Grammar Selection in the Absence of Evidence: Korean Scope and Verb-Raising Revisited

July 15, 2013

Abstract

In a Truth Value Judgment task study testing judgments on scope interaction between argument QPs and negation, Han, Lidz and Musolino (2007) found variability in scope judgments between speakers, but not within a speaker. They thus conclude that there are two groups of speakers of Korean, and attribute this split to the co-existence of two grammars differing on the height of the verb in the population. They hypothesize that as Korean is a head-final language, there is no evidence from the string to diagnose the syntactic height of the verb, and so not all speakers exposed to Korean acquire the same grammar as far as verb-raising is concerned. That is, given the paucity in input, learners of Korean choose one grammar over the other at random. This two-grammar hypothesis makes three additional predictions. First, an individual speaker should exhibit the same scope judgments for long negation and short negation, the two types of negation in Korean; second, an individual speaker should exhibit the same scope judgment over time; and third, there should be no correlation of scope judgments between parents and their children. We conducted two experiments to test these predictions. All three predictions were borne out, providing further support for the two-grammar hypothesis.

Keywords: grammar competition, multiple grammars, verb-raising, negation, quantifier, scope, Korean

1 Introduction

Han, Lidz and Musolino (2007) (HLM henceforth) put forth a proposal that when multiple grammars are compatible with the exposure language of a child learning a language, with little input to aid her to choose one grammar over another, she may choose a grammar at random. Consequently, some learners will acquire one grammar and others another, resulting in co-existence of multiple grammars in a single speech community. Supporting evidence for this proposal came from the grammar of verb-raising in Korean.

Korean is head-final, and so unlike head-initial languages, diagnostic tests based on word order cannot be used to tell us the syntactic height of the verb: whether the verb raises or not, it will be at the end of the sentence. Other intricate tests, not based on word order, have been proposed, and using these tests, some have argued for a verb-raising analysis, while others have argued for a non-verb-raising analysis for Korean (Otani and Whitman, 1991; Koizumi, 2000; Choi, 1999; Yoon, 1994). However, HLM, citing various works in the literature that question the validity of the tests proposed (Hoji, 1998; Kim, 1999; Fukui and Sakai, 2003; Chung and Park, 1997; Kim, 1995), show that all of the data used to argue for verb-raising are consistent with a non-verb-raising grammar and all of the data used to argue for the lack of verb-raising are consistent with a verb-raising grammar. This situation poses a problem both for the theorist and the child acquiring Korean. If as theorists, we cannot find data that distinguishes verb-raising from non-verb-raising, what data would children use to specify this aspect of clausal syntax?

HLM argue that the scope of negation and argument QPs could provide the relevant data for theorists (even though such facts are rare in the input to children) because of three background facts about Korean: frozen scope, object raising and the clitic status of negation. First, in Korean, argument QPs exhibit frozen scope: in a sentence as in (1) with canonical SOV word order, with subject and object QPs, the only reading available is the

one on which the subject takes scope over the object (Sohn, 1995; Hagstrom, 2000).

(1) **Nwukwunka-ka manhun salam-ul** piphanhay-ss-ta.
    someone-NOM   many   person-ACC criticize-PST-DECL
    'Someone criticized many people.' (some > many, * many > some)

Second, the object phrase in a transitive sentence must occur to the left of (i.e., higher than) *v*P/VP adverbs, such as *cal* 'well', as in (2). This provides support for the view that objects raise from a VP-internal position to a functional projection higher in the clause structure (Hagstrom, 2000, 2002).

(2)   a.   Toli-ka   **maykcwu-lul cal** masi-n-ta.   (S O Adv V)
          Toli-NOM beer-ACC   well drink-PRES-DECL
          'Toli drinks beer well.'

      b.   * Toli-ka   **cal maykcwu-lul** masi-n-ta.   (*S Adv O V)
          Toli-NOM well beer-ACC   drink-PRES-DECL
          'Toli drinks beer well.'

Third, Korean has two forms of negation: long negation is post-verbal and requires *ha* to support tense and other verbal inflections, as in (3a), whereas short negation is preverbal, with no *ha*-support, as in (4a). Both forms have the morphosyntactic status of clitics, and are treated as a unit with the main verb in the overt syntax. Long negation must occur immediately before *ha* as in (3), and short negation must occur immediately before the lexical verb as in (4).

(3)   a.   Toli-ka   maykcwu-lul cal masi-ci   **ani ha-n-ta**.
          Toli-NOM beer-ACC   well drink-CONN NEG do-PRES-DECL
          'Toli doesn't drink beer well.'

      b.   * Toli-ka   maykcwu-lul masi-ci   **ani** cal **ha-n-ta**.
          Toli-NOM beer-ACC   drink-CONN NEG well do-PRES-DECL
          'Toli doesn't drink beer well.'

(4)   a.   Toli-ka   maykcwu-lul **an masi-n-ta**.
          Toli-NOM beer-ACC   NEG drink-PRES-DECL
          'Toli doesn't drink beer.'

b.   * Toli-ka   **an**   maykcwu-lul **masi-n-ta**.
            Toli-NOM NEG beer-ACC   drink-PRES-DECL
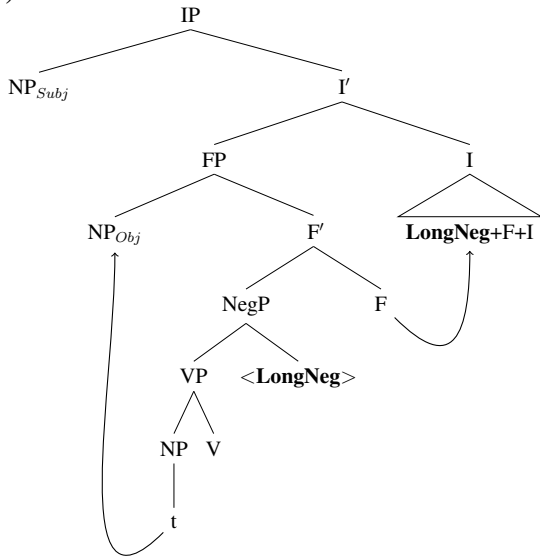   'Toli doesn't drink beer.'

Given the scope freezing effect, the scope of argument QPs will be determined in their surface position, without recourse to quantifier raising or reconstruction. This then means that the scope of negation and an argument QP will be determined by the position of negation in the clause structure. Finally, given that objects must raise out of the vP/VP and that negation is a unit with the verb, the relative scope of negation and an object QP will tell us whether the verb has raised. If the verb raises, then negation will occur in a position higher than an object QP and will therefore take scope over this QP. But if the verb remains low, then negation will also remain low and the object QP will take scope over negation.

HLM flesh out these predictions in more detail by postulating the clause structures in (5).[1] In (5a), long negation heads its own projection, and *ha*-support is assumed to take place in F. In (5b), short negation is adjoined to the left of VP. In both structures, the subject is in [Spec,IP], and the object raises to a functional projection (FP) external to VP. As the subject is high in the structure, a subject QP will scope over negation, independent of negation type. If *ha* raises in (5a) and the verb raises in (5b), then long negation cliticized to *ha* and short negation cliticized to the verb will occur in IP and so they will take scope over object QPs. If there is no *ha*-raising or verb-raising, then both long and short negation will remain below [Spec,FP] and so object QPs will scope over it.[2]
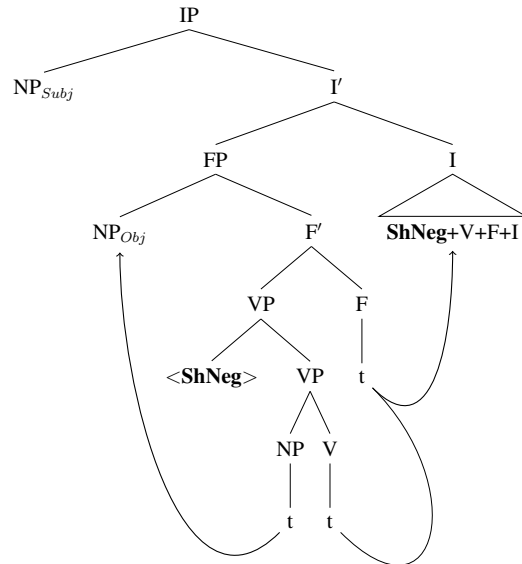
---

[1]The structures in (5a) and (5b) abstract away from splitting the verbal projection into vP and VP and raising the subject from a lower position to [Spec,IP].

[2]While this paper investigates Korean syntax, we will not add any new insight to the particulars of grammatical structure in this language. Rather, our aim is to use Korean as a window into the mechanisms by which children come to a grammatical analysis in the case of underinformative input.

