# An Experimental Investigation into the Syntax of Negation in Japanese*

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The goal of this paper is to provide a unified syntactic analysis of the two types of negation in Japanese: regular negation with *-na* affixed onto the main verb, and *wa*-negation with the so-called topic marker *-wa* on the main verb followed by auxiliary *suru* ('do') inflected with *-na*. We establish that *-na* heads a projection of its own, and argue that this negation projection is located low in the clause structure, within the lexical *v*P domain. Our proposal is supported by the data concerning scope of negation and argument quantified NPs, extracted through a set of psycholinguistic experiments using the Truth Value Judgment Task.

## 1. Introduction

Japanese has two main ways of forming sentential negation: regular negation with *-na* affixed onto the main verb, as in (1a), and *wa*-negation with the so-called topic marker *-wa* on the main verb followed by auxiliary *suru* ('do') inflected with *-na*, as in (1b).[1]

(1) a. Ken-ga    orenji-o    shokudoo-de  tabe-na-katta.
       Ken-NOM   orange-ACC  cafeteria-in eat-NEG-PST
       'Ken did not eat an orange in the cafeteria.'

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[1] We gloss *-wa* as TOP ('topic marker') for lack of a better term, but stay neutral as to the discourse function of this marker.

b.  Ken-ga      orenji-o      shokudoo-de  tabe-wa  shi-na-katta.
    Ken-NOM    orange-ACC    cafeteria-in  eat-TOP  do-NEG-PST
    'Ken did not eat an orange in the cafeteria.'

The goal of this paper is to provide a unified syntactic analysis of the two types of negation. To this end, we will first establish that *-na* heads a projection of its own, and then establish where this negation projection is located in the clause structure, using data concerning scope of negation and argument quantified NPs. The data is extracted through psycholinguistic experimentation using a technique known as the Truth Value Judgment Task (TVJT), as in Crain and Thornton (1998). We will argue that the findings from our experiments support a view that the negation projection is placed low in the clause structure, within the lexical *v*P domain.

   This paper is organized as follows. In section 2, we consider lexical and syntactic approaches to Japanese negation and conclude that the data calls for a syntactic approach with a negation projection (NegP) in the clause structure. We then argue that the scope interaction between negation and argument quantified NPs (QPs) makes a good test for the position of NegP in Japanese. We however point out that the data that is presented in the extant literature on this topic cannot be used as it is because the scope judgments reported there conflict with each other, making it impossible to reach any coherent conclusions. This raises a question as to the validity of the methodology employed in extracting these scope judgments. In section 3, we present a TVJT experiment that we conducted in order to extract more reliable scope judgments. The test sentences in this experiment contained negation and numeral QPs. After a discussion of the particulars of our experiment, we present our findings followed by their implications for the syntax of negation in Japanese. In section 4, we discuss a previously published experiment on the scope of negation and universal QPs (Han et al. 2004) and show that the findings from the universal quantifier experiment and the numeral quantifier experiment are consistent with each other.

## 2. Negation Projection

### 2.1. Motivating a Negation Projection

   In principle, negation *-na* can be incorporated into the clause structure in two alternative ways: lexically or structurally. Under the lexical approach, *-na* is a derivational morpheme, entering the syntactic derivation as a part of a single syntactic unit along with the verb to which it is affixed. Under the structural approach, *-na* is an inflectional morpheme, projecting its own functional

projection (NegP), and combines with the verb through a morpho-syntactic operation, either verb-raising or INFL-lowering. The form of the tense inflection on the verb occurring with *-na* appears to support the lexical approach. In Japanese, the tense inflection on the adjective is distinct from the verb. For example, while the past tense morpheme on verb *tabe* 'eat' is *-ta* as in (2a), the past tense morpheme on the adjective *oki* 'big' is *-katta* as in (2b). It turns out that negated verbs pattern with adjectives, not with verbs, taking the adjective tense inflection, as in (2c).

(2) a. Jiroo-ga       pizza-o       tabe-**ta**.
       Jiroo-NOM     pizza-ACC     eat-PST
       'Jiroo ate pizza.'
    b. Hon-wa        oki-**katta**.
       book-TOP      big-PST
       'The book was big.'
    c. Jiroo-ga       piza-o        tabe-**na-katta**.
       Jiroo-NOM     pizza-ACC     eat-NEG-PST
       'Jiroo did not eat pizza.'

This patterning of tense inflection seems to suggest that *-na* is a derivational morpheme that derives an adjectival category. However, there are at least two facts that support the structural approach to *-na*.

First, syntactically, negated verbs still behave like verbs. For example, transitive verbs usually assign an accusative case to their internal arguments as in (2a), while transitive adjectives usually assign a nominative case to them as in (3). The internal argument in negated verbs bear accusative case, patterning as a verb, not as an adjective, as in (2c).

(3) Noriko-wa     Shuya-ga       suki desu.
    Noriko-TOP    Shuya-NOM     fond of be
    'Noriko is fond of Shuya.'

Second, *-na* triggers weak island effects. While object extraction from an embedded clause across a negative matrix predicate is possible as in (4a), adjunct extraction in the same context is not possible (Hoji 1985, Miyagawa 2002). In (4b), only the reading in which the time of Shuya's thinking is questioned is available.

(4) a. Nani-o$_i$        Hanako-ga        [Taroo-ga t$_i$    kat-ta to]
       what-ACC$_i$      Hanako-NOM       Taroo-NOM t$_i$  buy-PST

   omottei-na-katta-no?
   COMP think-NEG-PST-Q

   'What didn't Hanako think that Taroo bought?'

   b. Shuya-ga      itsu    Noriko-ga      suupu-o      non-da
      Shuya-NOM     when    Noriko-NOM     soup-ACC     drink-PST

   to        omo-ana-katta-no?
   COMP      think-NEG-PST-Q

   'When didn't Shuya think that Noriko drank soup?'

According to Rizzi (1990), an empty operator in [Spec,NegP] is responsible for weak island effects in negative sentences. The fact that the same type of weak island effect is found in Japanese negative sentences thus provides evidence for an empty operator in [Spec,NegP], which in turn is evidence for positing a phrasal projection for negation.

## 2.2. Using Scope to Locate the Negation Projection

We have so far established that Japanese negation projects a NegP. The question now is where in the clause structure NegP is projected, and whether there are two different positions for NegP, given that Japanese has two ways of forming sentential negation, regular and *wa*-negation, as was illustrated in (1). The fact that these two negations cannot be combined to form a double negation, as in (5), suggests that there is only one NegP position in the Japanese clause structure.[2]

(5) *Ken-ga        orenji-o        shokudoo-de tabe-**na**-wa      shi-**na**-katta.
     Ken-NOM       orange-ACC      cafeteria-in eat-NEG-TOP      do-NEG-PST
     'Ken didn't not eat an orange in the cafeteria.'

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[2] A reviewer correctly points out that it is possible for Japanese sentences to contain multiple negations, one contained within a *-wa* marked construction, and another sentence-finally, as in (i).

    (i) Jiroo-ga        piza-o        tabe-na-i-no-de-wa                na-i.
        Jiroo-NOM    pizza-ACC    eat-NEG-NPST-NL-COP-TOP      neg-NPST
        'Jiroo doesn't not eat pizza.'

Note however that the second instance of negation in this sentence stands alone, bearing a separate tense marker, which suggests a bi-clausal structure for constructions of this type. The status of this *na* is discussed in Oishi (1986), and Storoshenko (2004) argues that it is not syntactically related to the regular or *-wa* forms of negation.

The issue of determining the exact position of NegP turns out to be a difficult one, even though there is a good diagnostic for it, namely scope interaction between negation and an object QP. Two independently motivated background facts about Japanese syntax make scope facts informative: object raising and scope rigidity.

First, the object NP in Japanese can occur before an adverbial or a postpositional phrase, as in (1a), repeated below as (6). This means that in sentences such as (6), the object is forced to undergo a clause-internal scrambling to a position higher than the adverbial phrase. Assuming that the adverbial phrase is adjoined to *v*P, the object in (6) can raise out of VP and adjoin to the higher layer of the *v*P, as in (7).

(6) Ken-ga     orenji-o     shokudoo-de  tabe-na-katta.
    Ken-NOM  orange-ACC  cafeteria-in   eat-NEG-PST
    'Ken did not eat an orange in the cafeteria.'

