

PHONETIC COMPRESSION OF MINOR PHONOLOGICAL PHRASES AS A LICENSOR OF WH *IN SITU* IN L2 JAPANESE: A PILOT STUDY OF CONTIGUITY THEORY IN SLA^{*}

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The field of second language acquisition (SLA) looks to probe the properties of the grammars of second language (L2) learners. While there is much research that investigates a single module such as phonology (Archibald 1998) or syntax (White 2003), there has also been much written on the grammatical interfaces (White 2011; Montrul 2011; Sorace 2011; Goad and White 2004). Considerable attention has been given to the morphology/syntax interface (Franceschina 2001), and also to the syntax/pragmatics interface (Sorace and Filiaci 2006), but there has been less attention given to the phonology/syntax interface (cf. Fodor 2002) in SLA, though, of course, it has been addressed in the theoretical literature (Elfner 2015). This paper looks at one aspect of the phonology/syntax interface related to the formation of WH-questions.

Richards (2010) articulates a theory which accounts for the variation between (a) languages which move WH elements to the left periphery, and (b) languages which allow WH elements to stay in place. English generates WH questions via WH-Movement as shown in (1).

- (1) Whom should Bob call?

Japanese, on the other hand, allows the WH word to remain *in situ*, as shown in (2):

- (2) Mito-ga nani-o katta no?
Mito-NOM what-ACC bought +Q
'What did Mito buy?'

1. Contiguity Theory

Richards (2010, 2016) argues that these are two strategies to achieve the *contiguity* of the WH word and the interrogative feature [+Q]. In English, surface linear adjacency achieves contiguity as a result of moving the WH word to the Complementizer position at the left edge (where the phonologically null [+Q] feature resides). In Japanese, note that the [+Q] feature is spelled out by a question particle (which in (2) is *no*). The WH word does not move, but contiguity is achieved in another fashion. Richards demonstrates that there are (a) no prosodic boundaries between the WH word and the [+Q] feature, and (b) what he

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calls phonetic compression on the WH phrases.

The research question I seek to answer in this paper is: Do advanced L2 speakers have a phonological grammar with no prosodic boundaries between the WH word and the Question complementizer ([+Q]) to properly license WH *in situ* as would be the case if Richards' (2010) Contiguity Theory holds? In order to understand the operationalization of this question, let us compare two sentences given in (3) and (4), where the direct objects are in **bold**, and the minor phonological phrases are in *italics*.

- (3) Naoya-wa **nani-o** *nomiya-de nonda* no?
 Naoya-NOM what-ACC bar-LOC drank +Q
 ナオヤは、何を飲み屋で飲んだの?
 'What did Naoya drink at the bar?'

- (4) Naoya-ga **nanika-o** *nomiya-de nonda*.
 Naoya-NOM something-ACC bar-LOC drank
 ナオヤが、何かを飲み屋で飲んだ。
 'Naoya drank something at the bar.'

For native speakers of Japanese, we expect (1) lower pitch on the objects which are WH words (such as *nani* in (3)) compared with objects which are DPs (such as *nanika* in (4)); and (2) no pitch peaks on the phonological phrases (e.g., *nomiya de nonda*) which come between the WH word and the [+Q] particle (as in (3)).

2. The present study

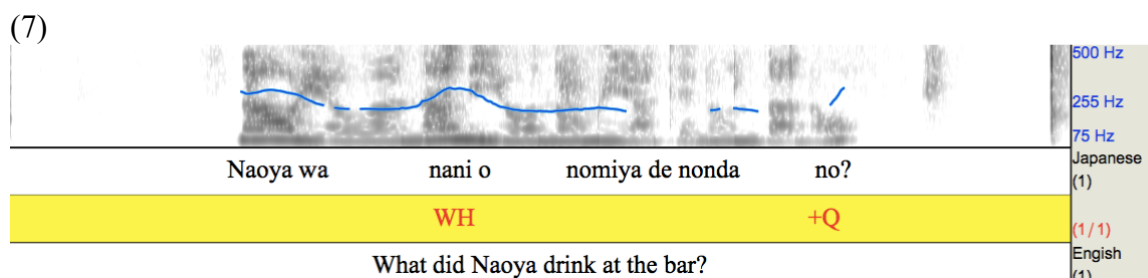
In this pilot study, I looked to see whether non-native speakers (NNS) of Japanese, are able to acquire L2 grammars which observe this property of contiguity. Five self-assessed, advanced/intermediate instructed learners of Japanese were recorded. The subjects were recruited as volunteers from announcements in senior-level Japanese classes at a Canadian university. Undeniably, the subject pool is heterogeneous in a number of ways which need to be stabilized for the final study. In the first place, the subjects have different L1s: three have English, one Mandarin, and one Cantonese. This, to my mind, is not a major impediment insofar as I am not looking to explore any aspects of L1 transfer but rather whether the L2 production is nativelike with respect to the phonological properties of the WH domain. The subject pool is also mixed in that there are two males and three females. I have grouped them together for analysis because nothing in the analysis depends on the absolute pitch of the production. Rather, it is the pitch *change* that is of interest.

