase.

Before Hartman (2011, 2012a,b), it was standardly assumed that the *for*-phrase to survive in *tough*-constructions is the experiencer PP and that it is the embedded subject that must disappear (e.g. Faraci 1974; Lasnik and Fiengo 1974; Rezac 2006). Hartman, however, provides a number of compelling arguments against this view and instead advances the generalisation in (7).

(7) Hartman's Generalisation
    In a *tough*-construction, no experiencer phrase can intervene between the *tough*-predicate and the embedded infinitival clause.

In light of the novelty of Hartman's conclusion, this section reviews six arguments supporting (7). The first three arguments are from Hartman (2011, 2012a,b). The remaining three are novel arguments of our own that provide converging evidence.

2.1. *Unambiguous PPs*

Hartman's (2011, 2012a,b) most direct argument comes from *tough*-predicates whose experiencer PP can be headed by a preposition other than *for*. Such *tough*-predicates allow one to circumvent the homophony between the experiencer and the embedded subject that would otherwise arise, as in (6). We have already seen one example of an experiencer PP headed by *to* in (4), which is repeated below in (8). Another example is provided in (9).[2]

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[1] For ease of exposition, we descriptively refer to the string '*for*+embedded subject' as a '*for*-phrase', although on standard analyses the two elements do not form a constituent. Nothing hinges on this terminological choice.
[2] Gluckman (2016) argues that the intervention effect in *tough*-constructions is a prohibition on having the *tough*-subject in the domain of two different perspective holders, namely the experiencer in the embedded

(8) a. It is important **(to Mary)** to avoid cholesterol.   (=4)

    b. Cholesterol$_1$ is important **(*to Mary)** to avoid ___$_1$.   (Hartman 2012a: 125)

(9) a. It was very hard **(on me)** to give up sugar.

    b. Sugar$_1$ was very hard **(*on me)** to give up ___$_1$.   (Hartman 2012a: 125)

In (9a), the PP *on me* is unambiguously the experiencer of *hard*; it cannot be an embedded subject. The fact that this PP is ungrammatical in the corresponding *tough*-construction (9b) shows that it is experiencer PPs that are disallowed in *tough*-constructions.

2.2. Scope

The second argument put forth by Hartman (2011, 2012a,b) is based on scope. In the expletive construction, a *for*-phrase can take scope either above or below the *tough*-predicate in the matrix clause (10a). This ambiguity corresponds to the two possible construals of the *for*-phrase. If *for every student* is construed as an experiencer, it takes matrix scope, whereas, if it is construed as the embedded subject, it takes embedded scope. Hartman observes that crucially, the corresponding *tough*-construction only allows for an embedded scope reading of the *for*-phrase (10b). This restriction indicates that the *for*-phrase *must* be construed as the embedded subject in *tough*-constructions.

(10) a. It is impossible [for every student] to fail this test.

                                  (*impossible ≫ every student; every student ≫ impossible*)

    b. This test$_1$ is impossible [for every student] to fail ___$_1$.

                                  (*impossible ≫ every student; *every student ≫ impossible*)

The fact that a matrix construal of *for every student* is impossible in (10b) follows if experiencer PPs are disallowed in *tough*-constructions.

2.3. Crosslinguistic evidence

Hartman's (2011, 2012a,b) third argument comes from languages that do not allow an infinitival subject to be overtly expressed. In Italian, for example, a PP headed by *per* 'for' is optional in the expletive construction (11a). Because *per* can never be used to introduce an infinitival subject in Italian, only an experiencer construal of *per gli studenti* is possible in (11a). (11b) shows that the presence of this experiencer PP yields ungrammaticality in *tough*-constructions, a constraint that follows from (7).

(11) a. È impossibile **(per gli studenti)** capire   questi problemi.   [Italian]

        is impossible   for the students understand these problems

        'It is impossible (for the students) to understand these problems.'

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clause and the speaker in the matrix clause. However, (9b) is a challenge to such an account because the experiencer and the speaker are the same, yet there is still intervention.

b. Questi problemi₁ sono impossibile (*per gli studenti) da capire ___₁.

these problems are impossible for the students DA understand ___

'These problems are impossible (*for the students) to understand.'

<div align="right">(Hartman 2012a: 123)</div>

2.4. Partial control

In addition to Hartman's (2011, 2012a,b) three arguments, we will present three more pieces of evidence that support Hartman's Generalisation in (7).

The first of these arguments is based on partial control, where PRO denotes a superset of its controller (Landau 2000 *et seq*). In (12a), the embedded verb *gather* requires a plural subject.[3] Crucially, the singular DP *Mary* is unable to satisfy this requirement; rather, the plural-subject requirement of *gather* can only be satisfied in (12a) if the embedded clause contains a plural PRO. This in turn entails that *for Mary* be construed as the experiencer PP of *tough* and partially control PRO. In other words, the only licit structure for (12a) is one in which the *for*-phrase is the experiencer PP of the *tough*-predicate and it partially controls PRO. Contrast the expletive construction in (12a) with the corresponding *tough*-construction in (12b), which is notably infelicitous.

(12) a. It will be tough for Mary₁ [**PRO**₁₊ to **gather** in this park].
   b. #This park₁ will be tough [for **Mary** to **gather** in ___₁].

What the infelicity of (12b) shows is that a structure in which the *for*-phrase is an experiencer PP and the embedded subject is plural PRO is unavailable in *tough*-constructions. The contrast between (12a) and (12b) follows straightforwardly from (7): As experiencer PPs are impossible in *tough*-constructions, *for Mary* must be construed as the embedded subject in (12b). This precludes PRO inside the embedded infinitival clause, and *Mary*, as a singular DP, violates the plural-subject requirement of *gather*.

2.5. Animacy

As shown in (13), it is possible for the *for*-phrase in *tough*-constructions to be inanimate (*pace* Faraci 1974).

(13) a. It is easy **for the chalk** to stick to the blackboard.
   b. The blackboard₁ is easy **for the chalk** to stick to ___₁.

The grammaticality of (13b) provides an indirect argument for the claim that experiencer PPs are prohibited in *tough*-constructions. In (13), an experiencer construal of the inanimate DP *the chalk* would give rise to infelicity. Therefore, *for the chalk* must be an embedded subject in both (13a) and (13b). The acceptability of (13b) thus shows that it is possible for the

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[3]   Standardly, *meet* is used to diagnose partial control. However, Poole (2015) observes that *meet* with a singular subject is in fact allowed in some environments where other plural predicates are not, e.g. *John can meet at 5pm*. Thus, its status as a diagnostic of partial control is confounded. *Gather*, on the other hand, does not face this problem, e.g. **John can gather at 5pm*.

for-phrase in *tough*-constructions to be the embedded subject. Recall now Chomsky's (1973) observation in (6b) that only a single *for*-phrase is allowed in *tough*-constructions. Taken together, these two observations entail that the *for*-phrase in *tough*-constructions *must* be the embedded subject and that experiencer PPs are disallowed in *tough*-constructions.

The animacy restriction gives rise to a prediction with respect to scope in the expletive construction. If the *for*-phrase is inanimate, as in (13a), only an embedded subject construal is pragmatically feasible, and, as such, the *for*-phrase should be confined to embedded scope. This prediction is indeed borne out, as shown in (14).[4]

(14) It is hard [for every piece of chalk] to stick to the blackboard.

<div align="right">(hard ≫ every; #every ≫ hard)</div>

This corroborates the conclusion that inanimate *for*-phrases are invariably embedded subjects and that this is the only position available to the *for*-phrase in *tough*-constructions.

2.6. *Arbitrary experiencer interpretation*

Finally, the experiencer in a *tough*-construction can be interpreted as arbitrary, even in the presence of a *for*-phrase. This is illustrated in (15). The embedded clause in (15) contains the adverb *courageously* in order to facilitate an embedded subject interpretation of *for Sue*. An experiencer construal of *for Sue* would assert that Sue walks the tightrope courageously and is simultaneously scared by doing so, a reading that attributes contradictory attitudes to Sue. Neither the expletive construction in (15a) nor the *tough*-construction in (15b) enforces such an interpretation.

(15) a. It is scary for Sue to walk the tightrope courageously.
      b. The tightrope$_1$ is scary for Sue to walk ___$_1$ courageously.