(7)

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                        TP
                   ┌─────┴─────┐
               NP_Sbj          T′
                           ┌────┴────┐
                          vP          T
                     ┌────┴────┐
                  NP_Obj       vP
                          ┌────┴────┐
                        AdvP        vP
                               ┌────┴────┐
                             t_Sbj       v′
                                      ┌──┴──┐
                                     VP      v
                                  ┌──┴──┐
                                t_Obj  V
```
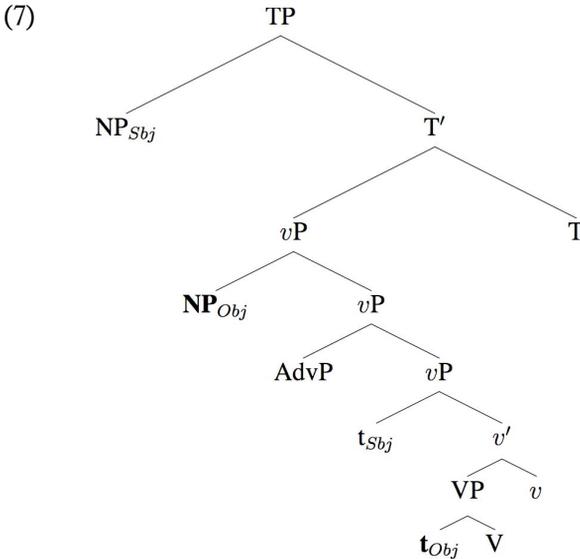
Second, scope for argument NPs is fixed before, and not at, LF in Japanese, as independently motivated by Scope Rigidity effects (Kuno 1973, Kuroda 1979, Hoji 1985). That is, the scope of argument QPs is determined by their surface c-command relationship, without recourse to QR or reconstruction. Thus, a sentence with canonical SOV word order containing quantifiers in both subject and object NPs only exhibits the reading in which the subject scopes over the object, as in (8).

(8)  Dareka   on'nanoko-ga  otokonoko  daremo-o    hihanshi-ta.
     Some     girl-NOM       boy         every-ACC   criticize-PST
     'Some girl criticized every boy.' (√some>every, *every>some)

Putting the two background facts together, a prediction emerges. Starting with the clause structure in (7), there are two possible positions for NegP in principle: NegP could be low in the clause structure within *v*P as in Hypothesis 1 in (9a), or it could be higher in the clause structure above *v*P as in Hypothesis 2 in (9b).

(9)  a.  Hypothesis 1            b.  Hypothesis 2
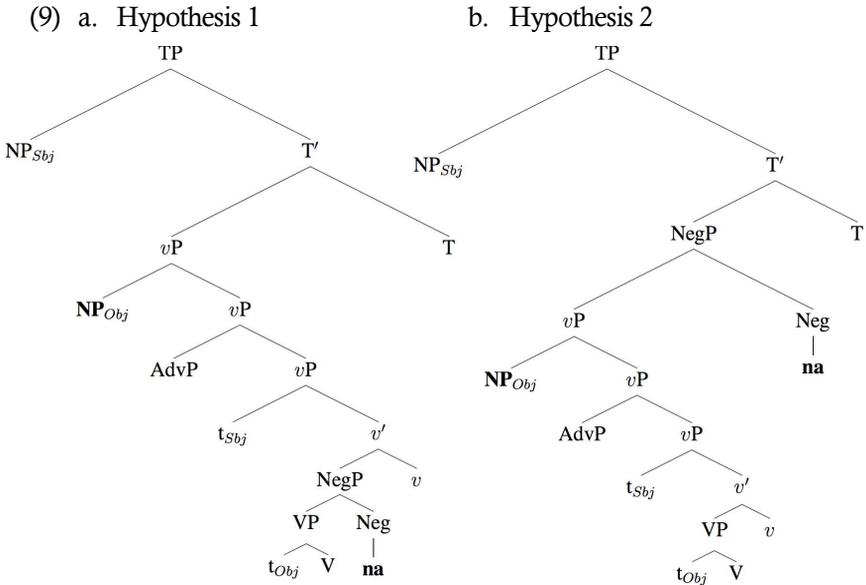


If scope rigidity holds between negation and an argument QP, just as it holds between argument QPs, then in a negative sentence with an argument QP, the relative scope of negation and the QP will directly reflect their relative positions with respect to each other.[3]  This means that in a negative sentence with a subject QP, under both Hypothesis 1 and Hypothesis 2 in (9), the subject QP should scope over negation but not the other way around. Results from our experimental investigation confirm this expectation, as will be discussed in section 3, supporting that negation has a scope freezing property. Given this, we can use negative sentences with a vP-adjoined object QP to tease apart the

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[3]  A reviewer asks whether scopal relations between negation and NPIs will be informative. Following the analysis of Nakanishi (2006), Japanese NPIs are in fact scalars which are interpreted as NPIs in negated contexts, despite taking scope over negation at LF. Because Japanese NPIs do not need to fall under the scope of negation to be licensed in this manner, NPI licensing will not be informative in determining the scope of negation in Japanese.

two hypotheses in (9), as they make different predictions: Hypothesis 1 predicts that the object QP should scope over negation, and Hypothesis 2 predicts that negation should scope over the object QP. The predictions are clear, but unfortunately, the claims made in the literature about this topic are not.

### 2.3. Disagreement in the Literature

When examining the relationship between sentential negation and an object QP, there are ultimately three possible relations: neg>Q, Q>neg, or ambiguity in which, for a given sentence, either relation can hold. In examining the existing literature on the topic, all three of these positions can be found. Kuno (1980) enters this discussion with the claim that verbally-adjoined negation takes scope only over the immediately preceding verb, but amends this claim when examining a case with an object QP:

(10)  Pai-o     zenbu   tabe-rare-na-katta.
      Pie-ACC   all     eat-can-NEG-PST
      'I could not eat all the pie.'

For examples like (10), Kuno claims that the reading should primarily be neg>Q, despite his earlier claim that negation should take the narrowest possible scope. The alternative reading of Q>neg is given as a possible secondary reading. The notion that an object QP should take scope over negation arises in Yatabe (1996), where it is claimed that all quantifiers in Japanese should take scope over negation. In this analysis, readings of neg>Q are never attained.

The possibility of outright ambiguity emerges in Ota and Kato (1986), where examples such as (10) are given as equally neg>Q or Q>neg, without hedges such as referring to primary or secondary readings. In attempting to solve a separate syntactic puzzle, Miyagawa (2001) uses both subject and object QP scope judgments as a source of evidence. Here, while the overall appraisal seems to agree with Kuno in that neg>Q seems to be the preferred reading when encountering an object QP, Miyagawa notes that for some consultants, Q>neg was also possible. Thus, while Kuno and others seem to believe that negative sentences are subtly ambiguous, Miyagawa introduces the notion that they may only be so for some native speakers.

There is much less said in the literature on the subject of the relative scope between an object QP and *-wa*-negation. This being the case, what little there is to be found is noteworthy in that, unlike the discussion of regular negation's scope, all discussions of *-wa*-negation's scope are consistent. There is general agreement with the stance taken in Ota and Kato (1986) that in *-wa*-negation,

negation should always scope over the object QP.

## 3. The Numeral Quantifier Experiment

Given the conflicting claims in the literature on the scope judgments, we cannot use them as they are to make any conclusions as to which hypothesis is superior. What could be the source of the disagreement in the literature? One possibility might be a methodological problem in the elicitation of scope judgments. Some speakers may have difficulty in identifying a reading associated with a sentence without a sufficient discourse context. Another possibility might be that the disagreement actually reflects speakers' grammars. It is possible that different speakers have different grammars, resulting in the apparent disagreement in scope judgments. To address these issues, we designed a psycholinguistic experiment using the TVJT technique and extracted scope judgments that we think clearly reflect speakers' grammars.

### 3.1. Methodology

The TVJT involves two experimenters. One experimenter acts out short stories in front of the participant using toys. The other experimenter plays the role of a puppet (e.g., Mickey Mouse) who watches the scenario alongside the participant. At the end of the story, the puppet makes a statement about the story. The participant's task is to determine whether the puppet understood the story and say whether it told the truth or not.

This task provides rich discourse contexts in a simple method, with little memory load on the participants. It has been shown to work in several languages such as English and Kannada (Lidz & Musolino 2002), Modern Greek (Papafragou & Musolino 2003) and Korean (Han et al. 2007), and to work with both adults and children as young as 4 years old (Crain & McKee 1985, Crain & Thornton 1998, Lidz & Musolino 2002, Han et al. 2007). It is an ideal tool for obtaining subtle interpretive judgments, which have proven to be difficult to obtain with a traditional method where native speakers are presented with a set of sentences taken out of context.

For instance, to test how speakers interpret a sentence with negation and an object QP, such as *Cookie Monster didn't eat every cookie*, an experimenter enacts a story, using Cookie Monster and three cookies. Cookie Monster is hungry and finds three cookies. He eats only two of them. After the enactment is over, the puppet says, "I know what happened. Cookie Monster didn't eat every cookie. Am I right?" In this story, the reading in which negation scopes over the object QP (neg>∀) is true, and the reading in which the object QP scopes over negation (∀>neg) is false. So if a participant accepts the test sentence in

