

# Speakers' Strategies on Prosody in Scrambled Wh-Interrogatives in Japanese

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## 1. Introduction

As Watanabe (1992) and Takahashi (1993) observed, there is a preference difference between the two scope interpretations in scope ambiguous Japanese canonical or scrambled wh-interrogatives. In this paper, the explanation of this difference was attempted from the prosodic point of view. In fact, Kitagawa and Fodor (2003) and Kitagawa and Hirose (2012) observed that prosody has strong relationship to wh-scope interpretation in Japanese wh-interrogatives: Both the length of post-focal reduction just after a focused wh-item and the pitch height on the wh-item play important roles to inform or detect whether the wh-scope is wide or narrow. In addition, Ishii, Oba and Ishikawa (2013) pointed out that listeners' strategies for detecting wh-scope with these prosodic clues are unchanged between in canonical sentences and in scrambled sentences.

Based on these results observed in the past researches, to explain the scope preference difference in canonical and scrambled wh-interrogatives, first, we hypothesized that speakers' strategies for encoding prosody to inform wh-scope are different between them, and next we investigated whether either the pitch height on wh-items or that on post-COMP positions is changed depending on the word order of wh-interrogative sentences. Finally, we considered whether the result of the experiment in this study, with the Implicit Prosody Hypothesis proposed by Fodor (2002), may become a clue to explicate the preference difference between canonical and scrambled sentences.

## 2. Background

### 2.1. Wh-scope and scrambling: Watanabe (1992) and Takahashi (1993)

Watanabe (1992) and Takahashi (1993) observed that in Japanese scope ambiguous wh-interrogative sentences like (1) and (4), there is a strong preference between wide and narrow scope interpretations. In (1), as observed in Watanabe (1992), the narrow scope interpretation shown in (2b) is much more preferred than the wide scope interpretation shown in (2a). Therefore, for most Japanese natives, the appropriate answer of (1) is (3b), although for some, the answer (3a) is acceptable.

- (1) *anata-wa* [*Mary-ga*    *dono hon-o*    *yonda ka*]            *siri taidesu*  
you-TOP [*Mary-NOM* *which book-ACC* *read*    *COMPwh*] *want-to-know*  
*ka* ?  
COMPwh

- (2) a. ‘Which book do you want to know whether Mary read?’

(Wh question = wide scope interpretation)

- b. ‘Do you want to know which book Mary read?’

(Yes-No question = narrow scope interpretation)

- (3) a. Higashino Keigo no ‘Ryuusei no kizuna’ desu.

‘Keigo Higashino’s book titled ‘Ryuuseino kizuna.’’

- b. *ie, siritaku arimasen.*

‘No, I don’t.’

On the other hand, in (4), where a wh-item is scrambled to the sentence initial position, Takahashi (1993) claimed most Japanese native speakers only allow the wide scope interpretation. However, later, other researchers (Maki and Ochi 1998; Kuwabara 1999; Aoshima et al. 2003) observed that the narrow scope interpretation is also possible although the interpretive preference exists as observed in Takahashi (1993). Namely, the strongly preferred interpretation is the wide scope interpretation like (2a), but some Japanese speakers allow the narrow scope interpretation like (2b).

- (4) [dono hon-o]<sub>i</sub> anata-wa [Mary-ga *e<sub>i</sub>* yonda ka]  
 [which book-ACC] you-TOP [Mary-NOM read COMPwh]  
 siri taidesu ka ?  
 want-to-know COMPwh

It should be noteworthy that there is a noticeable difference in wh-scope interpretive preference between in canonical word-order sentences and in scrambled sentences.

## 2.2. Wh-scope and prosody 1: Kitagawa and Fodor (2003) and Ishihara (2002)

Kitagawa and Fodor (2003) and Ishihara (2002) showed that each of the two wh-scope interpretations, wide or narrow, in (1), is closely related to a particular prosodic pattern; that is, the two scope interpretations in (1) have their own prosody shown in (5).

