Expressing Ignorance in Japanese:  
Contrastive wa versus sukunakutomo

Hitomi Hirayama¹, Adrian Brasoveanu²
Department of Linguistics, University of California, Santa Cruz
hhirayam@ucsc.edu¹, abrsvn@ucsc.edu²

Abstract

In a series of three experiments, we investigate ignorance inferences triggered by two numeral modifiers in Japanese, contrastive wa and sukunakutomo ‘at least’. Experiment 1 (self-paced reading followed by acceptability judgments) investigates how Questions under Discussion (QuDs) affect ignorance inferences and shows that wa is QuD sensitive, while sukunakutomo is not. Given the results, we hypothesize that there is a competition between the two ways of expressing ignorance: sukunakutomo unambiguously encodes ignorance and is therefore preferred when the speaker wants to express uncertainty. In contrast, wa simply requires the presence of alternatives to the at-issue content, which are possible as far as the speaker is concerned. These alternatives can be about numbers, which trigger ignorance inferences, but need not be. Experiments 2 and 3 are forced binary choice tasks. Experiment 2 investigated how sensitive people are to ignorance of the speaker or contextual contrast when they are given a choice between wa and ga. Experiment 3 compared wa and sukunakutomo and supported the competition hypothesis. Specifically, Experiment 3 shows that sukunakutomo is preferred when the speaker is ignorant, while wa is preferred when the speaker is knowledgeable, and there is a contextually salient contrast that wa picks up on.

1. Introduction

In Japanese, there are at least two ways to indicate speaker uncertainty about numbers or individuals. One way is to use the superlative numeral modifier sukunakutomo ‘at least’, as in English — see (1a) below. The other
way is to use contrastive \textit{wa} (Kuno 1973), which is a topic marker accompanying phonological focus — see (1b). Both ways of expressing ignorance associated with an NP in the subject position contrast with the default particle \textit{ga}, which usually conveys an exhaustive reading and is not associated with any ignorance inferences — see (1c).

(1)  a. sukunakutomo 10-nin-ga kita.  
\hspace{1em} at least 10-CL-NOM came  
\hspace{1em} ‘At least 10 people came.’ $\rightarrow$ not sure how many  

b. \text{[F10-nin]-wa} kita.  
\hspace{1em} 10-CL-wa came  
\hspace{1em} ‘10 people-wa came.’ $\rightarrow$ not sure how many  

c. 10-nin-ga kita.  
\hspace{1em} 10-CL-NOM came  
\hspace{1em} ‘10 people-ga came.’ $\not\rightarrow$ not sure how many

Because of the similarity between \textit{wa} and \textit{at least} with respect to their ability to trigger ignorance inferences, contrastive \textit{wa} is sometimes translated as \textit{at least} in English. In this paper, however, we will focus on the subtle differences between contrastive \textit{wa} and \textit{sukunakutomo} (‘at least’). While there are descriptive and theoretical studies on contrastive \textit{wa} in Japanese (Kuno 1973; Kuroda 2005; Hara 2006; Tomioka 2009), the contribution of \textit{sukunakutomo} — and more generally, modified numerals in Japanese — is not well understood; similarly, a systematic comparison between contrastive \textit{wa} and \textit{sukunakutomo} is still lacking.

The main goal of this paper is to provide this systematic comparison. Specifically, we investigate the speaker-ignorance meaning contribution made by contrastive \textit{wa} vs. \textit{sukunakutomo} ‘at least’ in Japanese with a series of experiments. In the process, we shed light on a major open issue in the literature on English modified numerals, namely the issue of whether the ignorance inferences they trigger are contributed semantically or pragmatically. One possibility is to lexically encode speaker uncertainty into the semantics of \textit{at least} (Hara 2006; Nouwen 2010). This is motivated by the fact that superlative modified numerals like \textit{at least four}, but not comparatives like \textit{more than three}, trigger ignorance inferences.
Alternatively, we can attribute ignorance inferences to pragmatic reasoning. The inferences could arise via Gricean reasoning from the disjunctive semantics of a lexical item like *at least* (Büring 2007).

We argue that the disjunctive semantic analysis provides a good account of the ignorance inferences brought by *sukunakutomo*. However, ignorance inferences could also arise from the interaction between modified numerals and contextually-provided Questions under Discussion (QuDs, Roberts 1996). The QuD-based pragmatic analysis is pursued by Westera and Brasoveanu (2014) for English modified numerals, and our experimental results indicate that a suitably modified version of this approach is appropriate for contrastive *wa*. We only sketch an analysis here; see Hirayama (2017) for the full analysis of *wa* as a contrastive topic (CT; Büring 2003).

We investigated *wa* and *sukunakutomo* in a series of three experiments. Experiment 1 is a preliminary experiment that studied the QuD sensitivity of ignorance inferences triggered by *wa* vs. *sukunakutomo* in a real-time (self-paced reading) experiment. In this paper, we only discuss the rating data obtained after the participants read the target sentences (presented in a moving-window self-paced reading format). The main result is that the ignorance inferences triggered by *wa* are quite sensitive to QuDs, while those triggered by *sukunakutomo* are QuD-insensitive. This experiment is discussed in section §2 below.

