Predictions of the Two-Grammar Hypothesis for Korean and Japanese

Abstract

We revisit Han, Lidz, and Musolino’s (2007) claim that each Korean speaker exclusively acquires one of two available grammars, either the one generating only the neg>object-QP scope with V-raising or the one generating only the object-QP>neg scope with I-lowering. This was based on the observation of bimodal distribution of speakers in acceptance of the neg>object-QP reading. We performed a new experiment with modifications to the original study, and observed some speakers’ simultaneous access to both readings. As these findings are inconsistent with the predictions of Han et al.’s two-grammar model, we propose some possible revisions to the original claim.

1. The Two-Grammar Hypothesis

Han, Lidz and Musolino (2007, HLM) set out to investigate the question of whether Korean has I-lowering or V-raising. In a head-final, agglutinative language like Korean and Japanese, the height of V and the functional heads above it is not easy to tell. To answer this question, HLM uses how object QPs are interpreted with respect to negation.\(^1\)

Adopting the assumption that there is a unique syntactic position for the direct object, HLM takes the scope reading in (1) as evidence for low negation derived by I-lowering, and the scope reading in (2) as evidence for high negation derived by V-raising. Trees are reproduced from HLM (pp. 33-34) in (3) with simplification, showing only one of the two negation types to be discussed shortly. In (3a), I lowers to V and negation cliticizes to V, giving rise to low negation, while in (3b), negation cliticizes to V, V raises to I, giving rise to high negation.\(^2\)
(1) Object QP > Neg

(2) Neg > Object QP

(3) a. 

b. 

HLM reports on an experiment using a Truth Value Judgment task (Crain and Thornton 1998) where adult Korean speakers were presented with test sentences such as (4) and (5) and asked to judge whether they were true or false in given contexts. Both sentences have direct objects with quantifier *motun* ‘every’. Sentence (4) contains so-called short form negation, which occurs preverbally, while sentence (5) contains so-called long form negation, which involves a -ci suffixed main verb and ha-support. The two potential scope readings can be paraphrased as (6) and (7).

(4) Khwukhi Monste-ka motun khwukhi-lul an mek-ess-ta. (short neg)

Cookie Monster-NOM every cookie-ACC NEG eat-PST-DECL

‘Cookie Monster did not eat every cookie.’
(5) Khwukhi Monste-ka motun khwukhi-lul mek-ci ani ha-yess-ta. (long neg)

   Cookie Monster-NOM every cookie-ACC eat-Cl NEG do-PST-DECL

   ‘Cookie Monster did not eat every cookie.’

(6) *every > not* reading (low negation): Cookie Monster ate no cookie.

(7) *not > every* reading (high negation): It is not the case that Cookie Monster ate every cookie.

   Focusing for the moment on the results of their experiment on the *not > every* reading, where participants were shown contexts that make only the *not > every* reading true, the acceptance rate was only 43%. Moreover, results on the *not > every* reading revealed a bimodal distribution of participants. We can see in figure 1 that out of 40 participants tested on this condition, 12 participants (30%) consistently accepted test sentences in this reading, while 17 participants (42.5%) consistently rejected them.

   Based on the results on the *not > every* reading (high negation), it is proposed by HLM that Korean has two grammars, one with high negation derived by V-raising, and the other with low negation derived by I-lowering. According to their proposal, Korean speakers set parameters randomly either to V-raising or to I-lowering, as the language data that they are exposed to are assumed to be impoverished and therefore compatible with either parameter setting. Roughly 50% of the population thus ends up with V-raising, while the other 50% ends up with I-lowering. In HLM’s model, for the sentences in (4) and (5), for instance, speakers of the low negation grammar are expected to obtain only the *every > not* reading in (6), and speakers of the high negation grammar are expected to obtain only the *not > every* reading in (7). A similar claim is made for
Japanese as well in Han (2008) and Han, Storoshenko and Sakurai (2004, 2008), and some of the points we will raise below for HLM’s analysis of Korean carry over to their analysis of Japanese.

