

Movement and alternatives don't mix: Evidence from Japanese*

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Abstract

Certain quantificational elements (“interveners”) have long been known to disrupt the interpretation of *wh*-in-situ (Hoji 1985 and many others), but the correct description of the set of interveners and the nature of intervention effects have been the subject of continued debate. In Erlewine and Kotek (2017), we offer a new generalization concerning the nature of intervener-hood in Japanese: A quantifier acts as an intervener if and only if it is scope-rigid. We argue that this generalization is explained by — and in turn supports — Kotek’s (2017) account of intervention effects as reflecting a logical incompatibility between Predicate Abstraction and the computation of Rooth-Hamblin alternatives. In this paper we provide additional evidence in support of the above generalization, and test several of its predictions.

1 Intervention and intervener-hood

This paper concerns the proper characterization of so-called *intervention effects* in *wh*-questions and the characterization of interveners in Japanese. Intervention effects refer to the inability of certain quantificational elements to precede an in-situ *wh*-phrase, in a c-commanding position at surface structure. For example, Hoji (1985) observes that a *wh*-MO universal quantifier cannot precede a *wh* object in canonical in-situ position (1).¹

- (1) **Intervention with universal *wh*-mo:** (Hoji 1985:270)

?? **Da're-mo-ga nani-o kai-mashi-ta-ka?**
who-MO-NOM what-ACC buy-POLITE-PAST-Q
Intended: ‘What did everyone buy?’

However, not all quantificational elements trigger intervention. For example, as noted by Tomioka (2007:1574), the universal quantifier *subete-no*-NP ‘all NP’ in the same configuration as in (1) does not lead to ungrammaticality:

- (2) **Universal *subete* ‘all’ does not cause such intervention:**

✓ **[Subete-no hito]-ga nani-o kai-mashi-ta-ka?**
all-GEN person-NOM what-ACC buy-POLITE-PAST-Q
‘What did everyone buy?’

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¹Throughout the paper, interrogative *wh* are in *italics* and quantifiers of interest (potential interveners) — as well as sentential negation below — are in **bold**.

Even without changing the choice of intervener, [Hoji \(1985\)](#) notes that scrambling the *wh* in (1) above the quantifier also yields a grammatical question, as in (3).

(3) **Intervention is avoided by scrambling the intervener**

- ✓ *Nani-o da're-mo-ga* ___ *kai-mashi-ta-ka?*
 what-ACC who-MO-NOM buy-POLITE-PAST-Q
 'What did everyone buy?'

What makes the *wh*-MO universal quantifier (1) an intervener but not the *subete* universal quantifier (2)? More generally: What is the proper characterization of the set of interveners, and what is the nature of intervention? Previous work has tied intervention — and therefore the set of intervening elements — to the semantics of focus ([Kim 2002](#), [Beck 2006](#), [Beck and Kim 2006](#)), quantification ([Beck 1996](#)), topichood ([Grohmann 2006](#)), prosody ([Tomioaka 2007](#)), (anti-)additivity ([Mayr 2014](#)), and semantic type-mismatch ([Li and Law 2016](#)).

Against this backdrop, we showed in [Erlewine and Kotek 2017](#) that intervener-hood tracks scope-rigidity in Japanese. For example, even though the two universal quantifiers in (1-2) may have the same denotation as a universal quantifier, they differ in their scope-rigidity with respect to negation:

(4) ***wh-mo* universal quantifier is scope-rigid; *subete* is not:**

- a. *Da're-o-mo tsukamae-nak-atta.*
 who-ACC-MO catch-NEG-PAST
 'pro did not catch anyone.' ✓every > not, *not > every
- b. [*Subete-no mondai*]-o *toka-nak-atta.*
 all-GEN problem-ACC solve-NEG-PAST ([Mogi 2000:59](#))
 'pro did not solve every problem.' ✓every > not, ✓not > every

[Shibata \(2015a\)](#) reports a similar correlation: *ka*-disjunction is scope-rigid with respect to negation whereas *naishi*-disjunction is not (5), and this correlates with intervener-hood (6).²

