

Intervention in *tough*-constructions as a semantic-type mismatch*

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1. Introduction

In this paper, we subject to closer scrutiny Hartman's (2011, 2012a,b) influential recent argument in favour of the long-movement analysis of *tough*-constructions (TCs), according to which the matrix subject originates in the embedded gap position, \bar{A} -moves to the edge of the infinitival clause, and finally A-moves to the matrix subject position (see e.g. Rosenbaum 1967, Postal 1971, Brody 1993, Hicks 2009, Fleisher 2013). Hartman's argument is based on PP intervention effects in TCs, which he takes as direct evidence for the presence of an A-movement step. We show that these intervention effects are more widely attested, crucially in structures not involving A-movement. We argue that, upon closer scrutiny, the intervention effects not only fail to provide evidence for a long-movement account, but in fact constitute compelling evidence in favor of Chomsky's (1977) base-generation account, according to which the embedded gap is filled by a null operator, which \bar{A} -moves to the edge of the infinitival clause, while the matrix subject is base-generated in the matrix clause (see e.g. Akmajian 1972, Lasnik & Fiengo 1974, Chomsky 1981).

Hartman's (2011, 2012a,b) novel discovery is that an experiencer PP leads to ungrammaticality in TCs (1a), but not in their expletive-construction (EC) counterparts (1b).

- (1) a. Cholesterol₁ is important (***to Mary**) to avoid ____₁.
b. It is important (**to Mary**) to avoid cholesterol. (Hartman 2012a, 125)

As Hartman notes, there is no general incompatibility between a TC and an experiencer PP. For example, if the PP is located above the matrix subject, the sentence is grammatical (2).

- (2) (**To Mary**), cholesterol₁ is important to avoid ____₁.

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Based on a similar type of intervention effect in Romance A-raising constructions, Hartman argues that the ungrammaticality of an experiencer PP in (1a) 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 \bar{A} -movement. He concludes from these considerations that the intervention effect in (1a) reveals the presence of an A-movement step over the experiencer PP. Because the long-movement account postulates such an A-movement step, but the base-generation account does not, Hartman concludes that the intervention effect supports the former.

This paper investigates the intervention effect in greater detail. We show that PP intervention analogous to that in TCs also arises in constructions that do not involve A-movement, namely *pretty*-predicate constructions and gapped degree phrases. As both constructions lack A-movement, PP intervention cannot be the result of A-movement. Consequently, the intervention effect in (1a) does not provide an argument for an A-movement step in TCs or for the long-movement analysis of TCs. This conclusion converges with the conclusion reached in Bruening (2014) on independent grounds. We argue instead that the cause of the intervention effect is not syntactic in nature, but semantic. We propose that what unifies TCs, *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*, which stems from the embedded clause being a null-operator structure.

2. Experiencer intervention in TCs

It has been well-known since Chomsky (1973) that while two *for*-phrases can occur in the EC (3a), only one *for*-phrase can occur in the TC (3b).¹

- (3) 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 (3a), *for the rich* is the experiencer PP, and *for the poor* is the embedded subject. In the TC (3b), one of the two has to disappear, but surface inspection alone does not reveal which one. Before Hartman (2011, 2012a,b), it was standardly assumed that the *for*-phrase to survive in TCs is the experiencer PP and that it is the embedded subject that must disappear (e.g. Faraci 1974, Lasnik & Fiengo 1974, Rezac 2006). Hartman, however, provides a number of compelling arguments against this view and instead advances the generalization in (4).

- (4) *Hartman's Generalisation*
 In a TC, 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 Hartman's Generalisation (4). The first three arguments are from Hartman (2011, 2012a,b). The remaining three are novel arguments of our own that provide converging evidence.

¹For 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 terminology.

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*. In (1) above, the PP is headed by *to* and hence unambiguously an experiencer. The fact that it is impossible in a TC constitutes evidence for (4).