(5) a.

```
                IP
        ┌───────┴───────┐
      NP_Subj           I'
                 ┌───────┴───────┐
                FP                I
          ┌──────┴──────┐    LongNeg+F+I
        NP_Obj          F'
                  ┌──────┴──────┐
                NegP             F
            ┌─────┴─────┐
           VP       <LongNeg>
        ┌───┴───┐
       NP       V
        │
        t
```

b.

```
                IP
        ┌───────┴───────┐
      NP_Subj           I'
                 ┌───────┴───────┐
                FP                I
          ┌──────┴──────┐    ShNeg+V+F+I
        NP_Obj          F'
                  ┌──────┴──────┐
                 VP              F
            ┌─────┴─────┐        t
         <ShNeg>       VP
                    ┌───┴───┐
                   NP       V
                    │       │
                    t       t
```

The predictions are clear, but there is much disagreement in the literature as to what the facts are. The scope judgments reported in the literature often conflict with one another (Cho, 1975; Song, 1982; Suh, 1989; Hagstrom, 2000; Baek, 1998; Kim, 2000; Hagstrom, 2002; Kim, 2002), raising doubts as to the usefulness of such data to reach any meaningful conclusions about the clause structure. HLM, however, showed experimentally that the variability in scope judgment exists between speakers and not within a speaker. They thus concluded that there are two groups of speakers of Korean, and attribute this split to the co-existence of two grammars differing on the height of the verb in the population (*the two-grammar hypothesis*): the neg>Q reading is available to speakers with a verb-raising grammar but unavailable to those with a non-verb-raising grammar. This split in the population, they argue, results from the sparseness of data that would help a learner identify the grammar. Given a lack of evidence, learners choose a setting of the head-movement parameter at random.

The two-grammar hypothesis makes three additional predictions. First, an individual speaker should exhibit the same scope judgments for both types of negation. This prediction follows because for both types the height of the verb determines the scope of negation

5

in the same way. Second, if an individual speaker maintains only one grammar, then she should exhibit the same scope judgment over time. Third, if learners of Korean choose a grammar at random because of the lack of relevant input, as HLM argue, then there should be no correlation of behaviour of the scope facts under consideration between parents and their children. In this paper, we present two experiments that test these predictions. All three predictions are borne out.

The rest of the paper is organized as follows. In section 2, we discuss HLM's experimental findings and the predictions they make in more detail. We then present our experiments and findings, and their implications for the two-grammar hypothesis in sections 3 and 4.

2   HLM's (2007) findings

HLM used the Truth Value Judgment task (Crain and Thornton, 1998) in an experiment to test scope judgments of sentences containing a subject universal QP and long negation as in (6a), a subject universal QP and short negation as in (6b), an object universal QP and long negation as in (7a) and an object universal QP and short negation as in (7b).

(6)   Subject QPs

    a.   **Motun mal-i**   wulthali-lul nem-ci   **ani** ha-yess-ta.
        every   horse-NOM fence-ACC jump.over-CI NEG do-PST-DECL
        'Every horse didn't jump over the fence.' (long negation)

    b.   **Motun mal-i**   wulthali-lul **an**   nem-ess-ta.
        every   horse-NOM fence-ACC NEG jump.over-PST-DECL
        'Every horse didn't jump over the fence.' (short negation)

(7)   Object QPs

    a.   Khwuki monste-ka   **motun khwuki-lul** mek-ci **ani**   ha-yess-ta.
        cookie monster-NOM every   cookie-ACC eat-CI NEG do-PST-DECL
        'Cookie monster didn't eat every cookie.' (long negation)

b. Khwuki monste-ka **motun khwuki-lul an** mek-ess-ta.
   cookie monster-NOM every cookie-ACC NEG eat-PST-DECL
   'Cookie monster didn't eat every cookie.' (short negation)

The experiment had a between-subjects design, and tested three factors with two levels each: scope (neg>every vs. every>neg) × negation type (short vs. long) × grammatical function of the QP (subject vs. object). It was thus divided into eight different conditions to which eight different sets of 20 participants were randomly assigned. In a trial, a participant watched a short video clip of an experimenter enacting a scenario using toys followed by a puppet making a statement (test sentence) about the scenario. The participant's task was to indicate whether the puppet's statement is true or not. For example, in the scenarios that tested the neg>every reading with test sentences in (6) and (7), two out of three horses (i.e., not all horses) jumped over the fence, and two out of three cookies (i.e., not all cookies) were eaten. In the scenarios that tested the every>neg reading with (6) and (7), none of the horses jumped over the fence and none of the cookies were eaten. Each participant was given four test trials and four filler trials in a pseudo-random order.

Figure 1 summarizes mean percentages of acceptances by condition. HLM found (i) a main effect for scope, and (ii) a main effect for grammatical function and an interaction between scope and grammatical function. So, regardless of negation type or grammatical function, speakers were more likely to accept the every>neg reading than the neg>every reading, and independently of negation type, speakers were more likely to accept the neg>every reading on an object QP than they were on a subject QP.

With subject QPs, speakers in general accepted the every>neg reading and rejected the neg>every reading. In Figure 1 (left), while the acceptance rate on the every>neg reading is 100% for both short and long negation, the acceptance rate on the neg>every is only 4% for short negation and 19% for long negation. This confirms the prediction laid out at the end of section 1 that subject QPs will scope over negation, independent of negation type.
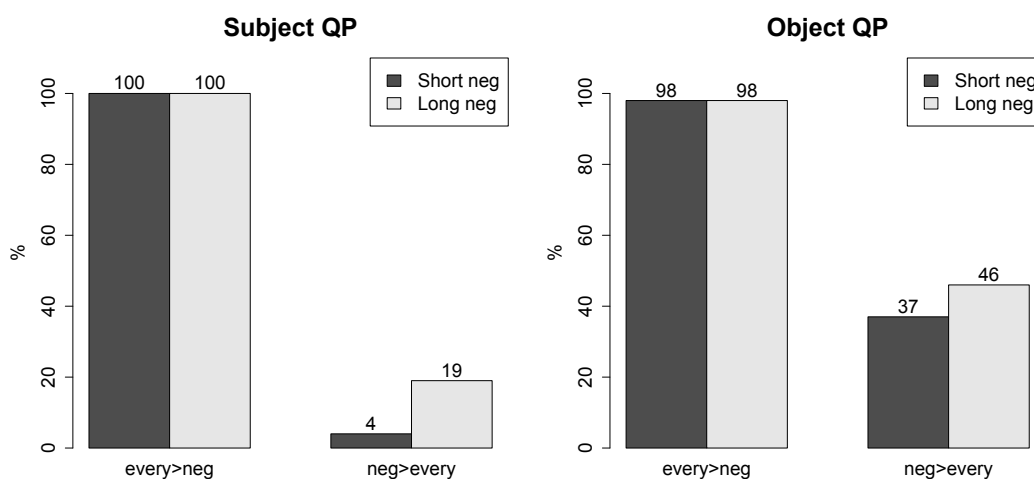
Figure 1: Mean percentages of acceptances: subject QP and object QP

But speakers seem to be divided when it comes to the neg>every reading with object QPs: as shown in Figure 1 (right), although the acceptance rate on the neg>every reading was higher in object conditions than in subject conditions, 37% with short negation and 46% with long negation, over 50% of the participants still did not accept this interpretation in object conditions. Upon further analysis of the data, HLM found a bimodal distribution of responses in the neg>every context in object conditions. That is, speakers either almost always accepted or almost always rejected the neg>every reading. This tendency is shown in Figure 2. Here, we divided participants from HLM into three groups based on their acceptance rates on the neg>every reading of the object QP: accept ($\geq$ 75% acceptance), ambivalent (= 50% acceptance), and reject ($\leq$ 25% acceptance).[3]

HLM argue that this bimodal distribution in responses is a reflection of two grammars in competition within the speech community of Korean: those speakers who have acquired the grammar with verb-raising and *ha*-raising accept the neg>every reading with object QPs, and those who have acquired the grammar with non-verb-raising reject the neg>every

---

[3]HLM report that 4-year old Korean children were also divided in accepting the neg>every reading with object QPs, showing a bimodal distribution of responses.
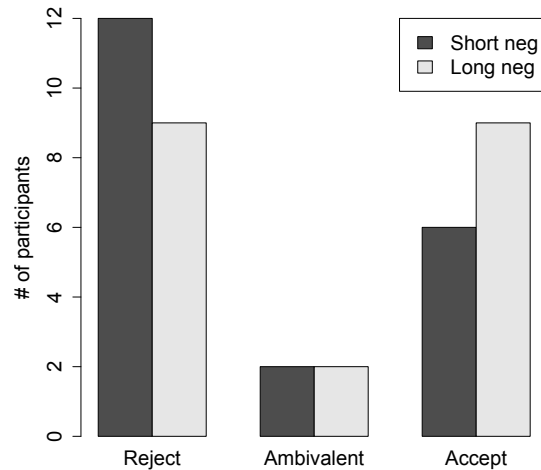
Figure 2: Number of participants accepting neg>every (adapted from HLM)

reading. The reason for the co-existence of two grammars, they argue, is that children acquiring Korean, a head-final language, are unlikely to receive sufficient input that provides clear evidence about the syntactic height of the verb. Learners of Korean therefore choose one grammar over the other at random.[4]

This two-grammar hypothesis raises three questions, which are unanswered in HLM. First, do speakers of Korean show the same pattern of behaviour for both long and short negation? This is predicted to be so because for both types of negation, the height of the verb that hosts negation determines the scope of negation in the same way. HLM's study showed roughly the same size split in the population for both long and short negation, but it doesn't tell us whether any given individual would show the same pattern for both types of negation because their experiment had no participants who were tested on both types of negation. Second, is the split population observed in HLM's study due to each

---

[4]A question arises as to why the acceptance rate for the every>neg reading of the object QP is near 100%. HLM note that the every>neg reading entails the neg>every reading, and as such a sentence with the neg>every reading will be true in an every>neg context. Consequently, speakers with a verb-raising grammar as well as those with a non-verb-raising grammar will say the sentence is true.

