FOCUS PROSODY IN TOKYO JAPANESE WH-QUESTIONS WITH LEXICALLY UNACCENTED WH-PHRASES

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ABSTRACT

This study presents new data on prosodic effects of focus in wh-questions in Tokyo Japanese, by examining prosodic effects of focus on and after lexically unaccented compound wh-words (e.g., *nani.iro* 'what.color'). The results show that the realization of post-focal reduction differs considerably depending on the accentedness of the wh-word as well as of post-wh-words.

When there is an accent on and/or after the wh-word, both an f_0-rise on the wh-word and an f_0-lowering in the post-wh-area are observed, as already shown in previous studies. When there is no accent on and after the wh-word, there is no significant f_0-lowering in the post-focal area. There is nevertheless a reduction of the amount of initial lowering in the post-focus area.

Keywords: Japanese, *wh*-question, lexical pitch accent, focus prosody

1. INTRODUCTION

Many studies have shown that wh-questions (WHQ) in Tokyo Japanese obligatorily exhibit a *focus prosody*: an f_0-rise on the wh-phrase (*focal f_0-rise*), followed by an f_0-compression of the post-wh-material (*post-focal reduction, PFR*) [1, 2, 3, 7]. Because of this obligatoriness, WHQs are used for elicitation of focus prosody without contextual information. It has also been claimed that focus prosody in WHQs play a crucial role in indicating the semantic scope of question [1, 3].

Wh-words used in previous studies, however, have always been lexically accented ones, such as *náni* 'what', *dáre* 'who', *ítu* 'when' and so on. As a result, the pitch contours of WHQs that have been examined so far have always been subject to the effects of lexical accents. For example, all lexically accented words—including the wh-words shown above—trigger *downstep*, a sharp compression of pitch register after each lexical H*L accent [5, 8, 9]. It still remains unclear whether there are pure intonational effects of focus in WHQs that are fully independent of the effects of lexical accent. No study has investigated PFR triggered by an unaccented wh-word.

While previous studies have often confirmed the existence of focal f_0-rise on the focused word regardless of its accentedness (in non-interrogative contexts) [8, 9], exact behaviors of PFR remain not as clear. Most studies have been interested in prosodic phrasing of post-focal areas and hence do not report their exact phonetic realizations, with an exception of Sugahara [12], who has reported that the excursion size of word-initial f_0-rises (often referred to as *initial lowering* [8, 10]) in the post-focal area is reduced regardless of the accentedness of the focused word. There are further questions to be examined, e.g., whether there is any lowering of the absolute f_0-height of the f_0-maximum of post-focal words, as often tacitly assumed.

The current study re-examines the interaction between phonetic effects of lexical accent and those of focus prosody triggered by wh-words by using unaccented compound wh-words such as *nani.iro* 'what color', *nani.go* 'what language', etc. Particularly interesting is the realization of PFR. Since unaccented wh-words are not expected to trigger downstep, it is possible to examine pure focal effects in the post-wh-area, as long as there is no other lexically accented word after the wh-word.

2. EXPERIMENT

2.1. Stimuli

All stimuli have the same syntactic structure in (1), containing a topic-marked subject (N_1-*wa*), a dative indirect object phrase with a genitive phrase (N_2-*no* N_3-*ni*), an accusative direct object (N_4-*o*) and a verb:

(1) $[N_1\text{-top}]_{SU}$ $[[N_2\text{-gen}\ N_3\text{-dat}]_{IO}$ $[N_4\text{-acc}]_{DO}$ $V]_{VP}$

Three binary factors are controlled (2×2×2=8 conditions): (i) *N2acc*: the lexical accent of N_2 (N_2 = U(naccented) or A(ccented), e.g., *néebii* 'indigo.color' vs. *ai.iro* 'navy.blue'), (ii) *N3acc*: the lexical accent of the post-N_2 word (N_3 = U or A, e.g., *enogu* 'paint' vs. *néndo* 'clay'), and (iii) *WH*:

sentence types (N_2 = –WH (declarative sentence) or +WH (wh-question), e.g., *ai.iro/néebii* 'indigo.color/navy blue' vs. *nani.iro/dóno.iro* 'what.color/which.color'). A sample set of the 8 conditions is given in (2):