Scope. Hartman's (2011, 2012a,b) second argument is based on scope. In an EC, a *for*-phrase can take scope either above or below the *tough*-predicate in the matrix clause (5a). 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. Crucially, the corresponding TC only allows for an embedded scope reading (5b). This restriction indicates that the *for*-phrase *must* be construed as the embedded subject in TCs, supporting (4).

- (5) a. It is impossible [**for every student**] to fail this test.
(*impossible* >> *every student*; *every student* >> *impossible*)
- b. This test₁ is impossible [**for every student**] to fail ___₁.
(*impossible* >> *every student*; **every student* >> *impossible*)

Crosslinguistic evidence. Hartman's (2011, 2012a,b) third argument comes from languages that do not allow overt infinitival subjects. For example, in Italian, a PP headed by *per* 'for' is optional in the EC (6a). Because *per* can never be used to introduce an infinitival subject in Italian, only an experiencer construal of *per gli studenti* is possible in (6a). (6b) shows that the presence of this experiencer PP yields ungrammaticality in the TC, a constraint that follows from (4).

- (6) a. È impossibile (**per gli studenti**) capire questi problemi. [Italian]
is impossible for the students understand these problems
- b. Questi problemi₁ sono impossibile (***per gli studenti**) da capire
these problems are impossible for the students DA understand
___₁. (Hartman 2012a, 123)
-

Partial control. We will present three more pieces of evidence that support (4). The first of these arguments is based on partial control, where PRO denotes a superset of its controller (Landau 2000 *et seq*). In (7a), the embedded verb *gather* requires a plural subject.² Because the matrix subject *Mary* is singular, it is unable to satisfy this requirement; the embedded clause must therefore contain 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 (7a) is one in which the *for*-phrase is the experiencer PP of the *tough*-predicate and it partially controls PRO. Notably, the corresponding TC in (7b) is infelicitous.

²Standardly, *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*.

- (7) 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].

The infelicity of (7b) shows that a structure in which the *for*-phrase is an experiencer PP and the embedded subject is plural PRO is unavailable in TCs. This follows straightforwardly from (4): Because experiencer PPs are impossible in TCs, *for Mary* must be construed as the embedded subject in (7b). This precludes PRO inside the embedded infinitival clause, and *Mary*, as a singular DP, violates the plural-subject requirement of *gather*.

Animacy. As shown in (8), it is possible for the *for*-phrase in TCs to be inanimate (*pace* Faraci 1974). Because an experiencer construal of *for the chalk* would give rise to infelicity, it must be an embedded subject in both (8a) and (8b). The acceptability of (8b) then shows that the *for*-phrase in TCs *can be* the embedded subject. In conjunction with the observation that only one *for*-phrase is allowed in TCs (see (3b)), this implies that the *for*-phrase *has to be* the embedded subject and that experiencer PPs are disallowed in TCs.

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

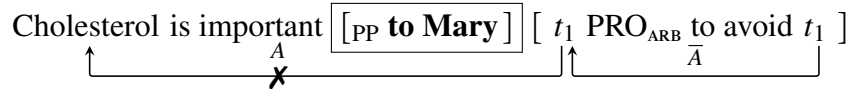
Arbitrary experiencer interpretation. Finally, the experiencer in a TC can be interpreted as arbitrary, even in the presence of a *for*-phrase, as (9) shows. Here, the embedded clause contains the adverb *courageously* to facilitate an embedded subject interpretation of *for Sue*. An experiencer construal 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 EC in (9a) nor the TC in (9b) enforces such an interpretation. Rather, the most natural reading of both sentences in (9) is that Sue's courageously walking 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 (9a) and (9b) 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, (9b) demonstrates that a *for*-phrase *can be* an embedded subject in TCs. Given that only one *for*-phrase can survive in TCs (recall (3b)), we conclude that the surviving *for*-phrase *must be* the embedded subject. Consequently, experiencer PPs must be ruled out in TCs.