9

speaker stably controlling one grammar or to each speaker oscillating between both grammars? HLM hypothesized that a speaker controls a single grammar. However there is an alternative interpretation of their result in which each individual maintains both a verb-raising and a non-verb-raising grammar (Kroch, 1989; Yang, 2002). This is because in the HLM's experimental task, it may be that the grammar that was chosen on the first item, whichever that is, may be exerting an influence over subsequent items, priming the participants' answers. This kind of priming effect would give the appearance of two populations of speakers when in fact there was a single population in which each speaker controlled two competing grammars. Third, is there correlation of behaviour between parents and their children? If learners of Korean choose a grammar at random because of the lack of relevant input, then we would expect to find no correlation between the two groups. Parents would have chosen a grammar randomly and their children, faced with the same indecisive evidence, would similarly choose a grammar randomly. We address the first and the second questions in Experiment 1 described in section 3, and the third question in Experiment 2 described in section 4.

3 Experiment 1

3.1 Design

Using the Truth Value Judgment task similar to HLM in a within-subjects experiment, we tested adult speakers of Korean on the scope of negation and object QP on two separate occasions, one month apart. We only tested sentences with object QPs and not subject QPs, as these are potentially informative about the structural height of the verb. The experiment tested three factors with two levels each: negation type (short vs. long) × scope (every>neg vs. neg>every) × test session (March vs. April). The experiment was thus divided into eight conditions. As this is a within-subjects experiment, each participant was tested on all

eight conditions.

3.2 Materials

We constructed a set of 16 scenarios for the March session, and a different set of 16 scenarios for the April session, all similar to the ones used in HLM. In each set, eight scenarios made the neg>every reading true and another eight made the every>neg reading true.[5] Test sentences were similar to those used in HLM as well, containing an object QP and long or short negation, but they contained an adverbial phrase right after the object, as in (8) and (9). The reason for adding the adverbial phrase to test sentences was to further ensure that the object had raised to a vP/VP external position.

(8) Object QP and short negation

Acessi-ka **motun catongcha-lul** cip   ap-eyse **an**   ssis-ess-ta
man-NOM every   car-ACC   house front-in NEG wash-PST-DECL
'The man did not wash every car in front of his house.'

(9) Object QP and long negation

Totwuk-i   **motun posek-ul**   kakey-eyse hwumchici **ani**   ha-yess-ta.
burglar-NOM every   jewelry-ACC store-at   steal   NEG do-PST-DECL
'The burglar did not steal every jewelry in the store.'

Participants were given 16 test trials (four trials per scope/negation combination) in each test session. The test sentences used in the March session are provided in appendix A, and the ones used in the April session are provided in appendix B. In addition, they were given 12 fillers in each session: three testing comprehension of subject QPs, three testing comprehension of object QPs, three testing comprehension of short negation and three testing comprehension of long negation. The same set of fillers were used in both test sessions. The filler sentences are given in appendix C.

---

[5]See HLM for detailed description of the experimental contexts.

3.3 Participants

We tested 31 adult speakers of Korean in the March session, and from these we tested 26 speakers again in the April session. The remaining 5 participants from the March session chose not to participate in the April session. Each participant was paid $10 for participating in each test session.

3.4 Procedure

Participants were shown a videotaped version of the scenarios. In each test session, they were introduced to the task with four practice trials, two in which the puppet's statements were true and two in which they were false. They were then shown 16 test trials and 12 filler trials in a pseudorandom order. They were given a score sheet and were instructed to indicate, for each story, whether the puppet spoke truthfully. They were asked to provide a brief justification for their answers. The participants were tested in groups of four or five in a small classroom.

3.5 Findings

Figure 3 summarizes the mean percentages of acceptances by condition. We constructed generalized linear mixed-effects models, fitted using the software package R, to analyze the participants' responses as a function of scope, negation type and test session, with participants and sentences included as random effects. We found a main effect of scope (β = -3.86, s.e. = .50, z = -7.78, $p < .001$), with participants more likely to accept the every>neg reading than neg>every reading, but no other main effects or interactions. This suggests that the speakers behaved uniformly across negation types and test sessions: those who rejected the neg>every reading did so on both test sessions and for both types of negation, and those who accepted the neg>every reading did so on both test sessions and

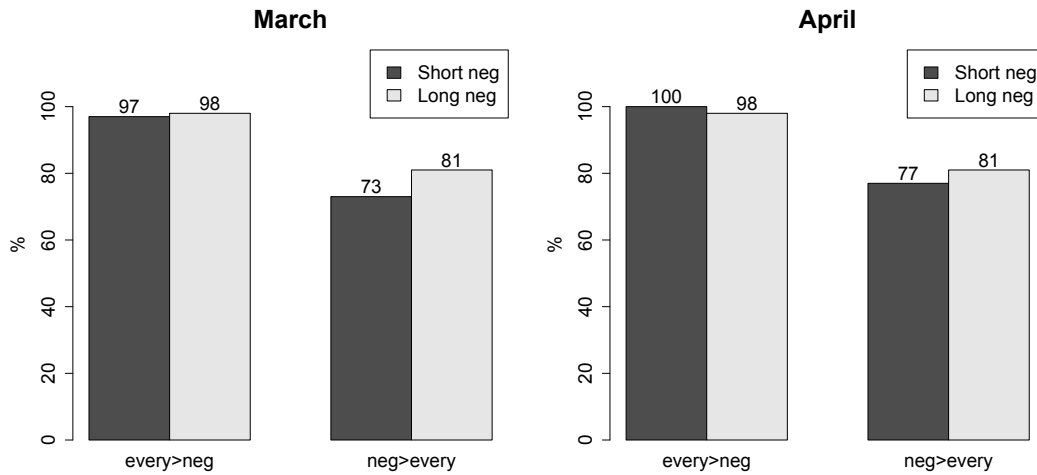for both types of negation.[6]

Figure 3: Mean percentages of acceptances: two test sessions

To confirm the uniform behaviour of each individual participant across negation types, we calculated, per participant, the difference score between the acceptance rate in short negation/neg>every condition and the acceptance rate in long negation/neg>every condition for both March and April sessions. A negative difference score indicates that a participant was more likely to accept the neg>every interpretation for long negation than short negation and a positive difference score indicates that a participant was more likely to accept the neg>every interpretation for short negation than long negation. A difference score of zero means that a participant behaved the same across negation types. Figure 4 plots the count of difference scores. The figure shows that the majority of participants behaved the

---

[6]The acceptance rates of neg>every in our within-subjects experiment were somewhat higher than in HLM's between-subjects experiment. In HLM, the mean percentages of acceptances in neg>every/object conditions for short negation and long negation were 37% and 46% respectively, whereas in the current within-subjects experiment, they range from 73% to 81%. This could be a consequence of the particular participants chosen. In Experiment 2, we see acceptance rates more like those in HLM, suggesting that the high acceptance rates here were simply due to variance in the population. It is also worth noting that Lee et al. (2011) report 54.6% as an acceptance rate of neg>every reading for short negation in a separate within-subjects Truth Value Judgment task experiment (long negation was not tested). This acceptance rate is again close to HLM's acceptance rates.

same across negation types in both March and April.