Interesting corroborating facts for this model are reported in Han, Lidz and Storoshenko (to appear). In an experiment which consists of two sessions with one month in between, they found that the participants who accepted the $\text{not}>\text{every}$ reading in the first session (putative high negation grammar speakers) also accepted the reading in the second session, and those who initially rejected the reading (putative low negation grammar speakers) continued to reject it. This consistency of judgment over time is consistent with the two-grammar hypothesis.

2. **Unexpected Judgment Patterns and Entailment Relations**

The two-grammar hypothesis predicts that approximately half of the Korean-speaking population would accept sentences such as (4) and (5) as true statements only in $\text{not}>\text{every}$ contexts (where only the $\text{not}>\text{every}$ reading comes out as true), while the other half would accept such sentences as true only in $\text{every}>\text{not}$ contexts. While the former prediction was borne out, as we just saw above, the latter prediction was not borne out, as test sentences were accepted in $\text{every}>\text{not}$ contexts 98% of the time (see *figure 2*). The participants who were tested on the $\text{every}>\text{not}$ condition consistently accepted the test sentences, even though half of them are supposed to be speakers of the high negation grammar and are therefore expected to reject the sentences. In other words, the speakers of the high negation grammar, though their syntax presumably only generates the $\text{not}>\text{every}$ reading, also have access to the low negation, $\text{every}>\text{not}$ reading.
The explanation offered by HLM of this unexpected pattern has to do with the entailment relation found in the two scope readings in (6) and (7). That Cookie Monster ate no cookie (*every>*not) in (6) entails that *it is not the case that Cookie Monster ate every cookie (*not>*every) in (7). In other words, any situation that makes the stronger *every>*not reading true also makes the *not>*every reading true. Thus, according to HLM, the speakers of the high negation grammar (though their syntax only generates *not>*every) also accept a statement in an *every>*not context (where the *every>*not reading is true), because the context is consistent with the weaker *not>*every reading that their syntax generates. If Cookie Monster ate no cookie, it is not incorrect, logically speaking, to describe the situation by saying that it is not the case that Cookie Monster ate every cookie. The claim is summarized in table 1.

3. Some Predictions Made by HLM's Analysis

3.1 Removing Entailment

HLM’s analysis of the unexpected judgment pattern sketched above makes several important predictions, one of which is that removing entailment should lead to a different judgment pattern. In general, apparent scope ambiguities in HLM’s model of Korean grammar are predicted to arise for a non-syntactic reason, namely, due to two potential readings that are related to each other by entailment. In particular, speakers of the high negation grammar are expected to accept the Object QP>Neg reading in addition to the Neg>Object QP reading only when the former entails the latter, giving rise to the situation where the Object QP>Neg reading is accepted close to 100% despite the two-grammar model.
Thus, if we used sentences whose two potential scope readings are not related to each other by entailment, for instance sentences containing numeral quantifiers, it is predicted (i) that the acceptance rate of the Object QP>\neg reading would drop to approximately 50%; and moreover, (ii) that the 50% acceptance is attributable to half of the population consistently accepting the Object QP>\neg reading, while the other half consistently rejecting it.\footnote{To illustrate, the examples in (8) and (9) are potentially ambiguous between the readings in (10) and (11). As we can see in Table 2, the two readings are not related by entailment as we can find scenarios where one reading is true while the other is false, and vice versa.} To illustrate, the examples in (8) and (9) are potentially ambiguous between the readings in (10) and (11). As we can see in Table 2, the two readings are not related by entailment as we can find scenarios where one reading is true while the other is false, and vice versa.

(8) Erica-ga se-jan-eui kup-eul an dwicip-ut-ta. (short negation)
    Erica-NOM 3-CL-GEN cup-ACC NEG flip-PST-DECL
    ‘Erica did not flip three cups.’

(9) Erica-ga se-jan-eui kup-eul dwicip-ci an-at-ta.\footnote{4 (long negation)}
    Erica-NOM 3-CL-GEN cup-ACC flip-CI NEG-PST-DECL
    ‘Erica did not flip three cups.’