**Table 1.** Experimental design (Numeral quantifier study)

| Grammatical Function | Scope | Regular neg | *Wa*-neg |
|---|---|---|---|
| Subject QP | 2>neg | n=32 | n=32 |
| | neg>2 | n=32 | n=32 |
| Object QP | 2>neg | n=32 | n=32 |
| | neg>2 | n=32 | n=32 |

this context, then we can conclude that the grammar makes available the wide scope reading of negation. But if a participant rejects the test sentence, we can conclude that it must be because the grammar does not generate the neg>∀ interpretation.

## 3.2. Participants

We tested 256 adult speakers of Japanese on the scope of negation and numeral QPs. The participants were 20-30 year old native Japanese speakers living in Vancouver at the time of the testing, who had spent no more than a combined span of 12 months in any English-speaking country (including their residence in Canada at the time of the experiment).

## 3.3. Experimental Design

The overall design of our experiment and the stories we used in the TVJT are closely modeled after the work reported in Han et al. (2007). We designed the experiment to test three factors with two levels each: grammatical function (Subject QP vs. Object QP), negation (regular neg vs. *-wa*-neg) and scope (2>neg vs. neg>2). The experiment was thus divided into 8 different conditions, each condition testing for the 2>neg or neg>2 reading in sentences containing regular neg or *-wa*-neg and a numeral quantifier *futa* ('two') in the subject or the object. We used a between-subjects design, and randomly assigned 32 participants to each condition. The design is summarized in Table 1.

## 3.4. Materials

We used four different types of test sentences: a subject QP and regular negation as in (11), a subject QP and *-wa*-negation as in (12), an object QP and regular negation as in (13) and an object QP and *-wa*-negation as in (14). Each test sentence was used in a scenario compatible with the 2>neg reading, and a scenario compatible with the neg>2 reading.

(11)  Futa-ri-no    otokonoko-ga  suika-o        shokudoo-de
      two-CL-GEN    boy-NOM       watermelon-ACC  cafeteria-in

      tabe-na-katta.
      eat-NEG-PST

      'Two boys did not eat a watermelon in the cafeteria.'

(12)  Futa-ri-no    otokonoko-ga  suika-o        shokudoo-de
      two-CL-GEN    boy-NOM       watermelon-ACC  cafeteria-in

      tabe-wa    shi-na-katta.
      eat-TOP    do-NEG-PST

      'Two boys did not eat a watermelon in the cafeteria.'

(13)  Junko-ga     futa-ri-no     otokonoko-o rooka-de    kera-na-katta.
      Junko-NOM two-CL-GEN boy-ACC      hallway-in kick-NEG-PST
      'Junko did not kick two boys in the hallway.'

(14)  Junko-ga     futa-ri-no     otokonoko-o rooka-de    kera-wa
      Junko-NOM    two-CL-GEN     boy-ACC     hallway-in kick-TOP

      shi-na-katta.
      do-NEG-PST

      'Junko did not kick two boys in the hallway.'

For instance, to test whether (11) and (12) can have the 2>neg reading, we used a scenario with four boys, in which two boys each eat a watermelon, but the other two do not. To test whether they can have the neg>2 reading, we used a scenario with two boys, in which only one boy eats a watermelon. The pictures in Figure 1 are the scenes at the end of the two scenarios. To test whether (13) and (14) can have the 2>neg reading, we used a scenario with four boys and one girl named Junko. Junko is showing off her karate moves. She kicks two boys, but does not kick the other two boys. To test the neg>2



2>neg = True; neg>2 = False          2>neg = False; neg>2 = True

**Figure 1.** Scenarios for 'Two boys did not eat a watermelon.'

| 2>neg = True; neg>2 = False | 2>neg = False; neg>2 = True |

**Figure 2.** Scenarios for 'Junko did not kick two boys.'

reading with (13) and (14), we used a scenario with two boys, and one girl named Junko. Junko kicks one boy, but does not kick the other. The pictures of the scenes at the end of the two scenarios are given in Figure 2.

Each participant was given four test trials. The test sentences stated by Mickey Mouse in the eight conditions are given in Appendix A. In addition to the four test trials, each participant was given four filler trials. The purpose of the filler trials was to separately test the participants' comprehension of negation and of numeral *futa*, and to prevent any priming effects. To add some variety to the material, participants in regular negation condition were given two filler sentences with *-wa*-negation as in (15a), and those in *-wa*-negation condition were given two filler sentences with regular negation as in (15b).

(15) a. Kaba-ga       kirikabu-ni     nobori-wa   shi-na-katta.
       hippo-NOM   tree trunk-onto climb-TOP   do-NEG-PST
       'The hippo did not climb onto the tree trunk.'
    b. Kaba-ga       kirikabu-ni     nobora-na-katta.
       hippo-NOM   tree trunk-onto climb-NEG-PST
       'The hippo did not climb onto the tree trunk.'

In addition, the participants in subject conditions were given two filler sentences with *futa* in the object as in (16a), while those in object conditions were given two filler sentences with *futa* in the subject as in (16b).

(16) a. Lisa-ga       futa-ri-no       otokonoko-o ie-no         mae-de
       Lisa-NOM   two-CL-GEN   boy-ACC       house-GEN front-in

       dakishime-ta.
       hug-PST

       'Lisa hugged two boys in front of her house.'

    b. Futa-ri-no       otoko-ga       neko-o     omise-de nade-ta.
       two-CL-GEN   man-NOM     cat-ACC   shop-in   pet-PST
       'Two men petted the cat in the shop.'

To introduce variation in the answers, we set up the filler scenarios such that two of the fillers should be true and the other two should be false. The filler statements made by Mickey Mouse in each condition are given in Appendix B.[4]

### 3.5. Procedure

The participants were tested in groups of 4 to 6 in a classroom. They were shown a series of video clips of the scenarios described in section 3.4. They were first introduced to the task with 4 practice trials. They were then given 4 test trials and 4 filler trials in a pseudorandom order. They were each given a score sheet and were instructed to indicate, for each trial, whether Mickey Mouse spoke truthfully. They were asked to provide a brief justification for their answers. This allowed us to check whether the answers of the participants are based on the right reasons and not on some irrelevant factors.[5]

To control for prosody, the test sentences were typed and shown to the participants on the screen right after a story was completed. The participants read each test sentence silently, and wrote down their answers on a score sheet. We reasoned that when the participants are reading the sentences silently, they will freely assign a prosody in order to make the sentence true. This reasoning relies on the assumption that listeners follow the Gricean Maxim of Quality (Grice 1975), and will give the speaker the benefit of the doubt. Thus, if a participant rejects a statement as false, we conclude that her grammar simply cannot generate the reading under investigation.

### 3.6. Findings

To obtain quantified results, whenever a participant accepted a statement, that response was scored as one, and the rejection of a statement was scored as zero. The mean percentage acceptance by condition was computed by first converting a participant's score out of four (= # of test trials) to a percentage, then arriving at the arithmetic mean of the 32 (= # of participants per condition) percentage scores. So, if all 32 participants in a condition accepted all 4 test trials, the percentage value for that condition is 100%. The overall results