Rather, the most natural reading of both sentences in (15) is that Sue's courageous walking of the tightrope is scary for *someone else*, e.g. her concerned parents. To achieve this latter interpretation, *for Sue* must be construed as the embedded subject and the experiencer must be interpreted as arbitrary. The fact that both (15a) and (15b) have this noncontradictory interpretation then demonstrates that an embedded subject interpretation of the *for*-phrase is available in both structures. Analogous to the argument based on animacy, (15b) demonstrates that a *for*-phrase *can* in principle be an embedded subject in *tough*-constructions. In light of Chomsky's (1973) observation that only one *for*-phrase survives in *tough*-constructions (recall (6b)), we conclude that the surviving *for*-phrase *must* be the embedded subject. Consequently, experiencer PPs must be ruled out in *tough*-constructions.

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[4] Thanks to an anonymous reviewer for pointing out this correct prediction of the animacy facts in (13).

2.7. *Section summary*

In this section, we have presented six arguments that experiencer PPs are possible in expletive constructions, but not in *tough*-constructions, as stated in Hartman's Generalisation (7), repeated below in (16) for convenience.

(16) Hartman's Generalisation   (=7)
   In a *tough*-construction, no experiencer phrase can intervene between the *tough*-predicate and the embedded infinitival clause.

The question that arises is why such a restriction should hold in the first place and what it reveals about the syntax of *tough*-constructions. Hartman (2011, 2012a,b) argues that the generalisation provides evidence for the long-movement analysis, proposing that the intervention is syntactic in nature. Based on the observation that experiencer PPs cause intervention in A-raising constructions in a number of languages (e.g. French, Spanish, and Greek; see McGinnis 1998, Torrego 1996, and Anagnostopoulou 2003 respectively), Hartman adopts the view that A-movement over an experiencer PP causes a 'defective intervention' effect, a term due to Chomsky (2000). Hartman proposes that experiencer intervention is explained on the long-movement analysis precisely because this account postulates A-movement into the matrix subject position, as schematised in (17).

(17) *Hartman's (2011, 2012a,b) account of experiencer intervention (16)*
   Cholesterol is important $\boxed{[_{PP} \textbf{ to Mary }]}$ [t_1 PRO$_{ARB}$ to avoid t_1]
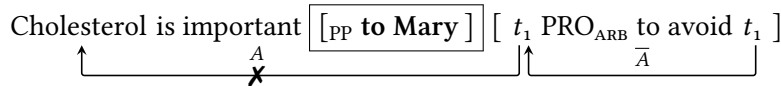
Moreover, because the base-generation analysis, on the other hand, does not postulate any syntactic dependency between the matrix subject and the embedded clause,[5] Hartman reasons that the intervention effect remains unaccounted for on this family of analyses. As such, experiencer intervention would appear to provide a forceful argument for the long-movement analysis of *tough*-constructions.

In the next section, we argue that, upon closer investigation, the experiencer intervention facts do not support the long-movement analysis, but, conversely, constitute

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[5] A noteworthy exception is Rezac's (2006) account, adopted in Fleisher (2013, 2015). In this account, matrix T^o enters into an Agree relation with the embedded clause. Fleisher (2013: 327, 2015: 96, fn. 32) proposes that this Agree relation is responsible for the intervention effect. One problem for this account is that Rezac (2006) argues that copy-raising constructions also involve this Agree relation. Crucially, however, copy-raising constructions do not exhibit intervention effects (i).

(i)   John$_1$ seems [$_{PP}$ **to Mary**] like he$_1$'s the smartest guy in the world.

To the extent that copy-raising constructions allow us to independently diagnose the properties of the alleged Agree step, the PP intervention facts are unaccounted for on this analysis because, as (i) shows, the Agree step could not be subject to intervention. Note that it is of course possible to reconcile the Agree account with the lack of intervention in copy raising by stipulating that *seem* is somehow immune to intervention. One desirable consequence of the account developed here in section 4 is that it does not require any special status for raising verbs like *seem*; the absence of intervention in A-movement structures follows directly because A-movement is never subject to intervention in English. Thanks to a reviewer for discussion of this issue.

compelling evidence in favour of the base-generation analysis. We crucially show that intervention also arises in structures that do not contain an A-movement step. Consequently, experiencer intervention cannot be attributed to A-movement. We then propose that the constraint is in fact semantic in nature wherein an experiencer PP leads to an irresolvable semantic-type mismatch in constructions containing a null-operator structure. On this view, *tough*-constructions are subject to experiencer intervention precisely because they instantiate a null-operator structure.

3. PP intervention is not about movement

This section presents a number of arguments that the empirical landscape is somewhat more intricate than Hartman's Generalisation (7) makes it out to be. Once these further considerations are taken into account, the intervention facts do not support the long-movement analysis of *tough*-constructions. First, as Hartman (2011, 2012a,b) himself notes, the clear instances of A-movement in English, like subject-to-subject raising, do not exhibit PP intervention. Second, Bruening (2014) has observed that intervention is not solely caused by experiencer PPs, but also by adverbs, which crucially do not trigger intervention effects in any known cases of A-movement. Third, PP intervention effects arise in structures that do not involve A-movement, namely *pretty*-predicate constructions and gapped degree phrases. Fourth, argument PPs do not incur an intervention effect, which remains mysterious on a defective intervention account.

3.1. *Nonintervention in A-movement*

A-movement over an experiencer PP without intervention is widely attested in English, as Hartman (2011, 2012a,b) himself notes (see also Bruening 2014). For instance, subject-to-subject raising in English, the prototypical example of A-movement, is possible across an experiencer PP (18).

(18) John$_1$ seems $\begin{bmatrix} {}_{PP} \textbf{ to Mary } \end{bmatrix}$ t_1 to be happy.

The fact that established cases of A-movement are possible across an experiencer PP undermines the basic claim that PP intervention diagnoses or is related to A-movement over this PP.[6]

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[6] Hartman (2012a) does propose an account of why there is no intervention in raising constructions. His account is built on the stipulation that A-movement in raising constructions leaves a trace, while A-movement in *tough*-constructions does not. This critical difference remains itself unaccounted for. The account is thus construction-specific in that it invokes a type of A-movement that only applies in *tough*-constructions. No such stipulation is necessary on a base-generation account: there is no A-movement in *tough*-constructions and A-movement is not subject to intervention (at least in English). A second problem with Hartman's (2012a) account is that it is incompatible with $\overline{\text{A}}$-movement in the lower clause, as such movement would leave a trace and thereby obviate the intervention effect in *tough*-constructions, contrary to fact. Thanks to Jeremy Hartman for discussion of this issue.

3.2. *Intervention of adjuncts*

An important contribution to the intervention generalisation is made by Bruening (2014). Bruening observes that intervention in *tough*-constructions is not limited to experiencer PPs. Regular adjuncts likewise incur an intervention effect (19). Crucially, these adjuncts do not block A-movement in English (20).

(19) a. It is always annoying $[_{PP}$ **at meetings** $]$ to talk about the budget.
      b. *The budget$_1$ is always annoying $[_{PP}$ **at meetings** $]$ to talk about ____$_1$.

(Bruening 2014: 710)

(20) John seemed $[_{PP}$ **at the meeting** $]$ to be agitated.

The same intervention effect of adjuncts is found in Romance languages, as shown in (21) for Italian.

(21) a. È   difficile $[_{PP}$ **al**   **crepuscolo**$]$ vedere questi colori   [Italian]
          is   difficult   at.the twilight   to.see these   colors
          'It is difficult at twilight to see these colors'
      b. *Questi colori$_1$ sono difficili $[_{PP}$ **al**   **crepuscolo**$]$ da   vedere ____$_1$
          these   colors are   difficult   at.the twilight   DA   to.see   ____
          'These colors are difficult at twilight to see'   (Bruening 2014: 711–712)

What Bruening (2014) importantly shows is that Hartman's original generalisation is too narrow in that the class of interveners is broader than previously thought. This extended generalisation is stated in (22).[7]

(22) **BRUENING'S GENERALISATION**
      In a *tough*-construction, no experiencer phrase **or adjunct** can intervene between the *tough*-predicate and the embedded infinitival clause.

