Prosodic disambiguation of *wh*-scope in Chinese

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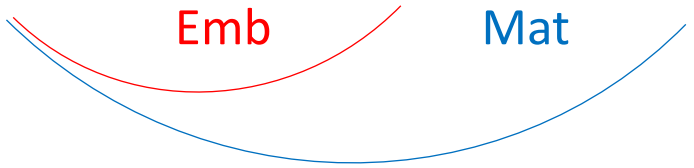
Background

- Recent studies including Ishihara (2002) and Hwang (2011) claim that the interpretation of the *wh*-phrase in (1) is ambiguous between an embedded scope (YNQ) (1a)and a matrix scope (WHQ) (1b) in Japanese and Korean.

(1) John-un [Mary-ka ***nwukwu-lul*** mannassnun-ci] mwuless-eo? (Korean)
John-Top [Mary-Nom ***who-Acc*** met-Q] asked-Q?
a. 'Did John ask who Mary met *t?'*
b. 'Who did John ask whether Mary met *t* ?'

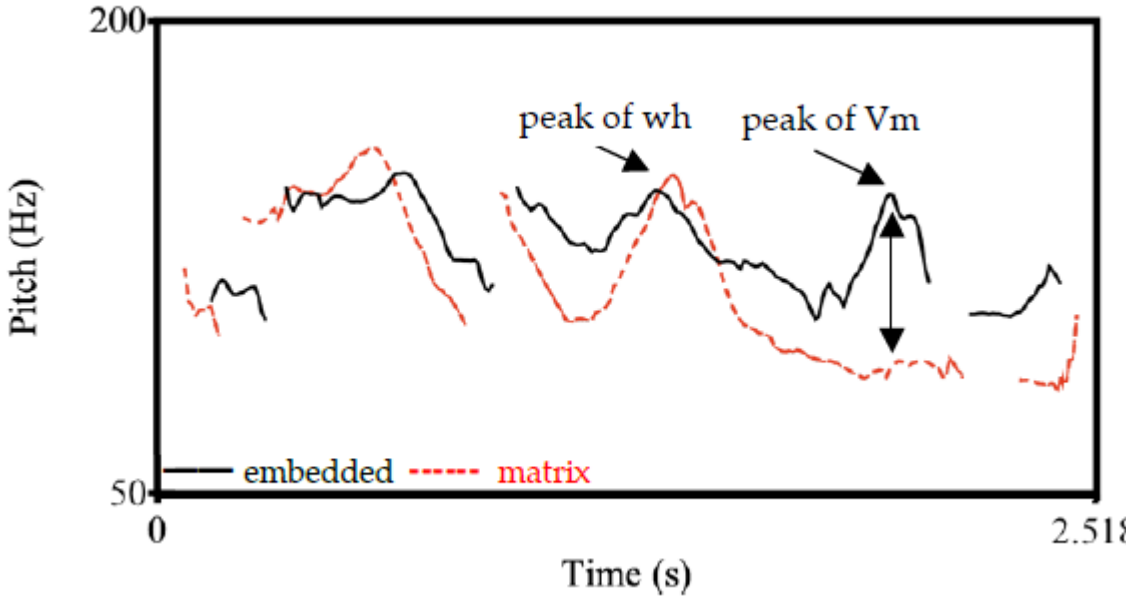
Background

- According to Ishihara (2002) and Hwang (2011), the semantic scope ambiguity of the *wh*-phrase in (1) can be disambiguated by **prosody**.
- The F0 pitch compression or high plateau appears between a *wh*-phrase and an associated complementizer.
- $[_{\text{Matrix}}$ … $[_{\text{Embedded}}$… *wh*-phrase … Q] … Q] ?