In the March session, the average difference score between short and long negation was -0.08 (s.e. = 0.03). Participants were slightly more likely to accept the neg>every interpretation in long-negation over short negation ($t(30)$ = -.3.24, $p < .003$), as shown in Figure 4 (left). This significant difference derives from the fact that 10/31 participants gave one more "yes" response for long negation than short negation, though only one participant gave one more "yes" response for short negation than long negation. However, because the difference scores are so close to zero in all cases, we do not take this to show that people are inconsistent in their choice of verb-raising across long and short negation. Further evidence for this conclusion comes from the April data, where the mean difference score between long and short negation was -0.02 (s.e. = 0.02), as shown in Figure 4 (right). This difference score was not significantly different from zero ($t(30)$ = -0.9, ns), lending further support to the view that people maintain a single grammar of verb-raising for both long and short negation.
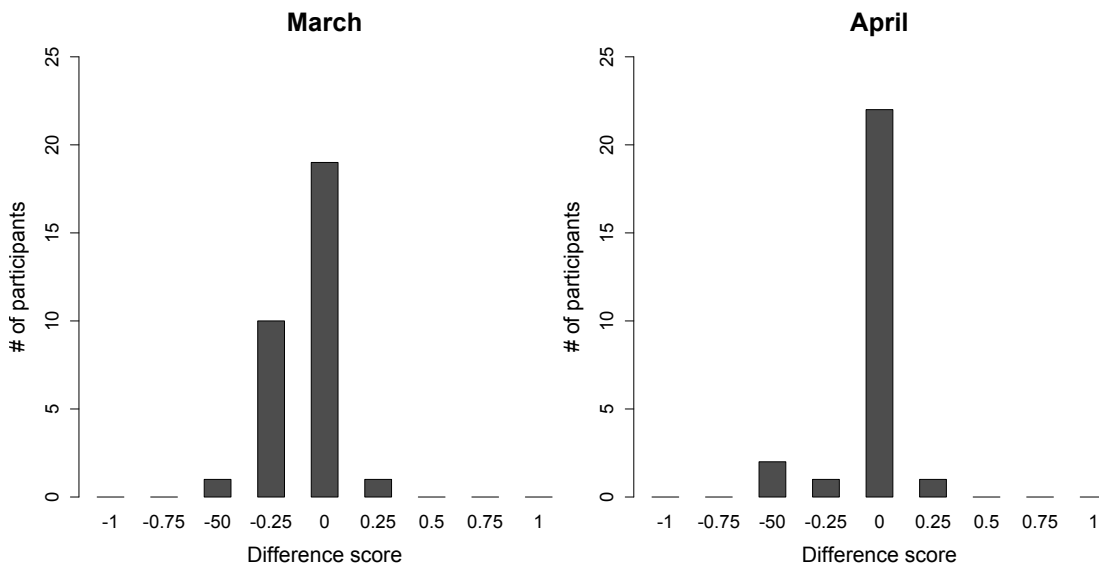

Figure 4: Number of participants in each difference score between Short neg and Long neg in neg>every conditions

Turning now to the potential effect of test session, we find no significant effects, consistent with the view that each subject controls only a single grammar. We calculated, per participant, the difference score between the acceptance rate of March/neg>every condition and April/neg>every condition for both short negation and long negation. Figure 5, which plots the count of difference scores, shows that the majority of participants behaved the same across test sessions for both short negation and long negation.
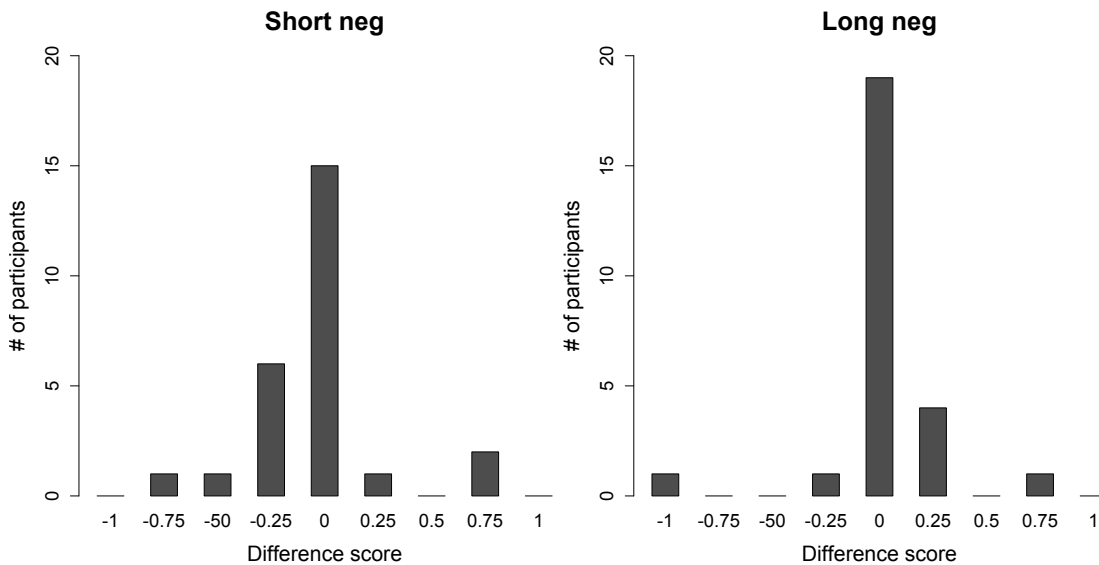

Figure 5: Number of participants in each difference score between March and April in neg>every conditions
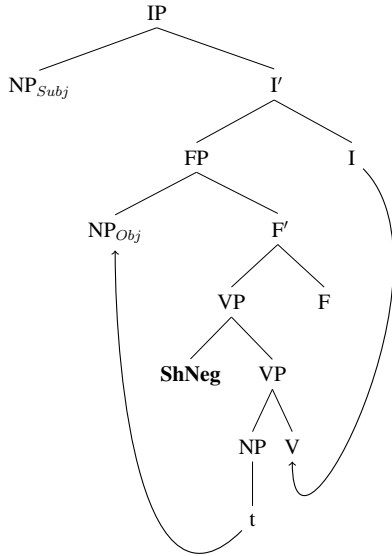
For short negation (Figure 5 (left)), the mean difference score between March and April was -0.03 (s.e. = 0.06). This is not significantly different from zero ($t(25) = -0.64$, ns). Thus, we have no evidence that participants changed judgments across test sessions. For long negation (Figure 5 (right)), the mean difference score between March and April was 0.01 (s.e. = 0.05). This is not significantly different from zero ($t(25) = 0.35$, ns). Again, we have no evidence that participants changed judgments across test sessions.
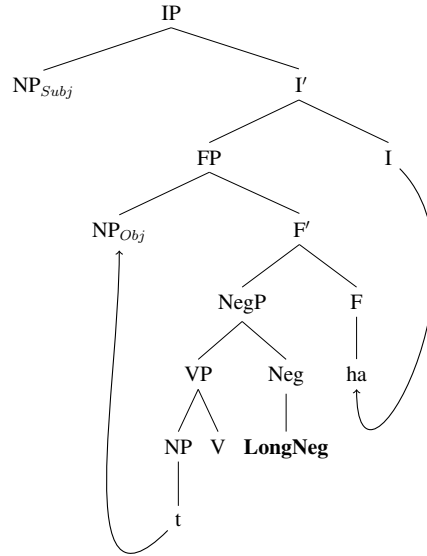
15

3.6 Discussion

We can now answer the first two questions raised at the end of section 2 about the two-grammar hypothesis of HLM. (i) Do speakers of Korean show the same pattern of behaviour for both long and short negation? (ii) Is the split population observed in HLM's study due to each speaker stably controlling one grammar? According to our findings, the answer to both questions is 'yes': a given individual shows the same pattern for both types of negation and she maintains one grammar and does not oscillate between two grammars over time.

Both results are predicted by the two-grammar hypothesis, and thus provide further support for the proposal advanced by HLM. In the population that has not acquired a verb-raising grammar, the neg>every reading for an object QP in sentences formed with short negation is not available because the grammar only generates the structure in which the object scopes over negation. In the same population, *ha*-raising does not take place, and so neg>every reading for an object QP is also unavailable in sentences with long negation. On the other hand, the population that has acquired a verb-raising grammar generates the neg>every reading for an object QP in sentences formed with short negation because the grammar generates the structure in which negation scopes over the object. In the same population, in sentences with long negation, *ha*-raising will take place, again generating the neg>every reading for an object QP. HLM's representation of the grammar with no verb-raising and no *ha*-raising (Grammar A) is given in (10), and their representation of the grammar with verb-raising and *ha*-raising (Grammar B) is given in (11).

(10) Grammar A

IP
NP$_{Subj}$ I′
FP   I
NP$_{Obj}$ F′
VP   F
ShNeg   VP
NP   V
t

IP
NP$_{Subj}$ I′
FP   I
NP$_{Obj}$ F′
NegP   F
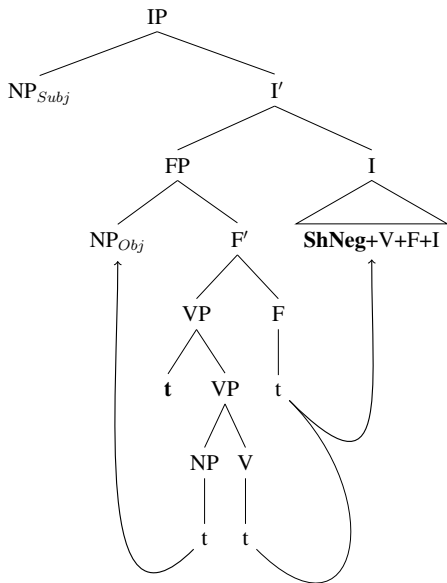VP   Neg   ha
NP   V   **LongNeg**
t

Infl lowers to V; Short neg cliticizes to V; Object scopes over short neg.