Experiments 2 and 3 were forced binary choice experiments. Given the results of Experiment 1, these two experiments investigated how finer-grained features of the context, specifically, different kinds of contextually-provided contrasts, biased participants towards using *wa*, *sukunakutomo* or the default particle *ga*. These experiments provide additional evidence that the ignorance inferences associated with *wa* are crucially context sensitive, and can disappear completely when we ensure that the contextually-salient contrast that *wa* is sensitive to has nothing to do with speaker uncertainty. Experiments 2 and 3 are discussed in section §3.

The theoretical consequences of the three experimental studies are discussed in section §4, and the conclusion (section §5) briefly outlines directions for future research.
2. Experiment 1: QuD-sensitivity of *wa* vs. *sukunakutomo*

As mentioned in the introductory section, Experiment 1 was a pilot study meant to examine whether the ignorance inferences triggered by *wa* and *sukunakutomo* ‘at least’ are sensitive to different kinds of Questions under Discussion (QuDs) (Roberts 1996). The design of the experiment followed Westera and Brasoveanu (2014), who investigated the QuD sensitivity of ignorance inferences for English modified numerals.

Assume ignorance inferences are QuD sensitive. Then, we expect modified numerals — which, roughly speaking, denote intervals — to trigger such inferences if the QuD asks for a precise number, but not if the QuD allows for an approximate answer, or is about an issue that is not necessarily number-related. The experiment manipulated QuDs along these lines and tested whether different QuDs are associated with different strengths for ignorance inferences.

2.1. Method and design

Participants were presented with conversations between a judge and a witness in a court setting. This setting was meant to reinforce the explicitly stated fact that the witness was fully cooperative and informative.

For each trial / stimulus, participants saw a sequence of three different screens. On the first screen, a question posed by the judge was displayed. On the second screen, the witness’s answer to the question was provided in a moving-window self-paced reading task (Just, Carpenter, and Woolley 1982). One region was displayed at a time, and participants pressed the space bar to read the next region. Once participants finished reading the whole answer, the third and final screen was presented, which displayed a conclusion the judge drew based on the witness’s answer. This conclusion was an ignorance inference: “The witness does not know the exact number of (the object)”.

The experiment had a 3×3 factorial design. The QuD type factor manipulated the judge’s question; this factor had three levels, POLAR, HOW MANY, and WHAT, exemplified in (2) below. The numeral modifier factor...
Expressing Ignorance in Japanese

manipulated the subject NP used in the witness’s answer; this factor also had three levels: WA, SUP(ERLATIVE) (sukunakutomo ‘at least’) and COMP(ARATIVE) (izyoo ‘more than’), as shown in (3). In this paper, we only discuss the WA and SUP numeral modifiers.

(2) QuD type (the judge’s question)

a. POLAR
Sono ningyoo no uchi, {10-tai-wa/ sukunakutomo 10-tai-ga / 10-tai izyoo-ga} that dolls out of 10-CL-wa/ at least 10-CL-ga / 10-CL more than-ga oohiroma-ni aru no o mimasita ka?
haul-LOC exist NL ACC saw Q
‘Did you see {10-wa / at least 10-ga / more than 10-ga} of the dolls in the hall?’

b. HOW MANY
Sono ningyoo no uchi ikutu-ga oohiroma-ni aru no o mimasita ka?
that dolls out of how many-NOM hall-LOC exist NL ACC saw Q
‘How many of the dolls did you see in the hall?’

c. WHAT
nani-ga oohiroma-ni aru no o mimasita ka?
what hall-LOC exist NL ACC saw Q
‘What did you see in the hall?’

(3) Numeral modifier (the witness’s answer)
Watashi-wa 1 sono ningyoo no uchi 2 10-tai-wa / sukunakutomo 10-tai-ga /
I 1 those dolls out of 2 10-CL-wa / at least 10-CL-NOM /
10-tai-izyoo-ga 3 oohiroma-ni 4 aru-no-o 5 mimasita. 6
10-CL-more than-NOM 3 hall-LOC 4 exist-NL-ACC 5 saw. 6
‘I saw 10-wa / at least 10 / more than 10 of the dolls in the hall.’

The witness’s answer was divided in 6 regions, separated by vertical bars in (3) above. Region 1 consists of the subject (watashi-wa ‘I’), region 2 consists of the partitive (sono ningyoo no uchi ‘of the dolls’), and region 3 contains the modified numerals we manipulated (10-cl-wa / sukunakutomo 10-cl-ga / 10-cl-izyoo-ga). Regions 4 (oohiroma-ni ‘at the hall’) and 5 (aru-no-o ‘exist’) are the spillover regions immediately following our manipulation; they were identical across all 9 (3×3) conditions and they are
the main regions of interest. Finally, region 6 (the matrix verb *mimasita* ‘saw’) is the wrap-up region.

