Intervention in *Tough*-Constructions
A semantic analysis

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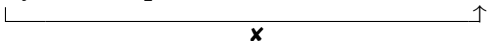
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1 Introduction[1]

- The *Tough*-Construction (TC) has been a topic for syntactic research due to the dependency between the main-clause subject and the gap in the infinitival clause.

(1)   a.   It was important to find Mary
        b.   Mary was important to find e.

- As evidence for the syntactic nature of the dependency, (2) is typically taken to show that "disrupting" the link between the subject and gap by situating an argument syntactically between the two positions leads to ungrammaticality – an instance of **defective intervention** (Chomsky, 2000).

     (2)   * Mary was important to John to find e.

- The contribution I'll make today is to offer a principled explanation for defective intervention, based on new data concerning TCs and a closer look at the semantics of TCs.
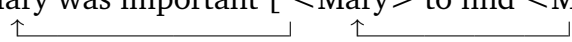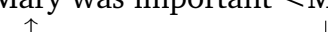
– Specifically, I'll argue that all defective interveners are of a certain semantic type, namely, they're all **attitude holders**.

– And further, I'll show that syntactically intervening non-attitude holders are perfectly fine.

– Consequently, I'll propose that the ungrammaticality of (2) is due not to a constraint on syntax, but to a constraint on interpretation: what goes wrong in (2) is that there are two different "versions" of *Mary*: the utterance context Mary, and John's version of Mary, and these two individuals are linked in a single syntactic chain.

• The proposal here covers a wider range of data not covered under a purely syntactic account of defective intervention.

Roadmap

2   Linking in the syntax
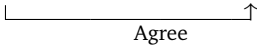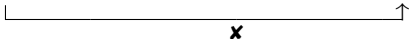
• The debate about *Tough*-Movement has mainly been concerned with whether there is a movement versus a predication derivation for the antecedent-gap relationship, (very) roughly sketched below (Chomsky, 1977; Browning, 1987; Řezáč, 2006; Hicks, 2009; Hartman, 2011, 2012; Fleisher, 2013, 2014; Bruening, 2014; Keine and Poole, 2015; Longenbaugh, 2015).

(3)   *Movement* : [Mary was important [<Mary> to find <Mary>]]

   Predication : [Mary was important <Mary> [λy to find y]]

• I'll largely put aside this issue here, coming back to it in §5.2.1. Nonetheless, the arguments put forth can generally be taken to be against an **Agree**-based analysis of *tough*-movement.

- **–** If Agree is understood to be the impetus for movement, then we can extend the argument to be against a movement analysis generally.[2]

- Agree analyses propose that a formal syntactic link is establish between the antecedent and the gap, and that if this link is disrupted/precluded, the result is ungrammatical.

(4) a.   Mary was important to find *e*.
              [antecedent ... [... gap]]
              └─────────────────────↑
                        Agree

      b.   * Mary was important to John to find *e*
              [antecedent ... intervener [... gap]]
              └──────────────────────────────↑
                              ✗

- We can be sure that defective interveners are indeed situated between the antecedent and the gap based on c-command tests like variable binding and Superiority/Weak Crossover.

(5) *Variable Binding*
     It was important to every parent$_i$ to find his$_i$ child.

(6) *Superiority*
      a.   It was important to who to find who
      b.   * Who was it important to who to find t_{wh}

(7) *Weak Crossover*
     ?? Which child$_i$ parent was it important to his$_i$ parents to find t_{wh}

- So given the basic scheme in (4), the Agree-analysis makes a basic prediction that anything (of the right category) occurring between the subject and the gap should lead to ungrammaticality.

- What I'll show here is that this purely syntactic process is insufficient to capture cases of "failed" intervention, i.e., syntactic interveners that do not yield ungrammaticality.

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[2]Řezáč (2006) argues for an Agree-based predication analysis.

3 An observation: TC predicates are subjective

- An undiscussed fact concerning TCs is that they all involve "subjective" predicates, that is, they are all predicates whose truth is evaluated based on the doxastic/epistemic state of an Experiencer/Judge (Kölbel, 2004; Lasersohn, 2005; Moltmann, 2006, 2012; Stephenson, 2007; Pearson, 2013; Sæbo, 2009; Kennedy, 2012).[3]

- For instance, they give rise to Faultless Disagreement, where John and Mary can say contradictory things but both be said to be speaking truthfully (Kölbel, 2004).[4]

(8)   Mary: "This book was important to read."
       John: "No, this book was not important to read."