2.1 The task

The subjects were given in advance 19 Japanese sentences (see Appendix A) which they were asked to rehearse in preparation for reading out loud. Two examples are given in (5) and (6).

- (5) Miki-wa kinō nani-o kaimashi-ta ka?
 Miki-NOM yesterday what-ACC buy-PAST +Q
 ミキは、昨日何を買いましたか?
 'What did Miki buy yesterday?'
- (6) Miki-wa kinō hon-o kaimashi-ta.
 Miki-NOM yesterday book-ACC buy-PAST
 ミキは、昨日本を買いました。
 'Miki bought a book yesterday.'

During the recording session, subjects were allowed to re-record the sentence if they felt they made a mistake. The final version was the one used for acoustic analysis. In this way, I tried to ensure that the production I analyzed was the best possible production that the subject could produce. Sentences were recorded on Audacity at 44KHz, and pitch tracking was done via on Praat 6.0.09. An example of the pitch tracking is shown in (7), where we note the pitch rise on *nani-o* and *no*.



The pitch peak was noted and entered into a spreadsheet for calculation. Given that I was comparing different lexical items, I wanted to take pitch accent into account as much as possible. All of the words (both WH and DP) contained both high and low pitch accents, so any difference which emerges in the average across subjects and across lexical items cannot be attributed to some words having either all high or all low pitch accents.

3. Results

The chart in (8) shows the data from two of the advanced speakers for the sentence given in (3). The boxed cells clearly indicate the level pitch between the WH Phrase (*nani-o*) and the question particle (*no*).

(8)

Subject #	nani-o WH	nomiya-de	nonda	no [+Q]
S1	141 Hz	103 Hz	108 Hz	140 Hz
S3	313 Hz	229 Hz	234 Hz	289 Hz

3.1 Prosodic structure

This almost-completely level pitch contour between the WH word and [+Q] is clearly consistent with Richards' hypothesis in that there is no prosodic boundary (as would be indicated by a pitch rise) in what he calls the *WH domain*. For these speakers, we posit the following structures (from Richards 2010):

- (9) $[_{DP} WH [_{DP} [_{VP}]] c$
 (MinP) (MinP)
 (MinP) \leftarrow WH domain

The two advanced subjects shown in (7) clearly show a natively-like prosodic pattern insofar as they maintain a level pitch contour between the WH word and the question particle. This particular sentence pair is used for illustration but we see the same pattern in other sentences.

3.2 Pitch compression

Let us now turn to a discussion of the second component of Richards' notion of contiguity by looking at the instantiation of pitch compression by comparing the sentences (in particular the bolded items) in (10) and (11).

- (10) Naoya-ga **nanika**-o nomiya-de nonda.
 Naoya-NOM something-ACC bar-LOC drank
 ナオヤが、何かを飲み屋で飲んだ。
 'Naoya drank **something** at the bar.'
- (11) Naoya-wa **nani**-o nomiya-de nonda no?
 Naoya-NOM what-ACC bar-LOC drank +Q
 ナオヤは、何を飲み屋で飲んだの?
 '**What** did Naoya drink at the bar?'

I calculated the mean pitch for the WH word for all subjects in sentence (11) and compared this to the mean pitch for the DP (i.e., the comparable non-WH direct object) for all subjects in sentence (10). The results are shown in (12).

(12)

Sentence #10	DP Direct Object	270 Hz Average (all subjects)
Sentence #11	WH Direct Object	262 Hz Average (all subjects)

Note the *modest* pitch compression on the WH direct object compared to the DP direct object. This difference, of course, is unlikely to be statistically significant but the hope is

that with a larger subject pool that I will be able to test for significance.

We see the same pattern in another pair illustrating the same contrast in (13) and (14).

- (13) Noboru-wa **piza**-o mottekitandesu ka?
 Noburo-NOM pizza-ACC brought +Q
 ノボルは、ピザを持って来たんですか?
 'Did Noburo bring **pizza**?'