Infl lowers to F; Long neg cliticizes to F; Object scopes over long neg.

(11) Grammar B

IP
NP$_{Subj}$ I′
FP   I
NP$_{Obj}$ F′   **ShNeg**+V+F+I
VP   F
t   VP   t
NP   V
t   t

IP
NP$_{Subj}$ I′
FP   I
NP$_{Obj}$ F′   **LongNeg**+F+I
NegP   F
VP   Neg   ha
NP   V   **t**
t

Short neg cliticizes to V; V raises to Infl; Short neg scopes over object.
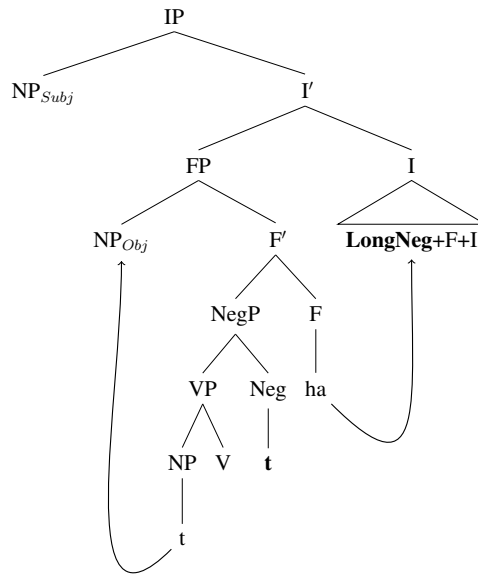
Long neg cliticizes to F; F raises to Infl; Long neg scopes over object.

4 Experiment 2

4.1 Participants

We tested 22 Korean children between the ages of 4;0 and 5;6 (mean 4;8) from a preschool in Pwuntang, Korea. We also tested mothers of 21 children that participated in the experiment. The mother of one of the children chose not to participate.

4.2 Design

We tested negation (long vs. short) as a within-subjects factor and relation (child vs. parent) as a between-subjects factor. The experiment was thus divided into four different conditions, each condition testing whether children or their parents accept the neg>every reading in long or short negation sentences containing an object QP. We did not include scope as a factor, as we did not want the testing sessions to be too long for pre-school aged children. In both HLM's study and Experiment 1, the mean percentages of acceptances in the every>neg conditions reached near 100%. We can thus assume that all native speakers of Korean will readily accept negative sentences with object QPs in the every>neg context.

4.3 Materials

The materials came from Experiment 1. Participants were given eight test trials (four trials for long negation condition and another four for short negation condition). In addition, they were given six fillers: two testing for the comprehension of object QPs, two testing for short negation and two testing for long negation.

4.4 Procedure

Children were tested individually in a quiet room away from the class. They each saw a videotaped version of the scenarios, and an experimenter recorded their responses on a score sheet. The parents were tested separately from their children, individually in the same

room used for testing the children at the preschool. Both the children and their parents were introduced to the task with two practice trials followed by eight test trials and six filler trials in one of the two pseudorandom orders.

4.5 Findings

The mean percentages of acceptances by condition are summarized in Figure 6. The results are similar to those reported in HLM: the acceptance rates in both short negation and long negation conditions for both children and their parents hover around 40%. Moreover, as in HLM, we found a bimodal distribution of responses for both children and parents, as shown in Figure 7: speakers tended to either always accept or always reject the neg>every reading.
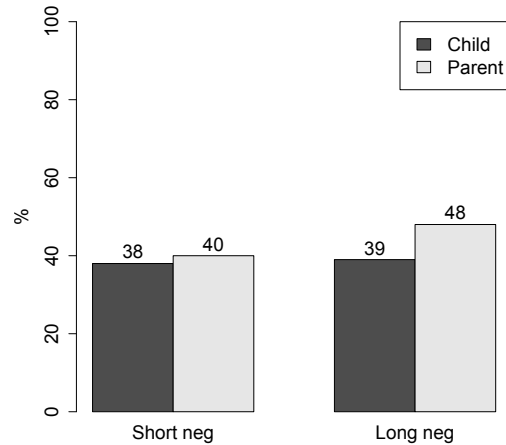

Figure 6: Mean percentages of acceptances: children and parents

We constructed generalized linear mixed-effects models to analyze the participants' responses as a function of negation and relation, with participants and sentences included as random effects. The analysis revealed no main effect of negation or relation, and no interaction between the two factors. We thus found no difference in the pattern of behaviours between the children and their parents: in both groups, only about half of the participants

19

accepted the neg>every reading in both short negation sentences and long negation sentences with object QPs.
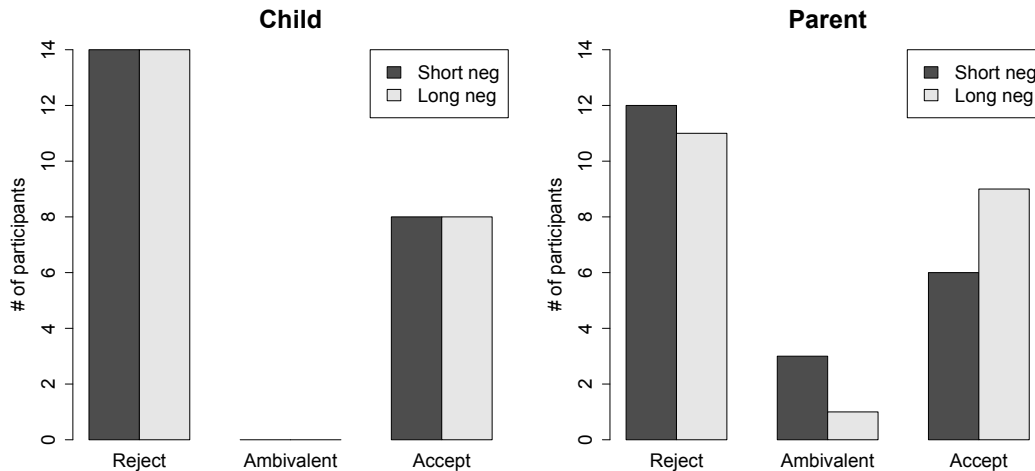

Figure 7: Number of participants accepting neg>every: children and parents

The results of the generalized linear mixed-effects analysis, however, do not tell us whether children's behaviour can be predicted by their parents' behaviour. To address this question, we ran three linear regressions using the children and their parents' proportions of 'yes' responses. The first linear regression was run on the proportions in the short negation condition only, and the second regression was run on the proportions in the long negation condition only, and the third regression was run on the proportions in both short negation and long negation conditions. The graphs in Figure 9 plot the children's proportions as a function of their parents' proportions. Each graph includes the line of best fit. The results of the linear regressions are summarized in Table 1. In all three regressions, the correlation coefficients were not different from zero, and thus there is no evidence of a relation between the children and their parents' behaviour.