### (5) Prosody A:

anata-wa [Mary-ga DONO hon-o yonda ka]  
 you-TOP [Mary-NOM which book-ACC read COMPwh]  
 siri taidesu ka ?  
 want-to-know COMPwh  
 ‘Do you want to know which book Mary read?’ (Narrow scope interpretation)

### Prosody B:

anata-wa [Mary-ga DONO hon-o yonda ka]  
 you-TOP [Mary-NOM which book-ACC read COMPwh]  
siri taidesu ka ?  
 want-to-know COMPwh  
 ‘Which book do you want to know whether Mary read?’ (Wide scope interpretation)

Before considering the two prosodic patterns in (5), we should make sure that there are two facts in the prosody of Japanese wh-interrogative sentences: 1) Wh-items are interpreted as focused, which is represented as boxed capital letters in (5), and the pitch of their sound has to be raised, 2) the focus prominence on wh-items must be also accompanied by post-focal reduction, which is represented as

underlined. Post-focal reduction means the prosodic process which compresses the pitch range of all items, thereby considerably reducing any rises from a low tone to a high tone throughout the domain.

When a focused wh-item is accompanied by a short post-focal reduction, like Prosody A in (5), it takes narrow scope and the sentence is interpreted as a yes-no question. On the other hand, when it is accompanied by a long post-focal reduction like Prosody B,<sup>1)</sup> it takes wide scope, and the sentence is interpreted as a wh question sentence. Therefore, the difference between these interpretations is due to the difference of the length of post-focal reduction. What Kitagawa and Fodor (2003) claimed is that if Japanese native speakers pay attention to the length of post-focal reduction, the corresponding wh-scope interpretation can be obtained easily by them.

### 2.3. Wh-scope and prosody 2: Kitagawa and Hirose (2012)

Kitagawa and Hirose (2012) examined whether Kitagawa and Fodor (2003)'s intuitional observation was also valid for real acoustic perception and production by a psycholinguistic experiment. There are two facts they found in their experiment: 1) Not only the length of post-focal reduction, but also the pitch height on a wh-item corresponds to wh-scope interpretation: The extraordinary high pitch on a wh-item indicates a wide wh-scope interpretation while the (relatively) low pitch a narrow wh-scope interpretation. 2) More interestingly, Japanese natives might use different processing strategies between on showing whether wh-scope is wide or narrow when they speak an ambiguous wh-scope sentence, and on detecting whether it is long or not when they listen to such a sentence: Actually, speakers and listeners use these two factors – the length of post-focal reduction and the pitch on a wh-item – to show and detect wh-scope, but in production, to show the wh-scope of such a sentence, speakers mainly focus on manipulating the height of the pitch on the post-COMP position, by which the length of post-focal reduction is determined to be long or short, while in perception listeners are likely to focus on the height of the pitch on a wh-item to detect whether wh-scope is wide or narrow.

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1) Another rule requires the pitch to be raised at the end of interrogative sentences in Japanese, so the pitch on the question marker “ka” at the end of the sentence in (5) is raised in real utterance although it is included in post-focal reduction.

#### **2.4. Perceptual strategies for detecting wh-scope in scrambled sentences: Ishii, Oba and Ishikawa (2013)**

In Ishii, Oba and Ishikawa (2013), one of the aims in our investigation was whether listeners can recognize the extraordinary high pitch on a wh-item at a sentence initial position as a cue for a wide scope interpretation in scrambled sentences as well as that at the embedded clause in canonical sentences observed in Kitagawa and Hirose (2012). The result was that listeners were likely to use the height of the pitch on a wh-item as a clue on determining wh-scope interpretation, as well as the height of the pitch on a post-COMP position, even in scrambled wh-interrogatives. That is, both in canonical and scrambled sentences, not only the length of post-focal reduction after a wh-item, but also the height of the pitch on a wh-item can inform listeners of a clue for interpreting whether wh-scope is wide or narrow. Namely, in perception, the strategies for detecting wh-scope are considered the same in canonical and scrambled ambiguous wh-interrogative sentences.