Bruening (2014) concludes that (22) discredits a defective intervention account because adjuncts do not intervene for A-movement (like passives), in English or elsewhere. However, Bruening (2014) does not develop an alternative analysis of the intervention effect. The account that we propose in section 4 captures the extended generalisation in (22).

3.3. *PP intervention in nonmovement structures*

Bruening's (2014) extension of Hartman's (2011, 2012a,b) intervention generalisation only concerns the class of interveners in *tough*-constructions. In this section, we demonstrate another extension of Hartman's Generalisation: intervention is not limited to *tough*-constructions. Identical intervention effects arise in constructions that do not plausibly

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[7]   As mentioned in the main text, Hartman (2011, 2012a,b) also discusses intervention in Romance A-raising constructions and Bruening (2014) demonstrates that adjunct intervention holds for these as well. As our concern here is *tough*-constructions, we will put Romance raising aside.

contain A-movement. This makes it clear that A-movement cannot be what underlies the intervention effect.

As is well-known, there are constructions that resemble *tough*-constructions, but crucially lack an expletive counterpart (Lasnik and Fiengo 1974). A traditional example are constructions with adjectives like *pretty* and *tasty* (23). We refer to this class of adjectives as PRETTY-PREDICATES.

(23) a. Marigolds₁ are **pretty** to look at ___₁.
    b. *It is **pretty** to look at marigolds.
    c. Oatmeal₁ is **tasty** to eat ___₁.
    d. *It is **tasty** to eat oatmeal.

The ungrammaticality of the expletive baselines in (23b) and (23d) makes it clear that (23a) and (23c) cannot be derived from them via movement. Put differently, the derivation of (23a), for instance, cannot involve A-movement of *marigolds* from within the infinitival clause into the matrix subject position.[8] Nevertheless, *pretty*-predicate constructions display the same PP intervention effect as *tough*-constructions, as shown in (24). Although *pretty*-predicates can in principle occur with an experiencer PP (24a), this experiencer cannot occur between the predicate itself and the embedded infinitival clause (24b). Moreover, just like in the case of *tough*-constructions, the two can cooccur if the PP occupies a position above the matrix subject (24c).

(24) a. Mary is pretty [₍PP₎ **to John**].
    b. *Mary₁ is pretty [₍PP₎ **to John**] to look at ___₁.
    c. [₍PP₎ **To John**], Mary₁ is pretty to look at ___₁.

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8 A reviewer asks whether a long-movement account could be reconciled with (23) by assuming that *pretty*-predicates select for a complement clause out of which A-movement is required. There are at least two factors that make such an account unappealing. First, the primary motivation for a long-movement account of *tough*-constructions is the (near) synonymy with their expletive counterparts. If the long movement is semantically vacuous, we would have a relatively straightforward account of their apparent synonymy. In the case of *pretty*-predicates, if (23a,c) were derived by long A-movement, they would have the nonsensical meanings of (23b,d), contrary to fact (see Lasnik and Fiengo 1974). Second, *pretty*-predicate constructions pass the same Ā-diagnostics that *tough*-constructions do: the embedded clause forms a *wh*-island (i.a), the relation between the matrix subject and the embedded gap is subject to Definiteness Islands (i.b), and the same relation licenses parasitic gaps (i.c):

(i) a. *[What (spice)]₂ is oatmeal₁ tasty [to eat ___₁ with ___₂]?
    b. *Oatmeal₁ is tasty [to eat [the bowl of ___₁]].
    c. Oatmeal₁ is not tasty [to eat ___₁ [without cooking *pg*]].

In other words, *pretty*-predicate constructions have the syntax of *tough*-constructions in that there is Ā-movement in the embedded clause. Thus, a long-movement analysis of *pretty*-predicate constructions would be forced to require *pretty*-predicates to select for a complement clause in which Ā-movement has taken place *and* out of which A-movement is required. This would be unlike any other known predicate in natural language, and it is unclear how one would state such a requirement technically as it is not the case that the predicate itself would mediate these movement dependencies. In sum, we conclude that a long-movement account does not extend to *pretty*-predicates for both theoretical and empirical reasons.

The PP intervention effect in (24) is thus descriptively identical to that in *tough*-constructions. However, because *pretty*-predicate constructions do not involve long A-movement, i.e. A-movement from the embedded clause into the matrix clause, (24b) does not involve A-movement of *Mary* over the experiencer PP. On a defective intervention account, it is therefore mysterious why the PP should give rise to intervention. Rather, the fact that the intervention effect occurs in a nonmovement structure like (24b) strongly suggests that it is not caused by A-movement.

A second construction that exhibits PP intervention in spite of not containing a long A-movement step are GAPPED DEGREE PHRASES (GDPs) (Brillman 2014).[9] Like *pretty*-predicate constructions, GDPs can occur in a *tough*-construction (25a), but lack an expletive counterpart (25b). Therefore, (25a) cannot be derived from (25b) by long A-movement of *this table*.

(25) a. This table$_1$ is **too heavy** to lift ___$_1$.
      b. *It is **too heavy** to lift this table.

In principle, it is possible for an experiencer PP to modify the adjective in a GDP because it can do so in the absence of an infinitival clause (26).

(26) This table is too heavy **for John**.

Moreover, a *for*-phrase is in fact possible in conjunction with an infinitival clause (27). However, just as in the case of *tough*-constructions, the status of this *for*-phrase is unclear based on surface inspection alone. It could be either an experiencer PP on a par with (26), or it could be the embedded subject.

(27) This table$_1$ is too heavy **for John** to lift ___$_1$.

Following Hartman's (2011, 2012a,b) reasoning discussed in section 2.2, scope can be used to identify the status of the *for*-phrase in (27). Consider the paradigm in (28). The sentence in (28a) is ambiguous. On one reading, where *only one* scopes above *too heavy*, all but one of the workers has the ability to lift the table by herself. On the other reading, where *only one* scopes below *too heavy*, the table is of too great a weight such that it cannot be lifted by any one worker individually, i.e. only a group of at least two workers is able to lift it. This ambiguity is the result of the variable attachment of *for only one worker*. If it attaches inside the lower clause, it takes narrow scope relative to *too heavy*, whereas, if it attaches inside the matrix clause, it scopes above *too heavy*. Support for this view comes from (28b), in which the PP unambiguously attaches in the matrix clause. Consequently, only a wide scope interpretation in the matrix clause is available for *only*. Against this backdrop, the crucial example is (28c). In (28c), the *for*-phrase occurs between the predicate and the infinitival clause. In this case, only the narrow scope interpretation of *for only one worker* is possible.

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[9] Brillman (2014) is the first to observe PP intervention effects in GDPs. However, she treats PP intervention as a diagnostic for A-movement and proposes that GDPs involve an A-movement step of a null operator to the edge of the degree phrase. Therefore, her analysis does not involve long A-movement.

(28) a. The table$_1$ is too heavy to lift ___$_1$ [$_{PP}$ **for only one worker**].

                                                            (*only one* ≫ *too heavy; too heavy* ≫ *only one*))

    b. [$_{PP}$ **For only one worker**] the table$_1$ is too heavy to lift ___$_1$.

                                                            (*only one* ≫ *too heavy;* *too heavy ≫ *only one*)

    c. The table$_1$ is too heavy [$_{PP}$ **for only one worker**] to lift ___$_1$.

                                                     (*only one ≫ *too heavy; too heavy* ≫ *only one*)

The unavailability of matrix scope of *only* in (28c) indicates that the *for*-phrase must attach inside the embedded infinitival clause. In other words, it has to be the embedded subject and cannot be construed as an experiencer PP of the matrix predicate.

    This state of affairs is entirely analogous to the *tough*-construction facts in section 2.2: An otherwise ambiguous *for*-phrase cannot be construed as the experiencer of the matrix predicate if it intervenes between the predicate and the infinitival clause. There is hence every reason to believe that *tough*-constructions and GDPs instantiate the same constraint. Crucially, GDPs cannot be derived via long A-movement. As a consequence, a defective intervention account of PP intervention along the lines of (17) does not generalise to GDPs.

    Converging evidence for the conclusion that experiencer PPs are impossible in GDPs comes from Romance. Recall from section 2.3 that languages like Italian do not allow the subject of an infinitival clause to be introduced by (the equivalent of) a *for*-phrase. Any PP following the matrix predicate must be an experiencer. We reviewed in section 2.2 Hartman's observation that such PPs are impossible in *tough*-constructions. (29) shows that the same restriction holds for GDPs. Adjectives modified by the degree operator *troppo* 'too' can occur with an experiencer PP in the absence of the infinitival clause (29a). However, this becomes impossible in a GDP (29b).