We also ran three linear regressions to test whether our participants' responses for short negation sentences can be predicted by their responses for long negation sentences. The
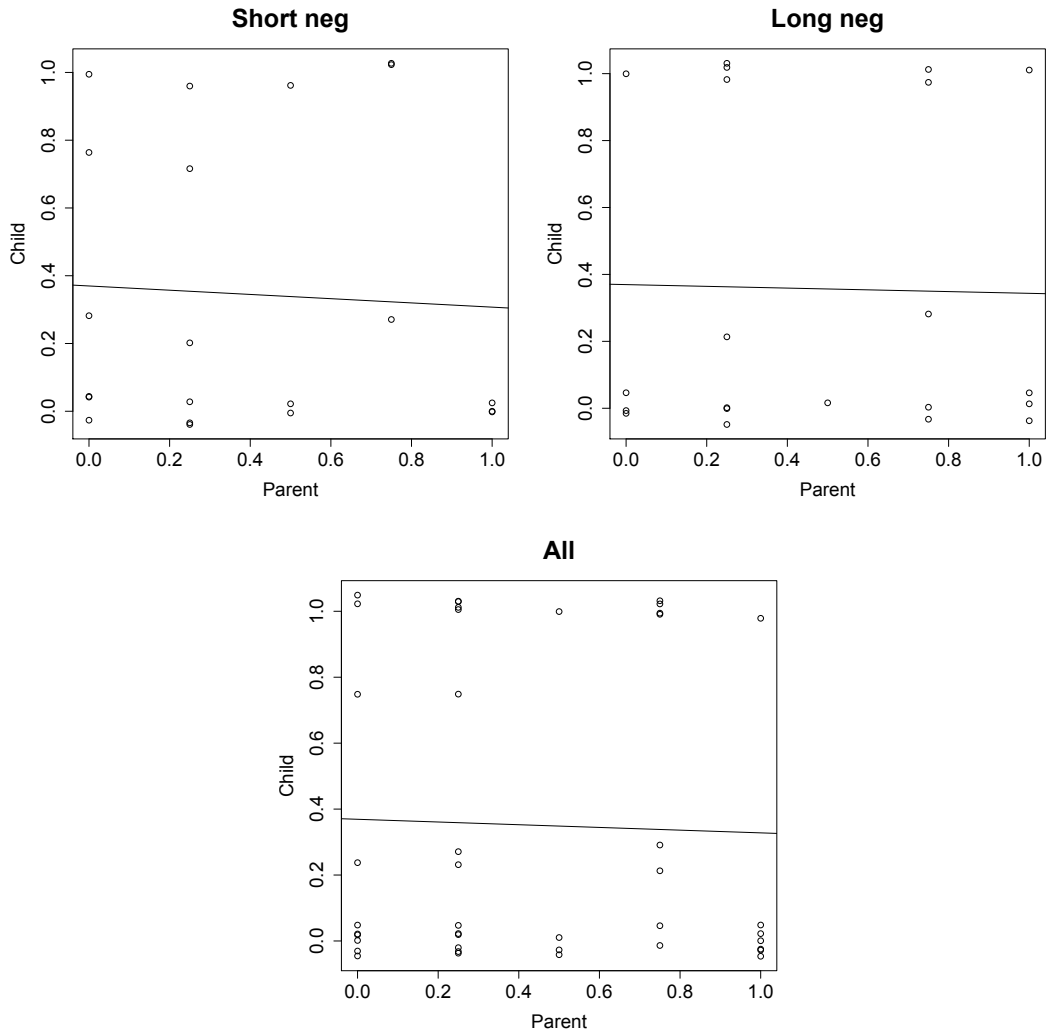
Figure 8: Correlation between parents and their children's proportions of 'yes' responses

| | LINE OF BEST FIT | | GOODNESS OF FIT | SIGNIFICANCE TEST | |
	Intercept	Slope	R^2	t-statistic	p-value
Short neg	.37	-.06	-.05	-.22	.83
Long neg	.37	-.03	-.05	-.09	.93
All	.36	-.01	-.02	-.06	.96

Table 1: Linear regressions modelling the children's proportions of 'yes' responses as a function of their parents' proportions of 'yes' responses

first regression was run on the children's proportions of 'yes' responses only, the second regression was run on the parents' proportions only, and the third regression was run on the proportions of 'yes' responses of both the children and their parents. The graphs in Figure 9 plot the proportions in the short negation condition as a function of the proportions in the long negation condition, including the line of best fit. The results of the linear regressions are summarized in Table 2.
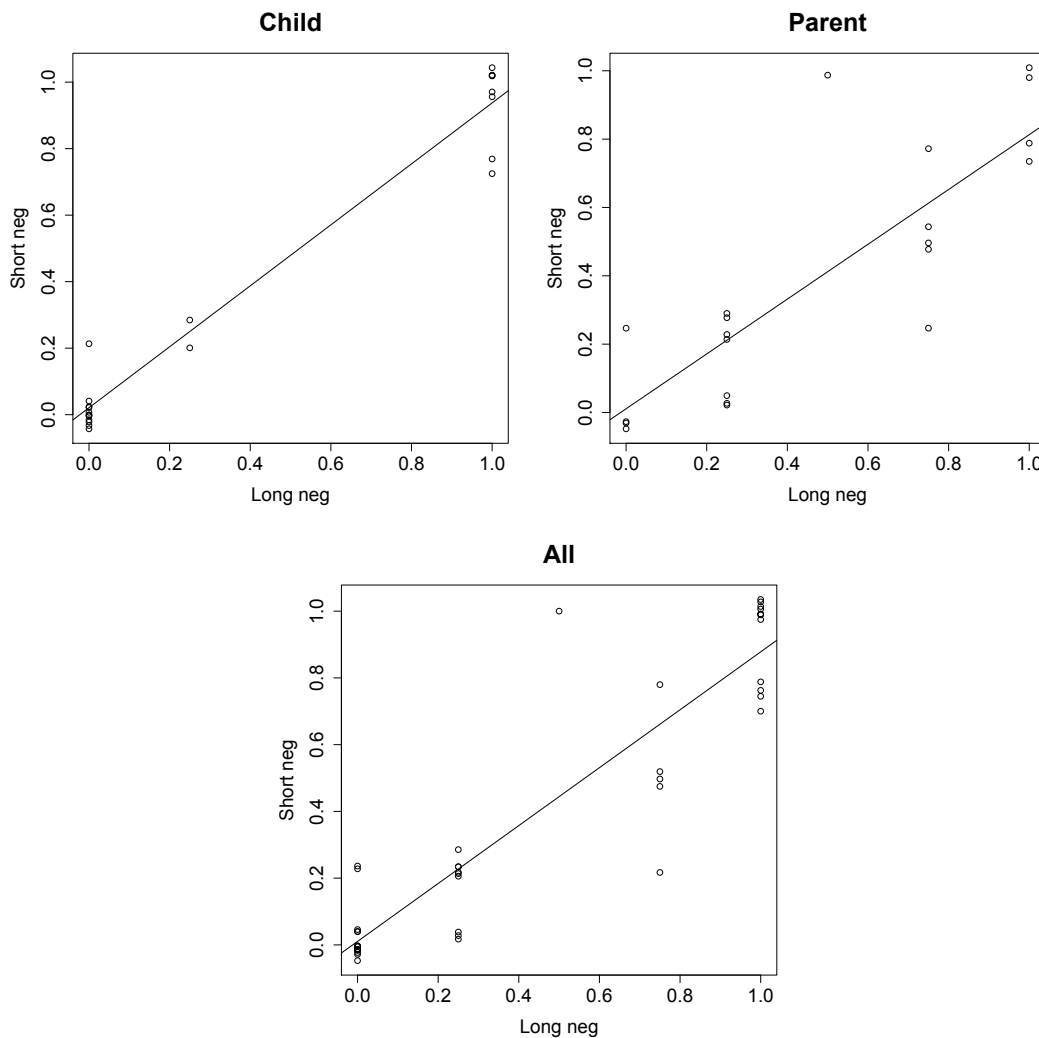

Figure 9: Correlation between mean acceptance rates of Short negation and Long negation

Unlike the regressions testing the correlation between the children and their parents'

22

	LINE OF BEST FIT		GOODNESS OF FIT	SIGNIFICANCE TEST	
	Intercept	Slope	R^2	t-statistic	p-value
Child	.02	.92	.96	23.21	<.001
Parent	.01	.80	.67	6.43	<.001
All	.01	.87	.85	15.21	<.001

Table 2: Linear regressions modelling the children and their parents' proportions of 'yes' responses in short negation sentences as a function of their proportions of 'yes' responses in long negation sentences

behaviours, the regressions testing the correlation between the participants' behaviours in short negation sentences and long negation sentences revealed that the correlation coefficients are significantly different from zero. That is, both the children and their parents behaved uniformly across negation types: those who accepted the neg>every reading did so for both negation types, and those who rejected the neg>every reading did so for both negation types. These results are consistent with the findings in Experiment 1.

4.6 Discussion

The findings of Experiment 2 answer the third question we raised at the end of section 2. Is there a correlation of behaviour between children and their parents? Although we found that both the children and their parents split in their responses, with about half of each group accepting the neg>every reading and the other half rejecting it, we found no correlation of behaviour between the two groups. That is, children's scope patterns cannot be predicted by their parents'. This is predicted by HLM's two-grammar hypothesis: lack of sufficient input will force a learner to randomly choose a grammar of verb-raising or a grammar of non-verb-raising, and as the choice is random, children do not necessarily acquire their parents' grammar of verb-raising (or non-verb-raising).

This does not however mean that the kind of scope data we are looking at never show correlational behaviour. In Experiment 2, we found that for both children and their parents, a speaker's pattern of responses in the two negation conditions correlate: the pattern of

behaviour with short negation can be predicted from the pattern of behaviour with long negation. This finding is consistent with the finding in Experiment 1 where we showed that speakers behave uniformly across negation types. These results are also predicted by HLM's two-grammar hypothesis: a speaker maintains a single grammar of verb-raising (or non-verb-raising) for both long and short negation, and as such, speakers should show the same scope pattern across negation types.

5   Conclusion

This paper set out to test three predictions of HLM's hypothesis that there exist two populations of Korean speakers with respect to the grammar of verb-raising. We found (a) that speakers are consistent in their scope judgments across negation type, (b) that speakers are consistent in their scope judgments across different testing sessions, and (c) that parents and children may acquire different grammars despite being exposed to roughly the same language community.

