Production and Perception of Prosody-Scope Correlation in Wh-interrogatives

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Construction of interest

“Did the health department confirm [what the patients ate t ]?”
(A possible answer: “Yes, they did.”)
Subordinate wh-scope domain

“Did the health department confirm [what the patients had eaten t ]?”
(A possible answer: “Yes, they did.”)
An alternative reading?
Matrix wh-scope domain

(?)~??~*

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[ hokenjo-wa [ kanjata’ti-ga na’ni-o ta’beta-ka ] tashika’metandesu ka ]
health dept.TOP patients-NOM what-ACC ate-COMP-Q confirmed-COMP-Q
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WH Q Q
```

“What did the health department confirm whether the patients ate t ?”
(A possible answer: “Raw oysters.”)

The status of the matrix wh-scope reading with respect to subjacency is under debate.
Prosody-scope correlation in Wh-questions
(Deguchi & Kitagawa 02, Ishihara 02, 03)

Local FPD (coinciding with Subordinate Wh-scope domain)

Global FPD (coinciding with Matrix Wh-scope domain)

Focus prominence

Decisive prosodic property of FPD

Post-focal reduction (PFR)
Biases toward Embedded Wh-scope
(Kitagawa & Fodor 2003)

Various extra-syntactic factors induce biases toward "local focus prosody-subordinate scope" pair in performance:

1. Pragmatic burden
2. Locality constraint on processing
3. Prosody induced processing
1. Pragmatic burden

Matrix wh-scope readings out of a wh-island tend to require elaborated presuppositions, which are difficult to satisfy
2. Locality constraint on processing

\[
\left[ \left[ \text{WH} \right] \right. \quad \left[ \text{Q} \right] \quad \left. \text{Q} \right]
\]

Resolve dependencies as soon as possible.

Miyamoto & Takahashi 2002
3. Prosody-induced processing

**Local FPD (coinciding with Subordinate Wh-scope domain)**

hokenjo-wa [kanjata’i-ga NA’ni-o ta’beta-ka ] tasiKA’metandesuka
health dept.TOP patients-NOM what-ACC ate-COMP-Q confirmed-COMP-Q

Focus prominence

**Global FPD (coinciding with Matrix Wh-scope domain)**

hokenjo-wa [kanjata’i-ga NA’ni-o ta’beta-ka] tasiKA’metandesu ka
health dept.TOP patients-NOM what-ACC ate-COMP-Q confirmed-COMP-Q

Focus prominence

Domain of PFR
3. Prosody-induced processing:
default (implicit) prosody
= Local FPD

Local FPD (coinciding with Subordinate Wh-scope domain)

Global FPD (coinciding with Matrix Wh-scope domain)
Matrix Wh-scope as a latent interpretation

Possibly, such strong biases may have demoted the matrix Wh-scope reading to a secondary and latent interpretation…

cf. Inversed Q-scope
Outline of the study

• **Production study** to test if speakers indeed establish prosody-scope correlation in the scopally ambiguous Wh-questions

• **Comprehension study** to examine if the speakers’ scopal intention is indeed conveyed to listeners with the prosody they produce

• **Comparison** of the above results to analyze the actual phonetic cues that are critically used by speakers and those used by listeners … to see if they coincide.
Production study

• Two Tokyo Speakers
  – Speaker A: Y. K.
  – Speaker B: A speaker who can get the both scope readings but naïve about our hypothesis

• 11 (originally 13) target sentences embedded in two versions of a preceding context each encouraging different scope, together with 24 fillers
Example context

Target sentence:
hokenjo-wa [kanjata’ti-ga na’ni-o ta’beta-ka] tashika’metandesuka?
health dept.TOP patients-NOM what-ACC ate-COMP-Q confirmed-COMP-Q

Target 1: Subordinate scope: “Did the health dept. confirm what the patients ate?”
Target 2: Matrix scope: “What is such that the health dept. confirmed whether the patients ate it?”

Situation: Conversation between a journalist and a spokesman of the Ministry of Health

Subordinate Wh-scope version

Journalist: It’s been 4 hours since you started interviewing the patients of the food poisoning. We need to know whether you finally identified the cause.

Spokesman: We are not ready to announce the name of the item yet.

Journalist: You don’t have to tell us what it is. We simply would like to know if you have already identify the cause.

Spokesman: Oh, yes. That we have.

Matrix Wh-scope version

Journalist: I heard that you have already identified the food item that caused the mass food poisoning. Tell us what it is.

Spokesman: Raw oysters.
Points of measurement (F0)

- hokenjo-wa
  health dept. TOP

- kanjata’chi-ga
  patients-NOM

- NA’ni-o
  what-ACC