(10) \(3 > \text{not reading (low negation)}\): There are 3 (or more) cups that Erica did not flip.

(11) \(\text{not} > 3\) reading (high negation): It is not the case that Erica flipped 3 (or more) cups.

Section 4 outlines our experiment that is designed to test the prediction we just described above.
3.2 Suppression of Scalar Implicature Computation

Before moving on, let us point to two more predictions made in HLM’s analysis of the unexpected judgment pattern, though we have not tested them. Recall that in HLM’s analysis, if a speaker accepts the not>every reading, he or she also consistently accepts test sentences in contexts where the every>not reading is true, though this reading is not generated by their syntax. The underlying assumption here is that the latter acceptance comes about because this population consistently suppresses the computation of the scalar implicature that a speaker uttering (7) ‘It’s not that CM ate every cookie’ implicates that the stronger (or entailing) proposition (6) ‘CM ate no cookie.’ is false. The prediction then is that if this particular group of speakers are tested on scalar implicature computation in a similar experimental setting, they should show consistent suppression of scalar implicature computation. This, however, seems to go against the general results found in the literature that adult speakers, as opposed to children, almost always compute scalar implicature in experiments such as those reported in, for example, Musolino and Lidz (2002) and Papafragou and Musolino (2003).

Furthermore, HLM’s model generates apparent ambiguity for high negation grammar speakers despite unambiguous syntax. The high negation grammar speakers thus have two very different routes to accepting statements in Truth Value Judgment tasks: (i) acceptances in not>every contexts are guaranteed by syntax, and (ii) acceptances in every>not contexts are based on entailment relations and not calculating scalar implicature. It is expected then that the nature of acceptance of sentence (4) or (5) in every>not contexts by the high negation grammar speakers is predicted to align with
the nature of acceptance of the syntactically and semantically unambiguous sentence in
(12) in every>not contexts by any speaker of Korean.

(12) Khwukhi Monste-ka motun khwukhi-lul mek-ci-neun an-at-ta
      Cookie Monster-NOM every cookie-ACC eat-CI-NEUN NEG-PST-DECL

‘It’s not (the case) that Cookie Monster ate every cookie.’

4. Experimental Investigation

In sum, HLM’s claims were as follows:

(13) Approximately half of the Korean speakers (as shown by subjects who
      consistently rejected not>every reading in Neg>object QP condition in HLM’s
      experiment) have access to only every>not reading, generated by the I-lowering
      grammar.

(14) The other half of the Korean speakers (as shown by subjects who consistently
      accepted not>every reading in Neg>object QP condition in HLM’s experiment)
      have access to only not>every reading, generated by the V-raising grammar.

      These claims were based on the bimodal distribution of speakers for judgment for
      not>every reading, where half of the speakers accepted and the other half rejected the
      reading (see figure 1). However, almost all of the speakers accepted the every>not
      reading, inconsistent with HLM’s predictions. HLM attributed this pattern to the
      entailment relation between the two readings, and claimed that speakers with the high
      negation grammar have access to every>not reading not through syntax but through
      semantics. The goal of the current experiment is to test this claim by examining Korean
speakers’ judgment on sentences that contain numeral quantifiers instead of universal quantifiers, and thus whose two potential scope readings are not related by entailment.

4.1 Participants

Participants were 24 (10 males, 14 females) adult monolingual Korean speakers (mean age: 23.9 years). The participants were given monetary reimbursements.

4.2 Design

The main factor in question was scope, which determines which scope reading is true in a given context: object QP taking scope over negation, or $Q \succ neg$, versus negation over object QP, or $neg \succ Q$. For example, for sentences (15) and (16), $Q \succ neg$ meant a woman flipped three out of six cups, making the object $QP \succ neg$ reading true and making the $neg \succ object QP$ reading false (see Appendix B for all the contexts).

(15) Yeoca-ga se-jan-eui kup-eul an dwicip-ut-ta. (short neg, prenom)
   woman-NOM 3-CL-GEN cup-ACC   NEG flip-PST-DECL
   ‘The/a woman did not flip three cups.’