The findings presented above support the view that the primary linguistic data that Korean learning children are exposed to is not sufficient to guarantee uniform convergence to a single grammar. The data that would allow a child to choose either verb-raising or non-verb-raising is simply not available. Consequently, it seems that learners choose a single grammar at random and discard the other option. The consistency within an individual that we find across testing sessions and across negation types lends further support to this view. If speakers maintained both grammars simultaneously, then we would expect them to fluctuate in which grammar they chose to use for any given sentence. Because we did not see such fluctuation, we are led to the conclusion that learners maintain only one grammar. Moreover, as there is no basis for the choice in grammar, we find some learners choosing one grammar and others choosing another, and as such, children's grammar cannot be

predicted by the grammar of their parents.

While these findings have consequences for the theory of Korean syntax, we see the more important contribution of this work to be what it shows us about language acquisition. This work highlights a novel kind of argument from the poverty of the stimulus. Even given a highly restricted space of possible grammars, the data to choose between alternatives may not always exist. This result emphasizes the fact that specifying a highly restricted range of possible grammars is not equivalent to specifying a theory of language acquisition (cf. Chomsky 1965, p. 30ff; Wexler and Culicover 1980; Yang 2002; Gagliardi 2012). A complete theory of language acquisition must also model the mechanisms that learners use to select the grammatical structure of the target language from the input. Indeed, we have seen here that this mechanism must be flexible enough to select a grammar even when the input data underdetermines the analysis. In such situations, speakers choose a grammar at random and do not maintain multiple grammars simultaneously. Given work in the field of diachronic syntax showing that individual speakers may control multiple grammars (e.g., Kroch 1989; Santorini 1992; Taylor 1994), in addition to work arguing for a grammar competition theory of language acquisition (e.g., Yang 2002, Pearl 2011), our findings highlight the need to specify the conditions under which a learner will choose a grammar rather than maintain multiple competing grammars.

A   Test sentences: March session

This appendix provides the test sentences we used in the March session of Experiment 1. The sentences in (13) and (15) were also used as test sentences in Experiment 2.

(12)   Short neg - every>neg

    a.   Acessi-ka motun catongcha-lul cip   ap-eyse an   ssis-ess-ta.
        man-NOM every car-ACC   house front-in NEG wash-PST-DECL
        'The man did not wash every car in front of his house.'

b. Yeca ai-ka motun panci-lul kakey-eyse an   sa-ass-ta.
   girl-NOM every ring-ACC store-at   NEG buy-PST-DECL
   'The girl did not buy every ring at the store.'

c. Swuni-ka   motun namca ai-lul phathi-ey an   chotayha-yess-ta.
   Swuni-NOM every boy-ACC   party-at   NEG invite-PST-DECL
   'Swuni did not invite every boy to the party.'

d. Acessi-ka motun kepwuki-lul aywan tongmwul kakey-eyse an
   man-NOM every turtle-ACC pet   animal   shop-at   NEG
   tuleolli-ess-ta.
   lift.up-PST-DECL
   'The man did not lift up every turtle at the pet store.'

(13)   Short neg - neg>every

a. Totwuk-i   motun posek-ul   kakey-eyse an hwumchi-ess-ta.
   burglar-NOM every jewelry-ACC store-at   NEG steal-PST-DECL
   'The burglar did not steal every jewelry in the store.'

b. Saylo o-n   kangaci-ka motun koyangi-lul nongcang-eyse an
   new   come-ADN dog-NOM every cat-ACC   farm-in   NEG
   ccoch-ass-ta.
   chase-PST-DECL
   'The new dog that moved in did not chase every cat in the farm.'

c. Yeca ai-ka motun sathang-ul pakwuni-ey an   tam-ass-ta.
   girl-NOM every candy-ACC basket-in   NEG put.in-PST-DECL
   'The girl did not put every candy in the basket.'

d. Pellay-ka motun pawi-lul swupsok-eyse an   ollaka-ss-ta.
   bug-NOM every rock-ACC forest-in   NEG climb-PST-DECL
   'The bug did not climb every rock in the forest.'

(14)   Long neg - every>neg

a. Namca ai-ka motun konglyong-ul tongmwulwon-eyse mancici ani
   boy-NOM   every dinosaur-ACC zoo-at   touch NEG
   ha-yess-ta.
   do-PST-DECL
   'The boy did not touch every dinosaur at the zoo.'

b. Acessi-ka motun pawi-lul cheyyukkwan-eyse kkayttulici ani ha-yess-ta.
man-NOM every rock-ACC gym-at break NEG do-PST-DECL
'The man did not break every rock at the gym.'

c. Swuni-ka motun namca ai-lul cip ap-eyse kkyeanci ani ha-yess-ta.
Swuni-NOM every boy-ACC house front-at hug NEG do-PST-DECL
'Swuni did not hug every boy in front of the house.'

d. Dora-ka motun chocolate-ul pwuek-eyse mekci ani ha-yess-ta.
Dora-NOM every chocolate-ACC kitchen-at eat NEG do-PST-DECL
'Dora did not eat every chocolate in the kitchen.'

(15) Long neg - neg>every

a. Swuni-ka motun kyokwase-lul tosekwan-eyse ilkci ani ha-yess-ta.
Swuni-NOM every textbook-ACC library-at read NEG do-PST-DECL
'Swuni did not read every textbook at the library.'

b. Yuri-ka motun namca ai-lul pokto-eyse chaci ani ha-yess-ta.
Yuri-NOM every boy-ACC hallway-in kick NEG do-PST-DECL
'Yuri did not kick every boy in the hallway.'

c. Dora-ka motun chocolate-ul Swuni-ney cip-eyse chacanayci ani
Dora-NOM every chocolate-ACC Swuni-GEN house-at find NEG
ha-yess-ta.
do-PST-DECL
'Dora did not find every chocolate at Swuni's house.'

d. Himseyn cangsa-ka motun pawi-lul cip ap-eyse tuleollici ani
strong man-NOM every rock-ACC house front-in lift.up NEG
ha-yess-ta.
do-PST-DECL
'The strong man did not lift up every rock in front of his house.'

B   Test sentences: April session

This appendix provides the test sentences we used in the April session of Experiment 1.

(16) Short neg - every>neg

a. Swuni-ka   motun kyokwase-lul tosekwan-eyse an   ilk-ess-ta.
   Swuni-NOM every textbook-ACC library-at   NEG read-PST-DECL
   'Swuni did not read every textbook at the library.'

b. Yuri-ka   motun yeca ai-lul pokto-eyse an   cha-ss-ta.
   Yuri-NOM every girl-ACC   hallway-in NEG kick-PST-DECL
   'Yuri did not kick every girl in the hallway.'

c. Dora-ka   motun panci-lul Swuni-ney cip-eyse an   chac-ass-ta.
   Dora-NOM every ring-ACC Swuni-GEN house-at NEG find-PST-DECL
   'Dora did not find every ring at Swuni's house.'

d. Himseyn cangsa-ka motun cha-lul cip   ap-eyse an   tuleolli-ess-ta.
   strong   man-NOM every car-ACC house front-in NEG lift.up-PST-DECL
   'The strong man lifted up every car in front of his house.'

(17)   Short neg - neg>every

a. Namca ai-ka motun konglyong-ul tongmwulwon-eyse an   manci-ess-ta.
   boy-NOM   every dinosaur-ACC zoo-at   NEG touch-PST-DECL
   'The boy did not touch every dinosaur at the zoo.'

b. Acessi-ka motun pyektol-ul cheyyukkwan-eyse an   pusi-ess-ta.
   man-NOM every brick-ACC gym-at   NEG break-PST-DECL
   'The man did not break every brick at the gym.'

c. Swuni-ka   motun namca ai-lul cip   ap-eyse an   kkyean-ass-ta.
   Swuni-NOM every boy-ACC   house front-at NEG hug-PST-DECL
   'Swuni did not hug every boy in front of the house.'

d. Dora-ka   motun chocolate-ul   pwuek-eyse an   mek-ess-ta.
   Dora-NOM every chocolate-ACC kitchen-at   NEG eat-PST-DECL
   'Dora did not eat every chocolate in the kitchen.'

(18)   Long neg - every>neg

a. Totwuk-i   motun posek-ul   kakey-eyse hwumchici ani   ha-yess-ta.
   burglar-NOM every jewel-ACC store-at   steal   NEG do-PST-DECL
   'The burglar did not steal every jewel in the store.'

b. Saylo o-n   kangaci-ka motun mal-ul   nongcang-eyse ccochci ani
   new   come-ADN dog-NOM   every horse-ACC farm-in   chase   NEG
   ha-yess-ta.
   do-PST-DECL

'The new dog that moved in did not chase every horse in the farm.'

    c. Yeca ai-ka motun sathang-ul pakwuni-ey tamci ani ha-yess-ta.
        girl-NOM every candy-ACC basket-in put.in NEG do-PST-DECL
        'The girl did not put every candy in the basket.'

    d. Pellay-ka motun pawui-lul swupsok-eyse ollakaci ani ha-yess-ta.
        bug-NOM every rock-ACC forest-in climb NEG do-PST-DECL
        'The bug did not climb every rock in the forest.'