- ta’beta-ka
  ate-COMP-Q

- tashiKA’metandesuka
  cofirmed-COMP-Q

Legend:
- Peak (pre Wh-phrase)
- Peak (Wh-phrase)
- Lowest measurable point (in the wh-scope domain)
- Peak (Post COMP item = matrix v.)
Points of measurement (duration)

Pause (if any)

Phrase-final segment duration
Results (F0)

**hokenjo-wa**
health dept.TOP

**kanjata’chi-ga**
patients-NOM

**NA’ni-o**
what-ACC

**ta’beta-ka**
ate-COMP-Q

**tashiKA’metandesuka**
cofirmend-COMP-Q

Peak (pre Wh-phrase)

Peak (Wh-phrase)

Lowest measurable point (in the wh-scope domain)

Peak (Post COMP item =matrix v.)

---

**Speaker A**

![Graph showing F0 levels for Speaker A with annotations P<.001 for each peak and lowest point.]

**Speaker B**

![Graph showing F0 levels for Speaker B with annotations P<.001 for each peak and lowest point.]

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*Please note that the graphical data includes error bars and indicates statistically significant differences.*
Results (final segment duration)

hokenjo-wa health dept.TOP
[kanjata’chi-ga patients-NOM]
NA’ni-o what-ACC
ta’beta-ka ate-COMP-Q
tashiKA’metandesuka confirmed-COMP-Q
Results (pause duration)

Pause (if any)

hokenjo-wa health dept. TOP
[kanjata’chi-ga patients-NOM
NA’ni-o what-ACC
[ta’beta-ka ate-COMP-Q
tashiKA’metandesuka cofirmed-COMP-Q

Speaker A

Speacker B
Factors contributing to the scope distinction in speakers (Stepwise Discriminant analysis)

<table>
<thead>
<tr>
<th></th>
<th>Speaker A</th>
<th>Speaker B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canonical correlation</td>
<td>.971</td>
<td>.976</td>
</tr>
<tr>
<td>Standardized canonical</td>
<td>Peak F0 of matrix verb</td>
<td>Peak F0 of matrix verb</td>
</tr>
<tr>
<td>discriminant function</td>
<td>1.038</td>
<td>1.112</td>
</tr>
<tr>
<td>coefficients</td>
<td>Lowest F0 in domain: -.718</td>
<td>Pause preceding Wh phrase: -.515</td>
</tr>
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</tbody>
</table>
Summary of production study results

• F0 peak height on the post-COMP item (matrix verb) as the most important prosodic encoding of the distinct wh-scope readings

• Between-speaker difference in richness of other phonetic cues (F0 cues on other items, durational cues)
Perception study

• 28 Tokyo Japanese-speaking subjects in total (N=14 for each speaker)
• 13 target sentences (11 analyzed) in isolation, in two versions (either matrix or subordinate wh-scope intended) + 44 fillers
• Forced-choice judgment on “possible answers”
Example answer choices

Answer options:

a. This question itself is incorrect as a sentence in Japanese.
b. It’s raw oysters.
c. Yes, we do.
Perception result: % accepted with matrix Wh-scope

Speaker A
- E-intended: 10%
- M-intended: 30%
  p<.05
  Both subj, item

Speaker B
- E-intended: 5%
- M-intended: 15%
  Subject: p<.01
  Item: p<.05
Prosodic effect on Wh-scope interpretation

Since addition of global FPD significantly increased matrix Wh-scope judgment, it should not be ruled out by a grammatical principle like the Subjacency condition (D&K)
Perception result: % rejected

Speaker A

E-intended: 0%
M-intended: 20%

p<.05
Both subj, item

Speaker B

E-intended: 0%
M-intended: 10%

p<.05 subj only
Problem

• The effect of prosody on wh-scope determination may not be as strong as it has been claimed by F&K.

• Yet, its effect is significant.

How does this state of affairs arise?
A common assumption

Speakers’ encoding of the Wh-scope information

mediated by the same kind of cue

= F0 peak of post-COMP item
(= in our example, matrix verb)

Hearers’ decoding of the Wh-scope information
Factors contributing to the scope distinction by hearers
(Stepwise Regression analyses)

N=44
Dependent factor: % matrix interpretation in the perception test

Independent factors: 4 F0 measures + 4 durational measures

$R^2 = .349$

Standardized regression coefficients:

- Peak F0 of Wh phrase: .399, $p<.005$
- Peak F0 of Pre-Wh phrase: -.273, $p<.05$
- COMP Final segment duration: -.224, $p=.095$
Speaker-hearer asymmetry

Speakers
- Mainly manipulate F0 cue on the post-COMP item (matrix verb) to encode Wh-scope

Hearers
- F0 cue on the post-COMP item was not utilized.
- Rely mainly on F0 cues on the Wh-phrase and pre-Wh phrase to decode Wh-scope?

This discrepancy may be the source of the mismatch between the speakers’ intention and hearers’ interpretation of Wh-scope.
Why should speakers and hearers have different strategies?

Our speculations
Speakers’ strategy