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[4]  A reviewer asks about scope interaction between the subject QP and the object QP. In a separate TVJT experiment, we tested whether 4 different quantifiers (*daremo* 'every', *minna* 'every', *subete* 'every', *futa*-'two') in the object position can take scope over an existential quantifier (*dareka* 'some') in the subject position. In this experiment, we were able to statistically confirm that these quantifiers in canonical positions do exhibit scope rigidity. This study will be reported in the 18th International Congress of Linguistics in Seoul, July 2008.

[5]  A reviewer notes that more follow-up questions should have been provided, for example asking the participants to write the names of those that didn't eat a watermelon in the scenario in Figure 1. In fact, many participants gave such answers in their justification statements.

**Table 2.** Mean percentage acceptances by condition (Numeral quantifier study)

| Grammatical Function | Scope | Regular neg | *Wa*-neg |
|---|---|---|---|
| Subject QP | 2>neg | 97.66% | 93.75% |
| | neg>2 | 9.38% | 32.03% |
| Object QP | 2>neg | 85.94% | 68.75% |
| | neg>2 | 38.28% | 64.84% |
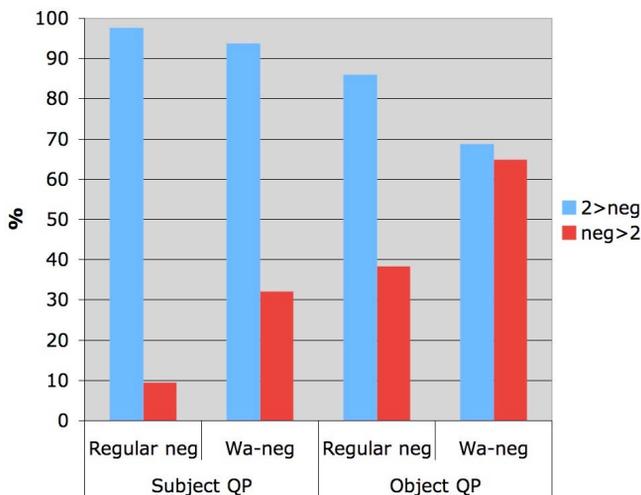


**Figure 3.** Mean percentage acceptances by condition (Numeral quantifier study).

from the experiment are summarized in Table 2 and in Figure 3.

Each participant's percentage score was entered into an analysis of variance (ANOVA), which revealed the following effects. First, we found a main effect of scope ($F(7,248) = 157.182$, $p<.001$): regardless of negation type and grammatical function, participants were more likely to accept the 2>neg reading than the neg>2 reading. Second, we found an interaction between grammatical function and scope ($F(7,248) = 37.489$, $p<.001$): independent of negation type, participants were significantly more likely to accept the neg>2 reading on an object QP than they were on a subject QP. Third, we found an interaction between negation type and scope ($F(7,248) = 19.127$, $p<.001$): independent of grammatical function, participants were significantly more likely to accept the neg>2 reading with *-wa*-negation than they were with regular negation.[6]

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[6] Participants were near perfect on filler items, indicating that they had no difficulty with the task, or with negation or numeral *futa* in isolation.

### 3.7. Discussion and Analysis

In this section, we consider the two hypotheses in (9) against our findings and argue that Hypothesis 1 is superior.

According to our findings, in 'Subject QP -Regular neg' conditions, while almost all the speakers accepted the 2>neg reading (97.66%), speakers rarely accepted the neg>2 reading (9.38%). This fact supports our assumption that scope of negation and argument QPs reflects structure: as the subject QP is high in the clause structure and it asymmetrically c-commands negation, the 2>neg reading, but not the neg>2 reading, is readily available to speakers. So, our findings regarding the scope of negation and a subject QP are consistent with both Hypothesis 1 and Hypothesis 2, as in both hypotheses, the subject QP is in [Spec,TP], asymmetrically c-commanding negation. Further, the subject QP in [Spec,TP] does not reconstruct to [Spec,vP]. If it were to reconstruct to [Spec,vP], then the object QP that has undergone a clause-internal scrambling to the higher layer of vP should be able to take scope over it. But this is not possible, as illustrated in (17). In (17), the object has moved out of VP, and the only reading available is the one which the subject QP scopes over the object QP.

(17)  Dareka on'nanoko-ga otokonoko daremo-o   gakkoo-de hihanshi-ta.
      some    girl-NOM       boy          every-ACC   school-in  criticize-PST
      'Some girl criticized every boy in school.'
      (√some>every, *every>some)

As scope rigidity holds between negation and the subject QP, we are justified in using scope of negation and the object QP to determine the structural relation between the two, to which we turn now.[7]

In 'Object QP -2>neg -Regular neg' condition, the majority of speakers accepted the 2>neg reading (85.94%). This suggests that a structure is available in which NegP is hierarchically lower than the object QP, as in (9a). However, a structure in which NegP is higher than the object QP, as in (9b), is also consistent with the data. This is because numerals are typical indefinites that can take scope using the choice function strategy (Reinhart 1997). An indefinite as a

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[7] A reviewer questions about the 9.38% acceptance rate in the 'Subject QP -neg>2 -Regular neg' condition. Anticipating the discussion a bit, it might be that for those speakers that accepted the reading in this condition, the verb may raise (along with negation) all the way up to C. In any case, we emphasize that the fact that the majority of speakers rejected the reading in this condition supports our assumption that scope rigidity holds between negation and argument QPs in Japanese. In languages that do not show scope rigidity, such as English, a similar TVJT experiment in Musolino et al. (2000) showed that participants almost always accepted both the Q>neg reading and the neg>Q reading in negative sentences containing a subject universal quantifier.

choice function can take scope over any other quantifiers in the same sentence. As the object QP in our test sentences contains a numeral, *futa* ('two'), speakers could have generated the 2>neg reading by Hypothesis 1, or by Hypothesis 2 using the choice function strategy. So, the data in this condition remains inconclusive in determining the superiority of the two hypotheses.

In 'Object QP -neg>2 -Regular neg' condition, the acceptance rate is only 38.28%. This fact simply cannot be accounted for with Hypothesis 2, because this hypothesis can only generate the neg>2 reading, hence incorrectly predicting near 100% acceptance given this condition. This fact cannot be accounted for with Hypothesis 1 either, because this hypothesis incorrectly predicts near 0% acceptance given this condition. The split response, given this condition, however, can be accounted for with Hypothesis 1 in conjunction with verb raising. According to Hypothesis 1, NegP is c-commanded by the object QP, accounting for the half of the speakers who rejected the neg>2 reading. For the other half of the speakers, a structure must be available in which negation is higher than the object QP. This can be obtained if the verb raises to $T^0$, picking up negation on its way to $T^0$, forming a complex head, as in (18b). Assuming the Kaynean definition of c-command, as in (19), negation in $T^0$ is able to c-command out of the complex head, and take scope over the object.

(18)  a.                                    b.
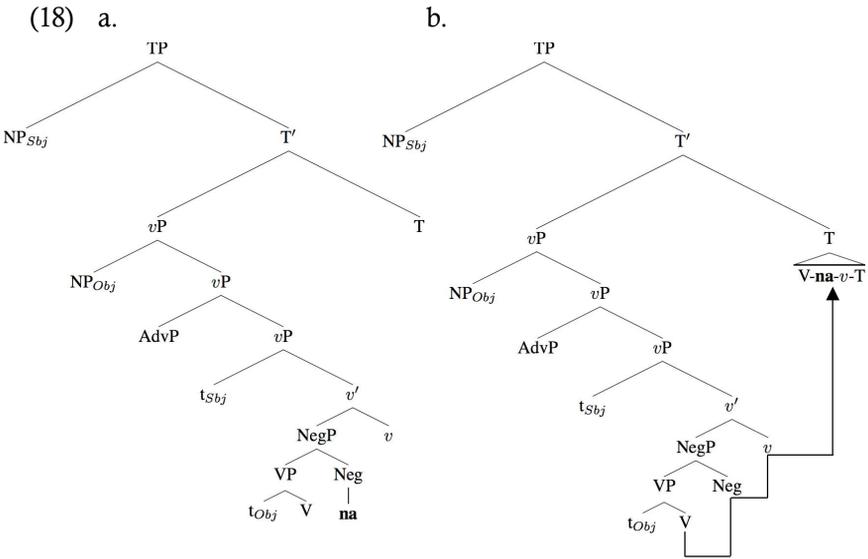


(19)  X c-commands Y iff X and Y are categories and X excludes Y [no segment of X dominates Y] and every category that dominates X dominates Y (Kayne 1994: 16).

But our reasoning so far implies that only half of the speakers have verb raising.

If all the speakers had verb raising, then all the speakers would incorrectly be predicted to accept the neg>2 reading, just as the prediction made by Hypothesis 2.[8]

The idea that there may be a variation concerning verb-raising within a single speech community has been proposed by Han et al. (2007). They report a similar TVJT experiment on scope of negation and an object QP in Korean with similar split in scope judgments. Han et al. argue that this split is a by-product of the head-final clausal structure which obliterates string order evidence for verb raising. Thus, as far as verb raising is concerned, they argue, the learners of Korean do not receive enough evidence to decide the matter, and hence not all speakers acquire the same grammar. We take our results from Japanese, another head-final language, to be a further support of the proposal put forth in Han et al. and conclude that the neg>2 reading is available only to the speakers that have acquired a verb raising grammar. This proposal is further supported by the fact that the split in scope judgments is not within a speaker but between speakers: that is, in general, a speaker that was tested for the neg>2 reading on an object QP and regular negation either uniformly accepted or uniformly rejected the neg>2 reading, giving rise to a bi-modal distribution of responses, as in Figure 4.[9]