There were 18 experimental items, each of which was passed through all 9 conditions; 9 lists were generated that balanced the items across conditions, with two items per condition and every item occurring exactly once in each list (Latin square design). Every participant was presented with 54 stimuli total (18 experimental items + 36 fillers) in random order varying from participant to participant. 18 native speakers of Japanese recruited online volunteered to participate in this experiment. Each session took less than 30 minutes.

The fillers included questions that did not always involve partitives, and answers with adverbs like *tabun* ‘probably’, *daitai* ‘approximately’, *tasikani* ‘certainly’, and *tatta* ‘only’. The judge’s conclusion for the fillers was of the form “*The witness thinks the number of the object was relatively large/small.*” or “*The witness thinks she might have seen 9/10/11 objects*”.

All three experiments reported in this paper were administered online using Alex Drummond’s Ibex platform (https://github.com/addrummond/ibex).

2.2. Predictions

The main goal of this experiment was to determine whether ignorance inferences triggered by certain lexical items are QuD sensitive or not, and if they are, how. If a lexical item triggers QuD-insensitive ignorance inferences, an answer with the lexical item should get high ratings across the all question types. If ignorance inferences are QuD sensitive, we predict:

(i) weaker ignorance inferences to be associated with POLAR questions for each answer type because the QuD does not ask for an exact answer, but only a lower limit;

(ii) stronger ignorance inferences to be associated with HOW MANY questions because the QuD explicitly asks for the exact number of entities under discussion; using any modified numerals or marked numeral expressions should trigger ignorance inferences because of Grice’s cooperative principle (Grice 1975);

(iii) finally, WHAT questions are open-ended, so they provide a control condition for the POLAR and HOW MANY QuDs.
2.3. Results

We only discuss the results of the acceptability judgment task in which participants evaluated the strength of the ignorance inferences in this paper.\(^1\) Tables 1-3 below summarize the ignorance-inference ‘acceptability’ data (means and standard errors for every one of the 9 conditions). Figures 1-3 show the proportions of each rating for each answer type.

Table 1. Mean and standard errors with *At least* answers

<table>
<thead>
<tr>
<th>How many</th>
<th>Polar</th>
<th>What</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.25 (0.18)</td>
<td>3.86 (0.23)</td>
<td>3.92 (0.20)</td>
</tr>
</tbody>
</table>

Table 2. Mean and standard errors with *Wa* answers

<table>
<thead>
<tr>
<th>How many</th>
<th>Polar</th>
<th>What</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.39 (0.23)</td>
<td>3.14 (0.26)</td>
<td>3.86 (0.21)</td>
</tr>
</tbody>
</table>

Table 3. Mean and standard errors with *More than* answers

<table>
<thead>
<tr>
<th>How many</th>
<th>Polar</th>
<th>What</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.03 (0.18)</td>
<td>4.17 (0.23)</td>
<td>3.78 (0.22)</td>
</tr>
</tbody>
</table>

\(^1\) We added a self-paced reading task, following the design of experiments by Westera and Brasoveanu (2014), but the reading time data did not produce appreciable results. This could be due to the fact that the data was not big enough. We will leave further analysis of reading times with ignorance inferences in Japanese for the future research.
Figure 1. Proportions of ratings for each QuD with *wa* answers

Figure 2. Proportions of ratings for each QuD with *sukunakutomo* answers
Since this paper focuses on the contrast between *wa* and *sukunakutomo*, we will not discuss the *izyoo* ‘more than’ data even though this data was included in the analysis.  

We used mixed-effects ordinal probit regression models to analyze the data, treating the rating data as ordered factors.  

We report the results of the model with the maximal random-effect structure that converged; this model included random intercepts for items and participants, QuD type random slopes for items and participants, and modifier type random slopes for participants (no correlation between random intercepts and slopes was assumed). The reference level was *sukunakutomo* for the quantifier type, and *WHAT* for the QuD type.

There was a main effect of QuD type: ignorance inferences were higher with *HOW MANY* questions than the reference level *WHAT* ($\beta=1.16$,

---

2 The comparative numeral modifier *izyoo* was included as a condition to investigate if/how comparative numerals convey ignorance inferences in Japanese. In English, it is reported that there is a contrast between ignorance inferences triggered by superlatives and comparatives (Geurts, Katsos, Cummins, Moons and Noordman 2010, Nouwen 2010). Japanese *izyoo* seems to behave differently than English comparative numeral modifiers. We leave a more in-depth discussion of this issue for a future occasion.

3 The models were estimated using the R package *ordinal* (Christensen 2015).
SE=0.48, z=2.43, p<0.05). In addition, there was an interaction between question types and answer types. In particular, we found that when *wa* answers were used to answer HOW MANY questions, ignorance inferences were weaker (β=-1.21, SE=0.43, z=-2.80, p<0.01). A similar trend can be observed with *wa* answers to POLAR questions, although it was not statistically significant (β=-0.7, SE=0.4, z=-1.75, p=0.08). Together, these results indicate that, overall, *wa* triggered weaker ignorance inferences than *sukunakutomo* in non-open-ended questions.