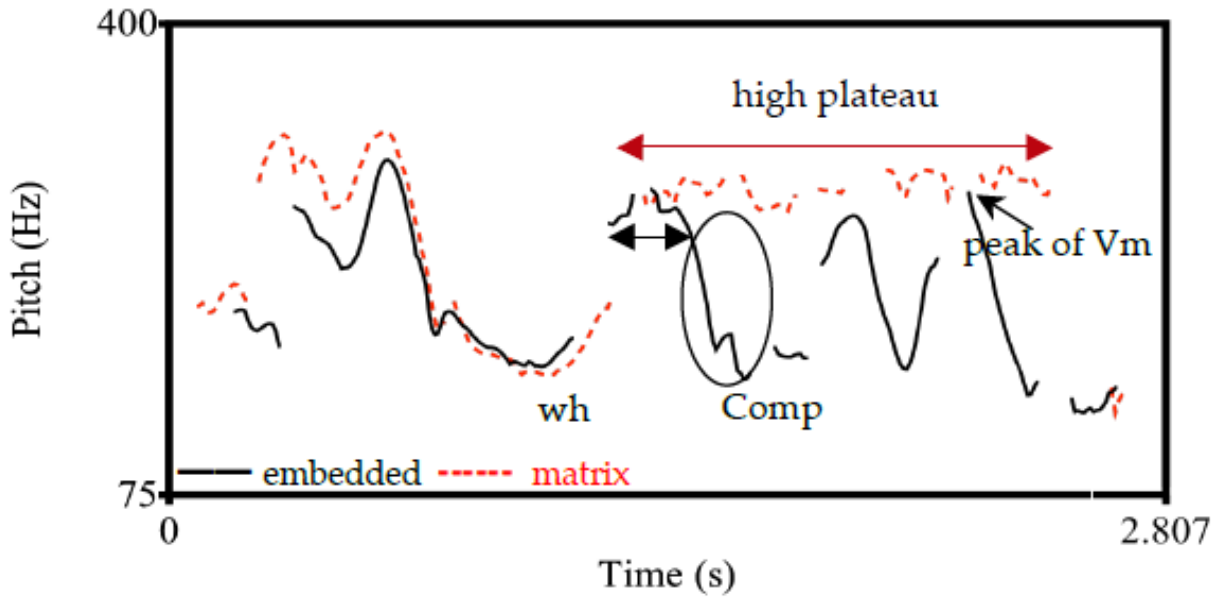


Background

F0 pitch compression



High plateau



(Hwang 2011)

Background

- Prosodic effect on different semantic interpretations of *wh*-phrases, regarding interrogative vs. *wh*-indefinite in Mandarin Chinese has been studied, as in Hu (2002).
- However, few studies have been done on the ambiguity of *wh*-phrases, regarding matrix scope vs. embedded scope in Mandarin Chinese, when *wh*-phrases function simply as interrogative pronouns.

Research Question

- This study investigates the following two questions:
  a) Will sentences like (2) in Chinese allow both scope readings listed?
  b) If so, will prosody disambiguate *wh*-scope interpretation? And what kind of prosodic strategy will be used?

(2) Zhengzhi	wen-guo	Lisi	jian-guo	shui?
Zhengzhi	ask-Perf	Lisi	meet-Perf	who

a. 'Did Zhengzhi ask who Lisi met?'(embedded)

b. 'Who did Zhengzhi ask whether Lisi met?'(matrix)

Experiments

- Experiment 1:
  - examines the existence of the scope ambiguity of *wh*-phrases in an embedded clause.
  - includes a forced choice task and an acceptability judgment task

- Experiment 2:
  - examines the way of prosodic disambiguation of the *wh*-scope
  - includes a production test

Experiment 1- Stimuli

- Three control factors:
  a) The position of *wh*-phrases: subject *vs.* object in an embedded clause
  b) The type of *wh*-phrases: regular *wh*-phrases *vs.* D-linked *wh*-phrases
  c) The embedded sentence types: default *vs.* A-not-A
- 4 sets of 8 target sentences (= 2*2*2)
- 32 target sentences intermingled with fillers were distributed across 4 sets in a Latin Square Design.

Experiment 1- Procedure

- 71 native Mandarin speakers participated.
- Forced choice task: they chose one of the two given answers as in (3).

(3) Question: Zhengzhi wen-guo Lisi jian-guo shui?

Answer: a. Shide('Yes') b. Liujun('Liujun')

- Acceptability judgment task: they rated the naturalness of a question-answer pair on a 7-point scale.

(4) Question: Zhengzhi wen-guo Lisi jian-guo shui?

Answer: Liujun('Liujun')

0 1 2 3 4 5 6

(The least natural) (The most natural)

Experiment 1- Result

- A forced choice task and an acceptability judgment task

	The type of wh-phrases	position	A-not-A	Forced Choice result (Matrix scope answer)	Acceptability judgment result (Max: 6)
1	Regular wh	Subject	No	50 %	3.1
2	Regular wh	Subject	Yes	57%	2.9
3	Regular wh	Object	No	52%	3.2
4	Regular wh	Object	Yes	45%	2.9
5	D-linking wh	Subject	No	43%	3.1
6	D-linking wh	Subject	Yes	43%	3.1
7	D-linking wh	Object	No	42%	3.5
8	D-linking wh	Object	Yes	35%	2.7

Experiment 1- Result

- The results of the forced choice task show that there exists scope ambiguity in Chinese as well.
  a) No significant difference between subject and object ($p > .05$, $t < 2$) or between default construction and A-not-A construction ($p > .05$, $t < 2$).
  b) Preference of embedded scope reading for D-linked *wh*-phrases ($p < .05$, $t > 2$)
- The results of the acceptability judgment task reached around 3. This suggests that the matrix scope reading of *wh*-phrases can be accepted as natural. (Lee & Yun 2016)

Experiment 2-Stimuli

- The same target sentences in Experiment 1
- The specific contexts leading to the different wh-scope were given.
- 64 target sentences (= 32 sentences * 2 different scopes)

Experiment 2-Stimuli

- Contexts

  “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.”