(5) ***ka*-disjunction is scope-rigid; *naishi* is not:**

- a. [*Taro-ka Jiro*]-ga *ko-nak-atta.*
 Taro-or Jiro-NOM come-NEG-PAST ([Shibata 2015a:23](#))
 'Taro or Jiro didn't come.' ✓or > not, *not > or
- b. [*Taro-naishi Jiro*]-ga *ko-nak-atta.*
 Taro-or Jiro-NOM come-NEG-PAST ([Shibata 2015a:96](#))
 'Taro or Jiro didn't come.' ✓or > not, ✓not > or

(6) ***ka* is an intervener; *naishi* is not:**

- a. ??? [*Taro-ka Jiro*]-ga *nani-o yon-da-no?*
 Taro-or Jiro-NOM what-ACC read-PAST-Q ([Hoji 1985:264](#))
- b. ✓ [*Taro-naishi Jiro*]-ga *nani-o yon-da-no?*
 Taro-or Jiro-NOM what-ACC read-PAST-Q
 'What did [Taro or Jiro] read?' ([Shibata 2015a:98](#))

²We note that many speakers, including the first author, do not have clear judgments for *naishi* or feel that *naishi* simply patterns together with *ka* in (5-6). The judgments in (5-6) are those reported by Shibata. There seem to also be speakers who allow the 'not > or' reading of *ka* in (5) and for whom *ka* is not an intervener; [Daisuke Bekki \(p.c.\)](#) notes that he is such a speaker. What is important here is simply that there is a correlation between scope-rigidity and intervener-hood.

Erlewine and Kotek 2017 shows that this correlation generalizes across a variety of quantificational elements in Japanese, as summarized in (7). Here, “Scope-rigid” (○) indicates that the given quantifier takes obligatory wide scope with respect to negation, whereas non-“scope-rigid” (×) quantifiers exhibit scope ambiguities with respect to negation. The nature of such scope ambiguities will be discussed in section 2.2 below.

(7) **Summary of Japanese data from Erlewine and Kotek 2017:**

	disjunction		universal		NPI only	NPI	modified numerals
	<i>ka</i>	<i>naishi</i>	<i>wh-mo</i>	<i>subete</i>	<i>-shika</i>	<i>wh-mo</i>	
<i>scope-rigid?</i>	○ (5a)	× (5b)	○ (4a)	× (4b)	○ (K:228)	○ ³	× (S:66)
<i>intervener?</i>	○ (6a)	× (6b)	○ (1)	× (2)	○ (DT:134)	○ (EK:4)	× (EK:5)

	indefinite	also	even	only	
	<i>wh-ka</i>	<i>-mo</i>	<i>-sae</i>	<i>-P-dake</i>	<i>-dake-P</i>
<i>scope-rigid?</i>	○ (S:72)	○ (M:59)	○ (M:59)	○ (F:12)	× (F:12)
<i>intervener?</i>	○ (HH:269)	○ (NH:119; Y:30)	○ (Y:30)	○ (EK:6)	× (EK:6)

Abbreviations: “*X:pp*” = *X* page *pp*; F = Futagi 2004; K = Kataoka 2006; M = Mogi 2000; HH = Hoji 1985; NH = Hasegawa 1995; S = Shibata 2015a; DT = Takahashi 1990; ST = Tomioka 2007; Y = Yanagida 1996; EK = Erlewine and Kotek 2017

Based on this evidence, we offered the following generalization in Erlewine and Kotek (2017):

(8) **Generalization: Intervention correlates with scope-taking**

Scope-rigid quantifiers above an in-situ *wh* cause intervention. Quantifiers that allow scope ambiguities — i.e., those that allow reconstruction below *wh* — do not.

We propose that the generalization in (8) can be derived based on Kotek’s (2017) account for intervention effects, as a corollary of a logical incompatibility between Predicate Abstraction and Rooth-Hamblin alternative computation (see e.g. Shan 2004, Novel and Romero 2009, Ciardelli, Roelofsen, and Theiler 2017, Charlow 2017). In section 2, we briefly present the Kotek 2017 theory for intervention and then explain how this derives the correlation observed in Japanese. The remainder of the paper, in section 3, presents new data corroborating predictions of this account for intervention in Japanese.

2 Analysis

2.1 Kotek’s (2017) proposal in a nutshell

Kotek (2017) proposes that intervention effects are due to a logical problem (described below) that occurs when any quantifier takes scope between a *wh*-phrase and *C* at LF:⁴

(9) **Intervention is the result of scope-taking across focus (Kotek 2017):**

Movement into a scope position above *wh*-in-situ at LF leads to ungrammaticality.