- By default, the Judge is (generically) speaker-oriented and implicit (Moltmann, 2006, 2012), but it can be overtly supplied in a prepositional phrase (Lasersohn, 2005; Pearson, 2013).

(9)   a.   It's important to find Mary
           ≈ I believe that it's important to find Mary
      b.   It's important to John to find Mary
           ≈ John believes that it's important to find Mary.

- More importantly, Judges of *tough*-predicates are attitudinal, as shown by the fact that they give rise to *de re/di dicto* ambiguities: (10) does not entail that it's important to John to meet Barack Obama.

(10)   It's important to John to meet the president.

- For convenience, I'll attempt to only use adjectives which license their Judge argument with a preposition other than *for* to control for ambiguity with the subject of the *for*-clause.[5]

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[3]To be clear, this claim is not uncontroversial. There are a number of analyses for subjectivity/evaluativity on the market; it is not universally agreed that these sorts of predicates assert beliefs. The discussion here presupposes that the general program adopted in Moltmann (2006, 2012); Pearson (2013) is correct.

[4]This is true of all *tough*-like predicates, including *too/enough*-clauses, and nominal predicates like *a pain, a joy, a bitch* etc.

[5]There are alternative ways to control for this, for instance by using partial control.

– *For*-clause subjects are not attitudinal, e.g., in (11) we don't attribute to John a belief about the president.

(11)   It's important for John to meet to the president.

• The importance of identifying the Judge argument as an attitude holder is that it allows us to state the generalization in (12).

(12)   *Generalization about Intervention in* Tough-*Constructions*
        Intervention effects in TCs only arise in the presence of an attitude holder.

• (12) captures the fact that purely being a *structural* intervener is insufficient to give rise to intervention effects. The intervener must also have a specific semantic role, namely, it must be an attitude holder.[6]

4 Evidence for (non-)attitudinal intervention

4.1 AP internal arguments

• Some *tough*-predicates permit non-Judge arguments to intervene between the subject and the gap. These are internal arguments of the adjective.[7]

(13)   a.   *Some things are harmful to the environment to throw __ in the garbage.*
                        http://inside.warren-wilson.edu/ recycle/howto.php

        b.   We use recycled and eco-friendly containers as much as possible and try to avoid *ingredients that are harmful to the environment to harvest __*, such as palm.
                        http://www.farmsteadapothecary.com/about.html

        c.   The other big reason that we need to recycle computers is because a lot of the pieces in a computer are other non-renewable resources or *they are harmful to the environment to produce __*, or both.
                        http://www.ajelectronicrecycling.com/computer-recycle-company-san-jose.html

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[6]Note that (12) is close to Hartman (2011, 2012)'s contention that "Experiencers" are defective interveners. The present account recasts this generalization in terms of semantics.

[7]Keine and Poole (2015) observe something similar for *too/enough* clauses, although it is crucial for them that these are merged in a different position than Judge interveners.

      d.   Yet typical building façades are comprised of *multiple elements that are harmful to the environment to manufacture __, install __ and maintain __*

<div align="center">http://tulsagrad.ou.edu/studio/biomimetic/jy-FINAL-thesis.pdf</div>

- Compare the same phrases with a Judge intervener. (I assume that Judges must at minimum be animate. Note that we are interested in the reading where the intervener "has an opinion" rather than is "harmed".)

(14)   a.   * Some things are harmful to scientists to throw __ in the garbage.
       b.   * . . . ingredients that are harmful to farmers to harvest __
       c.   * . . . they are harmful to engineers to produce __ . . .
       d.   * . . . multiple elements that are harmful to engineers to manufacture __, install __ and maintain __

- Importantly, the internal arguments can c-command into the lower clause, as diagnosed by the fact that they can variable bind, and can give rise to superiority/crossover effects.

(15)   *Binding*
      It's harmful to every ecosystem$_i$ to introduce a new species into it$_i$.

(16)   *Superiority*
      a.   It's harmful to what to introduce what?
      b. ?? What is it harmful to what to introduce t_{wh}?

(17)   *Weak-Crossover*
      What/Who would it be harmful to its economy to invade t_{wh}?