We emphasize that the split in responses in 'Object QP - neg>2 - Regular neg' condition cannot be attributed to contextual variation. In a TVJT experiment, the discourse context of each trial is held constant for all participants given the same condition. Further, when Lidz and Musolino (2002) conducted similar TVJT experiments with adult and child speakers of English and Kannada to test the scope of negation and an object QP, the pattern of responses was very consistent: in conditions testing the availability of neg>Q reading in sentences containing negation and an object QP, the adult and the child participants in both languages almost always accepted the test sentences. The fact that consistent responses were obtained from English and Kannada participants means that the split responses of Japanese speakers on similar sentences are not a by-product of the task itself, or some random variation in perception

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[8]  A reviewer asks why the verb raising stops at T. In principle, verb raising all the way to C should be possible. In fact, this may be what is going on for speakers who accept the neg>2 reading in subject conditions, as entertained in footnote 7. But for us, the fact that the majority of participants did not accept the neg>2 reading in subject conditions means that the verb stops at T for these speakers.

[9]  Interestingly, the literature on Japanese does not seem to agree on whether Japanese has verb raising, just as there isn't much agreement on scope judgments concerning negation and quantified arguments. For instance, while Otani and Whitman (1991) and Koizumi (2000) argue for verb raising, Hoji (1998) points out a flaw in Otani and Whitman's argument essentially concluding that their argument is not sufficient to support verb raising, and Fukui and Sakai (2003) refute all the arguments presented by Koizumi, and argue for the position that Japanese has no verb raising. See Storoshenko (2004) for a summary of the literature on this issue. A similar state of affairs for Korean is reported and summarized in Han et al. (2007).
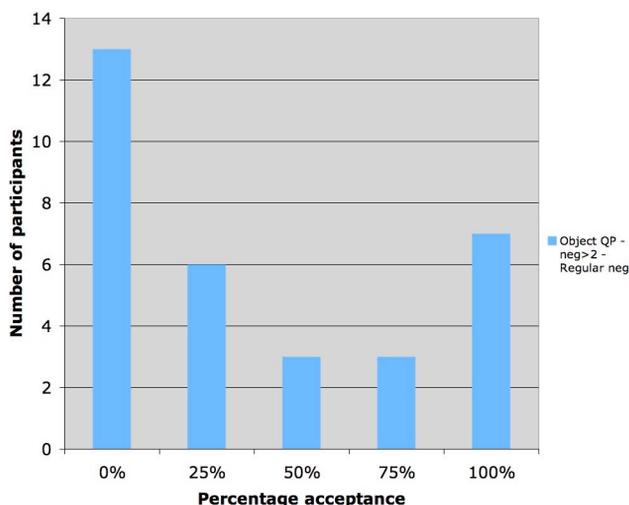
**Figure 4.** Number of participants accepting neg>2 on an object QP with regular negation (Numeral quantifier study).

or comprehension. Rather, it is a reflection of a real variation in the grammar of the speech community of Japanese.

We now need to recast the data in 'Object QP - 2>neg - Regular neg' condition in light of the split in verb raising. For the speakers who do not have verb raising, Hypothesis 1 straightforwardly generates the 2>neg reading. For the speakers who have verb raising, the structure will make available the neg>2 reading, as negation asymmetrically c-commands the object QP. But even these speakers will accept the statements given because (i) the 2>neg reading can be generated by the choice function strategy, as discussed earlier, and (ii) the *v*P-adjoined object c-commands negation, according to the Kaynean definition of c-command. This then accounts for the higher acceptance rate in this condition (85.94%) in comparison to the acceptance rate in 'Object QP - neg>2 - Regular neg' condition (38.28%).

Let us now turn to *-wa*-negation conditions. Just as in 'Subject QP - Regular neg' conditions, in 'Subject QP - *Wa*-neg' conditions, participants more readily accepted the 2>neg reading (93.75%) than the neg>2 reading (32.03%). A one-way ANOVA, comparing average scores across all eight conditions, and a post-hoc analysis using the Tukey test did not yield a significant difference when the 'Subject QP - 2>neg - Regular neg' condition was compared against the 'Subject QP - 2>neg - *Wa*-neg' condition, or when 'Subject QP - neg>2 - Regular neg' condition was compared against 'Subject QP - neg>2 - *Wa*-neg'. This result is certainly consistent with the clause structure of Hypothesis 1 where the subject, located high in the clause structure, is asymmetrically c-commanding negation.

A one-way ANOVA and a post-hoc analysis using the Tukey test yielded no significant difference between 'Object QP - 2>neg - Regular neg', 'Object QP - 2>neg - *Wa*-neg' and 'Object QP - neg>2 - *Wa*-neg' conditions, when compared against each other, whereas a significant difference was revealed when the 'Object QP - neg>2 -Regular neg' was compared against each of the other three object conditions. That is, even though the mean percentage acceptances in 'Object QP - 2>neg - *Wa*-neg' and 'Object QP - neg>2 - *Wa*-neg' conditions are not as high as the one in 'Object QP - 2>neg - Regular neg' condition, statistically, the acceptance rates of the two 'Object QP -*Wa*-neg' conditions are not different from 'Object QP - 2>neg - Regular neg' condition. However, the acceptance rates of the two 'Object QP - *Wa*-neg' conditions are statistically different from 'Object QP - neg>2 - Regular neg' condition. Our analysis therefore must freely allow both the 2>neg reading and the neg>2 reading in sentences with an object QP and *-wa*-negation, just as we freely allowed the 2>neg reading in sentences with an object QP and regular negation.[10]

To generate the neg>2 reading in 'Object QP - neg>2 - *Wa*-neg' condition, a structure should be available for all speakers in which negation is higher than the object QP. How could this be if negation is projected lower in the clause, as we just concluded from the regular negation data? A clause structure containing *wa*-negation which is consistent with Hypothesis 1 is as in (20), where *-wa* on the verb blocks the verb from coming together with the tense inflection, and instead *suru* 'do' is inserted in $T^0$ to support tense. Exploiting the fact that *-na* has an affixal status morphologically, the neg>2 reading can be generated if *na* moves and affixes onto *suru* in $T^0$. We assume that *-na* adjoins to $T^0$ in syntax and then it undergoes a morpho-phonological relinearization in morphology (in the sense of Embick and Noyer 2001, and Fukui and Sakai 2003) obtaining the surface string order *suru+na+*TENSE.

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[10]   While it is not statistically significant, the relatively low acceptance rating for the two 'Object - *Wa*-neg' conditions, in comparison to 'Object - 2>neg - Regular neg' condition, remains in need of explanation. We speculate that this is a result of the discourse-sensitivity of the *-wa* particle, and the fact that the test sentences were presented without prosody. Even with the controlled discourse contexts of the TVJT trials, a slight variation in prosody, as each participant was silently reading the test sentences with *-wa*, may have led to a variation in responses. Presented with a fixed prosody for all participants, we expect that the responses to these stimuli would be more stable. Moreover, although the difference between 'Subject QP - neg>2 - Regular neg' and 'Subject QP - neg>2 - *Wa*-neg' conditions was not statistically significant, the fact that the acceptance rating in the 'Subject QP - neg>2 - *Wa*-neg' condition is higher than in the 'Subject QP - neg>2 - Regular neg' condition remains in need of explanation. A reviewer suggests that when topic marker *-wa* is attached to a verb, it yields a contrastive topic meaning and when such a topic-marked verb is negated, it is more likely to yield a negation wide scope reading. The same reviewer also suggests a comparison between sentences with case particles on argument QPs and those with the topic marker *-wa*. We certainly agree with the reviewer that the discourse sensitivity of *-wa* can lead to some interpretational difference between the two types of sentences, and it would be interesting to do a TVJT experiment to tease apart the difference. We leave this for future research.

(20)