### **3. Hypothesis**

As our investigation showed, the perceptual strategies for determining wh-scope in scrambled ambiguous interrogative sentences was predicted to be the same as those in canonical sentences. If so, we could hypothesize that the asymmetry of the wh-scope preference between in canonical and scrambled sentences, observed in (1) and (4), is derived from the difference of the production strategies between them. To say more specifically, when speakers utter canonical sentences, as the past researches expected, they would be supposed to change the height of the pitch on a wh-item or the length of post-focal reduction to indicate whether wh-scope interpretation is wide or narrow. On the other hand, we could estimate that because of other reasons than indicating wh-scope, in scrambled sentences, the height of the pitch on a wh-item is always raised, or the length of post-focal reduction is always long. However, listeners' strategies for interpreting the pitch change on a wh-item or the length change for post focal reduction are assumed to be unchanged both in canonical sentences and in scrambled sentences, and so they would understand that the high pitch on a wh-item or the long length of post focal reduction indicates a wide wh-scope interpretation. The purpose of the following experiment is an attempt to examine whether what we hypothesized actually occurs in scrambled sentences.

## 4. Experiment

In this experiment, we examined whether Japanese native speakers uniformly raised the pitch on a *wh*-item, or whether they uniformly lengthened post-focal reduction, regardless of *wh*-scope interpretation when the *wh*-item was scrambled to the sentence initial position.

### 4.1. Materials

Sixteen scope ambiguous *wh*-interrogative sentences were used as target sentences. They had eight different types of verbs and two different word orders (canonical and scrambled). (6) and (7) show examples of target sentences which have a canonical word-order and a scrambled word-order, respectively.

(6) ano yakusho-wa [hoosyanoo-ga **dono toshi**-o osen-shiteiru  
that ministry-TOP [radiation-NOM which city-ACC contaminate-PRES  
ka] imademo  
COMP<sub>wh</sub>] still  
bunseki-shiteiru-no-desu ka?  
has-analyzed COMP<sub>wh</sub>

(7) **dono toshi**-o<sub>i</sub> ano yakusho-wa [hoosyanoo-ga *e<sub>i</sub>* osen-shiteiru  
which city-ACC that ministry-TOP [radiation-NOM contaminate-PRES  
ka] imademo  
COMP<sub>wh</sub>] still  
bunseki-shiteiru-no-desu ka?  
has-analyzed COMP<sub>wh</sub>

**1. Narrow scope interpretation:** “Has the Ministry analyzed which city radiation contaminates?”

**2. Wide scope interpretation:** “Which city has the Ministry analyzed whether radiation contaminates?”

In each target sentence, the *wh*-item “*dono* NP (which NP)” and the adverb “*imademo* (still)” at a post-COMP position were used and so the lexical accent was

realized on these words whose maximum  $f_0$  pitch value was measured; that is, “do” in “dono” and “i” in “imademo”. As shown in (7), in all scrambled target sentences, the wh-object of the embedded clause was scrambled out to the sentence initial position in order for participants to process them more easily.

Each target sentence was embedded in a dialogue, which includes the appropriate answer to the question of the target sentence. Thanks to the context of this dialogue, participants can easily predict whether the question is asked as a wh question (wide wh-scope interpretation) or as a yes-no question (narrow wh-scope interpretation). An example translated into English is shown in (8). In all target sentences, the first question asked a narrow scope interpretation and the second asked a wide scope interpretation. All of the questions were indicated by an underline as shown in (8).

(8)

[Exchange between a newspaper journalist and a PR officer from the Cabinet]

**Journalist:** We are strongly suspecting the Ministry of the Environment has seriously analyzed the degree of radiation contamination of all the cities for a while. We heard it was suspected that there was a city which had actually been contaminated.

**PR officer:** You want the name of the city? We are not ready to announce it yet.

**Journalist:** No. We would like to know whether it still has continued analyzing.  
Has the Ministry still analyzed which city radiation contaminated? <sub>(Target 1)</sub>

**PR officer:** Yes. It has continued analyzing that.

**Journalist:** OK. Well, I think you should announce the name of the city just now. Which city has the Ministry still analyzed whether radiation contaminated? <sub>(Target 2)</sub>

**PR officer:** . . . Sendai city. The Ministry of the Environment has strongly suspected that it has been contaminated with radiation, and it continued analyzing that.

In the pre-experiment phase, the whole dialogue was shown to participants, but in the experiment, this was divided into two parts; one included the question on a narrow scope interpretation and the other included that on a wide interpretation.