- AP internal arguments, like Judges, are syntactic interveners. The difference between the two is semantic: only attitude holders can be defective interveners.

4.2 The Take-TIME Construction

- The Take-TIME Construction (TTC) in (18) is another example of a *Tough-*Construction (Gluckman, 2016).

(18) a.   It took John an hour to read this article.

  b.   [This article took John an hour [to read e.]]

- For all relevant diagnostics ("weak" $\overline{\text{A}}$-movement in the lower clause, linked to something in an A-position), it patterns identically to TCs.

- What's surprising is that *John* can grammatically appear between the subject and the gap, a configuration where we expect *John* to function as a defective intervener.

- Observe that *John* in (18b) syntactically intervenes because,

(19) a.   *Binding*
            This article took every professor$_i$ an hour to read e to his$_i$ class

  b.   *Superiority*
            * What did it take who an hour to read t_{wh}

  c.   *Weak Crossover*
            ?? Who did it take his parents an hour to pick up t_{wh} from school?

- These interveners are not attitude holders. We do not attribute a belief to John in (20).

(20)   It took John a month to meet the president.

- So again, if syntactic intervention is all that is needed for defective intervention, the TTC would have to be an exception. But the data here fall under the generalization from earlier that non-attitude holders do not count as defective interveners.

4.3 "Speaker variation"

- Lastly, as noted elsewhere (cf (Hartman, 2011, endnotes 1 and 4), there is a great deal of "speaker variation" with respect to these intervention effects, in that they aren't always ungrammatical.[8]

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[8]These naturally occurring examples were found through searches on Google, COCA, and GloWBe.

(21) a. *What things are important to you to be able to continue doing __* throughout your treatment

  b. Make a list of *active projects that are important to you to complete __*.

  c. *What kinds of emails are important to you to store __* in recipients' contact records?

  d. So it's a personal choice whether you feel *the additional features are important enough to you to pay extra for __*

  e. If you have a lot of *things that are of course important to you to bring __ to your new place*, it is best if you hire a professional moving company

(22) a. I think that *sports and academics are important to us to have __*.

  b. I think *people that are important to us to get to know __*.

  c. I think *the point that's very important to us to make __* is that the forces of good work through humans who are flawed and imperfect and trying to

  d. These days, I put myself first by scheduling *the activities that are important to me to accomplish __*.

  e. I think *the point that's very important to us to make __* is that the forces of good work through humans who are flawed and imperfect and trying to

  f. I've *a few apps which are important to me to access __ real fast,*

- I hesitate to call this "speaker variation" because some patterns do emerge when we look more closely at the examples.

  – By and large, the most common interveners are *you* and *me/us*.

  – *You* appears frequently in questions and imperatives (21a-d).

  – Interveners are more likely to occur when the *tough*-predicate is embedded in an attitude environment (22a-c).[9]

- This suggests to me that the various interveners are really overt instantiations of the implicit Judge argument, which is (generically) speaker-oriented (thus *me(/us)*) and can be oriented towards the addressee in questions/imperatives (thus, *you*).

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[9]Also: Interveners are more likely to occur in relative clauses and other structures where the subject is a *wh*-element. It's not immediately clear to me why this should hold.

- More importantly, I don't see how *any* syntactic account could handle naturally occurring data like these. It would require massive stipulation, wherein the general process that normally gives rise to intervention simply fails to apply.

4.4   Summary

- To recap:

  - There are instances of "failed" intervention, where an argument syntactically sits between the subject and the gap, and yet fails to give rise to intervention effects, i.e., ungrammaticality (AP-internal arguments, the TTC).

  - There is a correlation between being a "successful" intervener and being an attitude holder (Judges vs. non-Judges).

  - Moreover, there are some instances where even attitude holders fail to successfully intervene ("speaker variation").

- All of three of these issues are unexpected under a purely syntactic treatment of defective intervention. The reason is that the syntactic mechanism that derives the antecedent-gap relationship does not take into account semantic types like attitude holder.[10]

5   Formalizing the account

- Intuitively, what goes wrong in (23) is that the individual **Mary** is getting two interpretations: There's the speaker's/utterance context Mary, and then there's John's version of that Mary.

(23)   * Mary is important to John to find *e*.

