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A Semantic Account of Matrix Scope of a *wh*–phrase in a *wh*–island in Korean and English*,**

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Wee, Hae–Kyung. 2019. A semantic account of matrix scope of a *wh*–phrase in a *wh*–island in Korean and English. *Korean Journal of English Language and Linguistics* 19–4, 644–667. This study investigates possibility of matrix scope interpretation of a wh–phrase occurring in a wh–island clause, with two types of predicates in Korean, i.e., *alta* 'know' and *kwungkumhata* 'wonder', in comparison to its English counterpart where a *wh*–phrase is extracted from a wh–island. It is shown that i) in the out–of–the–blue context, *alta* does not readily allow matrix scope of an embedded wh–phrase in Korean whereas *know* allows extraction of a wh–phrase out of the embedded wh–clause in English, but in a proper context, Korean also allows a wh–phrase to have the matrix scope interpretation just like English, ii) different acceptabilities of the interrogatives with a degree wh–phrase occurring in a wh–island with these two verbs in Korean can be accounted for by the semantic analysis proposed for English by Abrusan (2014), which is based on different satisfactions of exhaustifiability conditions resulting from different semantic properties of the two verbs, and iii) due to different semantic and presuppositional properties of *know* and *wonder*, *know* more strictly prohibits a wh–phrase from having the matrix scope out of an embedded wh–clause than *wonder* not only for degree wh–phrases but also for non–degree wh–phrases.

Keywords: wh–island, scope ambiguity, scope of wh–phrase, strong exhaustivity, responsive verb, rogative verb, semantics of embedded question, degree wh–question

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I. Introduction

In English, some wh-phrases can be extracted from an embedded interrogative clause but some others cannot, as shown by the contrast in (1a) and (1b):

(1) a. Which bottle of water do you know whether you should drink?
b. *How much water do you know whether you should drink?

Both (1a) and (1b) violate the locality syntactic constraint that prohibits extraction of a wh-phrase out of a wh-island. But only (1b) observes this syntactic constraint while (1a) allows extraction of wh-phrase out of the *whether* clause. For this distinction, a syntactic account such as Rizzi (1990) relies on the notion of 'referentiality' of the extractee. Referential wh-phrases as in (1a) can and non-referential ones as in (1b) cannot be extracted from the embedded wh-clause. The notion of 'referentiality', however, is hard to precisely define as discussed in the literature (cf. Cresti 1995, Rullman 1995, Szabolsci and Zwarts 1993 among others). Especially, an important problem is that 'referentiality' cannot solely account for the contrastive acceptability between (1b) and (2):

(2) How much water do you *wonder* whether you should drink?

This contrast of (1b) and (2) illustrates the importance of the type of predicates in (dis)allowing wh-extraction out a wh-island. In this respect, Lahiri (2002) distinguishes *know*-class verbs from *wonder*-class verbs, and calls the former *responsive predicates* and the latter *rogative or inquisitive predicates.* Recently there have been increasing number of researches on semantics of different types of question-embedding predicates, e.g., Abrusan (2014), Uegaki (2015, 2016) and Ciardelli and Roelofsen (2015), and also on embedded questions in general, e.g., Spector and Egré (2015), Uegaki (2015), Theiler, Roelofsen and Aloni (2018), adding on earlier pioneering works on this issue, e.g., Karttunen (1977), Groenendijk and Stokhof (1984), Heim (1994), and Dayal (1996), etc.

In *wh* in-situ languages such as Korean and Japanese, on the other hand, *wh*-island related issues have drawn substantial interest as well. There was a line of research claiming that the embedded object wh-phrase *mwuess* 'what' in (3) cannot take matrix scope and can only be interpreted as having the embedded scope (3a), e.g.,

Nishigauchi (1990, 1999), Watanabe (1992), and Choe (1995).

(3) John-un [Mary-ka **nwuess-ul** sass-nu-nci] mwuless-eo-Ø?
John-Top [Mary-Nom what-Acc bought -Q] asked-Ender-Q?
a. 'Did John ask what Mary bought *t*?'
b. *'What did John ask whether Mary bought *t*?'

More recently, however, there has been a contrasting view that a matrix scope reading is available with a proper prosodic pattern (e.g., with deaccentuation or F_0 suppression of the shaded part) for question like (4), e.g., Deguchi and Kitagawa (2002), Kitagawa and Fodor (2003), and Kitagawa (2005).

(4) John-wa [Mary-ga NAni-o katta-kadouka] shiritagatte-iru-no?
-Top -Nom what-Acc bought-$Comp_{Wthr}$ want.to.know-$Comp_{Wh}$
'What$_1$ does John wonder [whether Mary bought t_1]?'
(Watanabe 1992: 256-257, 263)

Considering that prosody is a reflection of the context of utterances, this observation suggests that with a proper context the wh-phrase can have the matrix scope, not obeying the wh-island constraint contra the earlier authors aforementioned.

Unlike inquistive verbs like *mutta* 'ask' or *kungkumhata* 'wonder', responsive verbs like *alta* 'know', however, seem to be more strongly prohibited from having the matrix scope reading in Korean as in (5). In contrast, the corresponding expressions with *kungkumhata* 'wonder' allows matrix scope interpretation as in (5')[1].

(5) Ne-nun [enu sangca-lul perieyaha nu-nci}] **a-ni**?
a. you-Top which box-ACC should.discard-Q_{wh} know-$Q_{polarity}$
'(Lit.)Do you know which box you should discard?'
b.*/?you-Top which box-ACC should.discard-Q_{whthr} know-Q_{wh}
'Which box do you know whether you should discard?'

[1] The same phenomenon exhibited in Korean Kyengsang dialects, which have two different Q markers, -no for a wh-question and -na for a polarity-question, is discussed in Park and Wee (2019).