As filler items, 7 dialogues, including a wh or yes-no question without scope ambiguity, were prepared. The question sentence in the filler dialogues had both a canonical word-order type and a scrambled word-order type, and therefore the total number of the filler items was 14.

#### **4.2. Subjects**

Seven graduate and undergraduate students took part in this experiment. Five speakers were female and two speakers were male; ages ranged from 19 to 40. They all were from Tokyo, Kanagawa, Saitama or Chiba, and native speakers of Tokyo Japanese dialect. All participants were not informed of the purpose of this study.

#### **4.3. Procedure**

Before the experiment, we had a pre-experiment phase, where we tried to screen out the participants who were not able to recognize the ambiguity in the scope interpretation of all the target sentences. In this phase, the participants were asked to read the whole dialogues, including two target sentences each of which induces a narrow or wide scope interpretation. However, none of them reported that these were totally unacceptable although some of the target sentences were difficult for some participants to get the wide scope interpretation. Therefore, we didn't have to screen out any participants.

After the pre-experiment phase and a short break following it, the participants received a sheet of paper on which a half of the dialogue as shown in (8) was written, and they were asked to make a (fake) conversation with one of the experimenters following the scenario defined by the dialogue on the sheet of the paper, and to play a role of the character who said the target sentence. Before doing so, they were also asked to read the dialogue carefully again and make sure that they fully understood it. Whenever they made a speech error, we repeated the recording from the beginning of the dialogue. And, after recording the conversation, if they thought that they were not



satisfied with the way they spoke, we repeated the recording as well.

The 16 target dialogues were first divided into two sets: If one set includes a dialogue including a canonical word-order target sentence, a dialogue containing the counterpart scrambled sentence must be put into the other set. Next, each of the two sets was counterbalanced into more two sets for the order. Finally, filler dialogues were inserted between the dialogues including a target sentence. So we had four sets each of which included 8 target dialogues and 7 filler dialogues, and each set has its own counterpart set. On the first day, one of the four set was shown to each participant and the counterpart set was used for him or her on the second day. Only the recordings of the second day were used for the analysis.

All of the utterances were digitally recorded onto a Sony ICD-SX71 IC recorder at the sampling rate of 22K Hz. All  $f_0$  values in the recordings were analyzed with a software Praat version 5.3.23 (Boersma and Weenink 2012) on Windows, and with the script on Praat (<http://www.linguistics.ucla.edu/faciliti/facilities/acoustic/praat.html>), the maximal  $f_0$  values both on wh-items and on post-COMP positions were extracted automatically and corrected manually if we thought we had to. All  $f_0$  values were converted into semitones.<sup>2)</sup>

## 5. Results

The aim of this experiment was to investigate whether there is a significant difference in the height of the pitch on wh-items or in the length of post focal reduction in scrambled sentences between when speakers intend to say the wide scope interpretation and when they intend to say the narrow scope interpretation. Before investigating that, however, we had to check whether the experiment can replicate Kitagawa and Hirose (2012)'s results for canonical sentences.

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2) A semitone scale was used to neutralize the variation of pitch ranges among speakers. Because of this, we were able to compare between-speakers maximum  $f_0$  values. Semitones between two Hzs ( $f_1$  and  $f_2$ ) were calculated using the following formula:  $12 * \log_2(f_1 / f_2)$ . In this experiment,  $f_1$  was the pitch of a wh-item or a post-COMP position and  $f_2$  was the pitch of the segment following it.

Variable	wide scope Mean (SD)	narrow scope Mean (SD)	<i>N</i>	<i>Z</i>	<i>p</i>	Effect size
wh-item	18.87 (4.32)	17.63 (4.24)	56	-5.82	<.001	<i>r</i> = 0.78 (very large)
post-COMP position	14.95 (4.40)	17.26 (3.92)	56	-5.96	<.001	<i>r</i> = 0.80 (very large)

**Table 1:** Average Max *f*<sub>0</sub> Values (Semitone)

### 5.1. Replication of Kitagawa and Hirose (2012)'s Results for Canonical Sentences

The total number (*N*) of the data of the canonical sentences from the 7 participants was 56 (= 26 x 2 (paired)). An examination of these data indicated that these were not normally distributed and these contained outliers, and so Wilcoxon Signed Ranked Test was conducted to see whether the maximum *f*<sub>0</sub> pitch values both on the wh-items and on the post-COMP positions were different between the wide scope interpretation and the narrow scope interpretation.