(29) a. Questo tavolo e' troppo pesante **(per me)**.   [Italian]
        this   table   is too   heavy   for me
        'This table is too heavy (for me).'

    b. Questo tavolo$_1$ e' troppo pesante **(*per me)** da sollevare ___$_1$.
        this   table   is too   heavy   for me to lift   ___
        Intended: 'This table is too heavy for me to lift.'   (Ilaria Frana, p.c.)

In sum, *pretty*-predicate constructions and GDPs exhibit the same restriction that Hartman (2011, 2012a,b) observes for *tough*-constructions: An experiencer PP cannot intervene between the predicate and the embedded infinitival clause. However, unlike *tough*-constructions, neither *pretty*-predicate constructions nor GDPs plausibly involve long A-movement because they lack the expletive, nonmovement counterpart. Therefore, the PP intervention effect cannot be attributed to an interaction of this PP with A-movement, contra Hartman (2011, 2012a,b).

    The claim that the intervention in *pretty*-predicate constructions and GDPs is the same as that in *tough*-constructions makes an interesting prediction: Given that intervention in *tough*-constructions is not only caused by experiencer PPs, but also by adjuncts (see section 3.2), we predict that adjuncts should likewise give rise to intervention with

pretty-predicates and GDPs. This prediction is indeed borne out, as shown in (30) and (31) respectively.

(30) a. Mary will be pretty [PP **at her wedding**].
    b. *Mary₁ will be pretty [PP **at her wedding**] to look at ___₁.

(31) a. [PP **With all these books**] the table₁ will be too heavy to lift ___₁.
    b. *The table₁ will be too heavy [PP **with all these books**] to lift ___₁.

    The observations in this section and section 3.1 give rise to a DOUBLE DISSOCIATION between PP intervention and A-movement: Subject-to-subject raising makes it clear that A-movement across an experiencer PP does not result in intervention (in English), and *pretty*-predicate constructions and GDPs demonstrate that PP intervention exists in the absence of A-movement. The combination of these two observations shows that there is no connection between PP intervention and A-movement. At the very least, then, PP intervention in *tough*-constructions does not diagnose the presence of A-movement. Consequently, PP intervention does *not* provide an argument for the long-movement analysis of *tough*-constructions.

3.4. *Nonintervening PPs*

A final complication for the defective intervention account is that not all PPs cause an intervention effect. While experiencer PPs and adjuncts do, what we will call ARGUMENT PPs do not. This is shown in (32) for *tough*-constructions and in (33) for GDPs.[10]

(32) a. It is damaging [PP **to cars**] to drive over these traffic cones.
    b. These traffic cones₁ are damaging [PP **to cars**] to drive over ___₁.
                                                   (Nicholas Longenbaugh, p.c.)

(33) a. John₁ is too fond [PP **of Mary**] to like ___₁.
    b. John₁ is too angry [PP **at Mary**] to invite ___₁.

No such asymmetry between argument and experiencer PPs is expected on a defective intervention account. If anything, argument PPs would be predicted to be more prone to causing intervention than experiencer PPs, precisely the reverse of what is found.

3.5. *Section summary: A new generalisation*

We argued in section 2 that the core empirical insight of Hartman (2011, 2012a,b) is correct: experiencer PPs give rise to intervention in *tough*-constructions. Bruening (2014) demonstrated that Hartman's original generalisation was too narrow in that adjuncts likewise cause intervention in *tough*-constructions. We have in turn shown that Bruening's (2014) extended generalisation in (22) is itself part of an even broader generalisation that incorporates *pretty*-predicate constructions and GDPs. The empirical generalisation that

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[10] Thanks to Nicholas Longenbaugh for bringing examples like (32) to our attention.

we propose is stated in (34). It properly includes Hartman's original generalisation (7) and Bruening's extended generalisation (22).

(34) Intervention Generalisation (final version)
In *tough*-constructions, *pretty*-predicate constructions, and GDPs, no experiencer PP or adjunct may occur between the adjective and the embedded infinitival clause.

The empirical distribution of the intervention effect is thus both broader and more nuanced than depicted in Hartman (2011, 2012a,b). In particular, we have shown that (i) PPs do not cause intervention in structures that unambiguously involve A-movement, e.g. subject-to-subject raising; (ii) PP intervention also arises in structures that could not plausibly involve long A-movement, i.e. *pretty*-predicate constructions and GDPs; (iii) adjunct PPs that do not intervene for A-movement cause intervention in *tough*-constructions, *pretty*-predicate constructions, and GDPs; and (iv) PPs do not intervene if they are an argument PP of the adjective. (34) encapsulates these findings.

Taken together, the facts discussed in this section make it clear that A-movement does not underlie the intervention effect as A-movement is neither necessary nor sufficient for intervention to arise. Consequently, PP intervention in *tough*-constructions does not provide an argument for the existence of A-movement in these constructions and hence does not constitute evidence for the long-movement analysis. In the next section, we present our account of the intervention effect as a semantic-type mismatch.

4. Analysis

If the intervention effect is not due to movement, what causes it then? This section argues that what underlies the intervention effect in *tough*-constructions, *pretty*-predicate constructions, and GDPs is that the embedded clause in all of them is a null-operator structure. In a null-operator structure, the operator $\overline{A}$-moves from the gap position to the edge of the embedded clause, which is then interpreted as a λ-abstraction over the trace (35) (Nissenbaum 2000).

(35) *Null-operator structure*
$[\text{Op}_1 [\ldots t_1 \ldots]] \rightsquigarrow \text{LF: } \lambda x [\ldots x \ldots]$

We show that experiencer PPs and adjuncts give rise to an *irresolvable semantic-type mismatch* when introduced in a construction in which the embedded clause is a null-operator structure. This incompatibility is the result of experiencer PPs and adjuncts only combining with propositions, while null-operator structures crucially denote properties.

The argumentation begins by sketching a semantics for *tough*-predicates that includes the essential ingredients to their interpretation. Next, this independently needed semantics for *tough*-predicates is shown to disallow experiencer PPs and adjuncts occurring between the adjective and the embedded clause in *tough*-constructions, thus deriving the intervention effect. Finally, we show that this analysis of the intervention effect as a semantic-type mismatch extends to *pretty*-predicate constructions and GDPs without further ado.

For the sake of concreteness, the main text will present one uniform rendition of our general proposal that the intervention effect is due to a semantic-type mismatch. There are a handful of alternative ways of implementing our general proposal, using the same semantic ingredients. We present what we believe to be the simplest rendition, though we will note conceivable alternatives as we proceed (see fn. 15 and 17 in particular).

4.1. *Semantics of tough-predicates*

Tough-predicates describe dispositions anchored to an individual. Thus, their semantics comprise two essential ingredients.[11] The first ingredient is that their truth is evaluated with respect to an individual, analogous to predicates of personal taste, e.g. *tasty* and *fun*. In the sense of Lasersohn (2005), they are JUDGE-DEPENDENT. As will be discussed in section 4.2, this property is important because experiencer PPs serve to overtly specify the judge. The second ingredient is that, as dispositions, they are modals and quantify over possible worlds (Kratzer 1981). There are several ways to implement these two components. We elect for a relatively straightforward semantics for *tough*-predicates that combines the semantics of predicates of personal taste, capturing the judge dependency, and the semantics of attitude predicates, capturing the modality.

We propose that the fundamental difference between the *tough*-construction and the expletive construction is that the embedded clause in the former is a null-operator structure (following Chomsky 1977). As a result, the two constructions also differ in how the embedded clause combines with the *tough*-predicate. We propose that *tough*-predicates come in two variants that differ in the semantic type of the clausal complement with which they combine.[12] The first variant combines with a PROPOSITION; this corresponds to the expletive construction (36).[13] The second variant combines with a PROPERTY OF INDIVIDUALS; this corresponds to the *tough*-construction (37). Following Lasersohn (2005) and Stephenson (2007, 2010), the judge is represented as the argument j of the denotation function.