(10) **Kotek’s intervention schema:**

$$* \text{LF: } C \dots \lambda \dots \underbrace{wh}$$

³We follow Shimoyama (2011) in analyzing *wh-mo* NPIs as wide-scope \forall over negation.

⁴Throughout, arrows indicate movement, and squiggly arrows indicate areas of in-situ (alternative) computation. These arrows are used as a notational convenience only.

That is, whether or not a quantifier acts as an intervener depends on whether or not it can *move out of the way* at LF to avoid the configuration in (10). We assume that *wh*-phrases can be interpreted in-situ at LF by introducing Rooth-Hamblin alternatives which compose pointwise (squiggly arrow) and which will be interpreted by the interrogative complementizer; see e.g. Beck (2006) and Kotek (2017) for details.

Previous literature on focus and *wh* semantics has recognized a problem with defining Predicate Abstraction (PA) over sets of alternatives in simple semantic models (Rooth 1985, Shan 2004, Novel and Romero 2009, Ciardelli et al. 2017; see also Poesio 1996, among others). In brief, standard syncategorematic PA rules (as in Heim and Kratzer 1998) are not well-defined over sets of alternatives. PA over a set of propositional alternatives should intuitively apply *pointwise*, yielding *a set of functions*. However, because the input to PA is an assignment-sensitive set of propositions, PA yields instead *a function returning a set of propositions*.

Shan (2004) demonstrates that simple solutions assumed in the previous literature — transposing a *function into sets of propositions* that a PA rule yields into a *set of functions*, using a type-shifter as in (11) — leads to a problem of over-generation. The result includes both (desired) constant functions (12) but also (undesired) non-constant ones (13).

- (11) **A type-shifter for turning type $\langle e, \langle \tau, t \rangle \rangle$ functions into type $\langle \langle e, \tau \rangle, t \rangle$ sets:**

$$\lambda Q_{\langle e, \langle \tau, t \rangle \rangle} \cdot \{ f_{\langle e, \tau \rangle} : \forall x_e \cdot f(x) \in Q(x) \}$$

- (12) **Constant $\langle e, t \rangle$ -functions**

$$\left\{ \left[\begin{array}{l} x_1 \mapsto \text{Alice saw } x_1 \\ x_2 \mapsto \text{Alice saw } x_2 \\ x_3 \mapsto \text{Alice saw } x_3 \end{array} \right], \left[\begin{array}{l} x_1 \mapsto \text{Barbara saw } x_1 \\ x_2 \mapsto \text{Barbara saw } x_2 \\ x_3 \mapsto \text{Barbara saw } x_3 \end{array} \right], \left[\begin{array}{l} x_1 \mapsto \text{Carol saw } x_1 \\ x_2 \mapsto \text{Carol saw } x_2 \\ x_3 \mapsto \text{Carol saw } x_3 \end{array} \right] \right\}$$

- (13) **Non-constant $\langle e, t \rangle$ -functions**

$$\left\{ \left[\begin{array}{l} x_1 \mapsto \text{Alice saw } x_1 \\ x_2 \mapsto \text{Carol saw } x_2 \\ x_3 \mapsto \text{Barbara saw } x_3 \end{array} \right], \left[\begin{array}{l} x_1 \mapsto \text{Alice saw } x_1 \\ x_2 \mapsto \text{Barbara saw } x_2 \\ x_3 \mapsto \text{Carol saw } x_3 \end{array} \right], \left[\begin{array}{l} x_1 \mapsto \text{Carol saw } x_1 \\ x_2 \mapsto \text{Barbara saw } x_2 \\ x_3 \mapsto \text{Alice saw } x_3 \end{array} \right] \right\}$$

Previous work has proposed instead to type-lift all denotations, either to take assignment functions as arguments (Novel and Romero 2009; see also Poesio 1996), or to operate over sets of propositions (Ciardelli et al. 2017, Charlow 2017), so PA can be defined. Another suggestion is to eschew movement/PA altogether (Shan 2004). In contrast, Kotek argues that this fundamental inability of defining PA over non-trivial sets of alternatives should not be “solved” — instead, it is precisely what gives rise to intervention, (10). We refer the reader to the above-cited works for more details and for additional data.