- (9) a. It is scary **for Sue** to walk the tightrope courageously.
 b. The tightrope₁ is scary **for Sue** to walk ___₁ courageously.

To summarize, we have presented six arguments that experiencer PPs are possible in ECs, but not in TCs, as stated in Hartman's Generalisation (4). Hartman (2011, 2012a,b) argues that (4) constitutes evidence for the long-movement analysis. 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 (Chomsky 2000) for A-movement over it (10).

(10) *Hartman’s (2011, 2012a,b) account of experiencer intervention (4)*



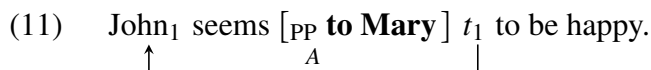
Only the long-movement account postulates the A-movement step crucial for this account. The base-generation account, on the other hand, does not postulate any syntactic dependency between the matrix subject and the embedded clause.³ Hartman reasons that the intervention effect remains unaccounted for on this analysis. As such, experiencer intervention would appear to provide a forceful argument for the long-movement analysis of TCs. The next section challenges this conclusion.

3. PP intervention is not about movement

This section presents evidence that the intervention effect has nothing to do with A-movement, because A-movement is neither a sufficient nor a necessary condition for intervention effects to arise.

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). (11) gives an example from subject-to-subject raising, the prototypical example of A-movement. 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.



3.2 PP intervention in nonmovement structures

There are constructions that resemble TCs, but crucially lack an expletive counterpart. A traditional example are constructions with adjectives like *pretty* (12). We refer to this class of adjectives as *pretty-predicates*.

(12) Marigolds₁ are **pretty** to look at ____₁. (cf. *It is pretty to look at marigolds.)

³A noteworthy exception is Rezac’s (2006) account, adopted in Fleisher (2013, 2015). In this account, matrix T⁰ enters into an AGREE relation with the embedded clause. It is not clear to us how this account would be able to handle (4) because Rezac (2006) argues that copy-raising constructions also involve this AGREE relation. Copy-raising constructions do not exhibit intervention effects, however (*John₁ seems [PP to Mary] like he₁’s the smartest guy in the world*).

The ungrammaticality of the expletive baseline in (12) makes it clear that it cannot be derived via long movement out of the infinitival clause. Nevertheless, *pretty*-predicate constructions display the same PP intervention effect as TCs, as shown in (13). Although *pretty*-predicates may in principle take an experiencer PP (13a), this experiencer cannot occur between the predicate itself and the embedded infinitival clause (13b). Moreover, just like in the case of TCs, the two can cooccur if the PP occupies a position above the matrix subject (13c).

- (13) 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.

The PP intervention effect in (13) is thus identical to that in TCs. However, because *pretty*-predicate constructions do not involve long A-movement from the embedded clause into the matrix clause (13b), this intervention effect cannot be 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). Like *pretty*-predicate constructions, GDPs can occur in a TC (14), but lack an expletive counterpart. Therefore, (14) cannot be derived by A-movement of *this table* out of the infinitival clause.

- (14) This table₁ is **too heavy** to lift ____₁. (cf. *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 (15a). Moreover, a *for*-phrase is in fact possible in conjunction with an infinitival clause (15b). However, just as in the case of TCs, the status of this *for*-phrase is unclear based on surface inspection alone and could be either an experiencer PP on a par with (15a) or the embedded subject.

- (15) a. This table is too heavy **for John**.
 b. This table₁ is too heavy **for John** to lift ____₁.

Following Hartman's (2011, 2012a,b) reasoning discussed in section 2, scope can be used to identify the status of the *for*-phrase in (15b). Consider the paradigm in (16). The sentence in (16a) is ambiguous, a result of the variable attachment of *for only one worker*.⁴ If it attaches inside the embedded 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 (16b), in which the PP unambiguously attaches in the matrix clause and only a wide scope interpretation is available for *only*. Against this backdrop, the crucial example is (16c). In (16c), 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.

