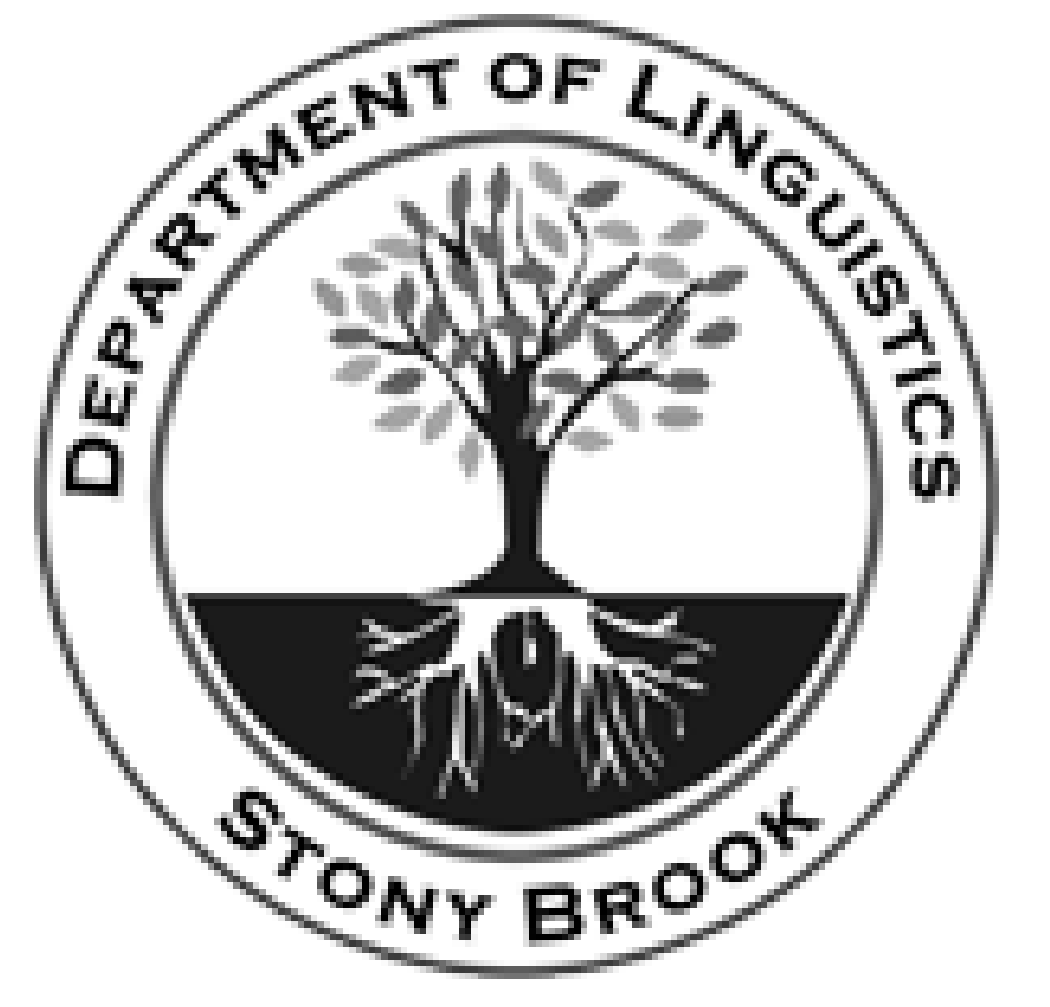


# Syntax and Prosody Interface of *Wh*-Scope in Mandarin

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## 1. Introduction

### *Wh*-movement languages (e.g. English)

- The position of *wh*-phrases determines their scope.