(5') ne-nun [enu sangja-lul perieyaha nu-nci}] **kwungkumha**-ni?
a. you-Top which box-ACC should.discard-Q_{wh} wonder -$Q_{polarity}$
'(Lit.) Are you wondering which box you should discard?'
b. you-Top which box-ACC should.discard-Q_{whthr} wonder -Q_{wh}
'Which box do you wonder whether you should discard?'

The contrastive acceptability between (5) and (5') in Korean should be also explored based on the difference between the responsive predicates and inquisitive predicates, in parallel with the contrast seen in English (1b) and (2). Inquisitive verbs such as *wonder* more easily violate the wh-island constraint than responsive predicate like *know* in both languages. Abrusan(2014) proposes a semantic account for these contrasts between (1a) vs. (1b) as well as (1b) vs. (2) based on different *semantic properties* of two types of predicates, i.e., *know* and *wonder,* which I adopt for explaining the contrastive acceptabilities of Korean interrogatives, too.

One difference observed between the two languages is that the matrix scope reading of wh-phrases with verb *alta* 'know' in Korean is unavailable as in (5b) whereas the English counterpart allows wh-phrase to be extracted from a wh-island in English as in (1a). This seems to suggest that Korean more strictly obeys the *wh*-island constraint than English. This is unexpected, if we adopt a semantic account as in Abrusan(2014), assuming that a semantic analysis should be valid to both languages. This study attempts to solve this problem and show that the same semantic analysis is in fact valid to both English and Korean in spite of the seeming difference.

Specifically, this study i) investigates the difference of acceptability observed between English wh-question extracted from a wh-island as in (1a), on the one hand, and Korean wh-question with matrix scope interpretation in a wh-island clause as in (5), on the other hand, occurring with the predicate *know* and ii) argues that in fact the same semantic account is applicable to both languages by showing that the same tendency is valid in both languages. This tendency is that a *know*-type predicate very restrictively allows wh-island violation, i.e., only when provided with a proper context, and a *wonder*-type predicate more freely allows wh-island violation than *know* in both languages, notwithstanding the seeming difference of acceptability between the two languages. This analysis is based on the semantic account of Abrusan (2014) where the contrast of acceptability of interrogatives involving these two verbs is explained by relying on availability of strongly *exhaustivite* answers to wh-questions in the sense of Groenendijk and Stokhof (1984).

Section 2 introduces the semantic account proposed by Abrusan (2014) for the contrastive acceptability of degree vs. individual wh-phrases seen in (1a) and (1b) involving two different types of question-embedding predicates, *know* vs. *wonder.* Section 3 shows that the same analysis is valid in accounting for the different acceptability observed above in Korean. Section 4 shows that in the out-of-the-blue context, *know* more strictly prohibits the wh-phrase from having the matrix scope than *wonder*, not only for degree wh-phrases but also for non-degree wh-phrases, due to different semantic and presuppositional properties of *know* and *wonder*. Section 5 is the conclusion.

2. Acceptability of Questions and Exhaustive Interpretation

2.1 Responsive Verb *know*

In this section, let us see i) how wh-questions extracted from *whether* clauses as in (1a) can be acceptable and ii) why the counterpart with degree *wh*-phrase as in (1b) cannot, under the semantic analysis proposed by Abrusan (2014).

Sentence 'x knows whether p' is the same as 'x knows that p ∨ x knows that ¬p'. Then, following Hamblin (1973), the meaning of a wh-question extracted from a wh-island as in (6a) is the set of possible answers as represented in (6b), adopting Karttunen (1977) style notation:

(6) a. Who does John know whether he should meet?

b. $\lambda q.\exists x[person(x) \wedge q=\lambda w.knows(w)(John_j, \lambda p.[p=\lambda w'.\ he_j \text{ should meet } x \text{ in } w' \vee p=\lambda w'.he_j \text{ should not meet } x \text{ in } w'])]$

This formula encodes a set of propositions such that *for certain x, John knows he should meet x* or *he should not meet x.* The truth condition of a sentence with a question-embedding verb *know* is defined as in (7):

(7) **know**(w)(x, Q(w)) is true iff

$\forall p \in Q(w).\forall w' \in Dox_x(w)[(\text{if } p(w)=1, \text{ then } p(w')=1) \ \& \ (\text{if } p(w)\neq 1, \text{ then } p(w')\neq 1)$,

where $Dox_x(w)=\{w' \in W:$ x's beliefs in w are satisfied in w'$\}$

This formula means that "for all propositions p, and for all doxastic worlds w' of the subject x, if p is true in the actual world w, then p is also true in x's doxastic world w', and if p is not true in the actual world w, then p is not true in x's doxastic world w', either."

Now supposing a model where the domain of individuals is the set {Mary, Jane, Sue}, the representation in (6b) should be specified as the set of propositions in (8a) and it can be represented more formally as in (8b):

(8) a. {that John knows whether he should meet Mary,
that John knows whether he should meet Jane,
that John knows whether he should meet Sue}

b. {∀w'∈Dox_j(w), (if meetM(w), meetM(w')) ∧ (if ¬meetM(w), ¬meetM(w')),
∀w'∈Dox_j(w), (if meetJ(w), meetJ(w')) ∧ (if ¬meetJ(w), ¬meetJ(w')),
∀w'∈Dox_j(w), (if meetS(w), meetS(w')) ∧ (if ¬meetS(w), ¬meetS(w')}
where meetX(w) is a notational shorthand for *John should meet X in w*.

Assuming strong *exhaustive* interpretation of Groenedijk and Stokhof (1984) for the interpretation of interrogatives, the meaning of an interrogative requires an availability of the most informative true proposition *p* as a proper answer to a question *Q* that negates all the remaining alternatives in *Q* that are not entailed by *p*, formalized as in (9).