⁴On 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.

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- (16) a. The table₁ is too heavy to lift ___₁ [PP **for only one worker**].
(*only* >> *too*; *too* >> *only*)
- b. [PP **For only one worker**] the table₁ is too heavy to lift ___₁.
(*only* >> *too*; **too* >> *only*)
- c. The table₁ is too heavy [PP **for only one worker**] to lift ___₁.
(**only* >> *too*; *too* >> *only*)

The unavailability of matrix scope for *only* in (16c) 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 TC facts in section 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 TCs and GDPs instantiate the same constraint. But because GDPs do not involve long A-movement, the intervention effect cannot be related to A-movement.

Converging evidence for the conclusion that experiencer PPs are impossible in GDPs comes from Romance. Recall from section 2 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 Hartman's observation that such PPs are impossible in TCs. (17) 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 (17a). However, this becomes impossible in a GDP (17b).

- (17) a. Questo tavolo e' troppo pesante (**per me**). [Italian]
 this table is too heavy for me
- b. Questo tavolo₁ e' troppo pesante (***per me**) da sollevare ___₁.
 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 TCs: An experiencer PP cannot intervene between the predicate and the embedded infinitival clause. As both do not involve long A-movement, the PP intervention effect cannot be attributed to an interaction of this PP with A-movement. A-movement is neither sufficient (section 3.1) nor necessary (this section) for PP intervention.⁵

⁵Bruening (2014) observes that intervention in TCs is not limited to experiencer PPs. Regular adjuncts likewise incur an intervention effect in TCs. *Pretty*-predicate constructions and GDPs are likewise subject to adjunct intervention:

- (i) a. Mary will be pretty [PP at her wedding].
 b. *Mary₁ will be pretty [PP at her wedding] to look at ___₁.
- (ii) a. [PP In this awkward position] the table₁ will be too large to lift ___₁.
 b. *The table₁ will be too large [PP in this awkward position] to lift ___₁.

This parallelism supports the view that intervention in *pretty*-predicates and GDPs is the same as in TCs.

3.3 Nonintervening PPs

A final complication for the defective intervention account is that not all PPs cause an intervention effect. While experiencer PPs do, what we will call *argument PPs* do not. This is shown in (18) for TCs and in (19) for GDPs.⁶

- (18) 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.
- (19) 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.

3.4 Section summary: A new generalization

We argued in section 2 that the core empirical insight of Hartman (2011, 2012a,b) is correct: experiencer PPs give rise to intervention in TCs. In this section, we have provided evidence that the empirical distribution of this intervention effect is both broader and more nuanced than previously recognised. To encapsulate the findings in this section, we propose the revised descriptive generalization in (20).

- (20) *Revised Hartman's Generalisation*
 In TCs, *pretty*-predicate constructions, and GDPs, no experiencer PP (or adjunct) may occur between the adjective and the embedded infinitival clause.

It is clear that A-movement cannot be responsible for PP intervention. Consequently, PP intervention in TCs 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

In this section, we propose that what underlies the intervention effect in TCs, *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 \bar{A} -moves from the gap position to the edge of the embedded clause; it is then interpreted as a λ -abstraction over its trace (Nissenbaum 2000). We show that experiencer PPs 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 only combining with propositions, while null-operator structures crucially denote properties of individuals.

⁶Thanks to Nicholas Longenbaugh for bringing examples like (18) to our attention.

4.1 Semantics of tough-predicates

Tough-predicates describe dispositions anchored to an individual. Thus, their semantics comprise two essential ingredients.⁷ 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.