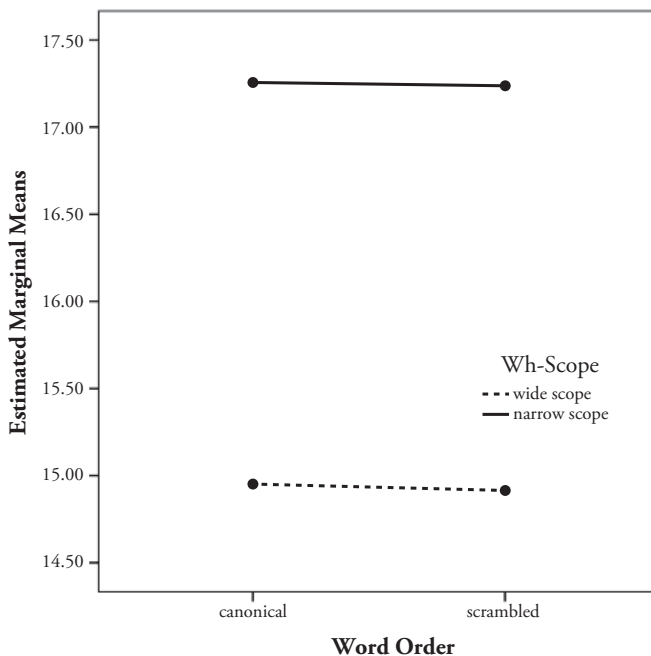
Table 1 shows the average maximum *f*<sub>0</sub> pitch values (semitones) and other statistical values on the wh-items and on the post-COMP positions. For wh-items, the maximum *f*<sub>0</sub> pitch values for the wide scope interpretation were significantly higher than those for the narrow scope interpretation, and the effect size was very large. For post-COMP positions, the maximum *f*<sub>0</sub> pitch values for the narrow scope interpretation were significantly higher than those for the wide scope interpretation, and the effect size was also very large: This indicated that the length of post-focal reduction was changed depending on wh-scope interpretation. These showed that the maximum *f*<sub>0</sub> pitch on the wh-item was raised and the post-focal reduction was lengthened only if speakers intended to say the wide scope interpretation. It was plausible to say that we were able to replicate Kitagawa and Hirose (2012)'s results in this experiment.

### 5.2. F<sub>0</sub> Analysis in Scrambled Sentences

To investigate how Japanese speakers change the height of the pitch on wh-items or the length of post-focal reduction in scrambled scope ambiguous wh-interrogative

sentences, the maximum  $f_0$  pitch values for the wh-items and the post-COMP positions were examined. The total number ( $N$ ) of the data was 112 (= 56 x 2 (paired)), and these were also not normally distributed and these contained outliers, but because these paired data had the same sample size and ANOVA is robust to normality (cf. Hirai ed. 2012), we used RM ANOVA. A 2 x 2 RM ANOVA examined the effects of Scope (wide and narrow) and Word Order (canonical and scrambled) to explain the maximum  $f_0$  pitch values on the wh-items and those on the post COMP positions.

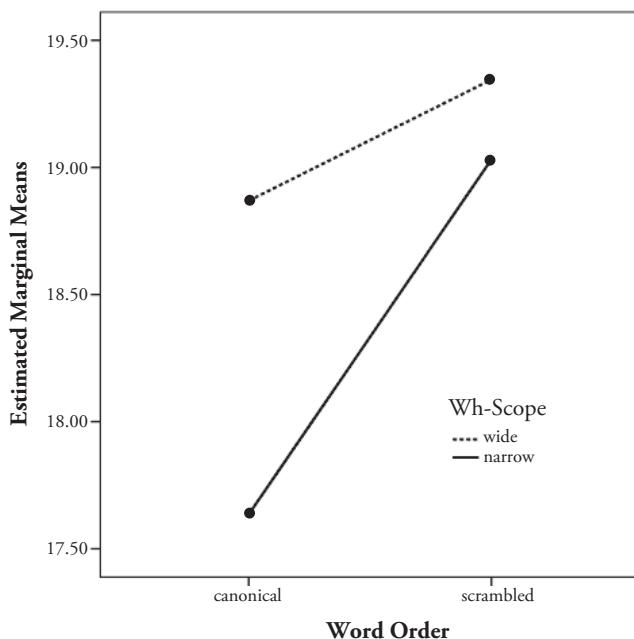
For post-COMP positions, the main effect of Scope was significant ( $F_1(1,6) = 22.90$ ,  $p = .003$ , partial eta-squared = .792;  $F_2(1,7) = 255.27$ ,  $p < .0005$ , partial eta-squared = .973). However, neither the main effect of Word Order ( $F_1(1,6) = .054$ ,  $p = .824$ , partial eta-squared = .009;  $F_2(1,7) = .029$ ,  $p = .87$ , partial eta-squared = .