(9) Exhaustive (complete) answer: Exh(Q)(w)=ιp[p∈Q∧p(w)∧∀p'∈Q [p⊄p'→ ¬p'(w)]]

If we suppose that the answer to question (6a) is *John knows whether he should meet Mary*, it is asserting that this is the complete true answer and the other alternatives (that are not entailed by this answer) among the set of propositions in (8a) are false, that is, *John does NOT know whether he should invite Jane* and *John does NOT know whether he should meet Sue*. This intuition can is represented as in (10b). In other words, the answer (10a) to question (6a) is equivalent to asserting (10b):

(10) a. John knows whether she should meet Mary.

b. ∀w'∈Dox_j(w).[(if meetM(w), meetM(w')) ∧ (if ¬meetM(w), ¬meetM(w'))]
and ∃w'∈Dox_j(w), (meetJ(w)∧¬meetJ(w')) ∨ (¬meetJ(w)∧ meetJ(w'))
and ∃w'∈Dox_j(w), (meetS(w) ∧ ¬meetS(w')) ∨ (¬meetS(w)∧ meetS(w')

For all doxastic worlds w' of *John*, if he should meet Mary in the actual world *w,* then he should meet Mary in his doxastic world w', and for other possible invitees, that is, *Jane and Sue,* for at least one doxastic world w' of *John*, he should have a non-factual knowledge, that is, *either* he *does not* believe that he should meet Jane, i.e., ¬meetJ(w'), although he *should* in the actual world i.e.,, meetJ(w), or he *does* believe he should invite Jane, i.e., meetJ(w'), although he should *not* in the actual world, i.e., ¬meetJ(w), which is represented in the second conjunct of the formalism in (10b). For *Sue* too, the same situation is valid as represented in the third conjunct of (10b). In this way, one can see that an exhaustive answer is obtainable in a model with individuals in the domain, resulting in wellformedness of interrogative (6a).

2.2 Degree *wh*-question with *know*

Now let us see a case involving a degree wh-phrase, which cannot move out of a wh-island as in (11a) or (1b). Since the meaning of *know whether p* is *either know p or know ¬p* as noted above, the answer to question (11a) should be based *either* i) on Mary's belief that for certain degree *d,* she *should be* at least d-tall *or* ii) on Mary's belief that for certain degree *d,* she does *not* have to be d-tall, which is represented as in (11b).

(11) a.*How tall does Mary know whether she should be?

b. $\lambda q.\exists d\ [d\in D_d \wedge q=\lambda w.\text{know}(w)(\text{Mary}, \lambda p.[p=\lambda w'.\text{she}_m \text{ should be d-tall in } w' \vee p=\lambda w'.\neg \text{she}_m \text{ should be d-tall in } w'])]$

'For what d, Mary knows whether she should be (at least) d-tall?'

Since the truth of each of the alternatives *q* should be based on either p or ¬p in the above way, however, considering each side of the polarity, i.e., p side or ¬p side, a problem arises. In each way, the exhaustivity interpretation as in (9) inevitably yields logical contradiction, which turns out to be the reason for the unacceptability of (11a), according to Abrusan (2014). Let us see the reasoning in the following:

The two alternative options, *p or ¬p*, with degree expressions, enforce entailment relationships in two opposite directions: for the former case, downward entailing and for the latter, upward entailing. For instance, for the positive side *p*, if Mary *does* know whether she should be 180cm, then it follows that she also knows that she should be 179cm or 178cm... (*downward entailing).* Contrarily, for negative side of *p*,

if she knows that she does *not* have to be 180cm, then she also knows that she does *not* have to be 181cm or 182cm... (*upward entailing*). Generalizing this aspect, for *positive* side of alternatives, *d* entails less than *d*, e.g., *d-1, d-2,...* but not greater than d, and for *negative* side, *d* entails more than *d*, that is, *d+1, d+2,* ... but not less than *d*. Let us convert this interpretation into a formal representation.

The set of propositions represented in (11b) for the unacceptable question (11a) can be specified as (12a). A more formal represention is in (12b).

(12) a. {that Mary knows whether her height should be d_1,
that Mary knows whether her height should be d_2,
that Mary knows whether her height should be d_3 ... etc., for all degrees d in D}

b. $\{\forall w' \in Dox_M(w), [\text{if } d_1(w)=1, d_1(w')=1] \wedge [\text{ if } \neg d_1(w)=1, \neg d_1(w')=1]$
$\forall w' \in Dox_M(w), [\text{if } d_2(w)=1, d_2(w')=1] \wedge [\text{ if } \neg d_2(w)=1, \neg d_2(w')=1]$
$\forall w' \in Dox_M(w), [\text{if } d_3(w)=1, d_3(w')=1] \wedge [\text{ if } \neg d_3(w)=1, \neg d_3(w')=1]\}$
where $d_n(w)$ is a notational shorthand for Mary's height should be d_n in w.

Suppose that the answer for this question is the second alternative in (12a) or (12b), that is, *Mary knows whether her height should be* d_2. Then, the answer can be represented as in (13) in the same fashion as (10b).

(13) $\forall w' \in Dox_M(w), [\underline{\text{if } d_2(w)=1, d_2(w')=1}] \wedge \underline{\underline{[\text{if} \neg d_2(w)=1, \neg d_2(w')=1]}}$
and for any $d' < d_2$, $\exists w' \in Dox_M(w), \underline{(d'(w)=1 \wedge \neg d'(w')=1)} \vee (\neg d'(w)=1 \wedge d'(w')=1)$
and for any $d'' > d_2$ $\exists w' \in Dox_M(w), (d''(w)=1 \wedge \neg d''(w')=1) \vee \underline{\underline{(\neg d''(w)=1 \wedge d''(w')=1)}}$

The first conjunct represents the information that for all doxastic worlds w' of *Mary,* if she should be d_2-tall in the actual world *w*, then she should be d_2-tall in her doxastic world w', too. Because this should be the strongly exhaustive answer, the second and the third conjuncts should be satisfied, too, which are stating that for other degrees, less or greater than *d*, she has a non-factual belief. That is, either she believes that she *should be* that tall although it is *not the fact* in the actual word, or contrarily she believes that she *should not* be that tall, although it *is* the case in the actual world. These are stated by the second and the third conjuncts in the semi-formalism (13).