Following Chomsky (1977), we view as the fundamental difference between the TC and the EC that the embedded clause in the former is a null-operator structure. 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.⁸ The first variant combines with a *proposition*; this corresponds to the EC (21). The second variant combines with a *property of individuals*; this corresponds to the TC (22). Following Lasersohn (2005) and Stephenson (2007, 2010), the judge is represented as the argument j of the denotation function.

$$(21) \quad \llbracket \text{tough}_{\text{EXPL}} \rrbracket^j = \lambda p_{st} \lambda w . \forall \langle w', j' \rangle \in \text{ACC}_{w,j} [\text{TOUGH}_{w',j'} (\llbracket p \rrbracket^{j'})] \quad \langle st, st \rangle$$

$$(22) \quad \llbracket \text{tough}_{\text{TC}} \rrbracket^j = \lambda Q_{\langle e, st \rangle} \lambda x \lambda w . \forall \langle w', j' \rangle \in \text{ACC}_{w,j} [\text{TOUGH}_{w',j'} (\llbracket Q \rrbracket^{j'}(x))] \quad \langle \langle e, st \rangle, \langle e, st \rangle \rangle$$

$$(23) \quad \text{ACC}_{w,x} = \{ \langle w', y \rangle : \text{it is compatible with what } x \text{ believes in } w \text{ for } x \text{ to be } y \text{ in } w' \}$$

$$(24) \quad \text{TOUGH}_{w,j}(p) \Leftrightarrow p \text{ is tough to } j \text{ in } w$$

Both $\text{tough}_{\text{EXPL}}$ and tough_{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 $\text{tough}_{\text{EXPL}}$, the *tough*-proposition is its single propositional argument λp . On the other hand, tough_{TC} combines first with an argument denoting a property of individuals λQ and then with an individual argument λx . 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 & 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 & Pancheva 2006). As will be discussed in section 4.2, the judge is overtly specified by the experiencer PP. For example, in (25), the judge *Mary* is specified overtly by the experiencer PP, and PRO, being

⁷We will abstract away from degree arguments in what follows.

⁸Note that a homophony account seems to be supported by the fact that there are adjectives like *possible*, which occur in the EC, but not in the TC.

coreferential with the judge, must refer to *Mary*. Crucially, (25) cannot have an interpretation in which PRO refers to someone else.

- (25) It was tough [on $Mary_1$] [**PRO**_{1/*2} to avoid cholesterol]
 ~ It was tough on **Mary** for **Mary** 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 (26) or as referring to a contextually salient individual (27); see Bhatt & Izvorski (1997) for discussion.

- (26) It is fun [**PRO**_{ARB} to play hockey] ~ GEN x [it is fun for x for x to play hockey]
 (27) 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 : $\llbracket \text{PRO} \rrbracket^j = j$.

Given these pieces, the interpretation of both the EC and the TC is straightforward. In the EC (28a), the embedded clause denotes a proposition, which composes with *tough*_{EXPL} (21). In the TC (28b), the embedded clause contains a null operator, which triggers λ -abstraction over individuals (Nissenbaum 2000). This yields a clause of type $\langle e, st \rangle$, a property of individuals, which composes with *tough*_{TC} (22).

- (28) a. $\llbracket \text{It is fun [PRO to play hockey]} \rrbracket^j =$
 $\lambda w . \forall \langle w', j' \rangle \in \text{ACC}_{w,j} [\text{FUN}_{w',j'} (\text{PLAY}(\text{hockey})(j'))]$
 b. $\llbracket \text{Hockey is fun [Op}_1 \text{ PRO to play } __] \rrbracket^j =$
 $\lambda w . \forall \langle w', j' \rangle \in \text{ACC}_{w,j} [\text{FUN}_{w',j'} (\text{PLAY}(\text{hockey})(j'))]$

In both constructions, the resulting truth conditions state that in all of the centred worlds where j is the centre, j 's playing hockey is fun 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 once the contribution of the experiencer PP is made clear. The experiencer PP serves to overtly specify the judge. For concreteness, we assume that it is introduced by the functional head Appl^0 , which combines first with a propositional argument λp and then with the experiencer PP $\lambda j''$ (29). Its role is to shift the judge argument of the denotation function for p to the individual(s) denoted by the experiencer PP.