```
                          TP
                 _____|_____
              NP_Sbj             T'
                          _____|_____
                        vP                    T
                   _____|_____            ___|___
                NP_Obj      vP          suru-na-v-T
                        ____|____
                      AdvP      vP
                           _____|_____
                         t_Sbj        v'
                                 _____|_____
                               NegP        v
                           _____|_____
                          VP        Neg
                       ___|___
                     t_Obj   V-wa
```
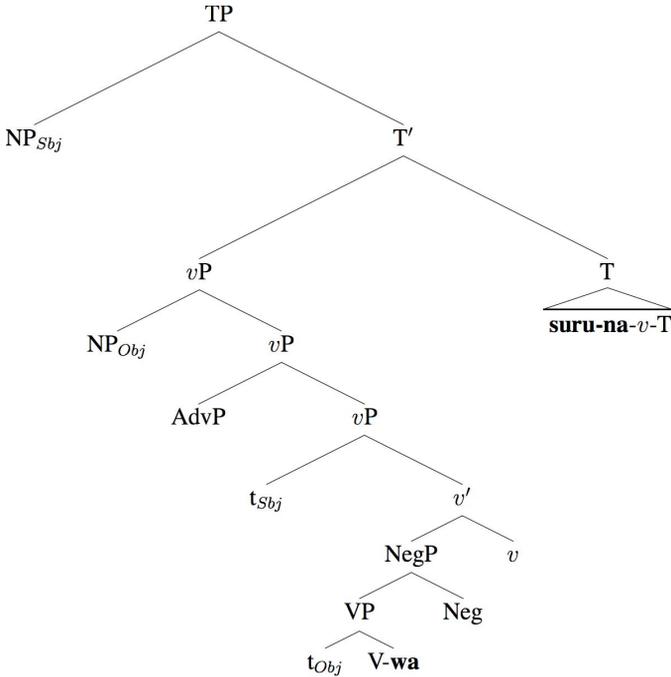
The structure in (20) also generates the 2>neg reading in sentences with an object QP and *-wa*-negation. This is because (i) as *futa* ('two') is a numeral, it can take scope over negation using the choice function strategy, and (ii) the vP-adjoined object c-commands negation, according to the Kaynean definition of c-command.

## 4. Comparison with the Universal Quantifier Experiment

In this section, we discuss a similar study, presented in Han et al. (2004), which tested the scopal relations between negation and the universal quantifier *subete* 'every' in object position. We show that the results from this study further support our claims made above.

### 4.1. Methods and Design

As in the previously-discussed experiment, we used a TVJT approach. For this experiment we chose to concentrate solely on object QP's, eliminating one variable from the design. Thus, there were two factors with two levels each: negation (regular neg vs. *-wa* neg) and scope ($\forall$>neg vs. neg>$\forall$), yielding four

**Table 3.** Experimental design (Universal quantifier study)

| Scope | Regular neg | *Wa*-neg |
|-------|-------------|----------|
| ∀>neg | n=12 | n=12 |
| neg>∀ | n=12 | n=12 |

different conditions. Participants were selected according to the same criteria as in the numeral quantifier experiment; overall, 48 native Japanese speakers were recruited. We used a between-subjects design, randomly assigning 12 participants to each group. The design is summarized in Table 3.[11]

### 4.2. Materials

For this experiment we used two types of test sentences, an object QP and regular negation as in (21) and an object QP and -*wa* negation as in (22). Each test sentence was used in a scenario compatible with the ∀>neg reading, and a scenario compatible with the neg>∀ reading.

(21) Donald-ga　　orenji　subete-o　　tabe-na-katta.
　　 Donald-NOM　orange　every-ACC　eat-NEG-PST
　　 'Donald did not eat every orange.'

(22) Donald-ga　　orenji　subete-o　　tabe-na-katta.
　　 Donald-NOM　orange　every-ACC　eat-NEG-PST
　　 'Donald did not eat every orange.'

For example, to test whether (21) and (22) have the ∀>neg reading, we used a scenario where Donald has three oranges, but does not eat any of them. To test for the neg>∀ reading, we used a scenario where Donald ate two out of the three oranges. Four test trials were created for each condition. All test sentences for this experiment are listed in Appendix C. To introduce variety into the responses, a series of unambiguously true and unambiguously false filler trials were created, using both regular neg and -*wa* neg. Similar to the numeral quantifier experiment, we also used quantifiers in subject positions, and alternated the types of negation used between test and filler trials. A full list of all filler sentences used in this experiment is presented in Appendix D.

### 4.3. Procedure

Participants were tested individually in this experiment, though the overall

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[11]　There was no overlap between the set of participants in the universal quantifier experiment and the numeral quantifier experiment.

procedure is the same as the experiment in section 3. All stimuli were presented as video recordings, with participants giving true/false responses at the end of every trial. Sessions began with four training trials, to familiarize participants with the task, followed by eight experimental trials (four test and four filler) presented in a pseudo-random order.

In this experiment, all stimuli were presented aurally to the participants, rather than typed on screen. The speaker providing the voice for Mickey Mouse was instructed to use a neutral prosody for each sentence. However, any differences in responses between participants cannot be ascribed to prosodic cues, as recordings were used; all participants heard the same prosody.

### 4.4. Findings

Experimental findings are quantified in the same manner as the numeral quantifier experiment. The percentage of acceptances for each condition is presented in Table 4, and graphically in Figure 5.

The results here clearly show that the condition in which regular negation interacts with an object universal quantifier is distinct from the other conditions, similar to the pattern shown in the object QP conditions in the numeral quantifier experiment. To verify this, a simple one-way ANOVA was carried out, comparing the scores across all four conditions ($F(3,44) = 9.156$, $p <$

**Table 4.** Mean percentage acceptances by condition (Universal quantifier study)

| Scope | Regular neg | *Wa*-neg |
|-------|-------------|----------|
| ∀>neg | 98% | 98% |
| neg>∀ | 54% | 94% |
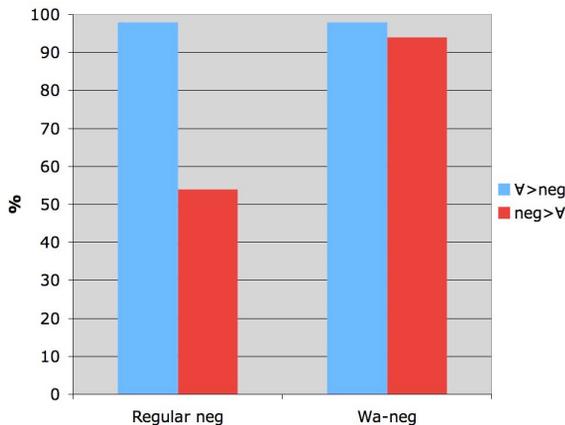


**Figure 5.** Mean percentage acceptances by condition (Universal quantifier study).

0.0001). Further post-hoc pairwise testing confirms that the neg>∀, regular negation results are significantly different from each of the other three conditions. This is the exactly the same statistical pattern shown among the object QP conditions in the numeral quantifier experiment.

### 4.5. Discussion and Analysis

According to our findings, almost all speakers accepted the reading where the universal quantifier scopes over regular negation, suggesting a low position for negation, in accordance with Hypothesis 1. However, this result could also be compatible with the high negation possibility presented in Hypothesis 2. This is due to the fact that a scenario which satisfies the truth conditions for ∀>neg will also satisfy the truth conditions for neg>∀. That is, a situation in which Donald eats none of the oranges is also a situation in which Donald eats 'not all' of the oranges. As such, the data from this condition are inconclusive with respect to deciding between either of the two hypotheses. This is a well known issue, identified as 'the entailment issue' by Lidz and Musolino (2002).