(2) (All sentences start with a topic subject)
Iiyama-wa …
Iiyama-top

a. N_2=U; N_3=U; N_2=–WH
ai.iro-no enogu-ni orénzi-o azemásita.
indigo.color-gen paint-dat orange-acc mixed
'Iiyama mixed orange with indigo paint.'

b. N_2=U; N_3=U; N_2=+WH
nani.iro-no enogu-ni orénzi-o azemásita ka?
what.color-gen paint-dat orange-acc mixed q
'What color of paint did Iiyama mixed orange with?'

c. N_2=U; N_3=A; N_2=–WH
ai.iro-no néndo-ni orénzi-o mazemásita.
indigo.color-gen clay-dat orange-acc mixed
'Iiyama mixed orange into indigo clay.'

d. N_2=U; N_3=A; N_2=+WH
nani.iro-no néndo-ni orénzi-o mazemásita ka?
what.color-gen clay-dat orange-acc mixed Q
'What color of clay did Iiyama mix orange with?'

e. N_2=A; N_3=U; N_2=–WH
néebii-no enogu-ni orénzi-o mazemasita.
navy.blue-gen paint-dat orange-acc mixed
'Iiyama mixed orange with navy blue paint.'

f. N_2=A; N_3=U; N_2=+WH
dóno.iro-no enogu-ni orénzi-o mazemasita ka?
which.color-gen paint-dat orange-acc mixed Q
'Which color of paint did Iiyama mixed orange with?'

g. N_2=A; N_3=A; N_2=–WH
néebii-no néndo-ni orénzi-o mazemásita
navy.blue-gen clay-dat orange-acc mixed
'Iiyama mixed orange into navy blue clay.'

h. N_2=A; N_3=A; N_2=+WH
dóno.iro-no néndo-ni orénzi-o mazemásita ka?
which.color-gen clay-dat orange-acc mixed Q
'Which color of clay did Iiyama mix orange with?'

2.2. Methods

A total of 6 sets of the 8 conditions like (2) were used in the experiment (6×3=48 target sentences), and mixed with 94 filler sentences (which are used as target sentences for other experiments). Each stimulus was presented to the speaker on a computer screen one by one, in a pseudo-randomized order. The entire stimuli were recorded twice per speaker, in two different pseudo-randomized orders (48 target sentences × 2 = 96 tokens per speaker). Nine subjects (4 females; 5 males) participated in the recording.

The f_0-maximum of each word and the preceding and following f_0-minima (excluding the sentence-final rising contours in WHQs) were measured for analysis. After examining the results for each speaker separately, linear regression was used for normalization of speakers' pitch range, with the formula and the two reference points (R_1, R_2) in (3).

$$(3)\quad normalized.value = \frac{original.value - R_2}{R_1 - R_2}$$

R_1 = Speaker-specific mean f_0-maximum of N_2
R_2 = Speaker-specific mean f_0-minimum after V

2.3. Results

Figures 1 and 2 show the mean normalized f_0 on each measurement points (the f_0-maximum and the preceding/following f_0-minima within each word) in the conditions with an accented target word N_2 ((2e)–(2h)) and in the conditions with an unaccented N_2 ((2a)–(2d)), respectively.

2.3.1. N_2 = Accented (conditions (2e)–(2h))

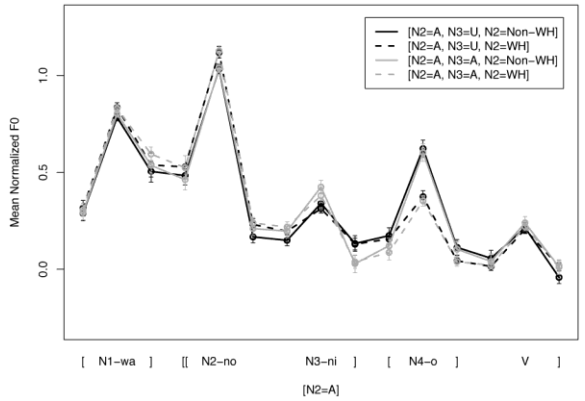
When the wh-word N_2 is accented (Figure 1, conditions (2e)–(2h)), focus effects are realized as reported in previous studies. The f_0-peak of wh-words (N_2, dashed lines, conditions (2f)/(2h)) is realized significantly higher than that of the non-wh-counterparts (solid lines, conditions (2e)/(2g)) [2-tailed t-test between –WH and +WH conditions: t=–6.6075, df=412.37, p<0.001]. There is a sharp f_0-fall after N_2 in all of the conditions shown in Figure 1, which is due to the pitch accent on N_2. Furthermore, the effect of PFR is clearly found on N_4, where the f_0-maximum is realized much lower in the +WH conditions (dashed lines) than in the –WH conditions (solid lines). [2-tailed t-test between +WH and –WH conditions: t=13.1263, df=373.415, p<0.001].