However, this yields a logical contradiction. Let us see how it is the case by considering an exemplary case. Let us assume the variable *d*'s in (12) as actual numbers

as in (12'a). Then this should be represented as the formal expressions in (12'b):

(12') a. {that Mary knows whether her height should be 179cm,
that Mary knows whether her height should be 180cm,
that Mary knows whether her height should be 181cm}

b. {$\forall$w'$\in$Dox$_M$(w), [if 179(w)=1, then 179(w')=1]$\wedge$[if $\neg$179(w)=1, then $\neg$1790 (w')=1]
$\forall$w'$\in$Dox$_M$(w), [if 180(w)=1, then 180(w')=1] $\wedge$ [if $\neg$180(w)= 1, then $\neg$180(w')=1]
$\forall$w'$\in$Dox$_M$(w), [if 181(w)=1, then 181(w')=1] $\wedge$ [if $\neg$181(w)= 1, then $\neg$181(w')=1]}
where N(w) is a notational shorthand for Mary's height should be N in w.

And now suppose that the answer to the question (11a) is the second alternative in (12'), that is, *Mary knows whether she should be 180cm*. Then, this answer should be represented as in (13'):

(13') $\forall$w'$\in$Dox$_M$(w) ([if 180(w)=1, then 180(w')=1] $\wedge$ [if$\neg$180(w)=1, then $\neg$180(w')=1])
and $\exists$w'$\in$Dox$_M$(w) ([179(w)=1$\wedge\neg$179(w')=1] $\vee$ [$\neg$179(w)=1$\wedge$179(w')=1])
and $\exists$w'$\in$Dox$_M$(w) ([181(w)=1$\wedge\neg$181(w')=1]$\vee$[$\neg$181(w)=1$\wedge$181(w')=1])

As discussed, the answer should be based *either* on Mary's *positive* belief for 180cm *or* her *negative* belief for this height, that is, either i) *Mary know she should be 180cm tall* or ii) *Mary knows she doesn't have to be 180cm tall*. But both of these two possibilities lead to logical contradiction for the following reasons:

Let us suppose the first case i). This corresponds to the underlined formula in the first conjunct in (13'), that is, [if 180(w)=1, then 180(w')=1]. This means that in the actual word *w* Mary should be 180cm tall, and she also knows this fact in her belief world *w'*. Given that she has this knowledge, it logically follows that she also knows that she should be 179cm tall, too, which is a downward entailment. In other words, it is not logically possible that she *knows* that she should be 180cm tall and she *does not know* that she should be 179cm tall simultaneously. However, the underlined formula in the second conjunct in (13'), that is, 179(w)=1$\wedge\neg$179(w')=1, enforces the contrary situation in which she does *not* know she should be 179cm (in w'), although it should *be* the case in the actual world *w*. This thus yields logical contradiction.

Now consider case ii) above, which is the case when the answer is based on the

double underlined part in (13'), that is, if ¬180(w)=1, then ¬180(w')=1. This represents the case that *Mary knows she doesn't have to be 180cm tall,* which means that in the actual world *w* Mary is not required to be 180cm tall, and she also *knows* this fact (in her belief world w'). Given this knowledge, it logically follows that she also knows that she is not required to be 181cm tall, too, due to an upward entailment. In other words, it is not logically possible that she *knows* that she doesn't have to be 180cm tall, while she *does not know* that she doesn't have to be 181cm tall. However, the double-underlined formula in the third conjunct in (13'), (¬181(w)=1∧181(w')=1), enforces such a situation in which she believes that she should be 181cm (in world w'), i.e., 181(w')=1, although it is not the case in the actual world *w*, i.e., ¬181(w)=1. And this is contradictory to the logical consequence following from the upward entailment of the negative side.

When the second conjunct in (13'a) that *Mary knows whether her height should be 180cm* is *p,* denial of all the other alternatives in set A, which is represented in the first and the third conjuncts in (13'a) (i.e., that Mary knows whether her height should be 179cm and that Mary knows whether her height should be 181cm) is not consistent with the answer proposition *p*, as have been shown so far.

So, both cases in i) and ii) above, which could serve as possible bases on which the answer could be evaluated as an exhaustive true answer to the question at hand, turn out to be contradiction. Hence, there is no maximally informative answer available that can negate all the other alternatives not entailed by that answer, that is, no true answer that can satisfy *strong exhaustivity condition* in (9). This explains why a question with degree *wh*-phrase and predicate *know* in (10a) cannot be a wellformed expression. It is due to this semantic incompatibility discussed so far.[2]

2.3 Degree *wh*-question with Inquisitive Verb *wonder*

Now, let us see how inquisitive verb *wonder* allows extraction of a wh-phrase from a wh-island. Abrusan (2014) discusses the following example to illustrate how degree wh-question with question-embedding predicate *wonder* can be a well-formed

[2] This analysis also conforms to Fox's (2007) generalization regarding non-exhaustifiability condition as follows:

Fox's (2007) generalization

Let p be a proposition and A a set of propositions. p is nonexhaustifiable given A: [NE(p)(A)] if the denial of all alternatives in A that are not entailed by p is inconsistent with p.

(i) [NE(p)(A)] ↔ p&∩{¬q: q∈A&¬(p→q)}=∅

interrogative expression.