2.2 Explaining the correlation

Based on the consideration of scope interactions between different quantificational objects and negation in Japanese, Shibata (2015a,b) argues that all objects in Japanese (DP arguments in *vP*) move overtly out of *vP*. Objects also necessarily move out of NegP, if present, which Shibata argues has a fixed position just above *vP*. We further assume the *vP*-internal subject hypothesis (see e.g. Fukui 1986, Kitagawa 1986, Kuroda 1988), concluding that all (DP) arguments evacuate *vP* in Japanese. These assumptions are illustrated schematically in (14a). Quantifiers then vary with respect to their ability to reconstruct: those which cannot reconstruct have obligatory wide-scope with respect to negation (14b), whereas those which can reconstruct lead to scope ambiguities with respect to negation, allowing the LFs in (14b) or (14c).

(14) **Scope-taking in Japanese (Shibata 2015a,b):**

- a. All arguments move out of *vP*:

$$[\text{CP} \dots \text{DP} \dots \underbrace{[\text{vP} \dots t \dots \text{V}]} \dots]$$
- b. LF interpretation in surface position leads to wide scope over negation:

$$\text{LF: } [\text{CP} \dots \text{DP} \lambda x \dots [\text{NegP} [\text{vP} \dots x \dots \text{V}] \text{Neg}]] \quad \text{DP} > \text{Neg}$$
- c. Some (not all) quantifiers reconstruct into *vP*, allowing narrow scope:

$$\text{LF: } [\text{CP} \dots [\text{NegP} [\text{vP} \dots \text{DP} \dots \text{V}] \text{Neg}]] \quad \text{Neg} > \text{DP}$$

Now consider a surface structure where the DP could lead to an intervention configuration (15a). (Movement of the *wh*-phrase to its surface position is not illustrated. The interpreting complementizer is at the left edge of CP for illustration purposes only.) If the quantifier is scope-rigid, it has no choice but to lead to the LF configuration as in (15b). This is a Kotek intervention configuration (10): the calculation of Rooth-Hamblin alternatives must cross an instance of Predicate Abstraction (λx , in bold), which cannot be defined. But if a quantifier is not scope-rigid — i.e. it can reconstruct at LF — the LF in (15c) will also be available. Alternatively, scrambling the *wh*-word above the potential intervener also avoids intervention (15d) without requiring the DP to reconstruct. Finally, the possibility of scoping the quantifier out of the question itself (15e) offers one additional means for avoiding intervention.⁵

(15) **Deriving the generalization (8):**

- a. Potential intervener (DP) above *wh*:

$$[\text{CP} \text{ C} \dots \text{DP} \dots \text{wh} \dots \underbrace{[\text{vP} \dots t \dots \text{V}]} \dots]$$
- b. LF interpretation in surface position lead to intervention!

$$* \text{LF: } [\text{CP} \text{ C} \dots \text{DP} \lambda \mathbf{x} \dots \text{wh} \dots [\text{vP} \dots \mathbf{x} \dots \text{V}]]$$
- c. Reconstruction avoids the intervention configuration:

$$\checkmark \text{LF: } [\text{CP} \text{ C} \dots \dots \text{wh} \dots \underbrace{[\text{vP} \dots \text{DP} \dots \text{V}]} \dots]$$
- d. Scrambling *wh* above also avoids intervention:

$$\checkmark \text{LF: } [\text{CP} \text{ C} \dots \text{wh} \lambda y \dots \text{DP} \lambda \mathbf{x} \dots y \dots \underbrace{[\text{vP} \dots \mathbf{x} \dots \text{V}]} \dots]$$
- e. Scoping the quantifier out of the question also avoids intervention:

$$\checkmark \text{LF: } \dots \text{DP} \lambda x \dots [\text{CP} \text{ C} \dots \dots \text{wh} \dots \underbrace{[\text{vP} \dots x \dots \text{V}]} \dots]$$

3 Predictions of the account

In the remainder of this paper we present three predictions of our account and show that they are indeed borne out by the data, supporting the approach to intervener-hood and intervention presented here. We believe that these findings are not predicted by existing accounts of intervention effects in Japanese.

⁵Note that in order to predict no intervention in cases of reconstruction (15c) and of further movement (15e), all intermediate landing sites of movement — between DP's base position and its final *scope* position at LF — must be ignored as far as the computation of intervention configurations is concerned. Instead, the λ -binder at the final LF position of the moved DP must directly bind its lower variable. See Kotek (2017) for discussion.