(16) Yeoca-ga kup se-jan-eul dwicip-ci an-at-ta. (long neg, postnom)
   woman-NOM cup 3-CL-ACC flip-Cl   NEG-PST-DECL
   ‘The/a woman did not flip three cups.’

In HLM’s experiment, each speaker was tested on only one type of reading, either $every \succ not$ or $every \succ not$, over the whole testing session; hence the scope was a between-subjects factor. In the current experiment, every speaker was tested on both types of reading (i.e., scope was a within-subjects factor). If speakers indeed had exclusive access to one of the two readings, as HLM predicted, then each speaker would accept sentences
in one of the two scope conditions, but reject sentences in the other condition. Each participant went through 8 test trials, half of which presented $Q > \text{neg}$ and the other half $\text{neg} > Q$, with the order of trials pseudorandomly counterbalanced.

There were additional factors that we examined to see whether they affect speakers’ judgment: first, type of negation used in a sentence could be either short neg versus long neg. As previously mentioned, HLM did not find evidence that varying between the two negation types affects speakers’ judgment. The current experiment sought to verify this with the new design. Each participant was presented with four test trials with short negation and the other four with long negation, with the order of the trials pseudorandomly counterbalanced.

Second, the type of numeral quantifier (quantifier from here on) used in a sentence was also manipulated. HLM only used sentences that contained prenominal motun ‘every’, but in previous literature, there have been claims that different quantifier types in Korean and Japanese generate varied scope judgments (e.g., Kwak 2010; Ochi 2012). Hence, to check whether quantifier types affect scope judgment, the current experiment used sentences that contained prenominal versus postnominal quantifiers (as in (15) and (16)). For example, the sentence ‘the girl didn’t flip three cups’ in Korean may contain either short or long negation, and either prenominal or postnominal quantifier (See Appendix A for examples). Each participant was presented with four test trials with prenominal quantifier and the other four with postnominal quantifier, with the order of the trials pseudorandomly counterbalanced.

4.3 Materials
Each trial consisted of two types of video clips: situation and sentence clips. In a situation clip, an experimenter acted out a particular action involving a set of objects. Each situation clip depicted one of the two scope conditions. Thus, for each sentence such as (15), there were two situation clips: one that showed $Q>\neg$ reading (low negation) and one that showed $\neg>Q$ reading (high negation). For example, the $Q>\neg$ situation clip for the sentence in (15) showed a woman flip three out of six cups, making the reading in (17) true and the reading in (18) false, whereas the $\neg>Q$ situation clip showed a woman flip two out of four cups, making the reading in (17) false and the reading in (18) true.

(17) $Q>\neg$ reading: There are three cups that the woman did not flip.

(18) $\neg>Q$ reading: It is not the case that the woman flipped three cups.

Each sentence clip showed a screenshot of the last scene in the preceding situation clip and a sentence caption at the bottom. The sentence could contain either the short or long negation, and either the prenominal or postnominal quantifier. Then the participant would judge whether the sentence is true, based on the previously shown situation.

4.4 Procedure

Participants were introduced to the task with one practice trial. Each participant went through 8 test and 8 filler trials in a pseudorandom order, then indicated his or her acceptance (‘yes’) or rejection (‘no’) of a given sentence after each trial on an evaluation sheet. Each participant was tested alone with no interaction from the researcher during the experiment and was debriefed after each session.

5. Results and Discussion
Our dependent measure was the acceptance rates, calculated by dividing the number of “yes” responses by the total number of responses for each condition. A repeated measures analysis of variance with 3 factors, scope ($Q>neg$ vs. $neg>Q$), negation (short neg vs. long neg), and quantifier (prenom vs. postnom), yielded significant main effect of scope ($p < .01$): subjects accepted sentences in $Q>neg$ condition ($M = 88\%$) significantly more than sentences in $neg>Q$ condition ($M = 52\%$). There was no other main effect or interaction.\(^{10}\)

Recall the prediction based on HLM’s claim: if the entailment relation between two scope readings is removed, then the acceptance rate for $Q>neg$ condition was expected to drop to approximately 50\%, since speakers with access to $neg>Q$ reading do not have access to $Q>neg$ reading. However, comparison of the acceptance rates in the scope conditions of the current experiment (figure 3) with the acceptance rates in HLM’s study (figure 2) revealed that the acceptance rates were similar: our experiment yielded a high mean acceptance rate of over 80\% for $Q>neg$, and a lower mean acceptance rate of near 50\% for $neg>Q$. Hence, the acceptance rate for $Q>neg$ condition remained high despite the removal of entailment.