(14) How many kilograms are the boxers wondering whether it is worth losing next year (in order to have a better chance to win)? (Abrusan 2014, p. 160)

Following Kartunnen (1977) and Guerzoni and Sharvit (2004), Abrusan regards the lexical meaning of *wonder* as 'want to know', which is semantically represented as follows:

(15) wonder(w) (x, Q(w)) is defined iff $\neg\forall p\in Q(w)$, x believe p.
If defined, wonder (w) (x, Q(w)) is true iff $\forall p\in Q(w)$, x wants-to-know whether p in w.

According to Guerzoni and Sharvit (2004), the lexical semantics of *wonder* is paraphrased as 'want to know' and thus *inquisitive* verbs like *wonder* and *ask* are different from *know* type verbs in that they have more complex lexical semantics, that is, an extra intentional layer of a buletic component 'want' as well as a doxastic one 'know'. Using this meaning of *wonder* and adopting Hintikka-style (1976) semantics for attitude verbs, sentence 'x wants to know whether p' is expressed as follows:

(16) 'x wants-to-know whether p in w' is true in w iff
for $\forall w'\in Bul_x$ (w), if p(w)=1, x knows p in w' and if p(w)=0, x knows $\neg$p in w',
where Bul_x (w)={w'∈W: x's desires in w are satisfied in w'}

This formula means 'in every world *w* in which x's desires are satisfied, if p, then x knows that p, and if $\neg$p, then x knows that $\neg$p'. Given this interpretation of *wonder*, question in (17a) with an extracted wh-phrase out of the wh-island can be represented as the set of propositions in (17b):

(17) a. How many pounds are the boxers wondering whether to lose next year?
b. $\lambda q\exists d$ [$d\in D_d \wedge q=\lambda w.$wonder(w)(the boxers, $\lambda p.[p=\lambda w'.$ lose at least d pounds in w' $\vee$ $p=\lambda w'.\neg$lose at least d pounds in w'])]

The set described in (17) can be specified as follows:

(18) {that the boxers are wondering whether to lose d_1 pounds,
that the boxers are wondering whether to lose d_2 pounds,
that the boxers are wondering whether to lose d_3 pounds, etc.,
for *d* in D_d}.

More formally, this can be represented as:

(19) {$\forall w' \in Bul_M(w)$, if d_{1w}, boxers know d_1 in w' $\wedge$ if $\neg d_{1w}$, boxers know $\neg d_1$ in w',
$\forall w' \in Bul_M(w)$, if d_{2w}, boxers know d_2 in w' $\wedge$ if $\neg d_{2w}$, boxers know $\neg d_2$ in w',
$\forall w' \in Bul_M(w)$, if d_{3w}, boxers know d_3 in w' $\wedge$ if $\neg d_{3w}$, boxers know $\neg d_3$ in w', etc.
for all intervals in D_d}
where d_{nw} is notational shorthand for 'the boxers should lose at least d_n pounds in w'.

The alternative answers in (19) are not entailed by any other alternatives, which enables a maximally informative true answer to obtain. For instance, the answer that *the boxers are wondering whether they have to lose 3 pounds* does not entail the alternative answer that *the boxers are wondering whether they have to lose more or less than 3 pounds*. The boxers' knowledge does not belong to the actual world but their buletic worlds, which does not cause failure of the exhaustification condition in (9). Or put differently, the extra universal attitude that 'x wants to know whether p' is not identical to 'x wants to know that p or x wants to know that not p', whereas 'x knows whether p' is equivalent to 'x knows that p or x knows that not p', as also noted in Abrusan. Considering this analysis of semantics of *wonder,* it can be concluded that the fundamental difference of *wh*-islands with verb *wonder* and those with *know* is that the former has an extra intentional layer, i.e., not only a doxastic component 'know' but also a buletic one 'want', under the assumption that the meaning of *wonder* is equivalent to 'want to know' as suggested by Guerzoni and Sharvit. The extra lexical modal component enables the island violation to be obviated. Because of this difference, *wonder* type verbs can allow the most informative true answer more readily.

So far we have reviewed Abrusan's (2014) semantic analysis on the different grammaticality between wh-island interrogatives occurring with responsive predicate *know* and those with inquisitive predicate *wonder.* We saw that a degree wh-phrase with verb *know* cannot have a matrix scope reading whereas that with verb *wonder* can because the former cannot satisfy the strong exhaustivity condition whereas the latter can. In the next section, let us examine Korean examples.

3. *alta* 'know' vs. *kwungkumhata* 'wonder' in Korean

In this section, I will argue that the same analysis can be applied to Korean examples, too.

3.1 *alta,* 'know' in Korean

Consider again the contrast of acceptability of (5) with *alta* 'know' and (5') with *kungkumhata* 'wonder' in Korean.

(5) Ne-nun [enu sangca-lul perieyaha nu-nci}] a-ni?
a. you-Top which box-ACC should.discard -Q_{wh} know-$Q_{polarity}$
'(Lit.)Do you know which box you should discard?'
b.*/?you-Top which box-ACC should.discard -Q_{whthr} know-Q_{wh}
'Which box do you know whether you should discard?'
(5') ne-nun [enu sangja-lul perieyaha nu-nci}] **kwungkumha**-ni?
a. you-Top which box-ACC should.discard-Q_{wh} wonder -$Q_{polarity}$
'(Lit.) Are you wondering which box you should discard?'
b. you-Top which box-ACC should.discard-Q_{whthr} wonder -Q_{wh}
'Which box are you wondering whether you should discard?'

As noted previously, Korean example in (5) is not as readily acceptable as the English counterpart in (1a) or (6a), repeated here.

(1) a. Which bottle of juice do you *know* whether you should discard?
(6) a. Who does John *know* whether he should meet?

As mentioned in section 1, Korean is apparently more strict in observing wh-island constraint with verb *know*, which can be violated in the English counterpart.