If we examine only the *wa* data, we see that POLAR questions induced weaker ignorance inferences relative to WHAT questions (β=-0.73, SE=0.33, z=-2.22, p<0.05), and that there was no difference between WHAT and HOW MANY. In contrast, for *sukunakutomo*, HOW MANY questions induced stronger ignorance inferences relative to WHAT questions (β=0.09, SE=0.52, z=2.10, p<0.05), but there was no significant difference between WHAT and POLAR questions.

Thus, two main generalizations emerge from Experiment 1. First, *wa*-triggered ignorance inferences are sensitive to QuD type, but QuD sensitivity is different from what we would expect for modified numerals in general. While the fact that polar questions with *wa* did not seem to induce ignorance inferences was predicted, it is surprising that *how many* questions, which are supposed to trigger strong ignorance inferences, induced weaker ignorance inferences with *wa*. Second, the behavior of *wa* contrasts with that of *sukunakutomo*, which induced ignorance inferences for all three QuD types across the board, with stronger ignorance inferences for HOW MANY questions.

### 2.4. Accounting for the behavior of *wa* and *sukunakutomo*

Experiment 1 shows that the ignorance inferences triggered by *wa* depend on contextually available information, and are generally weaker than the ignorance inferences contributed by *sukunakutomo*, which are less context-sensitive. This suggests that ignorance inferences for these two

---

4 The mixed-effect models used to analyze these subsets included random intercepts for items and participants, as well as QuD type random slopes (with no correlation between intercepts and slopes).
numeral modifiers are derived via two different mechanisms. Furthermore, the mechanism associated with *wa* should induce weaker ignorance inferences even when the QuD is a *how many* question, which explicitly signals that an exact answer is expected.

Our proposal is that *wa* is anaphoric to a contextually-available set of contrasting alternatives, and triggers ignorance inferences only when these alternatives are about different (exact) numbers. Consider, for example, the simple sentence in (4) below. This sentence can be interpreted in two different ways, paraphrased in (4a) and (4b). The interpretation in (4a) is of the kind we investigated in Experiment 1: the implicit contrast picked up by *wa* is between Taro and other people that came; the speaker knows that Taro came, but doesn’t know if other people came and if they did, who these people are. In (4b), however, the implicit contrast picked up by *wa* is between people that came and people that did not come out of a contextually-salient set of people. In this case, no ignorance inferences are triggered and the speaker is taken to be fully knowledgeable about the issue at hand.

(4) *[F Taro]-wa kita.‘*[F Taro]-wa came.’
   a. Taro came, but I do not know who else came.
   b. Taro came, and Jiro did not come.

Since all the modified numerals in Experiment 1 were partitives, it is possible that participants took *wa* numerals to refer back to a contrast between two subsets of the contextually-salient set of entities. For example, an experimental item shown above, which is repeated as (5) below, the contextually-salient set of dolls is split into two contrasting subsets: the set of 10 dolls that the witness saw in the hall, and the remaining dolls that the witness did not see. Thus, a *wa* sentence like the one in (5) below can have two interpretations, only one of which — namely, (5a) — triggers ignorance inferences.

(5) Watashi-wa sono ningyoo no uchi 10-tai-wa oohiroma-ni aruno-o mimasita.
    I those dolls out of 10-CL-wa hall-LOC exists-ACC saw
    ‘I saw 10-wa of the dolls in the hall.’
a. I saw at least 10 of the dolls in the hall, but I’m not sure how many they actually were.
b. I saw 10 of the dolls in the hall, but I saw the rest in the bedroom / but I did not see the rest of the dolls there.

This hypothesis can also explain why HOW MANY and POLAR questions triggered weaker ignorance inferences for \textit{wa} than open-ended WHAT questions: the non-open-ended questions contain the same partitive structure, thereby making the contrast between the two doll subsets in (5) even more salient.

In contrast, \textit{sukunakutomo} seems to trigger ignorance inferences in the same way as the English \textit{at least}: these inferences are unaffected by the partitive-triggered contextual contrast, and are instead simply sensitive to whether the QuD requires an exact number (HOW MANY questions) or not (POLAR and WHAT questions).

Experiment 2 and 3, discussed in the next section, were designed to test the ‘contextual contrast’ hypothesis about the interpretation of \textit{wa}.