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[11] The semantics of *tough*-predicates naturally also involves degrees. However, for the sake of simplicity, we do not incorporate degrees because it does not play a role in the intervention effect.

[12] Kratzer (2006) argues that the modality of attitude ascriptions does not originate in the attitude predicate itself, but in the left periphery of the embedded clause (see also Moulton 2009, 2015; Bogal-Allbritten 2016). Applied to *tough*-predicates, this approach would shift the difference that we attribute to the *tough*-predicate instead to the embedded clause, which already differs between the two constructions. We leave pursuing this approach for future research. However, it is worth noting that such an analysis still has to encode somewhere the syntactic frames available to each adjective. For example, *pretty*-predicates only have the *tough*-construction, and adjectives like *possible* only have the expletive construction (while *impossible* has both) (i). In our analysis, this variation derives from which of the denotations in (36) and (37) the adjective has.

   (i) a.   It is **(im)possible** to lift this table.
        b.   This table₁ is *__**(im)possible** to lift ___₁.

[13] We assume the following conventions: x and y are of type e (individual); w is of type s (possible world); and st is an abbreviation for $\langle s, t \rangle$.

(36) *Expletive-construction variant* $\langle st, st\rangle$
$[\![\text{tough}_{\text{EXPL}}]\!]^{j} = \lambda p_{st}\, \lambda w\, .\, \forall \langle w', j'\rangle \in \text{ACC}_{w,j}\big[\text{TOUGH}_{w',j'}([\![p]\!]^{j'})\big]$

(37) *Tough-construction variant* $\langle\langle e, st\rangle, \langle e, st\rangle\rangle$
$[\![\text{tough}_{\text{TC}}]\!]^{j} = \lambda Q_{\langle e,st\rangle}\, \lambda x\, \lambda w\, .\, \forall \langle w', j'\rangle \in \text{ACC}_{w,j}\big[\text{TOUGH}_{w',j'}([\![Q]\!]^{j'}(x))\big]$

(38) $\text{ACC}_{w,x} = \{\langle w', y\rangle : \text{it is compatible with what } x \text{ believes in } w \text{ for } x \text{ to be } y \text{ in } w'\}$

(39) $\text{TOUGH}_{w,j}(p) \Leftrightarrow p \text{ is tough to } j \text{ in } w$

Both *tough*$_{\text{EXPL}}$ and *tough*$_{\text{TC}}$ assert that some proposition is tough according to the judge j in all of the centred worlds where j is the centre. Where they differ is in how this "*tough*-proposition" is formed compositionally. For *tough*$_{\text{EXPL}}$, the *tough*-proposition is its single propositional argument p. On the other hand, *tough*$_{\text{TC}}$ combines first with an argument denoting a property of individuals Q and then with an individual argument x. The *tough*-proposition is then formed by saturating the predicate Q with x.

   Another important fact about the semantics of *tough*-predicates that our analysis captures is the interpretation of PRO in the embedded clause. Bhatt and Izvorski (1997) observe that PRO is obligatorily coreferential with the judge of the *tough*-predicate, regardless of whether it is overt or implicit (see also Epstein 1984; Lebeaux 1984; Bhatt and Pancheva 2006). As will be discussed in section 4.2, the judge is overtly specified by the experiencer PP. For example, in (40), the judge *Mary* is specified overtly by the experiencer PP, and PRO, being coreferential with the judge, must refer to *Mary*. Crucially, (40) cannot have an interpretation like (41) in which PRO refers to *Bill*.

(40) It was tough [on Mary$_1$] [**PRO**$_{1/*2}$ to avoid cholesterol]
      ⤳ It was tough on **Mary** for **Mary** to avoid cholesterol

(41) It was tough [on Mary] [for Bill to avoid cholesterol]

When the judge of the *tough*-predicate is implicit, PRO nevertheless refers to the implicit judge. However, the implicit judge is itself interpreted generically (42) or as referring to a contextually salient individual (43); see Bhatt and Izvorski (1997) for discussion.

(42) It is fun [**PRO**$_{\text{ARB}}$ to play hockey] ⤳ GEN x [it is fun for x for x to play hockey]

(43) John: This morning, it was fun to play hockey on the newly frozen lake.
      ⤳ It was fun for **John** for **John** to play hockey

To capture this generalisation, we follow the independently motivated proposal of Stephenson (2007, 2010) that PRO refers directly to the judge j (44).

(44) $[\![\text{PRO}]\!]^{j} = j$

   We are now in a position to see how these proposals apply to derive the expletive construction and the *tough*-construction. Let us take each in turn. In the expletive construction, the *tough*-predicate directly takes a propositional argument p, as shown in (45).

(45) *Derivation of the expletive construction*
It is important [PRO to avoid cholesterol]

$$AP : st$$

important$_{\text{EXPL}}$ CP : st
$\langle \underline{st}, st \rangle$

PRO to avoid cholesterol
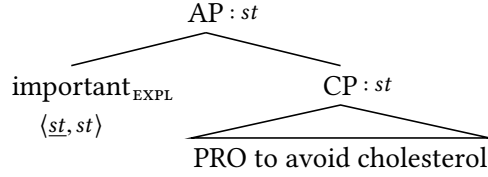
a. $[\![\text{CP}]\!]^{j} = \lambda w \,.\, \textsc{avoid}(\text{cholesterol})(j)(w)$

b. $[\![\text{important}_{\text{EXPL}}]\!]^{j} = \lambda p_{st} \, \lambda w \,.\, \forall \langle w', j' \rangle \in \textsc{acc}_{w,j}\big[\textsc{important}_{w',j'}([\![p]\!]^{j'})\big]$

c. $[\![\text{AP}]\!]^{j} = \lambda w \,.\, \forall \langle w', j' \rangle \in \textsc{acc}_{w,j}\big[\textsc{important}_{w',j'}(\lambda w.\textsc{avoid}(\text{cholesterol})(j')(w))\big]$

The derivation in (45) proceeds as follows: First, the *tough*-predicate *important* combines with the embedded CP, which denotes a proposition (45c). Second, the judge argument j is either bound by a generic operator or valued with a contextually salient individual.[14] The result is truth conditions stating that in all of the centred worlds where j is the centre, avoiding cholesterol is important to j.

In the *tough*-construction, the *tough*-predicate first combines with an argument denoting a property of individuals Q and then with an individual argument x. The embedded clause is a null-operator structure wherein the null operator $\overline{\text{A}}$-moves from the gap position to the clause edge. The null operator is then interpreted as a λ-abstraction over its trace, as illustrated in (46) (Nissenbaum 2000).

(46) *Null-operator structure*
[Op$_1$ [... t_1 ...]] $\rightsquigarrow$ LF: $\lambda x[\ldots x \ldots]$
　　$\overline{A}$
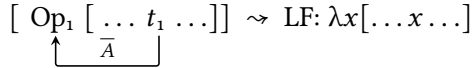
Consequently, the null-operator structure denotes a property of individuals, which is the appropriate semantic type to compose with the *tough*-construction variant of a *tough*-predicate, as shown in (47).

(47) *Derivation of the tough-construction*
Cholesterol is important [Op$_1$ PRO to avoid ___$_1$]

$$AP_2 : st$$

cholesterol AP$_1$: $\langle e, st \rangle$
e

important$_{\text{TC}}$ CP : $\langle e, st \rangle$
$\langle \langle e, st \rangle, \langle e, st \rangle \rangle$

Op$_1$ PRO to avoid ___$_1$
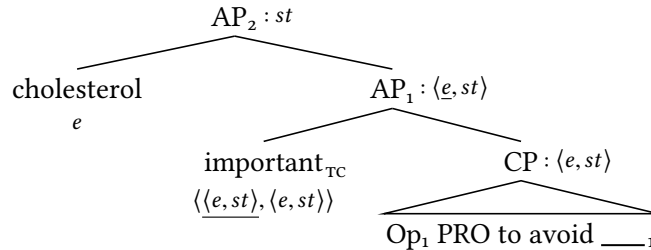
a. $[\![\text{CP}]\!]^{j} = \lambda x \, \lambda w \,.\, \textsc{avoid}(x)(j)(w)$

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[14] Our analysis differs from Stephenson (2007, 2010) in that the judge of a judge-dependent predicate is not one of its arguments. Thus, our implementation of judge-dependency is closer in spirit to Lasersohn (2005). We assume that the judge parameter can be valued contextually or bound by a generic operator.