Additionally, the use of the within-subjects design for scope factor allowed for analyses of responses of individual speakers to each of the two scope readings (see figure 4). According to HLM, speakers were predicted to accept one of the readings 100\% and the other reading 0\% (shown in gray in figure 4). However, the analyses revealed that most of the speakers who accepted $neg>Q$ also accepted $Q>neg$, causing the high acceptance rate for $Q>neg$. Overall, more than 40\% of the participants accepted each of
the two readings 50% of the time or more, and 17% of all the participants accepted both readings 100% of the time. Thus, there are speakers whose grammar seems to allow access to both scope readings, contrary to HLM’s claim that each speaker’s grammar has exclusive access to only one of the two readings.

As for the judgment pattern from the remaining population of speakers, interestingly, besides the speakers that accepted both readings relatively consistently (50% of the time or more), some other 42% of speakers primarily accepted only $Q>\text{neg}$ reading and accepted $\text{neg}>Q$ reading 25% of the time or less.\footnote{If the two readings indeed are derived from the syntactic processes of I-lowering and V-raising as HLM proposed, then these results may suggest that the latter group of speakers have access to only low neg reading through I-lowering. This might then suggest that the group of speakers who accepted both readings have the grammar that allows both I-lowering and V-raising and generates both scope readings. Another possibility is that there is some unknown factor that makes some speakers prefer $Q>\text{neg}$ reading over $\text{neg}>Q$, while other speakers freely access the two readings equally. In the previous literature, some experiments hinted at the possibility that speakers have varied ability to use context to resolve ambiguity in scopally ambiguous sentences, as some speakers show bias for one scope reading over the other regardless of what the semantic context suggests whereas other speakers use the semantic context to access either of the two possible scope readings (Gibson et al., 2011). It is thus possible that the speakers in the current experiment who consistently accepted the low neg but rejected the high neg reading in the current experiment simply had a bias to the low neg reading, and even though they could potentially access the high neg reading.}
reading, this particular experimental context failed to reveal that. This possibility should be verified in a future investigation.

Going back to HLM’s results, they found that speakers in $\text{neg} \triangleright Q$ condition in their experiment were divided into two groups, one that consistently accepted $\text{neg} \triangleright Q$ readings and one that consistently rejected $\text{neg} \triangleright Q$ readings. HLM claimed that the group that consistently accepted $\text{neg} \triangleright Q$ reading had access only to $\text{neg} \triangleright Q$ reading and their grammar thus had V-raising, whereas the group that consistently rejected $\text{neg} \triangleright Q$ reading, and hence presumably would accept $Q \triangleright \text{neg}$ reading, had access only to $Q \triangleright \text{neg}$ reading and their grammar thus had I-lowering. However, HLM lacked evidence to support the claim that it is the group with access to $\text{neg} \triangleright Q$ reading that would not have access to $Q \triangleright \text{neg}$ reading, because the speakers were tested on only one reading but not the other.

The current results show that HLM’s claims are not borne out, at least partially. There indeed were some speakers who seemed to have access to only the low neg and not the high neg readings of sentences with quantifier and negation, which may in theory correspond to the group of speakers that did not accept the high neg reading in HLM’s experiment. However, contrary to HLM’s prediction, there were also some speakers who had access to both high neg and low neg readings, rather than access to only high neg reading.\textsuperscript{12} Thus, the current experiment showed that HLM’s assumption that speakers who consistently accepted $\text{neg} \triangleright Q$ reading would necessarily reject $Q \triangleright \text{neg}$ reading was not on the right track, and HLM’s claim about Korean speakers’ exclusive access to one of the two grammars generated by either V-raising or I-lowering should be revisited.
6. Conclusion