3. Experiments 2 and 3: The flexibility of contrastive \textit{wa}

Experiments 2 and 3 aimed to determine whether native speakers of Japanese are sensitive to contextual contrasts when they choose to answer questions with \textit{wa} vs. \textit{sukunakutomo}, or \textit{wa} vs. \textit{ga}. If \textit{ga} is only used with an exhaustive interpretation, it should be felicitous only in contexts where the speaker is fully knowledgeable, and there is no contrast. Furthermore, if the hypothesis formulated in the previous section is correct, \textit{sukunakutomo} should be preferred in a context where the speaker is not knowledgeable due to its unambiguous meaning. In contrast, \textit{wa} should be preferred when the speaker is knowledgeable, and there is a contrast in the context. Experiment 2 investigated the contrast between \textit{wa} and \textit{ga}, and Experiment 3 the contrast between \textit{wa} and \textit{sukunakutomo}.

3.1. Design

Both Experiment 2 and Experiment 3 had the same design. There were three context types, exemplified in (6). The IGNORANT contexts were
contexts where the speaker was not presumed to have full knowledge about the number under discussion. In CONTRAST contexts, the speaker was supposed to be fully knowledgeable, and there was a contextually salient contrast. For example, in (6ii), there is a contrast between the people who came to the social gathering and those who did not. Finally, INCOMPATIBLE contexts were the control condition, meant to be incompatible with wa. In these contexts, the speaker was presumed to know the exact number under discussion, and there was no contextually available contrast. Therefore, both wa and sukunakutomo should be infelicitous in this condition.

(6) Question types used in Experiments 2 and 3:
   i. IGNORANT: the speaker is not knowledgeable, and there is no contrast
      There was a social gathering of a lab. Taro wanted to attend, but due to a schedule conflict, he just went to the venue a little before it got started and said hello to people who were there and left. Next day, Hanako, Taro’s friend, ran into Taro and asked,
      ‘How many people were there at the social gathering yesterday?’
   ii. CONTRAST: the speaker is knowledgeable, and there is a contrast
      There was a social gathering of a lab, and Taro was the organizer and counted how many people actually came and how many did not. Taro’s friend, Hanako, ran into him and asked,
      ‘How many people came to the social gathering yesterday?’
   iii. INCOMPATIBLE (with wa): the speaker is knowledgeable, no contrast in a context
      There was a social gathering of a lab and Taro was the organizer and counted how many people actually came. Taro’s friend, Hanako, ran into him and asked,
      ‘How many people came to the social gathering yesterday?’

Each context ended with a How-many question, exemplified below, to which the participants had to choose the best answer out of the two. In Experiment 2, the two options were wa vs. ga, as shown in (8), and in Experiment 3, the two options were wa or sukunakutomo, as shown in (9).
(7) A sample of *How-many* question

Kinoo nannin-ga konshinkai-ni kiteita no?

*yesterday how many people-NOM to the social gathering came Q*

‘How many people came to the social gathering yesterday?’

(8) Experiment 2 answer pair (*wa* vs. *ga*)

a. 10-nin wa kinoo zemi-no konshinkai-ni kiteita yo.

10-CL *wa* yesterday seminar-GEN to the social gathering came

‘10 people-*wa* came to the social gathering of the seminar yesterday.’

b. 10-nin ga kinoo zemi-no konshinkai-ni kiteita yo.

10-CL *ga* yesterday seminar-GEN to the social gathering came

‘10 people-*ga* came to the social gathering of the seminar yesterday.’

(9) Experiment 3 answer pair (*wa* vs. *sukunakutomo*)

a. 10-nin wa kinoo zemi-no konshinkai-ni kita yo.

10-CL *wa* yesterday seminar-GEN to the social gathering came

‘10 people-*wa* came to the social gathering of the seminar yesterday.’

b. sukunakutomo 10-nin ga kinoo zemi-no konshinkai-ni kita yo.

atleast 10-CL *ga* yesterday seminar-GEN to the social gathering came

‘At least 10 people-*ga* came to the social gathering of the seminar yesterday.’

There were four items for each context (12 items total), and 32 fillers. The fillers included 8 controls used to determine whether participants were actively paying attention to the experiment. Examples of control fillers are provided in (10). The controls involved two kinds of contexts: MORE THAN EXPECTED and LESS THAN EXPECTED, where the context suggests 10 is bigger or smaller than the speaker’s expectation. When 10 is larger than expected, only *mo*-answers should be felicitous because this particle encodes the presupposition that the number is bigger than expected. By contrast, with a LESS THAN EXPECTED context, only *sika*+NEG-answers should be acceptable for the same reason.
(10) Examples of filler contexts

a. MORE THAN EXPECTED

Taro had a make-up section yesterday. He had thought nobody might come because he told them that attendance was not obligatory and not going to be part of the grade. He just ran into Hanako, his colleague, and Hanako asked him ‘How many students came to your make-up class yesterday?’

b. LESS THAN EXPECTED

Taro had a make-up section of Intro to Linguistics, which had 50 students yesterday. He had thought almost everybody would come because he told them that attendance was obligatory and would be counted as part of the grade. He just ran into Hanako, his colleague, and Hanako asked him ‘How many students came to your make-up class yesterday?’