b. $[\![\text{important}_{\text{TC}}]\!]^j = \lambda Q_{\langle e,st \rangle} \lambda x \lambda w \, . \, \forall \langle w',j' \rangle \in \text{ACC}_{w,j}\big[\text{IMPORTANT}_{w',j'}([\![Q]\!]^{j'}(x))\big]$

c. $[\![\text{AP}_1]\!]^j = \lambda x \lambda w \, . \, \forall \langle w',j' \rangle \in \text{ACC}_{w,j}\big[\text{IMPORTANT}_{w',j'}(\lambda w.\text{AVOID}(x)(j')(w))\big]$

d. $[\![\text{AP}_2]\!]^j = \lambda w \, . \, \forall \langle w',j' \rangle \in \text{ACC}_{w,j}\big[\text{IMPORTANT}_{w',j'}(\lambda w.\text{AVOID}(\text{cholesterol})(j')(w))\big]$

The derivation in (47) proceeds as follows: First, the *tough*-predicate combines with the CP, which denotes a property of individuals as a result of being a null-operator structure (47c). Second, it combines with the *tough*-subject *cholesterol* and uses it to saturate the property denoted by the CP (47d). Third, the judge argument j is either bound by a generic operator or valued with a contextually salient individual. The result is truth conditions stating that in all of the centred worlds where j is the centre, avoiding cholesterol is important to j.

4.2. *Intervention is a semantic-type mismatch*

The intervention effects detailed in sections 2 and 3 follow from our proposed semantics of *tough*-predicates as a semantic-type mismatch. First, however, it is necessary to explicate the contribution of the experiencer PP. The experiencer PP serves to overtly specify the judge. There are two options as to how this PP is introduced into the structure. The PP could either be an adjunct or it could be introduced by a designated functional head. While either option is compatible with our proposal, we will assume here that the PP is introduced by an Exp(eriencer) projection, following the widespread consensus that (external) arguments of predicates are introduced by functional heads (Kratzer 1996; Pylkkänen 2002; amongst others).[15] The head Exp° combines first with a propositional argument p and then with the experiencer PP j'' (48). Its role is to shift the judge argument of the denotation function for p to the individual(s) denoted by the experiencer PP.

(48) *Introducing an experiencer PP*
$$[\![\text{Exp}°]\!]^j = \lambda p_{st} \lambda j'' \lambda w \, . \, [\![p]\!]^{j''}(w) \qquad\qquad \langle st, \langle e, st \rangle \rangle$$

Evidence that the experiencer PP specifies the judge of the *tough*-predicate comes from the incompatibility of such PPs with other judge-introducing expressions.[16] One such expression is *find* (Sæbø 2009; Kennedy 2013). If the experiencer PP specifies the judge, combining it with *find* is predicted to lead to an infelicitous "double specification" of the judge. This prediction is indeed borne out, as shown in (49).

(49) a. #John finds it easy for the rich for the poor to do the work.

b. #John finds it important to Mary to avoid cholesterol.

The crucial property of Exp° that will derive the intervention effect is that Exp° only combines with propositions and not with properties.

We make a handful of assumptions about the structure of the extended adjectival projection, for the sake of concreteness. As we will show below, the semantics of Exp° affords it the ability to attach at various points in the clausal spine, as long as its complement

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[15] Under a PP-adjunction analysis, P° would have the following denotation: $\lambda j'' \lambda p_{st} \lambda w \, . \, [\![p]\!]^{j''}(w)$.

[16] We are indebted to an anonymous reviewer for bringing the data in (49) to our attention.

denotes a proposition. For now, we will focus on ExpP occurring between AP and aP, as schematised in (50). In this case, Exp° parallels Appl° in the extended verbal projection.

(50) *Extended adjectival projection*
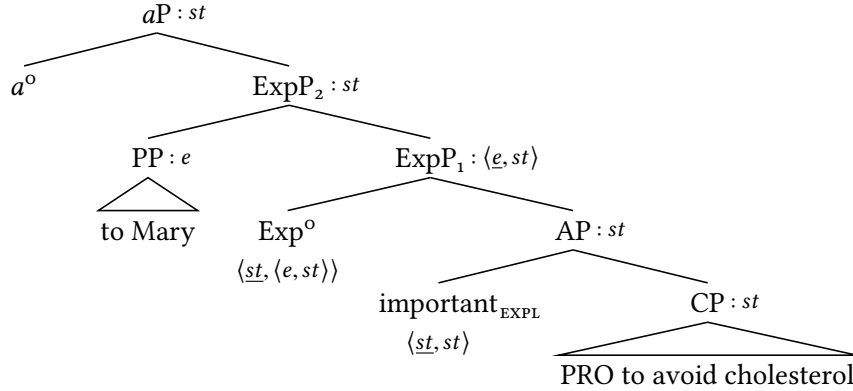$$[_{aP} \ldots a° [_{ExpP} \ldots Exp° [_{AP} \ldots A° \ldots]]]$$
head movement
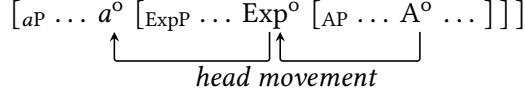
The linear order of the experiencer PP with respect to the adjective is achieved by head movement of A° (through Exp°) to a°, much like in the verbal domain in English. Following standard assumptions, this head movement reconstructs semantically. Consequently, the experiencer PP always takes scope over the *tough*-predicate. This derives Hartman's (2011, 2012a,b) observation that when a *for*-phrase has a matrix construal, i.e. as an experiencer, it necessarily takes scope over the *tough*-predicate (see (10)). For readability, we will not depict the movement of A° to a° in the examples to follow, because it does not affect the semantics. Finally, the *tough*-subject is merged in [Spec, aP], parallel to how the external argument of a verb merges in [Spec, vP].

Let us now consider how the addition of an experiencer PP interacts with our proposed semantics of *tough*-predicates. As we will show, the intervention effect is correctly predicted to occur in the *tough*-construction, but not in the expletive construction. In the expletive construction, the AP denotes a proposition. Therefore, it can successfully combine with Exp° and an experiencer PP, as shown in (51).[17]

(51) *No semantic-type mismatch in the expletive construction*
It is important [to Mary] [PRO to avoid cholesterol]

$aP : st$
$a°$ $ExpP_2 : st$
$PP : e$ $ExpP_1 : \langle e, st \rangle$
to Mary $Exp°$ $AP : st$
$\langle \underline{st}, \langle e, st \rangle \rangle$
$important_{EXPL}$ $CP : st$
$\langle \underline{st}, st \rangle$
PRO to avoid cholesterol

a. $[\![AP]\!]^j = \lambda w \, . \, \forall \langle w', j' \rangle \in ACC_{w,j} [IMPORTANT_{w',j'} (\lambda w. AVOID(cholesterol)(j')(w))]$

b. $[\![ExpP_1]\!]^j = \lambda j'' \lambda w \, . \, \forall \langle w', j' \rangle \in ACC_{w,j''} [IMPORTANT_{w',j'} (\lambda w. AVOID(cholesterol)(j')(w))]$

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[17] To maximize the similarity with other argument-introducing heads, Exp° could be type $\langle e, st \rangle$ and compose with the AP via Event Identification (following Kratzer 1996). Our proposal would remain unaffected, though it is unclear how Exp° could shift the judge of its complement via conjunction. It is also worth pointing out that although this proposal would allow Exp° to compose with the AP in a *tough*-construction via Generalised Conjunction, as both would be properties, there would still be a semantic-type mismatch, except now it would be when the derivation reaches the *tough*-subject, which would not be able to compose with a proposition.

c. $[\![\text{ExpP}_2]\!]^j = \lambda w \,.\, \forall \langle w', j' \rangle \in \text{ACC}_{w,\text{Mary}} \big[\text{IMPORTANT}_{w',j'}(\lambda w.\text{AVOID}(\text{cholesterol})(j')(w)) \big]$
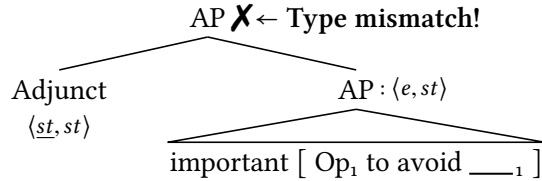
The derivation in (51) proceeds as follows: First, the *tough*-predicate *important* combines with the CP to form an AP that denotes a proposition (51a). Second, Exp° takes the AP as its propositional argument. This returns a property of individuals wherein the judge of the proposition denoted by the AP is abstracted over by the unsaturated individual argument j'' of Exp° (51b). Third, this individual argument is saturated with the experiencer PP *to Mary* (51c). Most importantly, the AP denotes a proposition and therefore is of the correct semantic type to compose with Exp°. As a result, the expletive construction is able to have an experiencer PP occurring between the adjective and the embedded clause, i.e. there is no intervention in the expletive construction.