**Figure 1:** Average Max  $f_0$  values on post-COMP positions (Semitone)

004) nor the interaction between Scope and Word Order ( $F_1(1,6) = .001, p = .975$ , partial eta-squared  $< .0005$ ;  $F_2(1,7) = .003, p = .957$ , partial eta-squared  $< .0005$ ) were significant. As illustrated in Figure 1, these indicated that if speakers intend to say a wide scope interpretation, the height of the pitch on post-COMP positions is lowered, or in other words the range of post-focal reduction is made longer. However, we were not able to find a significant difference in the height of the pitch on post-COMP positions between in canonical sentences and in scrambled sentences, and the effect size was quite small and negligible. We were able to say few things in inferential statistics, but at least in descriptive statistics all the participants did not make any difference in the pitch-height on post-COMP positions between in canonical sentences and in scrambled sentences.

For wh-items, the main effect of Scope was significant ( $F_1(1,6) = 10.92, p = .016$ ,



**Figure 2:** Average Max f0 values on wh items (Semitone)

partial eta-squared = .645;  $F_2(1,7) = 51.67$ ,  $p < .0005$ , partial eta-squared = .881), as were the main effect of Word Order ( $F_1(1,6) = 23.51$ ,  $p = .003$ , partial eta-squared = .797;  $F_2(1,7) = 33.02$ ,  $p = .001$ , partial eta-squared = .825) and the interaction between Scope and Word Order ( $F_1(1,6) = 6.59$ ,  $p = .042$ , partial eta-squared = .524;  $F_2(1,7) = 9.74$ ,  $p = .017$ , partial eta-squared = .582). Next, to interpret the interaction between Scope and Word Order, for each word order (canonical or scrambling), the effect of Scope (wide and narrow) was examined: For canonical sentences, there was a significant difference in the height of the pitch on wh-items between in the wide scope interpretation and in the narrow scope interpretation ( $p < .001$ , partial eta-squared = .50). On the other hand, for scrambled sentences, no significant difference was found and the effect size seemed small and negligible ( $p = .08$ , partial eta-squared = .06). In addition to those results, as illustrated in Figure 2, the average maximum f0 pitch values on wh-items in scrambled sentences (19.03) were higher than those in canonical sentences (18.87).

## 6. Discussion

Based on the results in this experiment, we would infer the following two Japanese speakers' strategies for disambiguating wh-scope interpretation: 1) Both in canonical sentences and in scrambled sentences, they uniformly change the range of post focal reduction after the focused wh-item depending on wh-scope interpretation. 2) In canonical sentences, speakers are likely to use the difference of the pitch height on wh-items to indicate wh-scope. On the other hand, in scrambled sentences, they are likely to uniformly raise the height of the pitch on wh-items regardless of wh-scope interpretation. That is, speakers make little difference in the pitch height between for wide scope interpretation and for narrow scope interpretation in scrambled sentences. In addition, the pitch on a wh-item for narrow wh scope interpretation in scrambled sentences is likely to be higher than that for wide wh scope interpretation in canonical sentences. This indicates that the pitch on a wh-item in scrambled sentences is so high that wh-scope would be considered wide if the wh-item was put in canonical sentences.

As a result, in scrambled sentences the height of the pitch on wh-items cannot be a cue for listeners to detect whether the wh-scope is wide or narrow, contrary to that in

canonical sentences, which Kitagawa and Hirose (2012) observed. This difference observed between in canonical sentences and in scrambled sentences might be one possible clue to explain the different preference for wh-scope interpretation between them.