- (29) $\llbracket \text{Appl}^0 \rrbracket^j = \lambda p_{st} \lambda j'' \lambda w . \llbracket p \rrbracket^{j''}(w) \quad \langle st, \langle e, st \rangle \rangle$

Crucially, Appl^0 only combines with propositions. This fact can be observed outside the context of *tough*-predicates with predicates of personal taste, which are also judge-dependent.

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For example, in (30), the experiencer PP can attach high in the structure, at the propositional level, but it cannot attach in a medial position that does not denote a proposition.

(30) **(To Kyle,)** the rutabagas are **(*to Kyle)** tasty **(to Kyle)**.

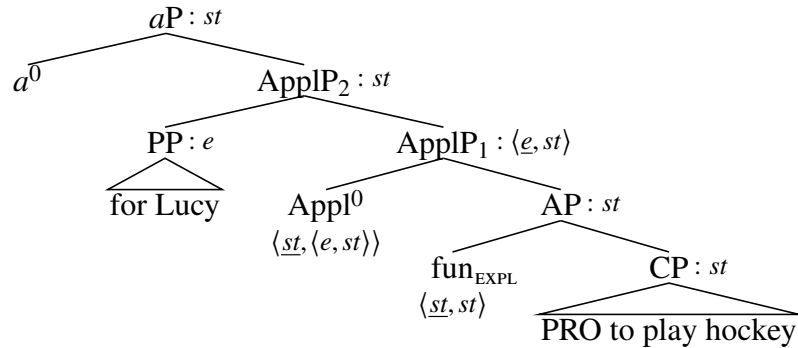
As for the structural position of $Appl^0$, we assume that the adjectival extended projection mirrors the verbal one, as in (31).

(31) $[_{aP} \dots a^0 [_{ApplP} \dots Appl^0 [_{AP} \dots A^0 \dots]]]$

The linear order of the experiencer PP with respect to the adjective is derived by head movement of A^0 to a^0 . Finally, the *tough*-subject is merged in $[Spec, aP]$, parallel to how the external argument of a verb merges in $[Spec, vP]$.

The addition of an experiencer PP to our proposed semantics of *tough*-predicates, correctly predicts intervention in the TC, but not in the EC. In the EC, the AP denotes a proposition. Therefore, it can successfully combine with $Appl^0$ and an experiencer PP, as shown in (32).

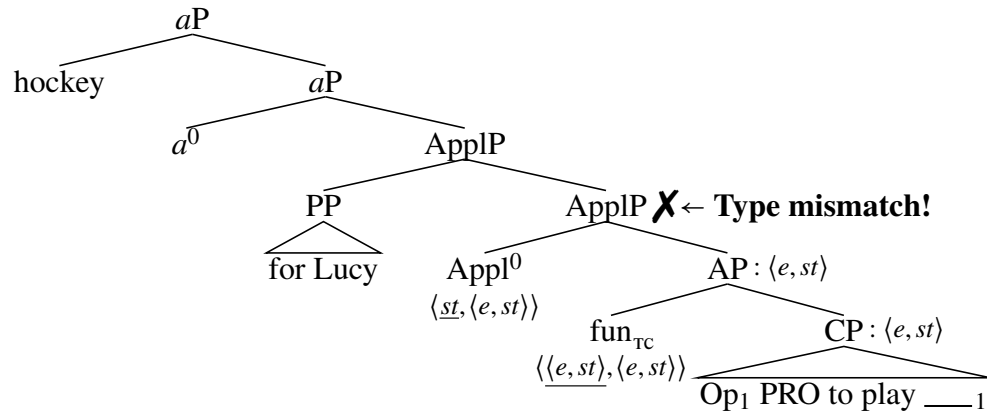
(32) a. It is fun [for Lucy] [PRO to play hockey]



b. $[[ApplP_2]]^j = \lambda w . \forall \langle w', j' \rangle \in ACC_{w, Lucy} [FUN_{w', j'}(PLAY(hockey)(j'))]$

However, in the TC, $Appl^0$ is unable to combine with the AP because it denotes a property of individuals. This creates an *irresolvable semantic-type mismatch*, as shown in (33).