Notwithstanding the seeming difference of acceptability between Korean and English, I claim that this difference is not very solid, and in fact it *is* possible that question like (5) can have matrix scope wh-interpretation if given a proper context. Let us suppose a following situation for illustration:

(20) There are some boxes of fruit in a warehouse. Some boxes contain rotten fruit and they should be discarded. For some of these boxes, I can figure out without checking inside whether they contain rotten fruit and thus whether they have to be discarded or not.

In such a context as in (20), suppose that I uttered sentence (21A).

(21) A: na-nun icung-e etten sangja-nun pelyeyaha-nunci an-pelyeto toy-nunci imi al-a.
I Top these among some box Top should discard Q_{whthr} or not may discard Q_{whthr} already know.
'As for some boxes among these, I already know whether I should discard them or not (without checking inside).'
B: enu sangja-lul pelyeya ha-nunci al-a?
which box-ACC should discard Q_{whthr} know-Q_{wh}
'Which box do you know whether you should discard?'
B': enu sangja-~~lul pelyeya ha- nunci al-a~~?
which box-ACC should discard Q_{whthr} know-Q_{wh}
'Which box ~~do you know whether you should discard~~?'

Assuming the above context, the matrix scope reading of *enu sangja* 'which box' in (21B) as a response to A's previous utterance becomes more acceptable compared to the out of the blue question in (5). Then why is it hard to get a matrix wh-scope without a context? The reason I would like to suggest for this question is as follows:

Korean Q morpheme *-nunci* is ambiguous, either interpreted as general *wh*-Q marker or as *whether*-Q marker as illustrated in the following:

(22) a. na-nun nuka oass-**nunci** molu-nta.
I TOP who came **Q_{wh}** not-now DEC
'I don't know who came.'
b. na-nun sumi-ka cip-e iss-**nunci** molu-nta.
I TOP sumi-NOM home-LOC be **Q_{whthr}** not-know DEC
'I don't know whether Sumi is at home.'

The contrastive scoping structures between *wh*-Q and *whether*-Q interpretations of *-nunci* in (5a) and (5b) can be schematized in the following patterns:

(23) a. embedded *wh*-scope: [[*wh*....-Q_{wh}] Q_{pol}]
b. matrix *wh*-scope: [wh_x [..x.. Q_{whthr}] Q_{wh}]

When the *wh*-phrase 'which box' remains in the embedded scope as in (23a), the embedded clause is interpreted as a wh-question and the matrix clause as a polarity question. In contrast, when the wh-phrase is interpreted as matrix scope, the embedded clause becomes a *whether* question and the matrix clause a wh-question. Although both readings are possible, the matrix scope reading is hard to get because it requires a specific presupposition that is not needed for embedded scope. Only when an existential information is available in the previous discourse (and also with a proper prosody) as in (21A), the matrix interpretation becomes available. The first utterance in (21A) suggests that there are some boxes such that the speaker knows whether she should discard them or not.

This can be explained by assuming the scopal parallelism along the lines of that originally proposed for ellipsis in Fox and Lasnik (2003) and Griffiths and Liptak (2014) and others as follows:

(24) Scopal Parallelism in ellipsis
Variables in the antecedent and the elided clause are bound from parallel positions.

Note that it is possible to utter this question with TP elided as in (21B'). Uttered in this particular context, wh-phrase, *enu sangja* 'which box', can be understood as a remnant of the TP ellipsis. The existential sentence that is available from (21A) is that 'there are some boxes such that I know whether I should discard them or not'. From this proposition, the LF representation in (25A) is obtained where a specific indefinite NP takes sentential scope, and thus *some box* raises to a position external to TP at LF (May 1985), leaving a variable in the base-generated position. This variable is then bound by a TP-adjoined λ-operator (Heim and Kratzer 1998) as in (24A).

(25) A: [some_box$_1$ λx$_1$ ([$_{TP}$ I know whether I should discard x$_1$])
B: [which_box$_1$ λx$_1$ ([$_{TP}$ I know whether I should discard x$_1$])
B': [which_box$_1$ λx$_1$ ([$_{TP}$ ~~I know whether I should discard x$_1$~~])

The *wh*-fragment in (21B') gets available by satisfying the scope parallelism in (24). The matrix scope of wh-phrase can be also explained in a parallel fashion. LF

representation in (25B), satisfying the LF-isomorphism with (25A), can allow both the *wh*-fragment and the matrix *wh*-scope. The availability of the matrix scope reading due to fragmenting can be understood in the same vein as the matrix reading associated with a proper prosodic pattern in (4) discussed in Deguchi and Kitagawa (2002), Kitagawa and Fodor (2003), and Kitagawa (2005). Assuming that eliding is the extreme version of prosodic deaccentuation (i.e., F_0 compression between the wh-phrase and the matrix complementizer), it is plausible to infer that the matrix scope reading occurring with prosodic deaccentuation of the embedded clause becomes readily available by entirely not pronouncing it as well. Conclusively, only when the presupposition that can satisfy the scope parallelism is available, can the matrix scope of wh-phrase be also available in Korean. This explains its seeming unavailability when uttered out of the blue.

In case of English, on the other hand, given that the wh-phrases are overtly scoped at matrix clause in (1a) and (7a), they are not ambiguous and thus acceptable by assuming the existential presupposition, as far as being semantically interpretable satisfying the exhuastivity condition.[3] Therefore, the possibility of eliding the entire embedded clause seems to suggest that Korean can have a matrix scope wh-interpretation like English, contrary to the non-acceptability judgment that is based on the out of the blue context as in (5). So it can be concluded that for non-degree wh-questions, the matrix scope reading of an embedded wh-phrase as in (5) becomes acceptable with a proper context just like English wh-question extracted from a *whether* clause as in (1a).