3.1 Non-intervention through reconstruction

First, we concentrate on our characterization of *non-intervening* quantifiers. We claim that quantifiers which descriptively do not intervene can do so by reconstructing into a lower, *vP*-internal base position. Therefore in a potential intervention configuration, we predict that the potentially intervening quantifier must be *interpreted* in this reconstructed position inside *vP*.

We first test this forced reconstruction by considering the scope of the intervening quantifier with respect to sentential negation. Following Futagi (2004), we showed in Erlewine and Kotek 2017 that the *only* particle *dake* inside a postposition (DP-*dake*-P) can take scope above or below sentential negation, and at the same time is descriptively a non-intervener. Now consider example (16) below. The quantificational PP 'with only Hanako' *Hanako-dake-to* is in a higher position than the *wh*-word in the surface structure, so we predict that it will be forced to reconstruct into its *vP*-internal base position, which will necessarily be below negation.

(16) **DP-*dake*-P must reconstruct below *wh*; *only* > *not* reading is not possible:**

- Taro-wa Hanako-**dake**-to *nani*-o tabe-**nai**-no?
 Taro-TOP Hanako-only-with what-ACC eat-NEG-Q
- a. * 'What does Taro only not eat with Hanako_F?' only > not
 Answer: Squid ink pasta (because he gets embarrassed)
- b. ? 'What does Taro not eat with only Hanako_F?' not > only
 Answer: Dimsum (because it's better with more people)

The two potential readings are illustrated by the potential expected answers and respective contexts: what is *x* such that, just when he is with Hanako, Taro won't eat *x* (wide scope for *only* over negation), *vs* what is *x* such that Taro does not eat *x* with Hanako alone (narrow scope for *only*). While both readings are plausible in appropriate supporting contexts, and *-dake*-P can generally scope above or below negation, only (16b) is possible here. This is as predicted by the reconstruction account of non-intervention, illustrated in (15c) above.

We note that scrambling the *wh*-word above *Hanako-dake-to* makes both readings available. This, too, is predicted by our account. See the LF schema in (15d).

(17) **When *wh* scrambles above intervener, both scope readings become available:**

- Taro-wa *nani*-o Hanako-**dake**-to ___ tabe-**nai**-no?
 Taro-TOP what-ACC Hanako-only-with eat-NEG-Q
- a. ? 'What does Taro only not eat with Hanako_F?' only > not
- b. ? 'What does Taro not eat with only Hanako_F?' not > only

Next, consider the collective *vs* distributive event interpretation of subjects. We assume that distributive readings require a short movement of the subject. Example (18) provides a baseline, illustrating that in the absence of an intervener, universally quantified subjects in Japanese allow for both collective and distributive interpretations. However, when these quantifiers c-command an in-situ *wh*-phrase, only a collective interpretation is possible, (19).

(18) **Baseline: collective and distributive readings with *zen'in*:**

- [Gakusei **zen'in**]-ga LGB-o ka-tta.
 student all-NOM LGB-ACC buy-PAST
- a. 'All the students together bought a copy of LGB.' collective
- b. 'All the students each bought a copy of LGB.' distributive

(19) **Zen'in must reconstruct below *wh*; only the collective reading survives:**

[Gakusei **zen'in**]-ga [dono hon]-o ka-tta-no?
 student all-NOM which book-ACC buy-PAST-Q

- a. ✓ 'Which book(s) did the students all buy together?' collective
 b. * 'Which book(s) did the students all individually buy?'
 (and they each bought other books too) distributive

Here too, scrambling the *wh*-phrase above the quantifier allows for both the collective and distributive readings (20). The distributive reading is possible in (20) because scrambling the *wh*-phrase higher (15d) makes it no longer necessary to reconstruct the quantifier (15c) in order to interpret the *wh*-question.