- Before formalizing this intuition, some assumptions:

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[10]For reasons of space, I leave out cross-linguistic evidence. Romance clitics, in fact, are nice case-in-point. While they may be logophoric centers (Charnavel and Mateu, 2014), they are not attitudinal.

ASSUMPTIONS

1. *De re* construals are the result of Concept Generators, functions from individual *res*'s to concepts of individuals, i.e., the version of the *res* in some context (Percus and Sauerland, 2003; Charlow and Sharvit, 2014)

(24)   *Concept Generators*[11]
       A concept generator G for an attitude holder α is a function from individuals x_e (the *res*) to individual-concepts, i.e., functions from contexts i_κ (<world,individual,time> tuples) to individuals y_e.

       A concept generator G for α must also provide a **suitable acquaintance-based relation** mapping α to a unique individual in each world.

2. *Tough*-predicates, like other attitude predicates, are quantifiers over worlds/contexts (Hintikka, 1969), and provide a concept generator for the embedded clause.

(25) $[\![\textbf{important}]\!]^{g,w} = \lambda P_{<<e,\kappa,e>,<\kappa,t>>}\lambda x_e\lambda i_\kappa$. There's a suitable acquaintance-based G such that for all i' in $\text{Dox}_{i(x)}$ where i' conforms to what is important to x in i, $P(G)(i') = 1$

- Given these assumptions, the semantics for the *tough*-constructions without a gap is below in (26).[12]

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[11]More rigorously, from Charlow and Sharvit (2014, p.23-24)

i.   **Concept-generators:** *G* is a concept-generator for individual x in w iff

   a.   *G* is a function from individuals to individual concepts; and
   b. $\text{Dom}(G)=\{z \in D_e: x \text{ is acquainted with } z \text{ in } w\}$.

ii. **Suitable concept-generators:** A function *G* of type $<e,<s,e>>$ is a suitable concept-generator for individual x in w iff

   a.   G is a concept-generator for x in w; and
   b.   there is a function *F* from individuals to suitable acquaintance functions such that $\text{Dom}(G)\subseteq\{z \in D_e: F_z(w)=z, \text{ and } \text{Dox}_{x,w}\subseteq\{w' \in D_s: F_z(w') = G(z)(w')\}$

[12]I'm simplifying the syntax of the adjectival phrase substantially for ease of explication. I assume that the Judge is merged above the adjective which first combines with the CP. The adjective subsequently undergoes movement to the functional head *a* to derive the linear order. I'm also completely ignoring PRO in these structures.

(26) a. It is important to John to find Mary

  b. λi It is [$_{AP}$ important-to-John-i [$_{CP}$ λG $\lambda i'$ to find G(Mary)(i')]]

  c. There's a suitable acquaintance-based Concept Generator G such that for all $i' \in$ Dox$_{John(i)}$ such that i' conforms to what is important to John in i. to find in i' John-in-i''s version of Mary = 1

  d. ≈ **John believes that it's important to find the person he thinks is Mary.**

- When there's a gap in the lower clause, there's an $\overline{\text{A}}$-step in the lower clause, where the object displaces via λ-abstraction.

(27) ... [$_{CP}$ λG $\lambda i'$ G(Mary)(i') λy to find y]

- The matrix subject is generated as an *in situ* topic which automatically λ-abstracts when it merges (cf (Řezáč, 2006)'s treatment of *tough*-movement); it binds the *res* of the G function below.

(28) a. * Mary is important to John to find e.

  b. [λi Mary λx is [$_{AP}$ important-to-John-i [$_{CP}$ λG $\lambda i'$ G(x)(i') λy to find y]]

- Suppose now that the John is under the impression that Mary is Susan. This creates the configuration in (29), where each variable is saturated by the individual below it.

(29) [λi Mary λx is [$_{AP}$ important-to-John-i [$_{CP}$ λG $\lambda i'$ G(x)(i') λy to find y]]
                    Mary   Susan

- I propose that this configuration linking two different individuals in a syntactic chain is not permitted. I formalize this in the constraint in (30).

(30) *Interpretive Chain Uniformity (ICU)*
   Every link in a syntactic chain between a head and gap must be intensionally referentially equivalent, where intensional referential equivalence is defined as,

    a.   *Intensional Referential Equivalence*[13]   inspired by Anand (2006)
        α is intensionally referentially equivalent to β iff,
        For g′ modified from g appropriately, $[\![\alpha]\!]^{g} = [\![\beta]\!]^{g'}$

- Informally, what the ICU constraint says is that if you form an antecedent-gap chain in the syntax, every link in the chain must evaluate to the same individual.