The effect of the pitch accent on post-wh-word N_3 is also detectable: the accented N_3 (gray lines, conditions (2g)/(2h)) has a higher f_0-maximum as well as a lower following f_0-minimum than the unaccented N_3 (black lines, conditions (2e)/(2f)).

The accentedness of N_3, however, does not affect the realization of N_4 (where the PFR is

found), as the gray lines and black lines coincide. The results of ANOVA on the mean f_0-maximum of N_4 do not show any significant effect of *N3acc* [MS=0.0501, F=1.2894 p=0.2568] or any interaction with *WH* (*N3acc* × *WH*) [MS=0.0000, F=0.0004, p=0.9839].

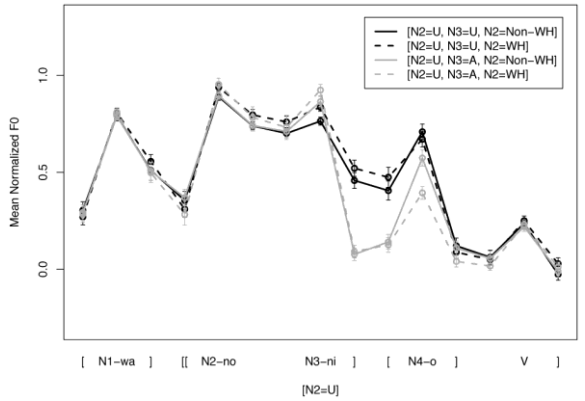
Figure 1: Mean normalized f_0 (with 95% CI) of the accented N_2 conditions (2e)–(2h). N_2 = –WH (solid line —) vs. +WH (dashed line - - -) / N_3 = U (black) vs. A (gray).



2.3.2. N_2 = Unaccented (conditions (2a)–(2d))

When the wh-word is unaccented (Figure 2, conditions (2a)-(2d)), the realization of PFR differs considerably depending on the accentedness of the post-wh-word N_3 [ANOVA on the mean f_0-maximum of N_4: *N3acc*: MS=4.5284, F=109.588, p<0.001; *WH*: MS=1.2929, F=31.289, p<0.001; *N3acc* × *WH*: MS=0.5303, F=12.834, p< 0.001]. This result contrasts with that of the [N_2=A] conditions in Figure 1, where the accentedness of N_3 does not exhibit any significant effect.

Figure 2: Mean normalized f_0 (with 95% CI) of the unaccented N_2 conditions (2a)–(2d). N_2 = –WH (solid lines —) vs. +WH (dashed lines - - -) / N_3 = U (black) vs. A (gray).



At the N_2-peaks, there was a significant focal f_0-rise on the unaccented wh-word in both of the [+WH] conditions (dashed lines, conditions (2b)/(2d), [2-tailed t-test between +WH (2b)/(2d) and –WH (2a)/(2c) conditions: t=–4.5649, df=379.316, p<0.001]. Together with the results in Section 2.3.1, it means that the F0-rise is observed regardless of the accentedness of the wh-word.

Since N_2 is unaccented, there is no sharp f_0-fall (i.e. downstep) after the f_0-peak of N_2. Instead, raised f_0 continues to N_3, where the accentedness is varied. The difference in N_3 accentedness triggers significantly different realizations of N_4.