(19) Long neg - neg>every

    a. Acessi-ka motun catongcha-lul cip ap-eyse ssisci ani ha-yess-ta.
        man-NOM every car-ACC house front-in wash NEG do-PST-DECL
        'The man did not wash every car in front of his house.'

    b. Yeca ai-ka motun panci-lul kakey-eyse saci ani ha-yess-ta.
        girl-NOM every ring-ACC store-at buy NEG do-NEG-PST
        'The girl did not buy every ring at the store.'

    c. Swuni-ka motun namca ai-lul phathi-ey chotayhaci ani ha-yess-ta.
        Swuni-NOM every boy-ACC party-at invite NEG do-PST-DECL
        'Swuni did not invite every boy to the party.'

    d. Acessi-ka motun kepwuki-lul aywan tongmwul kakey-eyse tulekollici ani
        man-NOM every turtle-ACC pet animal shop-at lift.up NEG
        ha-yess-ta.
        do-PST-DECL
        'The man did not lift up every turtle at the pet store.'

C Filler sentences

This appendix provides the filler sentences we used in both the March and the April sessions in Experiment 1. (21a), (21b), (22a), (22c), (23a) and (23b) were also used as fillers in Experiment 2.

(20) Subject QP

    a. Motun namca-ka tongmwulwon-eyse saca-lul ssutatum-ess-ta.
        every man-NOM zoo-in lion-ACC pet-PST-DECL

'Every man pet the lion in the zoo.'

b. Motun namca-ka kongwon-eyse pawi-lul tenci-ess-ta.
every man-NOM park-in rock-ACC throw-PST-DECL
'Every man threw a rock in the park.'

c. Motun kaykwuli-ka tulphan-eyse wulthali-lul ttwienem-ess-ta.
every frog-NOM field-in fence-ACC jump.over-PST-DECL
'Every frog jumped over the fence in the field.'

(21) Object QP

a. Mini-ka motun orengi-lul cip-eyse mek-ess-ta.
Mini-NOM every orange-ACC home-at eat-PST-DECL
'Mini didn't eat every orange at home.'

b. Yeca ai-ka motun pawi-lul kongwon-eyse tuleolli-ess-ta.
girl-NOM every rock-ACC park-in lift.up-PST-DECL
'The girl lifted up every rock in the park.'

c. Dora-ka motun kaykwuli-lul tulphan-eyse cap-ass-ta.
Dora-NOM every frog-ACC field-in catch-PST-DECL
'Dora caught every frog in the field.'

(22) Short neg

a. Hama-ka namwu wi-ey an ollaka-ss-ta.
hippo-NOM tree top-at NEG climb-PST-DECL
'The hippo did not climb onto the tree trunk.'

b. Homer-ka changmwun-ul pakkat-eyse an takk-ass-ta.
Homer-NOM window-ACC outside-at NEG wipe-PST-DECL
'Homer did not wipe the window from outside.'

c. Lisa-ka cip-ey an tuleka-ss-ta.
Lisa-NOM house-TO NEG enter-PST-DECL
'Lisa did not enter the house.'

(23) Long neg

a. John-i yeca-wa cip ap-eyse akswuha-ci ani ha-yess-ta.
John-NOM woman-with house front-in shake.hands NEG do-PST-DECL
'John did not shake hands with the woman in front of the house.'

b. Dora-ka   kewul-ul   sicang-eyse sa-ci ani   ha-yess-ta.
   Dora-NOM mirror-ACC markey-at   buy   NEG do-PST-DECL
   'Dora did not buy the mirror at the market.'

c. Dora-ka   nolan meli   yeca ai-lul kongwon-eyse chassanay-ci ani
   Dora-NOM blond-haired girl-ACC   park-in   find   NEG
   ha-yess-ta.
   do-PST-DECL
   'Dora did not find the blond-haired girl in the park.'

References

Baek, Judy Yoo-Kyung. 1998. Negation and object shift in early child Korean. In *The interpretive tract*, volume 25 of *MIT Working Papers in Linguistics*, 73–86. Cambridge: MITWPL.

Cho, Choon-Hak. 1975. The scope of negation in Korean. In *The Korean language: Its structure and social projection*, ed. Ho-Min Sohn, 63–80. The Center for Korean Studies, University of Hawaii.

Choi, Young-Sik. 1999. Negation, its scope and NPI licensing in Korean. In *Proceedings of ESCOL*, ed. Rebecca Daly and Anastasia Riehl, 25–36. Ithaca, NY: Cornell University.

Chomsky, Noam. 1965. *Aspects of the theory of syntax*. Cambridge, Mass: MIT Press.

Chung, Daeho, and Hong-Keun Park. 1997. NPIs outside of negation scope. In *Japanese/Korean linguistics*, ed. Ho-Min Sohn and John Haig, volume 6, 415–435. Stanford: CSLI Publications.

Crain, Stephen, and Rosalind Thornton. 1998. *Investigations in universal grammar: A guide to research in acquisition of syntax and semantics*. Cambridge, Massachusetts: The MIT Press.

Fukui, Naoki, and Hiromu Sakai. 2003. The visibility guideline for functional categories: Verb-raising in japanese and related issues. *Lingua* 113:321–375.

Gagliardi, Ann C. 2012. Input and intake in language acquisition. Doctoral Dissertation, University of Maryland, Maryland.

Hagstrom, Paul. 2000. Phrasal movement in Korean negation. In *Proceedings of SCIL*, volume 9. Cambridge: MITWPL.

Hagstrom, Paul. 2002. Implications of child error for the syntax of negation in Korean. *Journal of East Asian Linguistics* 11:211–242.

Han, Chung-hye, Jeffrey Lidz, and Julien Musolino. 2007. V-Raising and Grammar Competition in Korean: Evidence from Negation and Quantifier Scope. *Linguistic Inquiry* 38:1–47.

Hoji, Hajime. 1998. Null object and sloppy identity in Japanese. *Linguistic Inquiry* 29:127–152.

Kim, Ae-Ryung. 2002. Two positions of Korean negation. In *Japenese/Korean Linguistics*, volume 10, 587–600. Stanford: CSLI.

Kim, Jong-Bok. 1995. On the existence of NegP in Korean. In *Harvard Studies in Korean Linguistics*, ed. Susumu Kuno et al., volume VI, 267–282. Cambridge, MA: Harvard University, Department of Linguistics.

Kim, Jong-Bok. 2000. On the prefixhood and scope of short form negation. In *Harvard Studies in Korean Linguistics*, volume VIII, 403–418. Dept. of Linguistics, Harvard University.

Kim, Soowon. 1999. Sloppy/strict identity, empty objects, and NP ellipsis. *Journal of East Asian Linguistics* 8:255–284.

Koizumi, Masatoshi. 2000. String vacuous overt verb raising. *Journal of East Asian Linguistics* 9:227–285.

Kroch, Anthony. 1989. Reflexes of grammar in patterns of language change. *Language Variation and Change* 1:199–244.

Lee, Miseon, Hye-Young Kwak, Sunyoung Lee, and William O'Grady. 2011. Processing,

Pragmatics and Scope in Korean and English. In *Japanese/Korean Linguistics 19*, ed. Ho min Sohn, Haruko Cook, William O'Grady, Leon Serafim, and Sang Yee Cheon, 297–311. CSLI.

Otani, Kazuyo, and John Whitman. 1991. V-raising and VP-ellipsis. *Linguistic Inquiry* 22:345–358.

Pearl, Lisa S. 2011. When unbiased probabilistic learning is not enough: Acquiring a parametric system of metrical phonology. *Language Acquisition* 18:87–120.

Santorini, Beatrice. 1992. Variation and change in Yiddish subordinate clause word order. *Natural Language and Linguistic Theory* 10:596–640.

Sohn, Kwun-Won. 1995. Negative polarity items, scope and economy. Doctoral Dissertation, University of Connecticut.

Song, Seok Choong. 1982. On interpreting the scope of negation in Korean. *Language Research* 18:197–215.

Suh, Jinhee. 1989. Scope interaction in negation. In *Harvard Studies in Korean Linguistics*, volume III, 527–536. Department of Linguistics, Haravard University.

Taylor, Ann. 1994. The change from SOV to SVO in Ancient Greek. *Language Variation and Change* 6:1–37.

Wexler, Kenneth, and Peter W. Culicover. 1980. *Formal principles of language acquisition*. Cambridge, Mass: MIT Press.

Yang, Charles. 2002. *Knowledge and learning in natural language*. New York: Oxford University Press.

Yoon, James Hye-Suk. 1994. Korean verbal inflection and checking theory. In *The Morphology-Syntax Connection*, volume 22 of *MIT Working Papers in Linguistics*, 251–270. Cambridge: MITWPL.