- In the ungrammatical cases of intervention in *Tough*-Constructions, what goes wrong is the last step, where the lower variable will return the output of G, i.e., the most local attitude holder's version of Mary.

(31) $[\ \lambda i\ \text{Mary}\ \lambda x\ \text{is}\ [_{AP}\ \text{important-to-John-}i\ [_{CP}\ \lambda G\ \lambda i'\ G(x)(i')\ \lambda y\ \text{to find}\ y\ ]\ ]$
    ICU applies $[\![\text{Mary}]\!]^{g}$ $[\![G(x)(i')]\!]^{g'}$
                                        Mary $[\![G(\text{Mary})(i')]\!]^{g'}$
                                     | Mary   Susan |

- In the case of grammatical *tough*-movement, i.e., over an implicit Judge, **the syntax is identical**, but all the links in the chain will return the same individual, because the attitude holder is the speaker.

(32) $[\ \lambda i\ \text{Mary}\ \lambda x\ \text{is}\ [_{AP}\ \text{important-to-me-}i\ [_{CP}\ \lambda G\ \lambda i'\ G(x)(i')\ \lambda y\ \text{to find}\ y\ ]\ ]$
    ICU applies $[\![\text{Mary}]\!]^{g}$ $[\![G(x)(i')]\!]^{g'}$
                                        Mary $[\![G(\text{Mary})(i')]\!]^{g'}$
                                       | Mary   Mary |

- Now, antecedent-gap relationships crossing non-attitude holders will not lead to ungrammaticality, because there's no shift in perspective.

  – "Movement" across AP-internal arguments is predicted to be fine.

    (33)   ✓Some things are harmful to the environment to throw *e* in the garbage.

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[13]More rigorously:
Intensional Referential Equivalence
For any α and β such that β is of the form $[[\text{pro}_1\ t_2]\ \text{pro}_3]$, and α and β form a chain, α is intensionally referentially equivalent to β relative to g(i) iff:
for all w' V-accessible from g(i), there is a suitable concept-generator G such that
$[\![\alpha]\!]^{g} = [\![\beta]\!]^{g[1\to G, 2\to[\![\alpha]\!]^{g},\ 3\to w']}$

- – "Movement" in the TTC is predicted to be fine.

  (34)　✓This article took John an hour to read *e*.

- Moreover, the analysis predicts that movement past an overt attitude holder should be grammatical, provided all the links in the chain evaluate to the same individual.

  - – Indeed, this is precisely what is happening in the examples of "speaker variation" in §4.3.

    (35)　✓I think that *sports and academics are important to us to have __*.

  - – If these interveners are just the overt instantiations of the implicit Judge, then the grammaticality follows as a result of ICU.

- The core insight here is that syntax is only implicated in intervention effects if there's an attitude shift syntactically between the antecedent and the gap. Otherwise, **defective intervention is not syntactic**, it's merely a constraint on interpreting syntactic chains.

5.1　Doxastic privacy

- **Problem:** What prevents $G(x)(i')$ from returning **Mary** in (36).

(36)　$[\ \lambda i\ \text{Mary}\ \lambda x\ \text{is}\ [_{AP}\ \text{important-to-John-}i\ [_{CP}\ \lambda G\ \lambda i'\ G(x)(i')\ \lambda y\ \text{to find}\ y\ ]\ ]$

- **Solution:** *Doxastic Privacy*.

(37)　*Doxastic Privacy*　　　　　　　　　　　　　　(Percus, 2013, p. 12)
　　　When we describe a person's candidates for the actual world, we avoid explicitly situating individuals from other worlds among those candidates. (Or explicitly excluding them.)

- The result of Doxastic Privacy is that $G(\text{Mary})(i')$ relative to John's doxastic alternatives, won't return **Mary**, but always someone distinct from the speaker's/utterance context Mary.

5.2   Consequences

5.2.1   Movement vs. predication

- In general, I take the data above as an argument against a movement analysis for *tough*-constructions (on the assumption that movement is Agree-based), and in favor of a predication analysis, e.g., Keine and Poole (2015).