This paper has shown that the prediction made by HLM was not borne out that removing an entailment relation in two potential scope readings of test sentences would lead to a substantial drop of the acceptance rate of the Object QP>Neg reading. Moreover, the within-subjects design allowed us to verify individual speakers' scope judgment behavior, which did not fit with predications made by the two-grammar hypothesis. The question remains as to why the Neg > Object QP (high negation) reading is generally 'harder to access' in Korean and Japanese, and whether the reason has to do with the grammar itself. It remains to be seen how speakers would perform if they are given contexts biased toward the high negation reading.

Appendix A: Sentence Captions
(Note: here we provide sentences with only short negation and prenominal quantifiers for the lack of space, but all four types of sentences were shown to participants across trials)

(1) Yeoca-ga se-gwon-eui chek-eul an pyul-chut-ta.
   woman-NOM 3-CL-GEN sticker-ACC NEG open-PST-DECL
   ‘The woman did not open three books.’

(2) Yeoca-ga se-gae-eui sutika-reul an tte-ut-ta.
   woman-NOM 3-CL-GEN sticker-ACC NEG peel-PST-DECL
   ‘The woman did not peel off three stickers.’

(3) Yeoca-ga se-gae-eui kup-eul an dwicip-ut-ta.
   woman-NOM 3-CL-GEN cup-ACC NEG flip-PST-DECL
   ‘The woman did not flip three cups.’

(4) Yeoca-ga ne-gae-eui issusigae-reul an buruteu-ryut-ta.
   woman-NOM 4-CL-GEN toothpick-ACC NEG break-PST-DECL
   ‘The woman did not break four toothpicks.’

(5) Yeoca-ga se-gae-eui semo-reul an chil-haet-ta.
   woman-NOM 3-CL-GEN triangle-ACC NEG color-PST-DECL
   ‘The woman did not color three triangles.’

(6) Yeoca-ga ne-gae-eui pen-eul an ssut-ta.
   woman-NOM 4-CL-GEN pen-ACC NEG use-PST-DECL
   ‘The woman did not use four pens.’

(7) Yeoca-ga se-gae-eui pen-eul an ggunet-ta.
   woman-NOM 3-CL-GEN pen-ACC NEG take out-PST-DECL
   ‘The woman did not take out four pens.’
Appendix B: Situation Clip Contexts

(9) For sentence (1): Q>Neg: Out of six books, the woman opened three books.
    Neg>Q: Out of four books, the woman opened two books.

(10) For sentence (2): Q>Neg: Out of six stickers, the woman peeled three stickers.
     Neg>Q: Out of four stickers, the woman peeled two stickers.

(11) For sentence (3): Q>Neg: Out of six cups, the woman flipped three cups.
     Neg>Q: Out of four cups, the woman flipped two cups.

(12) For sentence (4): Q>Neg: Out of eight toothpicks, the woman broke four toothpicks.
     Neg>Q: Out of six toothpicks, the woman broke three toothpicks.

(13) For sentence (5): Q>Neg: Out of six triangles, the woman colored three triangles.
     Neg>Q: Out of four triangles, the woman colored two triangles.

(14) For sentence (6): Q>Neg: Out of eight pens, the woman used four pens.
     Neg>Q: Out of six pens, the woman used three pens.

(15) For sentence (7): Q>Neg: Out of six pens, the woman took out three pens.
     Neg>Q: Out of four pens, the woman took out two pens.

(16) For sentence (8): Q>Neg: Out of eight (pieces of) paper, the woman crumpled four.
     Neg>Q: Out of six (pieces of) paper, the woman crumpled three.

References


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Notes
* Acknowledgments to be added.

1 Though subject QPs are also looked at, it is not relevant to the main concerns in this paper.

2 A crucial assumption that they make is that the object QP position is fixed as shown in the trees. Reconstruction of QPs or negation is not assumed (see, for example, Kim and Sells 2007 and Kim, A.-R. 2002).