(11) An answer pair of test filler questions

a. mo-answer: compatible only with MORE THAN EXPECTED

10-nin mo kinoo zyugyoo-ni kita yo.
10-CL Mo yesterday to the class came

‘As many as 10 people came to the class yesterday.’

b. sika+NEG-answer:

compatible only with LESS THAN EXPECTED

10-nin sika kinoo zyugyoo-ni ko.nakatta yo.
10-CL SIKA yesterday to the class came.NEG

‘Only 10 people came to the class yesterday.’

Each stimulus in Experiments 2 and 3 had two parts, both consisting of a forced binary choice task. In the first part, participants were presented with a context plus a question and were asked to choose the most natural answer out of the two. Once an answer was selected, a new screen displayed the context again, and the participant was asked to answer a comprehension question. For the experimental items, the comprehension question asked if it was possible to assume that the speaker who answered the question knew the exact number of the people under discussion. The order of 44 stimuli (12 items + 32 fillers) was randomized for each participant. In both experiments, each session took less than 15 minutes.
3.2. Experiment 2: *wa* vs. *ga*

Eighty-eight native speakers of Japanese recruited online volunteered to participate in this experiment; 17 participants were excluded because they failed to choose the correct answers for the control fillers more than once. The data summary for the remaining 71 participants is provided in Table 4 and Figure 4 below.

<table>
<thead>
<tr>
<th></th>
<th>IGNORANT</th>
<th>CONTRAST</th>
<th>INCOMPATIBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>ga</em></td>
<td>65</td>
<td>255</td>
<td>267</td>
</tr>
<tr>
<td><em>wa</em></td>
<td>219</td>
<td>29</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 4. The results of Experiment 2 (*wa* vs. *ga*)

![Image of bar chart showing the results of Experiment 2](image-url)

**Figure 4.** Proportion of *wa* choice in Experiment 2

Mixed-effects logistic regression models were used to analyze the data; all models included crossed random intercepts and context random slopes for participants and items. The reference level was set to INCOMPATIBLE for the context factor, and to *ga* for the particle in the responses (hence, *wa* was coded as 1 / ‘success’). The only significant effect was associated with IGNORANT contexts ($\beta=5.34$, $SE=0.95$, $z=5.60$, $p<0.001$); CONTRAST contexts were not statistically different from INCOMPATIBLE contexts ($\beta=1.21$, $SE=0.93$, $z=1.30$, $p=0.20$). The results show that the particle *ga*,
which is used to mark an exhaustive answer, is preferred whenever the speaker is knowledgeable, that is, both in INCOMPATIBLE and in CONTRAST contexts, while wa is preferred in ignorance contexts.

The results for CONTRAST contexts are unexpected given the hypothesis formulated in the previous section: we expected contextual contrast to boost the participants’ preference for wa. It is worth noting, however, that there were nine participants who had a sharp contrast between ga and wa, that is, they chose ga for all INCOMPATIBLE contexts and wa for all IGNORANT contexts, and showed a preference for wa in CONTRAST contexts. There were also three participants who chose ga for all contexts, possibly because ga is the default particle to mark the subject.

Thus, Experiment 2 found that participants are sensitive to whether the speaker is supposed to be knowledgeable or not when deciding between wa and ga. The intuitive generalization in the previous literature that wa can be associated with ignorance is confirmed by the clear preference for wa relative to ga in IGNORANT contexts. However, we expected both wa and ga to be acceptable in CONTRAST contexts, an expectation that was not borne out. We attribute the strong preference for ga in contrast contexts to the fact that ga is the default subject particle, and participants will tend to prefer it when it is possible to give a complete answer regardless of whether there is a potential contrast in context. Experiment 3 was designed to avoid this issue by focusing on wa vs. sukunakutomo.

3.3. Experiment 3: wa vs. sukunakutomo

Fifty-nine native speakers of Japanese recruited online volunteered for this experiment. None of the 59 participated in either Experiment 1 or 2. Twelve participants were excluded for failing to choose the correct answers to the control fillers more than once. The data summary for the remaining 47 participants is provided in Table 5 and Figure 5 below.

Table 5. The results of Experiment 3 (sukunakutomo vs. wa)

<table>
<thead>
<tr>
<th></th>
<th>IGNORANT</th>
<th>CONTRAST</th>
<th>INCOMPATIBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>sukunakutomo</td>
<td>146</td>
<td>63</td>
<td>93</td>
</tr>
<tr>
<td>wa</td>
<td>42</td>
<td>125</td>
<td>95</td>
</tr>
</tbody>
</table>
For INCOMPATIBLE contexts, both sukunakutomo and wa are predicted to be infelicitous because the speaker is presumed to be knowledgeable, and there is no contrast. We therefore correctly predict that particle choice for this condition should be more or less at chance (50-50) level.