However, in the *tough*-construction, Exp° is unable to combine with the AP because the AP denotes a property of individuals. This creates an *irresolvable semantic-type mismatch*, as shown in (52).

(52) *Semantic-type mismatch in the tough-construction*
  *Cholesterol is important [to Mary] [Op$_1$ PRO to avoid t_1]
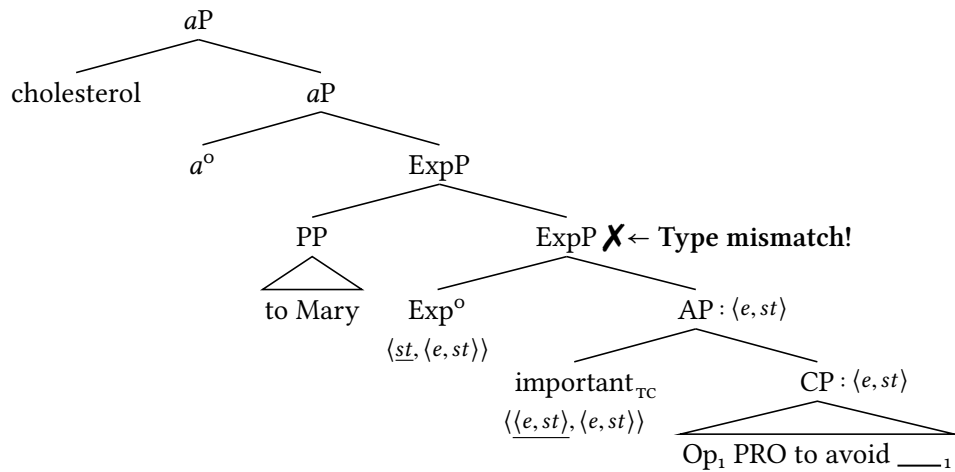
The derivation in (52) proceeds as follows: First, the *tough*-predicate *important* combines with the CP to form an AP that denotes a property of individuals. Second, Exp° tries to combine with the AP. Exp° wants a propositional argument, but the AP denotes a property. With no way to semantically compose these two elements, the derivation crashes.[18] As a result, the *tough*-construction is unable to have an experiencer PP occurring between the adjective and the embedded clause, i.e. there is intervention in the *tough*-construction.

A semantic-type mismatch occurs with adjuncts as well. Ignoring tense, intervening adjuncts are of type $\langle st, st \rangle$, crucially combining with a propositional argument, as Exp°

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[18] A question that arises is whether nonstandard modes of composition could in principle allow Exp° and AP to compose semantically in (52). The obvious candidate is Function Composition or its decomposed variant of the Geach Rule followed by Function Application (Geach 1972; Jacobson 1999). The role of Function Composition in natural-language semantics is well beyond the scope of this paper. We make the common assumption that Function Composition is not (freely) available in the syntax, decomposed or not.

does. The AP in a *tough*-construction, which denotes a property of individuals, therefore cannot compose with these adjuncts, as shown in (53).[19]

(53)   *Adjuncts result in a semantic-type mismatch*

AP ✗ ← **Type mismatch!**

Adjunct
$\langle \underline{st}, st \rangle$ AP : $\langle e, st \rangle$

important [Op_1 to avoid ___$_1$]

   Although experiencer PPs and adjuncts cannot occur between the adjective and the embedded clause, they can occur elsewhere in the sentence (54)–(55).

(54)   **(To Mary)** cholesterol is important **(*to Mary)** to avoid **(to Mary)**

(55)   **(At XMas)** cholesterol is important **(*at XMas)** to avoid **(at XMas)**

According to our account, (54) is not the result of moving the experiencer PP because the crucial type mismatch underlying intervention occurs between Exp^o and AP. We propose that (54) involves the attachment of Exp^o to a node higher than aP that denotes a proposition. This variable placement of Exp^o follows from the fact that its semantic contribution is to shift the judge argument of the denotation function, which the *tough*-predicate will pick up as long as it is in the scope of Exp^o. As a result, Exp^o can still modify the judge of a *tough*-predicate if it attaches to a high projection in the clausal spine. In this regard, Exp^o is crucially different from other argument-introducing heads like v^o or $Appl^o$, which modify events and are hence restricted to the domain of the clause lower than the existential closure of the event argument. In the same vein, adjuncts can merge at different points in the clausal spine, as long as the node denotes a proposition, thus predicting (55).[20, 21]

   This analysis of the intervention effect extends to *pretty*-predicate constructions and GDPs. The latter are addressed in the next section. *Pretty*-predicates differ from *tough*-predicates in that they only have a single denotation that corresponds to the *tough*-

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[19]   This account predicts that if an adjunct can be independently shown to to compose with $\langle e, st \rangle$ complements, then it should be able to occur between the *tough*-predicate and the infinitival clause. However, we are not aware of any such adjuncts.

[20]   One general empirical question is whether it is possible for the experiencer PP or adjunct to occur between the *tough*-predicate and its subject. Bruening (2014) judges such examples grammatical:

(i)   a.   The president is [**to many people**] annoying to listen to.
      b.   The budget is [**at meetings**] extremely annoying to talk about.   (Bruening 2014: 708,710)

   Our account predicts that the placement in (i) is possible, given that the experiencer PP or adjunct can be introduced between aP and TP. In this case, it will combine with the propositional aP node, but linearly follow the subject after the subject has undergone regular movement to [Spec, TP]. If the sentences in (i) are indeed grammatical, they provide additional support for our account. We should note, however, that the judgments in (i) are contested; a reviewer finds them degraded and we concur. Given that the empirical facts are murky here, we hesitate to draw firm conclusions from (i).
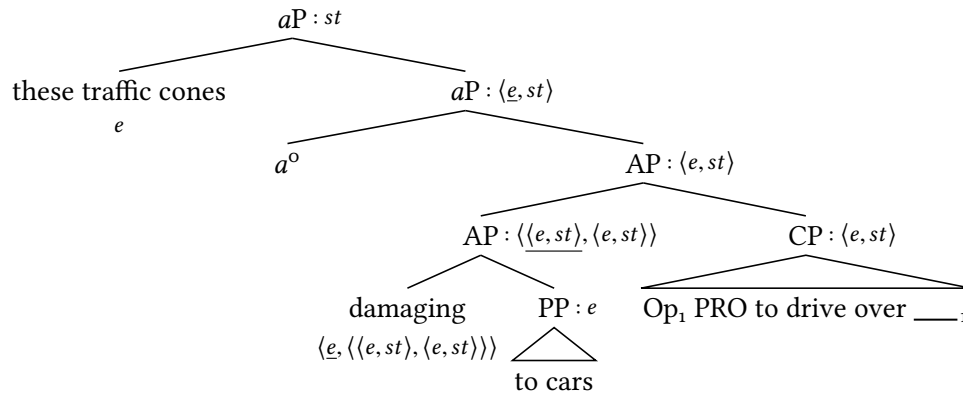
[21]   Under a PP-adjunction analysis of experiencer PPs, movement of the PP would also not remedy the semantic-type mismatch because such movement would leave a trace of either type s or $\langle st, st \rangle$ (depending on one's assumptions), neither of which could compose with the AP in a *tough*-construction.

construction variant (37). It combines with a null-operator structure, which denotes a property of individuals. As a result, experiencer PPs and adjuncts always intervene between a *pretty*-predicate and the embedded clause, identically to the derivation in (52).

Finally, as discussed in section 3.4, argument PPs do not intervene when they occur between the adjective and the embedded clause. The reason is that such a PP is directly an argument of the adjective's denotation, unlike experiencer PPs, thereby avoiding intervening in the semantic composition process, as shown in (56).