In 'neg>∀-Regular neg' condition, there was only slightly more than 50% acceptance. This fact cannot be accounted for under Hypothesis 2, as the high negation structure will only generate readings where negation scopes over the quantifier, predicting 100% acceptance. However, Hypothesis 1, with the low negation, would predict 0% acceptance. Again, this result can be accounted for with an appeal to a split within the population along the parameter of verb raising. For the half of the population for whom verb raising is an option, wide scope negation is available, and the responses in this condition come out to be true. For those with a non-verb-raising grammar, the quantifier takes the wider scope, resulting in false responses to a neg>∀ scenario.

This finding is further supported by the distribution of true and false responses within the group, shown in Figure 6. Similar to the numeral quantifier study, an examination of the responses within this group reveals a bi-modal distribution, with the majority of speakers presenting an 'all true' or an 'all false' pattern. This indicates that the responses here are being guided by a stable facet of the participants' grammar, rather than varying from scenario to scenario.

Looking at the *-wa* negation cases, the data pattern here can be interpreted as compatible with Hypothesis 1 with the structure in (20) in the same manner as in the discussion around the numeral quantifier experiment. Almost all speakers accepted the neg>∀ reading and the ∀>neg reading. The neg>∀ reading is available because *na* is sitting high in the clause structure, c-commanding the universally quantified object. The near 100% acceptance rate in the '∀>neg - *Wa*-neg' condition is expected because a context that verifies
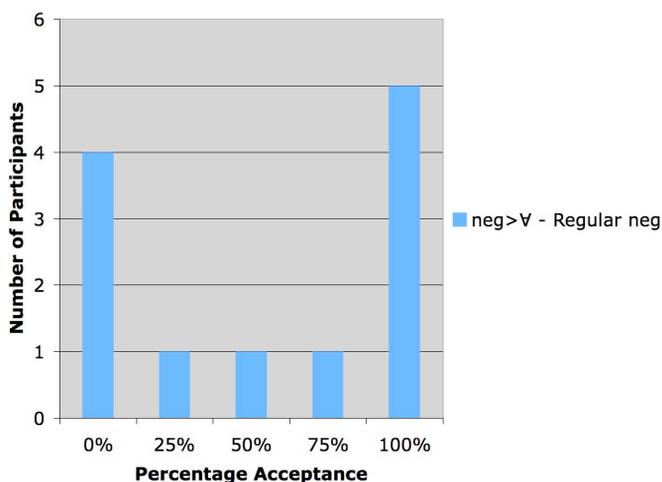
**Figure 6.** Number of participants accepting neg>∀ on an object QP with regular nega-tion (Universal quantifier study).

the ∀>neg reading also verifies the neg>∀ reading and also the vP-adjoined object c-commands negation, according to the Kaynean definition of c-command.

## 5. Conclusion

In this paper, we have shown, through scope judgments obtained from a numeral quantifier TVJT experiment, that Japanese speakers uniformly accept the 2>neg reading, while rejecting the neg>2 reading, in negative sentences with a subject QP. This fact supports that the scope of negation and argument QPs reflects structure. We have also shown that in negative sentences with an object QP, the majority of Japanese speakers seem to accept the 2>neg reading with regular and -*wa*-negation, and neg>2 reading with -*wa*-negation, but there is a split in the population when it comes to the neg>2 reading with regular negation. We have attributed this split in scope judgments to a split in the availability of verb raising within the population, and argued that all the data can be accounted for if negation is projected lower in the clause structure. We have also shown that these findings on the scope of negation and numeral QPs are consistent with the findings from a previously published experiment (Han et al. 2004) on the scope of negation and universal QPs. With our analysis, we are able to present a unified account of the two types of sentential negation in Japanese, and also provide an explanation for the disagreement in the extant literature on the topic of negation scope as a reflection of speakers' grammars.

By supplementing traditional introspective judgments with a quantitative analysis, we have been able to show that what appeared to be inconclusive data consisting of conflicting judgments is reducible to a statistically significant pattern of variation within the population, allowing us to gain new insight into the grammar, or indeed grammars, of the language.

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## Appendix A: Test sentences - Numeral quantifier experiment

This appendix provides the test sentences we used in each condition in the numeral quantifier experiment.

(23) 'Subject QP - 2>neg - Regular neg'; 'Subject QP - neg>2 - Regular neg'
    a. Futa-ri-no    otokonoko-ga iwa-o    kooen-de nage-na-katta.
       two-GL-GEN    boy-NOM    rock-ACC   park-in   throw-NEG -PST
       'Two boys did not throw a rock in the park.'
    b. Futa-ri-no    on'nanoko-ga yubiwa-o omise-de kawa-na-katta.
       two-CL-GEN    girl-NOM    ring-ACC   shop-at   buy-NEG -PST
       'Two girls did not buy a ring at the shop.'
    c. Futa-ri-no    otokonoko-ga suika-o    shokudoo-de
       two-CL-GEN    boy-NOM    watermelon-ACC  cafeteria-in

       tabe-na-katta.
       eat-NEG-PST

       'Two boys did not eat a watermelon in the cafeteria.'

    d.  Futa-ri-no      on'nanoko-ga  inu-o      omise-de  nade-na-katta.
        two-CL-GEN    girl-NOM      dog-ACC   shop-in   pet-NEG-PST
        'Two girls did not pet the dog in the shop.'

(24)  'Subject QP - 2>neg - *Wa*-neg'; 'Subject QP - neg>2 - *Wa*-neg'
    a.  Futa-ri-no      otokonoko-ga  iwa-o      kooen-de   nage-wa
        two-CL-GEN  boy-NOM     rock-ACC    park-in    throw-TOP

        shi-na-katta.
        do-NEG-PST

        'Two boys did not throw a rock in the park.'

    b.  Futa-ri-no     on'nanoko-ga  yubiwa-o  omise-de  kai-wa
        two-CL-GEN   girl-NOM     ring-ACC   shop-at   buy-TOP

        shi-na-katta.
        do-NEG-PST

        'Two girls did not buy a ring at the shop.'

    c.  Futa-ri-no      otokonoko-ga  suika-o        shokudoo-de
        two-CL-GEN    boy-NOM     watermelon-ACC   cafeteria-in

        tabe-wa   shi-na-katta.
        eat-TOP    do-NEG-PST

        'Two boys did not eat a watermelon in the cafeteria.'

    d.  Futa-ri-no     on'nanoko-ga  inu-o      omise-de  nade-wa
        two-CL-GEN   girl-NOM     dog-ACC   shop-in   pet-TOP

        shi-na-katta.
        do-NEG-PST

        'Two men did not pet the dog in the pet shop.'

(25)  'Object QP - 2>neg - Regular neg'; 'Object QP - neg>2 - Regular neg'
    a.  Shigeru-san-ga      futa-ri-no     on'nanoko-o ie-no
        Shigeru-*san*-NOM   two-CL-GEN    girl-ACC     house-GEN

        mae-de front-in dakishime-na-katta.
        hug-NEG-PST

        'Shigeru did not hug two girls in front of his house.'

    b.  Junko-ga     futa-ri-no     otokonoko-o rooka-de
        Junko-NOM   two-CL-GEN    boy-ACC     hallway-in

kera-na-katta.
kick-NEG-PST

'Junko did not kick two boys in the hallway.'

c. John-ga      futa-ri-no      on'nanoko-o   kooen-de
John-NOM    two-CL-GEN    girl-ACC        park-in

mitsuke-na-katta.
find-NEG-PST

'John did not find two girls in the park.'

d. Ken-ga       futa-ri-no      on'nanoko-o   doobutsuen-de
Ken-NOM     two-CL-GEN    girl-ACC        zoo-in

mochi-age-na-katta.
lift-up-NEG-PST

'Ken did not lift up two girls in the zoo.'

(26) 'Object QP - 2>neg - *Wa*-neg'; 'Object QP - neg>2 - *Wa*-neg'
a. Shigeru-san-ga       futa-ri-no       on'nanoko-o   ie-no
Shigeru-*san*-NOM    two-CL-GEN     girl-ACC        house-GEN

mae-de   dakishime-wa    shi-na-katta.
front-in   hug-TOP           do-NEG-PST

'Shigeru did not hug two girls in front of his house.'

b. Junko-ga      futa-ri-no      otokonoko-o   rooka-de
Junko-NOM    two-CL-GEN    boy-ACC        hallway-in

keri-wa      shi-na-katta.