When N_3 is accented (gray lines, conditions (2c) vs. (2d)), a clear PFR effect is observed on N_4. The f_0-maximum of N_4 is significantly lower in the +WH condition (dashed line, (2d)) than in the –WH condition (solid line, (2c)) [2-tailed t-test, t=6.5879, df=214, p<0.001].

When N_3 is unaccented (black lines, conditions (2a) vs. (2b)), on the other hand, there is no significant difference in the f_0-maximum on N_4 between the +WH condition (dashed line, (2b)) and the –WH counterpart (solid line, (2a)). [2-tailed t-test between –WH (2a) and +WH (2b) conditions: t=1.3651, df=209, p=0.1737].

This does not mean, however, that there is no significant difference between the WHQ and the non-wh-counterpart. The lack of significant difference on N_4-peak means that the effect of focal f_0-rise, which is carried over from N_2 to the unaccented N_3, is no longer found at N_4. Furthermore, in the +WH condition (2b), the amount of f_0-rise from the F-minimum at the beginning of N_4 to its f_0-peak is significantly smaller than in the –WH condition (2a) [2-tailed t-test: t=3.5938, df=201.585, p< 0.001].

3. DISCUSSION

In the results of the experiment, three points are particularly important for theoretical discussion of focus prosody in Tokyo Japanese.

3.1.1. Focal f_0-rise

First, focal f_0-rise is found uniformly in the +WH conditions on N_2, regardless of the accentedness of the wh-word (or that of the post-wh-word), replicating the results of previous studies. The amount of the focal f_0-rise was, however, not very large, as Figures 1 and 2 show. It should be noted that this effect cannot be explained in terms of insertion of an intermediate phrase boundary on

the left of wh-phrase, contrary to previous claims (e.g., [8]). Given that N_2 is located at the left edge of a VP in all of the stimuli, the syntax-prosody mapping principle [11] predicts that there is an intermediate phrase boundary at the left of N_2 throughout the stimuli. In fact, there is a large f_0-rise at the beginning of N_2 in all the conditions, indicating the existence of an intermediate boundary. The difference between the [+WH] and the [–WH] conditions cannot be attributed to the existence of an intermediate phrase boundary, but must be due to some other factor.

3.1.2. Interaction of focus and lexical accents

Second, the present study has made clear how focus and lexical accents interact. While the existence of obligatory focus prosody in WHQs has been confirmed, for both focal f_0-rise and PFR, only the realization of the latter differs considerably according to the accentedness of the wh- and post-wh-words. It has also been shown that accents in the post-wh-area show significant effects on the realization of PFR only when the wh-phrase is unaccented. This means that what matters is the existence of lexical accents within a domain of focus prosody, i.e., either on or after the wh-phrase. Neither the exact location nor the number of accents is relevant. Given that the realization of PFR is much larger and clearer when there is a lexical accent in the focus prosody domain, one can also say that the existence of lexical accents enhances the realization of PFR.

3.1.3. Two types of post-focal reduction

Lastly, the results have shown that in contrast to focal f_0-rise, which is realized consistently throughout all WHQs, PFR is realized in two radically different manners. When there is a lexical accent on and/or after the wh-phrase, PFR is realized as a pitch-register compression of post-wh-area, as many studies have already confirmed. When there is no accent, it is realized in a more subtle way, namely, as a reduction of pitch excursion of word-initial f_0-rise (initial lowering), replicating Sugahara's [12] finding in non-WHQs. A lowering of f_0-peaks in the post-focal area, which has often been (tacitly) assumed to be an essential aspect of PFR as well as an important phonetic cue for the scope-marking of WHQ, is observed only when there is a pitch accent in the domain of focus prosody. It is also interesting to note that the second type of contour resembles that of indeterminate constructions [6], or that of WHQs in Fukuoka Japanese [4], where lexical accents appear to be removed throughout the post-wh-area.

4. CONCLUSION

While confirming previous findings, the present study presented new data on focus prosody in WHQs, especially in relation to the interaction of focus prosody and lexical pitch accent. These findings raise new questions for future research, for example, how focus prosody should be phonologically explained without attributing them to prosodic phrasing, whether both types of PFR are in fact used as a scope-marker for WHQs, or whether listeners recognize both of them as an indicator of semantic scope, and so on.

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