Speakers’ concern: to mark the end of post-focus reduction domain clearly

N.B. PFR = decisive prosodic property of FPD (K&D, Ishihara)

Local FPD (coinciding with Subordinate Wh-scope domain)

hokenjo-wa
health dept.TOP

[kanjata’ti-ga
patients-NOM

NA’ni-o
what-ACC

ta’beta-ka
ate-COMP-Q

]      tasika’metandesu
↓
ka
↑

health dept.TOP
patients-NOM
what-ACC
ate-COMP-Q
cofirmed-COMP-Q

Global FPD (coinciding with Matrix Wh-scope domain)

hokenjo-wa
health dept.TOP

[kanjata’ti-ga
patients-NOM

NA’ni-o
what-ACC
↓ta’beta-ka
ate-COMP-Q

]      tasika’metandesu↓ka↑
cofirmed-COMP-Q

→ Manipulate pitch on post-COMP item.
Hearers’ need

Hearers’ concern: to learn, at the earliest possible point, at which COMP the WH-COMP dependency should be resolved.

Local FPD (coinciding with Subordinate Wh-scope domain)

| hokenjo-wa | [kanjata’ti-ga | NA’ni-o | ta’beta-ka | tasiKA’metandesuka |
| health dept.TOP | patients-NOM | what-ACC | ate-COMP-Q | cofirmed-COMP-Q |

Global FPD (coinciding with Matrix Wh-scope domain)

| hokenjo-wa | [kanjata’ti-ga | NA’ni-o | ↓ta’beta-ka | tasika’metandesu ↓ ka↑ |
| health dept.TOP | patients-NOM | what-ACC | ate-COMP-Q | cofirmed-COMP-Q |

→ Be alert to extra prominence on Wh-phrase, in case the preferred (local) dependency must be overridden. Post-COMP cues would be too late and useless for an on-line decision.
Speaker-hearer asymmetry observed in another construction (Hirose 2006)

Left-branching (LB)  
Hearers’ cues: relative duration of W1 and W2

ao’i blue (the case of a blue CD)  

Right-branching (RB)  
Hearers’ cues: relative duration of W1 and W2

ao’i blue (the blue case of a CD)  

Speaker’s cue: F0
Summary and conclusions

• **Production study** to test if speakers indeed establish prosody-scope correlations in the scopally ambiguous Wh-questions

  →YES, mainly by the F0 manipulation on the post-COMP item

• **Comprehension study** to examine if the speakers’ scopal intention is indeed conveyed to listeners with the prosody they produce

  →YES, but only partially.

• **Comparison** of the above results to analyze the actual phonetic cues that are critically used by speakers and those used by listeners
  … to see if they coincide.

  →Speaker-hearer asymmetry on the use of prosodic cues:
    F0 information on the post-COMP item was not helpful for hearers
    ---possibly due to different on-line needs for speakers and hearers
Thank you!
References

Prosody-scope correlation in Wh-questions
(Deguchi & Kitagawa 02, Ishihara 02, 03)

Local FPD (coinciding with Embedded Wh-scope domain)

Global FPD (coinciding with Matrix Wh-scope domain)

Definitions (Ishihara 2004)
- F0 boosting on the focused phrase
- Post-focus F0-reduction
- Pitch reset after focus intonation domain
Prosody-induced ungrammaticality (Kitagawa & Hirose 2006)

Forced Matrix wh-scope

Kango’fu-wa [kanjata’ti-ga NA’ni-o ta’beta-to ] SHI’njiteirundesuka
nurse.TOP patients-NOM what-ACC ate-COMP-NON-Q blieve-COMP-Q

With Global FPD

With Local FPD

Rejected as ungrammatical

(wrongly) accepted as embedded wh-scope

With Global FPD

5% p<.05

With Local FPD

16%

0.5% p<0.1

4%
Factors contributing the scope distinction in hearers
(Stepwise Regression analyses)

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<tbody>
<tr>
<td>( R^2 )</td>
<td>.45, ( p&lt;.01 )</td>
<td>.39, ( p&lt;.05 )</td>
</tr>
<tr>
<td>standardized coefficients</td>
<td>PreWh pause: .469 ( p&lt;.05 )</td>
<td>Peak F0 of Wh phrase : .437, ( p&gt;.05 )</td>
</tr>
<tr>
<td></td>
<td>PostComp pause: -.337 ( p=.085 )</td>
<td>Domainrange: -.348, ( p=.079 )</td>
</tr>
</tbody>
</table>
Speaker-hearer asymmetry

Speaker’s concern: to mark the end of post-focus reduction domain clearly

→ Manipulate pitch on matrix verb.

Hearer’s concern: to learn, at the earliest possible point, at the end of which clause the Wh-COMP dependency should be resolved. Matrix verb would be too late.

→ Seek extra prominence on wh-phrase, lest the default prosody should be overridden.
Inversed Q-scope

(E) **One** very difficult problem was assigned to **every** student.

— (i) **ONE** > ∀

(ii) ∀ > **ONE**

(J) **1 0**以上の講座に **3 0 0**人近い学生が登録した。

'too-izyoo-no kooza-ni sanzyuu-nin-tikai gakusee-ga tooroku-sita more.than.10 classes-for almost.300 students-nom registered

'For more than 10 classes, almost 300 students registered.'

— (i) **MORE THAN 10** > **ALMOST 300**

'Almost 300 students registered for more than 10 classes.'

— (ii) **ALMOST 300** > **MORE THAN 10**