(20) **When *wh* is scrambled above zen'in, both readings are again available:**

[Dono hon]-o [gakusei **zen'in**]-ga ___ ka-tta-no?
 which book-ACC student all-NOM buy-PAST-Q

- a. ✓ 'Which book(s) did the students all buy together?' collective
 b. ✓ 'Which book(s) did the students all individually buy?' distributive

3.2 Non-intervention by scoping out

Next, we consider another way of avoiding intervention, discussed in prior literature for German in Beck 1996 and for English in Pesetsky 2000 and Kotek 2014: A quantifier can avoid causing an intervention effect if it is able to scope out of the question and quantify-in, see (15e). This is possible with universal quantifiers, and leads to a predicted wide-scope reading of the quantifier with respect to the *wh*-phrase — a pair-list reading (see e.g. Karttunen 1977, Comorovski 1989, 1996, É Kiss 1993, Krifka 2001).

The relevant example is given in (21). The embedded question in (21) allows the collective interpretation but not a distributive interpretation, just as in (19) above. However, this sentence has another reading where *all students* takes wide scope out of the question. The resulting interpretation, then, expects that each student bought a (potentially different) book, and that this *list of pairs* is what the teacher would like to know.⁶

(21) **An additional possible reading: A pair-list with *zen'in* quantifying-in**

Sensei-wa [CP [gakusei **zen'in**]-ga [dono hon]-o ka-tta-ka] shiri-tai.
 teacher-TOP student all-NOM which book-ACC buy-PAST-Q know-want

'The teacher wants to know...

- a. ✓ [which book(s) the students all bought together].' collective (19a)
 b. * [which book(s) the students all individually bought].' distributive (19b)
 c. ✓ [for each student_{*i*}, which book(s) they_{*i*} bought].' pair-list

⁶Matrix questions with universal quantifiers also permit pair-list interpretations, but this reading seems clearer at least in this example when embedded, as in (21).

3.3 Base-generated quantifiers are not interveners

Finally, we return again to the fact that the proposal above ties intervention to movement into a position between the in-situ *wh* and C. The data we have seen so far is compatible with the interpretation of *wh*-in-situ being interrupted by (a) *any* quantification or (b) λ -binders of quantifiers in *derived* positions. Here we offer an argument to tease these two potential explanations apart.

Our proposal predicts that quantifiers that are base-generated high and can be interpreted in their base positions would not be interveners.⁷ In example (22), this is shown to be the case using the adjunct ‘only on Tuesdays,’ which unlike arguments, can be base-generated in a high position and does not require movement out of a low *vP* position (see section 2.1).

(22) **Temporal modifiers base-generated high do not cause intervention:**

- ✓ Taro-wa kayoubi-ni-dake nani-o tabe-ru-no?
 Taro-TOP Tuesday-on-ONLY what-ACC eat-NONPAST-Q
 ‘What does Taro eat only on Tuesdays?’

We observe that this adjunct does not cause an intervention effect, supporting hypothesis (b), that it is specifically quantificational material interpreted in a derived position that triggers intervention, over hypothesis (a), that simply any quantificational material triggers intervention.

4 Conclusion

Intervention effects have been the subject of a large and growing body of literature over the past 30 years. Previous work offered rigid descriptions of the set of interveners — be it as related to the semantics of focus (Kim 2002, Beck 2006, Beck and Kim 2006), quantification (Beck 1996), topichood (Grohmann 2006), prosody (Tomioka 2007), (anti-)additivity (Mayr 2014), or semantic type-mismatch (Li and Law 2016). We argued here that these descriptions will all necessarily fall short of the desired result.

Instead, we argued that intervener-hood is crucially tied to a (potential) intervener’s scope position at LF: Following Kotek 2017, interveners are those elements which *move* into a scope position that separates an in-situ *wh*-phrase from the interrogative complementizer that must interpret it at LF, and which *cannot* move out of the way. A (potential) intervener can evade intervention by moving out of the way in one of two ways: (a) some quantifiers are able to reconstruct to a base-position below *wh*-in-situ, and (b) some quantifiers are able to scope above interrogative C and quantify into the question. In addition, as has been widely observed, *wh*-in-situ can evade intervention through scrambling above the intervener. We conclude that all DPs in a derivation act as potential interveners, and their precise nature as interveners or non-interveners in a particular derivation will be tied to their possible syntactic positions at LF and the reflexes of their interpretation. It follows that the goal of a theory of intervention is not to pre-classify quantifiers as interveners or non-interveners, but instead to consider the scope-taking possibilities of all potential interveners.

⁷We thank Paloma Jeretić (p.c.) for suggesting this prediction and to Yohei Oseki (p.c.) for initial discussion.

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