Mixed-effects logistic regression models were used to analyze the data; all models included crossed random intercepts and context random slopes for participants and items. The reference level is again set to INCOMPATIBLE for the context factor and to sukunakutomo for answers (once again, wa was coded as 1 / ‘success’). As predicted by our hypothesis, there was a significant preference for sukunakutomo in IGNORANT contexts ($\beta=-1.70$, $SE=0.48$, $z=-3.52$, $p<0.001$), and a significant preference for wa in CONTRAST contexts ($\beta=1.01$, $SE=0.36$, $z=2.78$, $p<0.01$). If ignorance interpretations triggered by wa were always (lexically) available, we would not expect a difference between wa and sukunakutomo in IGNORANT contexts; they would be equally good to be used in answers. The preference for sukunakutomo in IGNORANT contexts indicates that the ignorance interpretation of wa is dependent on the context, and participants will tend to prefer sukunakutomo when given the choice because it unambiguously expresses ignorance.

In sum, Experiments 2 and 3 show that the selection of a subject-marking...
Expressing Ignorance in Japanese

particle / modifier in Japanese is sensitive to fine-grained contextual features. Experiment 2 showed that participants are sensitive to whether the speaker is knowledgeable or not when choosing between *wa* and *ga*, while Experiment 3 showed that both speaker ignorance and contextually-salient contrasts influence the decision between *wa* and *sukunakutomo*.

### 4. General Discussion

Experiment 1 showed that the ignorance inferences triggered by superlative modified numerals formed with *sukunakutomo* ‘at least’ are relatively QuD insensitive. This contrasts with superlative modified numerals in English: the experimental findings reported in Westera and Brasoveanu (2014) show that the ignorance inferences triggered by *at least* in English are QuD sensitive. However, contrastive *wa* in Japanese exhibited QuD-sensitive behavior, but of a different kind than the English *at least*. First, *wa* triggers weaker ignorance inferences than *sukunakutomo*, and these inferences are particularly weak with *HOW MANY* questions, which are associated with the stronger ignorance inferences for English *at least*.

Experiment 2 and 3 aimed to examine our hypothesis that contrastive *wa* is anaphoric to contextually-provided contrasts that can, but do not have to be related to speaker uncertainty. Experiment 3, in particular, indicated that *sukunakutomo* ‘at least’ is preferred when the speaker wants to convey her ignorance because of its unambiguous interpretation, and *wa* is preferred when the speaker is knowledgeable but there is a contextually-available contrast.

We tentatively suggest that *sukunakutomo* could be analyzed along the lines of the analysis for English *at least* proposed in Büring (2007, (30)), that is, as a disjunction of the form *exactly n ∨ more than n*. The ignorance inferences associated with *sukunakutomo* can be derived as implicatures associated with a disjunctive meaning: when a speaker uses a disjunction (rather than simply one of the disjuncts), it is implicated that the speaker considers both disjuncts possible; these implicatures can be derived by the maxim of manner, for example (Grice 1975). This analysis predicts that the ignorance inferences triggered by *sukunakutomo* are relatively QuD
independent: irrespective of the QuD, the underlying disjunctive form of the meaning of *sukunakutomo* should generally be sufficient to trigger ignorance implicatures.

To account for the QuD-sensitivity of *wa*-triggered ignorance inferences, as well as the fact that *wa* is compatible with contexts in which the speaker is knowledgeable but there is an independent contextually-salient contrast, we propose that contrastive *wa* could be analyzed as a contrastive topic, anaphoric to a complex discourse structure in which an overarching QuD is broken down into multiple sub-QuDs (Büring 2003; Constant 2014; Lee 2017). Different types of sub-QuD sets will therefore derive different inferences for *wa*. For example, when ignorance inferences are available, the set of QuDs available in context is (12). A *wa*-answer is taken to address the sub-QuD in (12a), and signals that there are other sub-QuDs, like (12b), that still remain unaddressed — hence, the ignorance inferences.

(12) *Sub-QuD sets that deliver ignorance inferences*

a. Who came, as far as you know for sure?
   [or: How many people came for sure?]

b. Who else do you believe might have been there?
   [or: How many (more) people do you think might have been there?]

But *wa* is also compatible with sub-QuD sets like (13) that do not involve speaker uncertainty. This is the kind of sub-QuD sets that, we conjectured, were contributed by the use of partitives in Experiment 1. These sub-QuD sets are associated with weaker / no ignorance inferences. For a detailed analysis of *wa* as a contrastive topic, see Hirayama (2017).

(13) *Sub-QuD sets that deliver contrastive statements*

a. Out of a contextually salient set of people, who came?

b. Out of the same contextually salient set of people, who didn’t come?
5. Conclusion and Implications

In a series of three experiments, we showed that the ignorance inferences associated with \textit{sukunakutomo} ‘at least’ and contrastive \textit{wa} in Japanese exhibit an interestingly different behavior, and therefore probably arise via different mechanisms. For the superlative modifier \textit{sukunakutomo}, we proposed that ignorance inferences are implicatures triggered by its underlyingly disjunctive semantics (following the analysis of English \textit{at least} in Büring 2007). Contrastive \textit{wa}, however, was analyzed as a contrastive topic anaphoric to sub-QuD sets, which triggers ignorance inferences only when the context licenses a sub-QuD set that is about speaker (un)certainty.