(56)   *Argument PPs do not result in a semantic-type mismatch*
       These traffic cones are [damaging [to cars]] [Op₁ to drive over ___₁].   (=32b)

$aP : st$

these traffic cones $aP : \langle e, st \rangle$
e

a° $AP : \langle e, st \rangle$

$AP : \langle\langle e, st \rangle, \langle e, st \rangle\rangle$ $CP : \langle e, st \rangle$

damaging $PP : e$ Op₁ PRO to drive over ___₁
$\langle e, \langle\langle e, st \rangle, \langle e, st \rangle\rangle\rangle$
to cars

One way of characterising this distinction is that argument PPs are *internal arguments*, but experiencer PPs are *external arguments* (in the sense of Kratzer 1996). External arguments, but not internal arguments of an adjective cause intervention. While this distinction might be a useful characterisation of the intervention, it still does not capture why experiencer PPs and adjuncts pattern alike with respect to intervention. However, characterising the intervention in terms of semantic types and composition, as we have done, does capture this commonality: Both experiencer PPs and adjuncts semantically select for propositions. An embedded clause with a null operator denotes a property of individuals and hence is unable to compose with experiencer PPs and adjuncts.

Before moving on to applying our account to GDPs in the next section, we would like to point out that the present analysis also captures, without further ado, an observation that Hartman (2012b: 95) attributes to David Pesetsky (p.c.): only experiencers in the highest clause cause intervention.[22] Consider (57) and (58). In (57b), the experiencer PP *to Mary* does not cause an intervention effect because it does not modify the highest *tough*-predicate. In (58), PP modification of the highest *tough*-predicate leads to ungrammaticality in the *tough*-construction (58b), but not in the expletive construction (58a).

(57)   a.   It is impossible for it to be important [to Mary] to avoid cholesterol.
       b.   Cholesterol is impossible for it to be important [to Mary] to avoid.

(Hartman 2012b: 95)

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[22]   Thanks to an anonymous reviewer for pointing out the relevance of this restriction to our account.

(58) a. It is important [to Mary] for it to be easy to avoid cholesterol.
   b. *Cholesterol is important [to Mary] for it to be easy to avoid.

Hartman (2012b) captures this contrast by appealing to a difference between A-movement and Ā-movement: only A-movement is subject to PP intervention. The account developed here likewise derives these facts, but without resorting to the A/Ā-distinction. In (57b) and (58b), the null operator moves to the edge of the highest embedded clause, below the higher *tough*-predicate in the matrix clause. The higher *tough*-predicate is the *tough*-construction variant, while the lower *tough*-predicate is the expletive construction variant. Therefore, an experiencer PP can modify the lower *tough*-predicate (59a), where the AP denotes a proposition, but an experiencer PP cannot modify the higher *tough*-predicate without resulting in the by-now-familiar semantic-type mismatch (59b).

(59) a. Cholesterol is impossible$_{\text{TC}}$ [λx for it to be important$_{\text{EXPL}}$ [to Mary] [to avoid x]].

   Op-mvt

   b. *Cholesterol is important$_{\text{TC}}$ [to Mary] [λx for it to be easy$_{\text{EXPL}}$ [to avoid x]].

   Op-mvt

4.3. *Gapped degree phrases*

GDPs differ from *tough*-constructions in both their syntax and semantics, primarily as a result of the embedded clause being an argument not of the adjective, but of the degree operator *too*. Nevertheless, like *tough*-constructions, the embedded clause in a GDP is a null-operator structure, and thus the analysis in section 4.2 extends to intervention in GDPs as well. In this section, we briefly review Nissenbaum and Schwarz's (2011) proposal for GDPs and show that intervention in GDPs is the result of an irresolvable semantic-type mismatch induced by the null-operator structure, in the same vein as *tough*-constructions.

   Nissenbaum and Schwarz propose that the degree phrase in a GDP is a null-operator structure, which is interpreted via COMPOSE, a semantic operation that exhaustively applies Function Application (FA) and Predicate Modification (PM) to its two arguments (Nissenbaum 2000). To illustrate, the derivation of (60) is given in (61) and (62).

(60) The table is too heavy [Op$_1$ [to lift t_1]]
   ⤳ LF: The table is [heavy] [λx [too [to lift x]]]

(61) a. $\llbracket$heavy$\rrbracket = \lambda x_e \, \lambda d_d \, \lambda w_s \, . \, \text{HEAVY}_w(x) \geq d$
   b. $\llbracket$Op$_1$ [too [to lift t_1]]$\rrbracket =$
      $\lambda x_e \, \lambda f_{\langle d, st \rangle} \, \lambda w_s \, . \, \exists d \, [f(d)(w) \wedge \neg \exists w' \in \text{Acc}_w \, [f(d)(w') \wedge \text{LIFT}(x)(w')]]$

(62) a. COMPOSE $(\underbrace{[\![\lambda x\,[\,\text{too}\,[\,\text{to lift}\,x\,]\,]\,]\!]}_{\langle e,\,\langle\langle d,\,st\rangle,\,st\rangle\rangle})\,(\underbrace{[\![\text{heavy}]\!]}_{\langle e,\,\langle d,\,st\rangle\rangle})\,=$ *(by PM)*

   b. $\lambda y\,.\,\text{COMPOSE}\,(\underbrace{[\![\lambda x\,[\,\text{too}\,[\,\text{to lift}\,x\,]\,]\,]\!]\,(y)}_{\langle\langle d,\,st\rangle,\,st\rangle})\,(\underbrace{[\![\text{heavy}]\!]\,(y)}_{\langle d,\,st\rangle})\,=$ *(by FA)*

   c. $\lambda y\,.\,[\![\lambda x\,[\,\text{too}\,[\,\text{to lift}\,x\,]\,]\,]\!]\,(y)\,([\![\text{heavy}]\!]\,(y))$

The derivation in (62) proceeds as follows: First, COMPOSE takes *heavy* and the degree phrase as its two arguments (62a). Second, PM abstracts over the first individual argument of *heavy* and the degree phrase (62b). COMPOSE applies to these two arguments after PM. Third, FA applies wherein the degree phrase takes *heavy* as its argument. The result is a property of individuals, an $\langle e,\,st\rangle$-function (62c). Fourth, the property of individuals will apply to the base-generated matrix subject *the table*.

   As (62) makes clear, there is no point in the derivation of a GDP where an experiencer PP or an adjunct could be interleaved without resulting in a semantic-type mismatch because no relevant constituent in a GDP denotes a proposition (*st*), the semantic type required for composition with an experiencer PP or adjunct. Therefore, even though the semantics of GDPs are more nuanced than those of ordinary *tough*-constructions, intervention in both results from an irresolvable semantic-type mismatch induced by the null-operator structure. The analysis that we have proposed for *tough*-constructions thus extends to GDPs without further stipulation.

5.   Conclusion

Hartman (2011, 2012a,b) contributes the novel observation that in *tough*-constructions, an experiencer PP cannot intervene between the *tough*-predicate and the embedded infinitival clause. He argues that this intervention effect provides evidence for the long-movement analysis of *tough*-constructions, wherein the matrix subject originates in the embedded clause and undergoes a series of movement steps into the matrix subject position.

   In this paper, we have argued that this restriction is in fact part of a larger generalisation, incorporating insights by Bruening (2014). The central empirical observation is that the same intervention effect occurs in *nonmovement* structures, namely *pretty*-predicate constructions and gapped degree phrases. We proposed that what unifies these three constructions is that the embedded clause in all of them is a null-operator structure. Thus, the more general restriction is that no experiencer PP (or adjunct) may intervene between an adjective and a null-operator structure. We argued that this restriction is semantic in nature, the result of an irresolvable semantic-type mismatch between an experiencer PP (or adjunct) and a null-operator structure. Crucially, this larger pattern would remain unaccounted for on the long-movement analysis of *tough*-constructions. However, the analysis presented in this paper shows that a uniform account of the intervention effects falls out from a base-generation analysis of *tough*-constructions as an incompatibility in the semantic composition. Upon closer scrutiny, the intervention facts thus provide strong support for the base-generation analysis of *tough*-constructions.

Acknowledgments

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