- (14) Tarō-wa **nani**-o mottekitandesu ka?
 Taro-NOM what-ACC brought +Q
 タローは、何を持って来たんですか?
 '**What** did Taro bring?'

The same comparison is shown for another pair of sentences in (15). Once again, I calculated the mean pitch for the WH word for all subjects in sentence (14) and compared this to the mean pitch for the DP (i.e, the comparable non-WH direct object) for all subjects in sentence (13).

(15)

Sentence #13	DP Direct Object	287 Hz Average (all subjects)
Sentence #14	WH Direct Object	278 Hz Average (all subjects)

Again, note the modest (though likely insignificant) pitch compression on the WH direct object compared to the DP direct object.

The preceding two comparisons are illustrative but let us also compare across *all* of the sentences. Remember that Richards would predict that the pitch of WH phrases would be compressed compared to comparable non-WH phrases (which I call DPs for sake of contrast). This comparison is shown in (16).

(16)

All Subjects' DP Direct Objects Average	250 Hz
All Subjects' WH Objects Average	244 Hz

While, it is true that the WH pitch across all subjects and all sentences is lower than the pitch for DPs, the difference is minimal, and unlikely to be significant. Small sample size of this pilot study precludes statistical analysis.

4. Multiple WH questions and prosodic structure

There was one test sentence which illustrated multiple WH words, as shown in (17).

- (17) Dare-ga nani-o kaimasi-ta ka?
 who-NOM what-ACC buy-PAST +Q
 誰が何を買いしましたか?
 'Who bought what?'

This provides an interesting structure to investigate the syntactic and prosodic structure. The syntactic structure would be as given in (18).

- (18) [WH [WH [V] C]]

Let us, then, look at whether there are any prosodic boundaries between the WH words and the [+Q] feature on the Complementizer. The pitch data are given in (19).

- (19) *Averaged across all subjects.*

WH1 279 Hz	WH2 245 Hz	Verb 197 Hz	C 235 Hz
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There is a decline from the first WH word to the second, a further decline to the verb, and then a rise on the question particle. This pattern is consistent with there being no prosodic boundaries between WH and C, as predicted by Richards.

5. Effects of instruction & proficiency

These preliminary results suggest that the advanced-proficiency L2 learners *are* able to acquire the target grammar insofar as they have no pitch peaks within the WH domain. It is worth noting that as this phenomenon of pitch compression is *not* taught in class; I would argue that the knowledge cannot be attributed to an effect of instruction. What *has* been taught in class, though, is that rising intonation is used on questions. Sometimes, the intermediate subjects would use falling intonation on the WH questions (as they would in an English WH question). However, the advanced subjects used rising intonation, and it might be the case that the pitch plateau observed before the question particle is merely a consequence of rising intonation.

6. Interfaces

Sorace (2011) argues that interfaces between syntax and pragmatics show optionality or indeterminate acquisition. Furthermore, she suggests that the syntax/lexicon interface shows optionality when involving encyclopedic knowledge or extralinguistic factors (external) but not with semantic roles (internal). Sorace (2011: 9) summarizes by saying:

"There is sufficient evidence for important developmental differences between linguistic structures that require conditions of a formal nature within the grammar, and structures that require the integration of contextual factors."

The structures under investigation here seem well-suited to contributing to the literature on the Interface Hypothesis in two ways. First of all, this is an area where the structures in question are narrowly grammatical (and do not involve pragmatic or other external factors). Secondly, in probing what actually *causes* the residual optionality observed in the L2 learners for structures involving external interfaces, Sorace et al. (2009) and Serratrice et al. (2009) argue that it is restricted *input* which drives the incomplete acquisition. The subjects discussed in this study are classroom learners of Japanese who have spent no extended periods in Japan. Their exposure to Japanese has not been extensive. And yet, the advanced subjects *have* acquired the target structure of the phonological phrasing which licenses WH *in situ*. These results then, confirm the prediction of the IH that these formal properties are, indeed, acquirable, and yet raise questions as to whether the acquisition is, in fact, input-driven. Rather, it seems to suggest more that the L2-learner grammars are governed by universal properties (such as contiguity) which are not directly read off the input.