kick-TOP     do-NEG-PST

'Junko did not kick two boys in the hallway.'

c. John-ga       futa-ri-no      on'nanoko-o   kooen-de
John-NOM     two-CL-GEN    girl-ACC        park-in

mitsuke-wa   shi-na-katta.
find-TOP      do-NEG-PST

'John did not find two girls in the park.'

d. Ken-ga       futa-ri-no      on'nanoko-o   doubutsuen-de
Ken-NOM     two-CL-GEN    girl-ACC        zoo-in

mochi-age-wa    shi-na-katta.
lift-up-TOP      do-NEG-PST

'Ken did not lift up two girls in the zoo.'

## Appendix B: Filler sentences - Numeral quantifier experiment

This appendix provides the filler sentences we used in each condition in the numeral quantifier experiment.

(27) 'Subject QP - 2>neg - Regular neg'; 'Subject QP - neg>2 - Regular neg'
    a. Kaba-ga    kirikabu-ni    nobori-wa  shi-na-katta.
       hippo-NOM   tree trunk-onto climb-TOP  do-NEG-PST
       'The hippo did not climb onto the tree trunk.'
    b. Dora-ga    kagami-o    omise-de kai-wa    shi-na-katta.
       Dora-NOM   mirror-ACC  shop-at    buy-TOP  do-NEG-PST
       'Dora did not buy the mirror at the shop.'
    c. Lisa-ga     futa-ri-no     otokonoko-o ie-no
       Lisa-NOM    two-CL-GEN     boy-ACC      house-GEN

       mae-de   dakishime-ta.
       front-in  hug-PST

       'Lisa hugged two boys in front of her house.'

    d. On'nanohito-ga futa-ri-no    otokonoko-o paati-ni manei-ta.
       woman-NOM   two-CL-GEN  boy-ACC     party-to invite-PST
       'The woman invited two boys.'

(28) 'Subject QP - 2>neg - *Wa*-neg'; 'Subject QP - neg>2 - *Wa*-neg'
    a. Kaba-ga    kirikabu-ni    nobora-na-katta.
       hippo-NOM    tree trunk-onto climb-NEG-PST.
       'The hippo did not climb onto the tree trunk.'
    b. Dora-ga    kagami-o    omise-de  kawa-na-katta.
       Dora-NOM   mirror-ACC  store-at   buy-NEG-PST
       'Dora did not buy the mirror at the store.'
    c. Lisa-ga     futa-ri-no     otokonoko-o ie-no
       Lisa-NOM    two-CL-GEN     boy-ACC     house-GEN

       mae-de   dakishime-ta.
       front-in  hug-PST

       'Lisa hugged two boys in front of her house.'

    d. On'nanohito-ga futa-ri-no    otokonoko-o paati-ni manei-ta.
       woman-NOM   two-CL-GEN  boy-ACC     party-to invite-PST
       'The woman invited two boys.'

(29) 'Object QP - 2>neg - Regular neg'; 'Object QP - neg>2 - Regular neg'
    a. Kaba-ga     kirikabu-ni     nobori-wa   shi-na-katta.
       hippo-NOM    tree trunk-onto climb-TOP   do-NEG-PST
       'The hippo did not climb onto the tree trunk.'
    b. Dora-ga     kagami-o    omise-de  kai-wa    shi-na-katta.
       Dora-NOM    mirror-ACC  shop-at  buy-TOP   do-NEG-PST
       'Dora did not buy the mirror at the shop.'
    c. Futa-ri-no    otoko-ga    iwa-o     kooen-de nage-ta.
       Two-CL-GEN   man-NOM   rock-ACC  park-in   throw-PST
       'Two men threw a rock.'
    d. Futa-ri-no    otoko-ga    neko-oo  mise-de  nade-ta.
       two-CL-GEN   man-NOM   cat-ACC   shop-in   pet-PST
       'Two men petted the cat in the shop.'

(30) 'Object QP - 2>neg - *Wa*-neg'; 'Object QP - neg>2 - *Wa*-neg'
    a. Kaba-ga     kirikabu-ni     nobora-na-katta.
       hippo-NOM    tree trunk-onto climb-NEG-PST.
       'The hippo did not climb onto the tree trunk.'
    b. Dora-ga     kagami-o    omise-de  kawa-na-katta.
       Dora-NOM   mirror-ACC  store-at   buy-NEG-PST
       'Dora did not buy the mirror at the store.'
    c. Futa-ri-no    otoko-ga    iwa-o     kooen-de nage-ta.
       Two-CL-GEN   man-NOM   rock-ACC  park-in   throw-PST
       'Two men threw a rock in the park.'
    d. Futa-ri-no    otoko-ga    neko-o   omise-de  nade-ta.
       two-CL-GEN   man-NOM   cat-ACC   shop-in   pet-PST
       'Two men petted the cat in the shop.'

## Appendix C: Test sentences - Universal quantifier experiment

This appendix provides the test sentences we used in each condition in the universal quantifier experiment.

(31) '∀>neg - Regular neg'; 'neg>∀ - Regular neg'
    a. Lisa-ga     yubiwa-subete-o kaw-ana-katta.
       Lisa-NOM    ring-every-ACC    buy-NEG-PST
       'Lisa did not buy every ring.'
    b. Donarudo-ga   orenji-subete-o    tabe-na-katta.
       Donald-NOM   orange-every-ACC eat-NEG-PST
       'Donald did not eat every orange.'

   c. Otokonohito-ga   kuruma-subete-o   araw-ana-katta.
       man-NOM          car-every-ACC        wash-NEG-PST
       'The man did not wash every car.'
   d. Otokonohito-ga   zou-subete-o          mochi-age-na-katta.
       man-NOM          elephant-every-ACC   lift-up-NEG-PST
       'The man did not lift up every elephant.'

(32) '∀>neg - *Wa*-neg'; 'neg>∀ - *Wa*-neg'
   a. Lisa-ga        yubiwa-subete-o  kai-wa     shi-na-katta.
       Lisa-NOM    ring-every-ACC   buy-TOP  do-NEG-PST
       'Lisa did not buy every ring.'
   b. Donarudo-ga  orenji-subete-o      tabe-wa  shi-na-katta.
       Donald-NOM   orange-every-ACC   eat-TOP   do-NEG-PST
       'Donald did not eat every orange.'
   c. Otokonohito-ga   kuruma-subete-o  arai-wa     shi-na-katta.
       man-NOM          car-every-ACC    wash-TOP   do-NEG-PST
       'The man did not wash every car.'
   d. Otokonohito-ga   zou-subete-o          mochi-age-wa  shi-na-katta.
       man-NOM          elephant-every-ACC   lift-up-TOP   do-NEG-PST
       'The man did not lift up every elephant.'

## Appendix D: Filler sentences - Universal quantifier experiment

   This appendix provides the filler sentences we used in each condition in the universal quantifier experiment.

(33) '∀>neg - Regular neg'; 'neg>∀ - Regular neg'
   a. Zou-ga         kirikabu-ni      nobori-wa    shi-na-katta.
       elephant-NOM   tree trunk-onto  climb-TOP     do-NEG-PST
       'The elephant did not climb onto the tree trunk.'
   b. On'nanohito-ga  Lisa-ni  kagami-o       uri-wa     shi-na-katta.
       woman-NOM     Lisa-to  mirror-ACC    sell-TOP   do-NEG-PST
       'The woman did not sell the ring to Lisa.'
   c. Otokonohito-subete-ga  iwa-o        nage-ta.
       man-every-NOM         rock-ACC    throw-PST
       'Every man threw a rock.'
   d. Kyooryuu-subete-ga  kirikabu-kara      ochi-ta.
       dinosaur-every-NOM   tree trunk-from    fall-PST
       'Every dinosaur fell from the tree trunk.'

(34)  '∀>neg - *Wa*-neg'; 'neg>∀ - *Wa*-neg'

    a. Zou-ga              kirikabu-ni        nobor-ana-katta.
       elephant-NOM    tree trunk-onto   climb-NEG-PST
       'The elephant did not climb onto the tree trunk.'

    b. On'nanohito-ga  Lisa-ni kagami-o        ur-ana-katta.
       woman-NOM        Lisa-to mirror-ACC      sell-NEG-PST
       'The woman did not sell the ring to Lisa.'

    c. Otokonohito-subete-ga   iwa-o          nage-ta.
       man-every-NOM                rock-ACC      throw-PST
       'Every man threw a rock.'

    d. Kyooryuu-subete-ga    kirikabu-kara      ochi-ta.
       dinosaur-every-NOM    tree trunk-from    fall-PST
       'Every dinosaur fell from the tree trunk.'

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