The next question is whether a degree wh-question in Korean has the same behaviour as English. Let us move on to this issue. Consider the degree wh-question (26) that corresponds to English question (12):

(26) ne-nun (khi-ka) elmana kheya ha-nun-ci a-ni?
  a. you Top (height-Nom) how tall should.be Q_{wh} know Q_{pol}
    'Do you know how tall you should be?'
  b. *you Top (height-Nom) how tall should.be Q_{whthr} know Q_{wh}
    '*How tall do you know whether you have to be?'

[3] Existential presupposition of *wonder* is provided in section 5 and I assume that verb *know* in weak island context has the same existential presupposition. The reader of a question like (1b) may automatically accommodate the existential presupposition that *there is certain bottle of water that you know you should drink.*

(26) can only be interpreted as a matrix polarity-question as in (26a), but not as a matrix wh-question with an embedded whether-clause as in (26b). (26b) is as bad as the English counterpart. This unacceptability of wh-matrix scope can be accounted for by the same analysis given for that of English degree interrogative in (11). That is, no maximally informative answer that can negate all the other alternatives not entailed by that answer is available. So there is no true answer available that can satisfy *strong exhaustivity condition* in (9). This is the reason why (26b) as well as (11) is judged unacceptable.[4]

So far, we saw that Korean non-degree and degree wh-questions with verb *alta* can be explained by the same semantic analysis for the English counterparts. In the next, let us consider a case where the same question occurs with verb *wonder.*

3.2 *kungkumhata* 'wonder' in Korean

Consider (27).

(27) ne-nun (khi-ka) elmana khe-ya ha-nun-ci kwungkumha-ni?
you Top (height-Nom) how tall should.be Q be-wondering Q
a. Are you wondering how tall you should be?
b. How tall are you wondering whether you should be?

The acceptability with the matrix wh-scope in (27b) improves to a great extent compared to (26b). This can be supported by the fact that (28), for instance, can be a possible answer to that.

(28) na-nun 180cm-ka toyeya ha-nunci-(ka) kwungkwum-hay.
I top Nom be should Q (Nom) be wondering Dec.
'I am wondering whether I should be 180cm.'

For the same reason as the English interrogative with *wonder* in (15), the matrix

[4] As one reviewer suggested, when a degree wh-phrase has an 'exactly' reading, the monotonicity effect might be avoided, which would enable a degree wh-matrix to have the matrix scope. But it is hard to conceive a situation where a wh-phrase with an 'exactly' reading for this weak island environment with verb *alta* and *know.* I would leave this issue for a future research.

scope reading of the wh-phrase for (27) is available. The answer that *I am wondering whether I have to be 180cm* does not entail any of the alternative answers, i.e., *I am wondering whether I have to be 181cm* or that *I am wondering whether I have to be 170cm*, and so on. So the answer can be considered as the most informative true answer that can negate all these alternatives, satisfying the strong exhaustivity condition in (9). Question (27b) thereby can be regarded as a semantically wellformed expression, which is a correct prediction.

In this section, we have seen that Korean matrix scope interpretation of a wh-phrase occurring with a wh-island is accounted for in the same semantic analysis proposed for English by Abrusan (2014). First, the seeming unacceptability of the matrix scope of a non-degree wh-question with *alta* can be invalidated and judged to the contrary assuming a specific context which strongly encourages the matrix scope interpretation, that is, where an existential presupposition is available, which can satisfy the scope parallelism as in (25). Second, we saw that a degree wh-phrase occurring with *alta* cannot have the matrix scope interpretation because it cannot satisfy the strong exhaustifiability condition in (9) just like English. The answer to this type of questions cannot negate all the other possible alternatives without causing contradiction, and hence it is regarded unacceptable. In contrast, degree wh-phrases with *kwungkumhata* can be answered by a proposition that can satisfy exhaustifiability condition without causing contradiction, and hence it should be judged acceptable.

Now, the remaining problem is why non-degree wh-questions with *wonder* in (5'b) can be judged better than those with *know* in (5b) in the out-of-the-blue context.

(5) Ne-nun [enu sangca-lul perieyaha nunci}] a-ni?
  a. you-Top which box-ACC should.discard -Q_{wh} know-Qp_{pol}
    '(Lit.)Do you know which box you should discard?'
  b.*/?you-Top which box-ACC should.discard-Q_{whthr} know-Q_{wh}
    'Which box do you know whether you should discard?'

(5') ne-nun [enu sangja-lul perieyaha nunci}] **kwungkumha**-ni?
  a. you-Top which box-ACC should.discard-Q_{wh} wonder Q_{pol}
    '(Lit.) Are you wondering which box you should discard?'
  b. you-Top which box-ACC should.discard-Q_{whthr} wonder Q_{wh}
    'Which box do you wonder whether you should discard?'

In the next section, we move on to this issue.

4. Presupposition of *wonder*

For the answer to the question of why *kwungkumhata* 'wonder' more readily allows matrix scope than *alta* 'know', I would like to propose an explanation based on the semantic and presuppositional difference between *wonder* and *know.*

As noted already, the two verbs, *know* and *wonder,* are different in the kinds of the complement that they can take. *Know,* as a responsive verb, can take both declarative and interrogative complements whereas *wonder,* as a rogative verb, can only take interrogatives. In other words, *wonder* is fundamentally a question-taking verb. To explain this semantic property of *wonder,* i.e., the fact that it cannot embed declarative complements, Uegaki (2015, 2016, 2019) and Ciardelli and Roelofsen (2015) provide a following line of analysis for expression 'x wonders Q'.

(29) $[[\text{wonder}]]^w(Q)(x)=1$ only if
(i) there is some $p \in Q$ such that x neither believes p nor believes $\neg p$
(ii) x believes that there is some $p' \in Q$ that is true[5]

These two conditions are part of the semantic meaning of *wonder* with an embedded clause. These two conditions specify the information that *wonder* must embed a set Q consisting of at least two propositions, one proposition p whose truth value is unknown to the subject x of *wonder* as stated in (29i) and another proposition p' that must be true in the subject x's belief as stated in (29ii).