- However, the data are not compatible with the intervention story for a predication account either, where defective intervention results from a type mismatch between the infinitival CP and what it composes with.

- In particular, I don't see how the naturally occurring examples discussion in §4.3 can be made to follow without further stipulation.

- The analysis proposed here covers the entirety of the data without additional processes.

5.2.2   A parallel: Dahl's Puzzle and *de re* blocking

- Consider again the configuration that emerges: There is a variable embedded under two λ-abstractions.

(38)   [λi Mary λx is [$_{AP}$ important-to-John-i [$_{CP}$ λG $\lambda i'$ G$(x)(i')$ λy to find y]]

- This configuration is reminiscent of two other more familiar configurations: Dahl's Puzzle and *de re* blocking. In such contexts, the generalization is that the more local binding configuration must apply (Fox, 2000; Anand, 2006).

(39)   John said he loves his mother, and Bill did too.

- Out of all the possible binding configurations for the pronouns in the elided content, one is ruled out, namely, the "strict>sloppy" interpretation where Bill said that John loves Bill's mother.

- There is a natural parallel to defective intervention. If the utterance context Mary is the "strict" reading, and the intensional *de re* Mary is the "sloppy"

reading, then by analogy, *** Mary is important to John to find __** is in fact expected to be ruled out as an instance of "strict>sloppy".[14]

(40)   * Mary$_{strict}$ is important to John to find <Mary$_{sloppy}$>

- Thus, we can view defective intervention as falling under a more general mechanism involving a constraint on local-binding, which we need independently (e.g., Rule H (Fox, 2000)).

6   Conclusion

- I've shown here that syntactic intervention is not categorical. There are many instances of failed intervention in *tough*-constructions. Moreover, there's a correlation between being an attitude holder and a successful intervener.

- I used this correlation to offer a semantic analysis of intervention effects, arguing that antecedent-gap chains must meet the condition of being "intensionally referentially equivalent", i.e., each link must be the same individual.

- Recasting defective intervention in terms of a semantic constraint allows us a principled explanation for cases of a wide range of data unexplained under a purely syntactic analysis.

<div align="center">Thanks!</div>

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[14]Another parallel to Dahl's Puzzle and *de re* blocking: Focus can (sometimes) "fix" the bad reading.

(i) ? This book was important only to John to read *e*.

(ii) ? Bill and Sue didn't think so, but this book was important to JOHN to read *e*.

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Appendices

A: $\overline{\text{A}}$-movement

- $\overline{\text{A}}$-movement out of intensional domains is clearly possible, *Which book does John think Mary read t_{wh}?*, seemingly in violation of ICU.

- This isn't really a problem for the ICU. We merely need a way to reconstruct, which we know is one of the defining characteristics of $\overline{\text{A}}$-movement.

- Note that this same strategy (i.e., reconstruction) doesn't apply in TCs in general because there's one instance of the variable that is not wrapped in a G function.

B: The natural class of *tough*-predicates

- Lastly, it seems to me that by viewing TC through the lens of subjectivity, we can being to understand a natural class of *tough*-predicates.

- Kennedy (2012)'s tests for "evaluative vague predicates" appears to pick exactly the *tough*-predicates, including *too/enough* clauses and nominals like *a pain, a please, a bitch, etc*.

  (41)   John found the book easy/too long/a pain to read *e*.

- It's not clear to me yet why this should be, but it suggests to me that subjectivity is the crucial factor in defining *tough*-predicates in general, and if that's the case, then it's unsurprising that there's a semantic constraint on intervention in these contexts.

C: Raising

- Classic cases of raising – a noted thorn in the side of syntactic accounts of defective intervention (Haegeman, 2006; Hartman, 2011, 2012) – support ICU. Consider the "failed" intervention with *seem*, where raised across an Experiencer is grammatical. Notably, these Experiencers are attitudinal.

 (42)   It seems to John that the American president is popular in Argentina (but not Barack Obama).

- The prediction is that there is an intensional reading of the subject according to John when there's movement across this intervener.

(43)   a.   The American president seems to John to be popular in Argentina (but not Barack Obama).

- We of course still have to lexically specify why this movement is possible with raising predicates, and generally not tolerated with *tough*-predicates – but every analysis will have to stipulate something here.

- The present account suggests that something in the semantics of the raising predicates differs from *tough*-predicates – perhaps the ordering source? I'm still working on this. . .