Assume Fodor (2002)'s Implicit Prosody Hypothesis (IPH) defined in (9). In canonical narrow wh-scope sentences, it is estimated that the (relatively) low f0 pitch is projected onto wh-items as a default prosodic contour, and so Japanese natives strongly prefer narrow wh-scope interpretation as intended. On the other hand, based on speakers' strategies we would infer, in scrambled narrow wh-scope sentences, the extraordinary high f0 pitch is supposed to be projected onto wh-items as a default, and, therefore, they are more likely to choose wide wh-scope interpretation when they parse those sentences based on listeners' strategies.

- (9) In silent reading, a default prosodic contour is projected onto the stimulus, and it may influence syntactic ambiguity resolution. Other things being equal, the parser favors the syntactic analysis associated with the most natural (default) prosodic contour for the construction.

When we go back to the examples in (1) and (4), in the canonical sentence as in (10) = (1) the IPH leads the pitch of the focal wh-item “*dono hon-o* (which book-ACC)” to be raised, but not extraordinarily. And the IPH, based on listeners' strategies, leads the parser to choose that the appropriate scope interpretation is narrow, and so the meaning of the sentence in (10) is (12b). On the other hand, in the scrambled sentence in (11) = (4), the IPH, based on speakers' strategies, always assigns the scrambled wh-item at the sentential initial position to an extraordinary high pitch. And, based on listeners' strategies, the parser is likely to decide to choose the wide wh scope interpretation like (12a).

- (10) = (1) *anata-wa* [Mary-ga    ↑ DONO *hon-o*    *yonda ka*]  
           you-TOP [Mary-NOM    which book-ACC read COMPwh]  
           *siri taidesu*    *ka* ?  
           want-to-know COMPwh

- (11) = (4)  $\uparrow$  **DONO** hon-o anata-wa [Mary-ga e yonda ka]  
 which book-ACC you-TOP [Mary-NOM read COMPwh]  
 siri taidesu ka ?  
 want-to-know COMPwh

- (12) a. ‘Which book do you want to know whether Mary read?’  
 (Wh question = wide scope interpretation)  
 b. ‘Do you want to know which book Mary read?’  
 (Yes-No question = narrow scope interpretation)

Finally, we will consider why the pitch on wh-items is uniformly raised in scrambled sentences. There would be at least two possibilities: 1) In Japanese, as well as in other languages, the sentence initial position is a special place where a phrase is focused or topicalized, and when a focused wh-item is located there, its pitch would be raised to indicate its function. Or 2) a wh-item is (long-distance) scrambled from the object position of the embedded clause to the sentence initial position, and to indicate long filler-gap relationship between them, its pitch would be raised. However, which assumption is plausible is beyond the scope of this paper, and therefore we leave it to future research to explore that.

## 7. Summary

In this paper, we tried to explain the preference difference between the two scope interpretations in scope ambiguous wh-interrogatives from the prosodic point of view. In fact, as Kitagawa and Fodor (2003) and Kitagawa and Hirose (2012) claimed, prosody has strong relationship to wh-scope interpretation: Both the length of post focal reduction just after a focused wh-item and the pitch height on a wh-item play important roles to inform or detect whether the wh-scope is wide or narrow. In addition, as Ishii, Oba and Ishikawa (2013) pointed out, listeners’ strategies on detecting wh-scope are unchanged between in canonical sentences and in scrambled sentences. Based on these results, we hypothesized that speakers’ strategies for encoding prosody to inform wh-scope are different between in canonical and scrambled sentences, and we did the experiment to investigate whether either the pitch height on wh-items or that on post-COMP positions is changed depending on

the word order of the wh-interrogative sentences.

The result was that there was a huge difference detected only in the height of the pitch on wh-items between in canonical sentences and in scrambled sentences. It was suggested that this result, with the Implicit Prosody Hypothesis proposed by Fodor (2002), might become a clue to explain the preference difference observed between in canonical and scrambled sentences. However, the reason the height of the pitch on wh-items is uniformly raised for both wide and narrow interpretations in scrambled sentences remained untouched in this study. This is left to future work.

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