3 Reversing entailment is also predicted to lead to a different judgment pattern, namely, the pattern where the Object QP>Neg reading is accepted by about 50% of the population, while the Neg>Object QP reading is accepted by close to 100% of the population. This can in principle be tested by replacing a universal QP with an existential QP, but we have not tested the predications as complications arise (i) due to the positive polarity nature of muwun-ka/nani-ka ‘something’ and (ii) due to an extra existence assumption that needs to be added to a scenario.

4 From here on, we use an-at-ta ‘NEG-PST-DECL’ in our examples, as opposed to ani-ha-yess-ta ‘NEG-do-PST-DECL’ used in HLM. The former is assumed to be a phonological contraction of the latter (Hagstrom 1995) and is more common than the non-contracted form in spoken Korean.
When this group of speakers (i.e., high negation grammar speakers) accept test sentences in the every>not context by suppressing scalar implicature computation, it is expected that it involves less effort (in terms of response time and less memory cost) than when they compute scalar implicature. See, for instance, Marty, Chemla and Spector (2013) and the many references there.

HLM explained that they used the between-subjects design to avoid the issue of the ‘contaminating effect’ when speakers are exposed to two different readings during one study session: “once participants become aware of one of the possible interpretations for these statements, they may later find it difficult to assign a similar statement a different interpretation. In other words, the initial interpretation that participants assign to statements containing a QP and negation may influence the way they interpret subsequent statements containing the same elements. (p. 27)” However, this so-called contaminating effect remains in their procedure, because once participants become aware of one of the possible interpretations for these statements, they may find it difficult to reject a similar interpretation to a similar statement. Hence, a potential contaminating effect continues to exist regardless of design. However, if the two-grammar model is correct, that is, if each speaker has exclusive access to one reading, then there should be no contaminating effect since the speaker could not have access to the other reading. We used the within-subjects design with the counterbalanced scope condition, such that a half of the speakers were presented with \(Q>Neg\) in the first test trial, and the other half with \(Neg>Q\).
See Kim, Han, Lidz and Musolino (2003) for a higher acceptance rate (76.7%) for the *not*>*every* reading with long negation.

We did not use 'floating' numeral quantifiers, which follow a case-marked NP (*e.g.,* *kup-eul se-jan* ‘cup-ACC 3-CL’), because there is a possibility that they do not form a constituent with the NP (see Yoon and Shimoyama 2012). Even though there was no interaction between scope and quantifier type, as reported in section 5, this may simply mean that this type of experiment failed reveal subtle variations. More careful considerations are necessary regarding interpretive properties of different forms of numeral quantifiers (see, *e.g.*, Muromatsu 1998, Kwak 2010, Ochi 2012, Nomura 2013). For comments and discussions on this point, we would like to thank Junya Nomura and John Whitman.

In an effort not to affect the participants' judgments, we avoided the use of voiced reading of sentences, thereby departing from HLM's design (see, for instance, Hirotani 2004, Ishihara 2007, Jun and Oh 2006). We would like to thank Shin Ishihara and Duygu Özge for comments and pointers on this issue.

Although there was no interaction between scope and negation, that is, speakers were not more likely to accept Q>neg or neg>Q if the sentence used the long negation or short negation, the analyses of the current data revealed a possibility that the negation type may affect the speakers’ judgment. When the scope and negation type for the first test trial were included in the analyses, we discovered that there was a significant interaction between scope across all trials and the negation type in the first test trial (*p*
such that speakers who were presented with the short negation accepted $Q > \neg$ (95.3%) significantly more than $\neg > Q$ (33.9%) across all trials, while speakers who were presented with the long negation did not show significant difference between the means for acceptance rate for $Q > \neg$ (80.2%) and $\neg > Q$ (70.8%) across all trials. This suggests that negation type might have a subtle priming effect, to be examined in future studies. It is worth mentioning here that in judgments reported in the previous studies summarized in HLM, if short and long negation showed any difference at all, it was that long negation made Neg $> Q$ easier to obtain than short negation. Furthermore, as pointed out to us by Shin-sook Kim (p.c.), we can bring out a difference between short and long negation in the following types of sentences where scope bearing elements such as only and also occur in the subject position. The wide scope negation reading is much harder with short negation than with long negation.