(33) *Hockey is fun [for Lucy] [Op₁ PRO to play t₁]



Because App^0 requires a propositional argument, but the AP denotes a property, there is no way to semantically compose these two elements. This derives PP intervention as semantic ineffability.⁹ This account also extends to Bruening's (2014) observation that adjuncts likewise incur an intervention effect (see fn. 5 above), if the relevant class of adjuncts is of type $\langle st, st \rangle$ (modulo things like tense).

Although experiencer PPs and adjuncts cannot occur between the adjective and the embedded clause, our analysis predicts that they should be able to attach in the structure to a higher node if that node denotes a proposition. This prediction bears out (34).

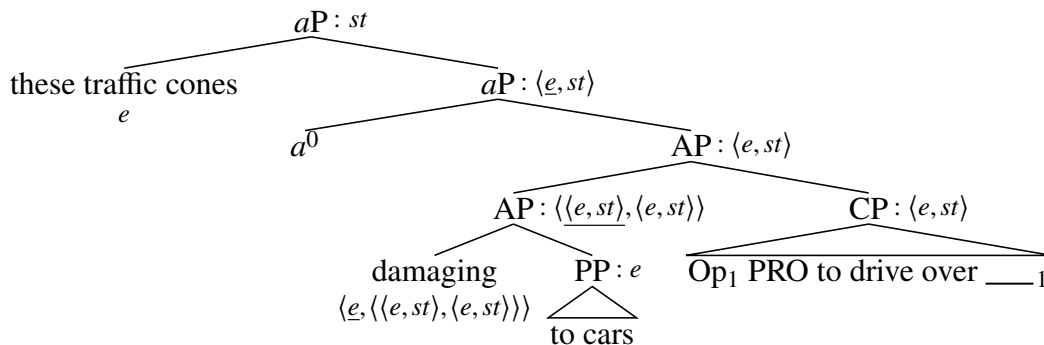
(34) **(To Mary)** cholesterol is important **(*to Mary)** to avoid **(to Mary)**

In (34), the PP composes above the subject *cholesterol* and hence with a constituent of propositional type. As a consequence, no type mismatch arises.

This analysis of the intervention effect extends without further ado to *pretty*-predicate constructions and GDPs, simply because these too involve null operators. Specifically, our account is compatible with the analysis of GDPs put forth in Nissenbaum & Schwarz (2011). On their account, no constituent of a GDP denotes a proposition. It hence follows that PP intervention arises in these constructions as well.

Finally, as discussed in section 3.3, argument PPs do not intervene when they occur between the adjective and the embedded clause. The reason is that argument PPs compose with the adjective *before* the embedded clause does, thereby avoiding intervening in the semantic composition process, as shown in (35).

(35) These traffic cones are [damaging [to cars]] [Op₁ to drive over ___₁]. (=18b)



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.

⁹A question that arises is whether nonstandard modes of composition could in principle allow App^0 and AP to compose semantically in (33). 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.

5. Conclusion

Hartman (2011, 2012a,b) contributes the novel observation that in TCs, 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 TCs. In this paper, we have argued that this restriction is in fact part of a larger generalisation. The central empirical observation is that the same intervention effect occurs in *nonmovement* structures as well. This larger pattern remains unaccounted for on a long-movement account. We proposed that what unifies these constructions is that the embedded clause in all of them is a null-operator structure. We argued that the intervention effect is semantic in nature, the result of an irresolvable semantic-type mismatch between an experiencer PP and a null-operator structure. This account provides a uniform analysis of the intervention effects. Crucial for this explanation is a base-generation account of TCs. Upon closer scrutiny, the intervention facts thus provide strong support for such an account.

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