The behavior of \textit{sukunakutomo} in Japanese is similar, but not identical to the behavior of English \textit{at least} reported in Westera and Brasoveanu (2014): English \textit{at least} is clearly QuD sensitive while its Japanese counterpart is much less so. It is possible that this might be due to the fact that there is a pragmatic competition in Japanese between \textit{wa} and \textit{sukunakutomo}. Since Japanese has \textit{wa}, which is sensitive to QuDs, speaker prefers using the unambiguous \textit{sukunakutomo} ‘at least’ whenever they want to convey ignorance inferences explicitly.

We conclude by mentioning that the proposed QuD-based analysis of \textit{wa} can also explain its negative-island obviation behavior, which \textit{sukunakutomo} does not share. This behavior was reported in Schwarz and Shimoyama (2010), and is exemplified in (14) below.

\begin{enumerate}
\item \textit{*} doredake nagaku taizai simasen desita ka?
\item [r]doredake nagaku]-wa taizai simasen desita ka?
\item *? sukunakutomo doredake nagaku taizai simasen desita ka?
\end{enumerate}

\begin{enumerate}
\item how long stay didn’t cop Q (lit.) ‘How long did you not stay there?’
\item how long-wa stay didn’t cop Q ‘What is the minimum length such that you did not stay there?’
\item at least how long didn’t stay cop Q (Intended:) ‘What is the minimum length such that you did not stay there?’
\end{enumerate}
Schwarz and Shimoyama (2010) conjecture that the *wa*-sentence in (14b) is acceptable because *wa* has the minimizer semantics of *at least*. Without this semantic contribution, negative questions cannot have an answer that is maximally informative — hence the infelicity of the questions in (14a). However, this analysis incorrectly predicts that the *sukunakutomo* question in (14c) should also be acceptable.

Analyzing *wa* as a contrastive topic opens the way for a different account. Negative questions like the ones in (14) are marked questions (Farkas and Roelofsen 2017), and it is therefore reasonable to conjecture that they require a specific kind of context to be licensed. It is therefore possible that (some of) the sub-QuD sets that license *wa* also license negative questions. We leave a more detailed investigation of the exact semantic/pragmatic process through which *wa* obviates negative islands for a future occasion.

**Reference**


Appendix

Results of Experiment 1: Acceptability judgment task
The model used:
Random intercepts for items and participants, QuD type random slopes for items and participants, and modifier type random slopes for participants (no correlation between intercepts and slopes is assumed)

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
<th>Standard Errors</th>
<th>z-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question Type Polar</td>
<td>-0.14</td>
<td>0.31</td>
<td>-0.47</td>
<td>0.64</td>
</tr>
<tr>
<td>Question Type How Many</td>
<td>1.16</td>
<td>0.48</td>
<td>2.43</td>
<td>0.015   *</td>
</tr>
<tr>
<td>Quantifier wa</td>
<td>-0.35</td>
<td>0.43</td>
<td>-0.81</td>
<td>0.42</td>
</tr>
<tr>
<td>Quantifier Comp</td>
<td>-0.42</td>
<td>0.34</td>
<td>-1.24</td>
<td>0.22</td>
</tr>
<tr>
<td>Polar:wa</td>
<td>-0.70</td>
<td>0.40</td>
<td>-1.75</td>
<td>0.08    .</td>
</tr>
<tr>
<td>How many: wa</td>
<td>-1.21</td>
<td>0.43</td>
<td>-2.80</td>
<td>0.005   **</td>
</tr>
<tr>
<td>Polar: Comp</td>
<td>0.58</td>
<td>0.40</td>
<td>1.44</td>
<td>0.15</td>
</tr>
<tr>
<td>How many: Comp</td>
<td>-0.40</td>
<td>0.43</td>
<td>-0.92</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Results of analysis of sub-data: *wa*
The model included:
Random intercepts for items and participants, as well as QuD type random slopes participants (no correlation between intercepts and slopes is assumed)

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
<th>Standard Errors</th>
<th>z-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question Type Polar</td>
<td>-0.73</td>
<td>0.33</td>
<td>-2.22</td>
<td>0.02    *</td>
</tr>
<tr>
<td>Question Type How Many</td>
<td>-0.20</td>
<td>0.34</td>
<td>-0.58</td>
<td>0.56</td>
</tr>
</tbody>
</table>
Results of analysis of sub-data: *sukunakutomo*

Random intercepts for items and participants, as well as QuD type random slopes participants (no correlation between intercepts and slopes is assumed)

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Coefficients</th>
<th>Standard Errors</th>
<th>z-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question Type Polar</td>
<td>0.008</td>
<td>0.35</td>
<td>0.02</td>
<td>0.98</td>
</tr>
<tr>
<td>Question Type How Many</td>
<td>1.09</td>
<td>0.52</td>
<td>2.1</td>
<td>0.04 *</td>
</tr>
</tbody>
</table>