(i) John-man ku chayk-ul an ilk ess-ta (short neg)

\[
\text{John-only that book-ACC NEG read-PST-DEC}
\]

'Only John didn't read that book.' (only > Neg)

(ii) John-to ku chayk-ul an ilk ess-ta (short neg)

\[
\text{John-also that book-ACC NEG read-PST-DEC}
\]

'John also didn't read that book.' (also > Neg)

\[11^\text{There were three speakers who primarily accepted} \neg > Q: \text{one speaker who only accepted} \neg > Q, \text{and two speakers who accepted} \neg > Q 100\% \text{of the time and}]

\[23\]
Q>neg only 25% of the time. There was only one speaker who showed an anomalous pattern of responses, with the acceptance rate of 50% to neg>Q and 25% to Q>neg.

12 This is a desirable result also because if half of the speakers only had access to Neg>Q reading as HLM predicted, we would run into immediate problems with certain scope-bearing expressions in Korean and Japanese (e.g., only, also, or, etc.) whose preferred interpretation is narrow scope negation. We would like to thank Shin-sook Kim and Hideaki Yamashita for drawing our attention to such data (see Goro 2007 for scope properties of disjunction in Japanese).

(i) Hanako-wa Mari-mo shootaishi-nakat-ta.

Hanako-wa Mari-also invite-not-past

'Mari also, Hanako didn't invite.'

13 It has come to our attention that Han (2008) and Han, Storoshenko and Sakurai (2008) report on an experiment on Japanese where prenominal numeral quantifiers were used (in the form of ‘Num-Cl-Gen NP-case’). For regular negation, they obtained results comparable to ours, and those reported in HLM on Korean universal quantifiers. They propose that the high negation grammar speakers can get apparently low negation reading by a choice function strategy. This seems to be an ad hoc solution because the similar patterns with numerals and universals come out as an accident in the proposal that relies on a choice function strategy for numerals on the one hand, and on entailment relations for universals on the other hand. The availability of the Q>Neg reading among the high negation grammar speakers attributed to a choice function strategy is not dependent on
the availability of the Neg>Q reading (in the way that the Q>Neg reading was dependent on the Neg>Q reading in the case of universal quantifiers). This would make possible other types of analyses that are not built on the two-grammar hypothesis. For example, one might say that while the syntax produces Neg>Q for everyone, an existential quantifier over choice functions above negation is obligatory for some (giving rise to the Q>Neg reading only), but optional for the others (giving rise to both readings). This is a somewhat unlikely story (where wide scope existential via a choice function strategy is forced), but it is only mentioned here to highlight the adhocness of the proposal.

14See Imani (1993), where it is pointed out that a high negation reading is easily obtained in the antecedent of conditionals.

Tables

Table 1: Explanation of asymmetry by HLM

<table>
<thead>
<tr>
<th></th>
<th>i. Syntax of low neg grammar generates</th>
<th>ii. Syntax of high neg grammar generates</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. every&gt;not reading</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td></td>
<td></td>
<td>but masked by entailment</td>
</tr>
<tr>
<td>b. not&gt;every reading</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

Table 2: Independence of the two scope readings
Scenario i. Erica flips 3 out of 6 cups. 

Scenario ii. Erica flips 2 out of 4 cups.

<table>
<thead>
<tr>
<th>a. $3 &gt; \text{not}$ reading</th>
<th>true</th>
<th>false</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. $\text{not} &gt; 3$ reading</td>
<td>false</td>
<td>true</td>
</tr>
</tbody>
</table>

Figures

*Figure 1: Number of participants accepting the not>every reading, short and long neg combined (reconstructed based on data in HLM:31, figure 4)*
Figure 2: Acceptance rates in HLM (across negation types)

Figure 3: Acceptance rates for scope conditions (across negation and quantifier types).
Figure 4: Acceptance rates for individual subjects