7. Conclusion

The advanced L2 learners (n=3; with different L1s) show evidence of (a) modest pitch compression in the WH domain, and (b) no prosodic boundaries in the Minor Phonological Phrases internal to the WH domain. Consistent with Richards (2010), these learners appear to have acquired the appropriate spell-out strategy for ensuring contiguity in Japanese WH Questions, though the evidence for (b) seems to be stronger than the evidence for (a). More subjects at both proficiency levels are needed to pursue the research question further to determine whether L2 learners are more able to acquire the phonological structures necessary for (b) than the phonetic implementation strategies implicated in (a).

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Appendix A. Reading Sentences

1. Satsuki ga depāto de ojōsan no tame ni ranpu o eranda.
Satsuiki-NOM dept.store-LOC daughter-GEN sake-DAT lamp-ACC chose
サツキが、デパートでお嬢さんのためにランプを選んだ。
'Satsuki chose a lamp for her daughter at the department store.'
2. Naoya ga nanika o nomiya de nonda.
Naoya-NOM something-ACC bar-LOC drank
ナオヤが、何かを飲み屋で飲んだ。
'Naoya drank something at the bar.'
3. Naoya wa nani o nomiya de nonda no?
Naoya-NOM what-ACC bar-LOC drank Q
ナオヤは、何を飲み屋で飲んだの?
'What did Naoya drink at the bar?'
4. Umi ga depāto de dare no tame ni ranpu o eranda no?
Umi-NOM dept. store-LOC who-GEN sake-DAT lamp-ACC chose Q
ウミが、デパートで誰のためにランプを選んだの?
'Who did Umi choose a lamp for at the department store?'
5. Dare ga depāto de dare no tame ni ranpu o eranda no?
Who-NOM dept.store who-DAT
誰が、デパートで誰のためにランプを選んだの?
'Who chose a lamp for whom at the department store?'
6. Anata wa Haru ga nani o suki ka shitteimasu ka?
you-TOP Haru-NOM what-ACC like Q know Q
あなたは、ハルが何を好きか知っていますか?
'What do you know Haru likes?'
7. Anata wa dare ga Tatsuo o suki ka shitteimasu ka?
you-TOP who-NOM Tatsuo-ACC like Q know Q
あなたは、誰がタツオを好きか知っていますか?
'Who do you think likes Tatsuo?'
8. Dare ga nani o kaimasita ka?
who-NOM what-ACC bought Q
誰が何を買いましたか?
'Who bought what?'

9. Seiko wa dare ga tsukutta sushi o tabeta no?
 Seiko-TOP who-NOM made sushi-ACC ate Q
 セイコは、誰が作った寿司を食べたの?
 'Seiko ate sushi that who made?'

10. Shiro wa_ hon'ya de nani o katta no?
 Shiro-NOM bookstore-LOC what-ACC bought Q
 シロは、本屋で何を買ったの?
 'What did Shiro buy at the bookstore?'

11. Kumiko wa doko de zasshi o katta no?
 Kumiko-NOM where-LOC magazine-ACC bought Q
 クミコは、どこで雑誌を買ったの?
 'Where did Kumiko buy a magazine?'

12. Hayao ga senshū katta hon ga nakunatta
 Hayao-NOM last week bought book-NOM disappeared
 ハヤオが先週買った本が、無くなった。
 'The book Hayao bought last week disappeared.'

13. Masahiro ga katta hon ga itsu nakunatta no?
 Masahiro-NOM bought book-NOM when disappeared Q
 マサヒロが買った本は、いつ無くなったの?
 'When did the book Masahiro bought disappear?'

14. Ponyo wa kinō hon o kaimashita ka?
 Ponyo-NOM yesterday book-ACC bought Q
 ポニョは、昨日本を買いましたか?
 'Did Ponyo buy a book yesterday?'

15. Miki wa kinō nani o kaimashita ka?
 Mik-NOM yesterday what-ACC bought Q
 ミキは、昨日何を買いましたか?
 'What did Miki buy yesterday?'

16. Miki wa kinō hon o kaimashita.
 Miki-NOM yesterday book-ACC bought
 ミキは、昨日本を買いました。
 'Miki bought a book yesterday.'

17. Noboru wa piza o mottekitandesu ka?
 Noburu-NOM pizza-ACC brought+POL Q
 ノボルは、ピザを持って来たんですか?
 'Did Noburu bring pizza?'
18. Noboru wa kinō piza o kaimashita.
 Noburu-NOM yesterday pizza-ACC bought
 ノボルは、昨日ピザを買いました。
 'Nobouru brought pizza yesterday.'
19. Tarō wa nani o mottekitandesu ka?
 Taro-NOM what-ACC brought+POL Q
 タローは、何を持って来たんですか?
 'What did Taro bring?'