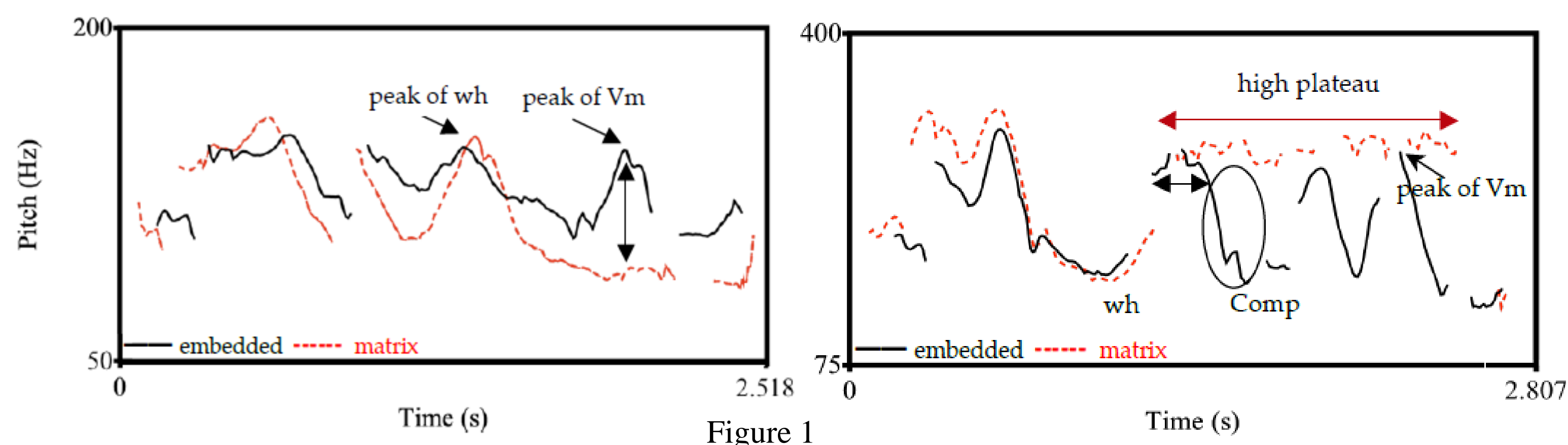
- (1) Did Mary say [<sub>CP</sub> **what** John bought *t* ]? (Embedded scope-YNQ)
- (2) **What** did Mary say [<sub>CP</sub> John bought *t* ]? (Matrix scope-WHQ)

### *Wh*-in-situ languages

- The position of *wh*-phrases does NOT determine their scope. Sentences with *wh*-phrases are ambiguous between a Yes-No question reading and a *wh*-question reading.

- (3) Bill-un [Mary-ka **nwukwu-lul** mannessun-ci] mwulesseo? (Korean)  
Bill-top Mary-nom **who-acc** met-Q asked-Q  
Embedded *wh*-scope reading (YNQ): 'Did Bill ask who Mary met?'  
Matrix *wh*-scope reading (WHQ): 'Who did Bill ask whether Mary met?'

- To disambiguate, prosodic cues are utilized in these languages (Ishihara 2002, Hwang 2011): F0 pitch compression (Figure 1, left) or high pitch plateau (Figure 1, right) is observed between a *wh*-phrase and an associated complementizer.



- Scrambling of *wh*-phrases are possible in *Wh*-in-situ languages such as Mandarin, Japanese and Korean.

- (4) Zhengzhi wen-guo [Lisi jianguo **shei**] / [**shei** Lisi jianguo]? (Chinese)  
Zhengzhi ask-asp Lisi meet-asp **who** / **who** Lisi meet-asp  
Embedded *wh*-scope reading (YNQ): 'Did Zhengzhi ask who Lisi met?'  
Matrix *wh*-scope reading (WHQ): 'Who is the person such that Lisi met such that Zhengzhi asked about?'

## 2. Research Question

- Similar to Japanese and Korean, will Chinese speakers use prosodic cues in order to disambiguate *wh*-scope in the ambiguous sentences as in (4)?
- Will the same prosodic strategies be used to disambiguate *wh*-scope in production and perception?
- Does the syntactic position of *wh*-phrase play a role in interpretation preference?

## 3. Experiments

- *In-situ wh*-questions
  - Production test Experiment 1
  - Perception test Experiment 2
- Scrambled *wh*-questions
  - Comprehension test Experiment 3
  - Production test Experiment 4

### Experiment 1 – production test

#### Stimuli

- Controlled syntactic factors
  - Position of *wh*-phrases: subject vs. object
  - Type of *wh*-phrases: regular *wh*-phrase vs. D-link phrase
  - Embedded clause type: default question vs. A-not-As question
- Two contexts leading to embedded and matrix interpretations of *wh*-phrases
- 32 target sentences: 4 sets consisting of 8 sentences (=2x2x2)
- 64 sentences (32 targets \* 2 interpretations) were recorded

#### An annotated example

**Context (matrix scope)** Wang Qiang is a fashion leader and has influenced the fashion trend several times. Last night, your friend saw a TV interview of Wang Qiang by a journalist, Li Hua. By watching the interview, your friend learned some fashion trends that Wang Qiang has influenced. Suppose that you are chatting with your friend now and you want to know which fashion trends Wang Qiang has influenced.