In contrast, *know,* as a responsive verb, does not have such a presupposition. It does not require that the complement should be an interrogative that presupposes existence of a true proposition. Even when embedding a wh-question, *know* does not require that the subject believes that there exists a true proposition unlike *wonder,* as shown by the contrast in (30).

[5] In 2.3, definition of 'wonder' by Abrusan is provided. The first sentence in (15) is the precondition for the definition of *wonder,* that is, 'wonder(w) (x, Q(w)) is defined iff $\neg\forall p \in Q(w)$, x believe p'. This means that the subject does not believe all alternatives of the question. In other words, there is at least one alternative proposition that the subject does not believe. This amounts to the same meaning as statement (29i). But in Abrusan's precondition, the second statement (29ii) is not present, which is the essential part for the existential presupposition.

(30) a. John knows who came. He does not believe somebody came.
b. John wonders who came. #He does not believe somebody came.

The acceptability of the second sentence of (30a) indicates that *know* does not require that the subject believe that there is a true proposition that can answer the embedded wh-question. In contrast, the same sentence cannot follow the sentence with *wonder.* As discussed, *wonder* requires that the subject believe existence of a true proposition, and thus it cannot be followed by the sentence that nullifies it as shown by unacceptability of (30b). The interrogative versions of these sentences can show the same point as follows:

(31) a. A: Do you know who came?
B: Yes, I do. I do not believe somebody came.
b. A: Do you wonder who came?
B: Yes, I do. #But I do not believe somebody came.

(31a) is good, but (31b) sounds weird. A question and the answer with *wonder* should be felicitous only when the speaker assumes that the subject believes existence of a true proposition as specified in (29ii). The content of the question like (31b) with *wonder* is asking whether the hearer accepts both parts of (29), that is, whether B accepts the existential presupposition as well as that the true proposition is unknown to the subject. So once speaker B responds with a positive answer as in (31bB), it means that speaker B accepts both presuppositions. As far as B answers 'yes', it cannot be followed by a statement that nullifies the existential presupposition as in (31bB). The fact that answering 'yes' means accepting these presuppositions of the question indicates that the question itself suggests these presuppositions.

Applying this analysis into the matrix scope reading in example (5'), condition (29i) evokes the presupposition that there are some boxes that you do not know whether you should discard or not, and (29ii) corresponds to the presupposition that you believe that there are some boxes that you know whether you should discard. In other words, the verb *wonder* has this existential information as presupposition. So when uttered, the question with verb *wonder* can enable the hearer to accommodate this presupposed information. Hence, even without a specific context provided, the fact that *wonder* is used as the main verb enables the hearer to assume a context where these two pieces of information in (29i) and (29ii) are presupposed. This presupposition as

a part of the meaning of *wonder* enables the hearer to imagine a situation where the answer to this question can satisfy the strong exhaustivity in (9), since this question should be understood as a means of seeking for the identity of the existing proposition guaranteed by the meaning (29ii) of *wonder*. Due to this, although this matrix scope interpretation is not the default reading just like the case with *know* as discussed in section 3.1, this interpretation still can be considered as a possible interpretation since the meaning of main verb *wonder* inherently guarantees that this question can be answered by a proposition that satisfies the exhaustivity.

Therefore, without a context where a true proposition that can satisfy the strong exhasutivity is guaranteed to exist, the matrix scope reading of a wh-phrase with *alta* in (5a) is not readily available. But with *kwungkumhata*, even without such a context provided, the existential presupposition is readily accommodated, since it is already implied by the meaning of the verb, and enables an answer that can satisfy the exhaustivity condition to be available. This difference of the lexical meaning of *wonder* and *know* thus can explain the difference of acceptability of (5) and (5') uttered out of the blue.

In contrast, in English, the scope of the wh-phrase is overtly expressed, and thus question like (1a) can be judged acceptable without such a context as in Korean (21B).

(1) a. Which bottle of water do you know whether you should drink?

So now we can conclude that assuming the same presuppositional difference between Korean verbs *kwungkumhata* and *alta* as *wonder* and *know* suggested in (29), the better acceptability of matrix scope of wh-phrase with *kwungkumhata* is due to the existential presupposition as a part of its meaning, which lacks in *alta*.

5. Conclusion

In this study, I have tried to show why some wh-questions can have the matrix scope out of the embedded clause, whereas some others cannot, as exemplified by the contrast in (5) and (5') in Korean in comparison to the English counterparts. First, we saw that *alta 'know'* does not allow matrix scope of the wh-phrase occurring with a wh-island clause in the out-of-the-blue context in Korean, but I showed that in a

proper context like (21), that is, where an existential presupposition is available, which can satisfy the scope parallelism as in (25). Korean also allows a wh-phrase to have the matrix scope interpretation just like English, although it apparently looks otherwise. Second, I showed that the same semantic analysis proposed for English by Abrusan (2014), which is based on different satisfactions of exhaustifiability conditions resulting from different semantic properties of the two verbs, *know* and *wonder,* can account for different acceptability of the interrogatives with a degree wh-phrase involving these verbs in both languages. Third, in the out-of-the-blue context, verb *know* is stricter than *wonder* in prohibiting the wh-phrase from having the matrix scope out of an embedded wh-clause, not only for degree wh-phrases in (26b) and (27b) but also for non-degree wh-phrases in (5b) and (5b'), because of the different semantic and presuppositional properties of these two verbs. Verbs *wonder* and *kwungkumhata* inherently contain the meaning of the existence of a proposition that can satisfy the exhaustive interpretation as an answer to the embedded question whereas *know* and *alta* allow a declarative complement and does not require the same presupposition as part of the verb itself even when embedding an interrogative. It is argued that this difference can account for different acceptabilities of wh-matrix scope interpretations in wh-island structures of (5b) and (5b') in Korean.

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