**Target sentence Q:** Lihua wen-guo Wangqiang yingxiang-guo shenme?  
**Lihua ask-Perf Wangqiang influence-Perf what**  
'What did Lihua ask whether Wangqiang has influenced?'

**Context (matrix scope)**  
A: hanliu ya.  
S. Korean-wave Interj.  
Wangqiang de sheji zai hanguo mingsheng hen hao.  
Wangqiang DE design in S. Korea reputation very good  
'Korean wave. Wangqiang's design has good reputation in S. Korea.'

#### Procedure

- 16 native Mandarin speakers participated in this experiment.
  - First, they were asked to read each context silently;
  - Then, they read the target sentence aloud;
  - The target sentences were recorded twice.

## 3. Experiments, continued

### Experiment 1, cont'd

#### Results

Mandarin speakers disambiguate the semantic scope ambiguity of *wh*-phrases by making the *wh*-phrase more prominent in their speech.

Average pitch excursion on...	Embedded scope	Matrix scope	Linear regression result (p-value)
Matrix Verb	1.23	1.20	>.05
Embedded Verb	1.73	1.75	>.05
<i>Wh</i> -phrase (subj or obj)	1.45	1.61	<.05

### Experiment 2 – perception test

#### Stimuli

- The same target sentences in Experiment 1
- A Mandarin native speaker recorded two versions of every target sentence by using prosodic strategies observed in Experiment 1.
- 64 target sentences with 112 fillers were distributed across 4 sets in a Latin Square Design.

#### Procedure

- 30 native Mandarin speakers participated in this experiment.
- They were asked to complete a forced choice task after listening to an audio file.
- The two choices in the task corresponded to the two interpretations (matrix and embedded).
- The specific context was not given in order to exclude the effect of context.
- Qualtrics was used in the experiment

#### Results

Prosodic cues observed in the production test do not play a role in perception disambiguation.

	Embedded scope prosodic cue	Matrix scope prosodic cue	p-value
Matrix scope reading	60%	65%	0.21

### Experiment 3 – comprehension test

#### Stimuli

- Modified from the same target sentences in Experiment 1
- Added syntactic factor: landing site of *wh*-scrambling
  - left edge of embedded clause (Short Distance Scrambling), left edge of matrix clauses (LDS)
- Removed factor: subject / object positions of *wh*-phrases

#### Procedure

- 36 native mandarin speakers participated in the experiment
- Similar to experiment 2, except that no audio recordings are played before forced choice tasks.

#### Results

Scrambling *wh*-phrases increased the preference of matrix scope reading.

	Matrix scope reading	p-value
a. <i>Wh</i> -in-situ	49%	} <.05
b. SDS	76%	
c. LDS	94%	

### Experiment 4 – production test

#### Stimuli

- The same as Experiment 3 while excluding LDS

#### Procedure

- 6 native mandarin speakers participated in the experiment
- Similar setting as experiment 1

#### Results

*Wh*-phrases were not prosodically focused under scrambling conditions

	Avg pitch discursion on		Wh-in-situ		SDS	
	Emb	Mat	Emb	Mat	Emb	Mat
<i>Wh</i> -phrase	1.490	1.652	1.578	1.559		
Matrix verb	0.826	0.848	0.929	0.912		
Embedded verb	1.416	1.472	1.604	1.241		

## 4. Discussion and Conclusion

### A recap of experiment findings

- *In-situ wh*-questions
  - Production test – Exp. 1: matrix scope, large pitch discursion on *wh*-phrases
  - Perception test – Exp. 2: large pitch discursion not observed
- Scrambled *wh*-questions
  - Comprehension test – Exp. 3: scrambled *wh*-phrases, matrix scope more likely
  - Production test – Exp. 4: scrambled *wh*-phrases, prosodic emphasis less likely

### From experiment 1 and 2

- There is a mismatch between speakers' encoding and hearers' decoding of *wh*-scope information in Mandarin.
- As a tone language, Chinese is typologically different from Japanese and Korean. The large pitch discursion is the only significant indicator of scope in Mandarin, which is possibly due to the need of tone preservation. (Jun 2005)

### From experiment 3 and 4

- Overt syntactic movement of *wh*-phrases increased the likelihood of matrix scope interpretation
- Prosody and syntactic position are two cues for scope disambiguation. Under *wh*-in-situ conditions, prosodic cues are utilized to signal scope. When *wh*-phrases are scrambled, prosodic cues might no longer be necessary, under the economy view.

### Next step

since morphological information and syntactic information can affect *wh*-scope processing, it would be interesting to explore the predictive power of Mandarin sentence final particles *-ma* and *-ne*.

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