  Embedded scope: Li Hua asked Wang Qiang many questions during the interview. Suppose that you are chatting with your friend now and you want to know which questions Li Hua asked Wang Qiang.

  Q: Lihua wen-guo Wangqiang yingxiang-guo shenme?
  Lihua ask-Perf Wangqiang influence-Perf what
  ‘Did Lihua ask what Wangqiang has influenced?
  A: (embedded scope) zhexie wenti Lihua dou wen-guo.
  these question Lihua all ask-Perf
  ‘These questions, Lihua has asked them all.’

Experiment 2-Stimuli

- Contexts

  “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.”

  Matrix scope: 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.

  Q: Lihua wen-guo Wangqiang yingxiang-guo shenme?
  Lihua ask-Perf Wangqiang influence-Perf what
  What did Lihua ask whether Wangqiang has influenced?’

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

Experiment 2-Procedure

- 15 native Mandarin speakers participated in this experiment but one participant was excluded from the analysis because we couldn’t measure the pitch height due to the creaky voice.
- First, they were asked to read each context silently. The proper answer to the target sentence (question) was also given in order to prime a specific scope reading.
- Then, they read the target sentence aloud. The target sentences were recorded twice.
- No restriction to record the target sentences more than twice.

Experiment 2-Analysis

- We measured the lowest and the highest pitch heights on the embedded verb, the matrix verb and the *wh*-phrase.
- All collected pitch heights were normalized with Z-score.
- The gap between the lowest and highest pitches was calculated.

Experiment 2-Result

- The average of the pitch excursion

S V [S/wh V O/wh]?

	Embedded scope	**Matrix scope**	**Linear regression result (*p*-value)**
Matrix Verb	1.232002	1.195059	> .05
Embedded Verb	1.733613	1.751208	> .05
Wh-phrase (subj or obj)	1.447142	1.612952	< .05

Experiment 2-Result

- The average of the pitch excursion on *wh*-phrases

Wh-type	**A-not-A**	**Embedded Scope**	**Matrix scope**	***p*-value**
D-linked *wh*	No	1.918692	2.020285	< .05
Regular *wh*	No	1.257796	1.400369	
D-linked *wh*	Yes	1.604984	1.818547	
Regular *wh*	Yes	1.016003	1.222323	

Experiment 2-Result

- The average of the pitch excursion on matrix verb

Wh-type	A-not-A	Embedded Scope	Matrix scope	*p*-value
D-linked *wh*	No	1.270386	1.151225	< .05
Regular *wh*	No	1.338576	1.195081	
D-linked *wh*	Yes	1.231659	1.255531	> .05
Regular *wh*	Yes	1.204188	1.240146	

Experiment 2-Result

- The average of the pitch excursion on embedded verb

Wh-type	**A-not-A**	**Embedded Scope**	**Matrix scope**	***p*-value**
D-linked *wh*	No	1.436072	1.369298	> .05
D-linked *wh*	Yes	2.027558	1.992079	
Regular *wh*	No	1.413712	1.611547	> .05
Regular *wh*	Yes	2.014911	2.023553	




Experiment 2- Result

- Overall, the results show that *wh*-phrases were prosodically focused for the matrix scope reading (linear regression: $p < .001$, $t = 5.03$, $df = 879.09$) regardless of syntactic conditions.
- In addition, two different patterns were found on matrix verbs and embedded verbs depending on the presence of A-not-A construction or the type of *wh*-phrases.
  a) The matrix verbs were focused for **embedded scope reading** in **default constructions**, but focused for **matrix scope reading** in **A-not-A constructions.**
  b) However, the big pitch excursion is found on embedded verbs for **matrix scope reading** when **regular *wh*-phrases** were included, but it is found for **embedded scope reading** when **D-linked *wh*-phrases** were included.

Discussion

- This study confirms that there is *wh*-scope ambiguity in Mandarin similar to Japanese and Korean.
- The Mandarin speakers used the specific prosodic strategy to disambiguate the semantic scope ambiguity of *wh*-phrases.
  - Contrary to Japanese and Korean, the scope is not marked by the span of F0 pitch compression or high plateau.
  - Instead, the biggest pitch excursion was found always on the ***wh*-phrase** for the matrix scope reading, and found sometimes on matrix verbs and embedded verbs contingent upon syntactic structure and wh-phrase type.

Further study

- Perception test:

  Will the same prosodic strategy aid to disambiguate the *wh*-scope when they hear the ambiguous sentences?

- Another factor to be investigated:

  Mandarin allows topicalization of wh-phrase in an embedded clause. Will the syntactic position affect processing of the wh-scope?

References

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Thank you!

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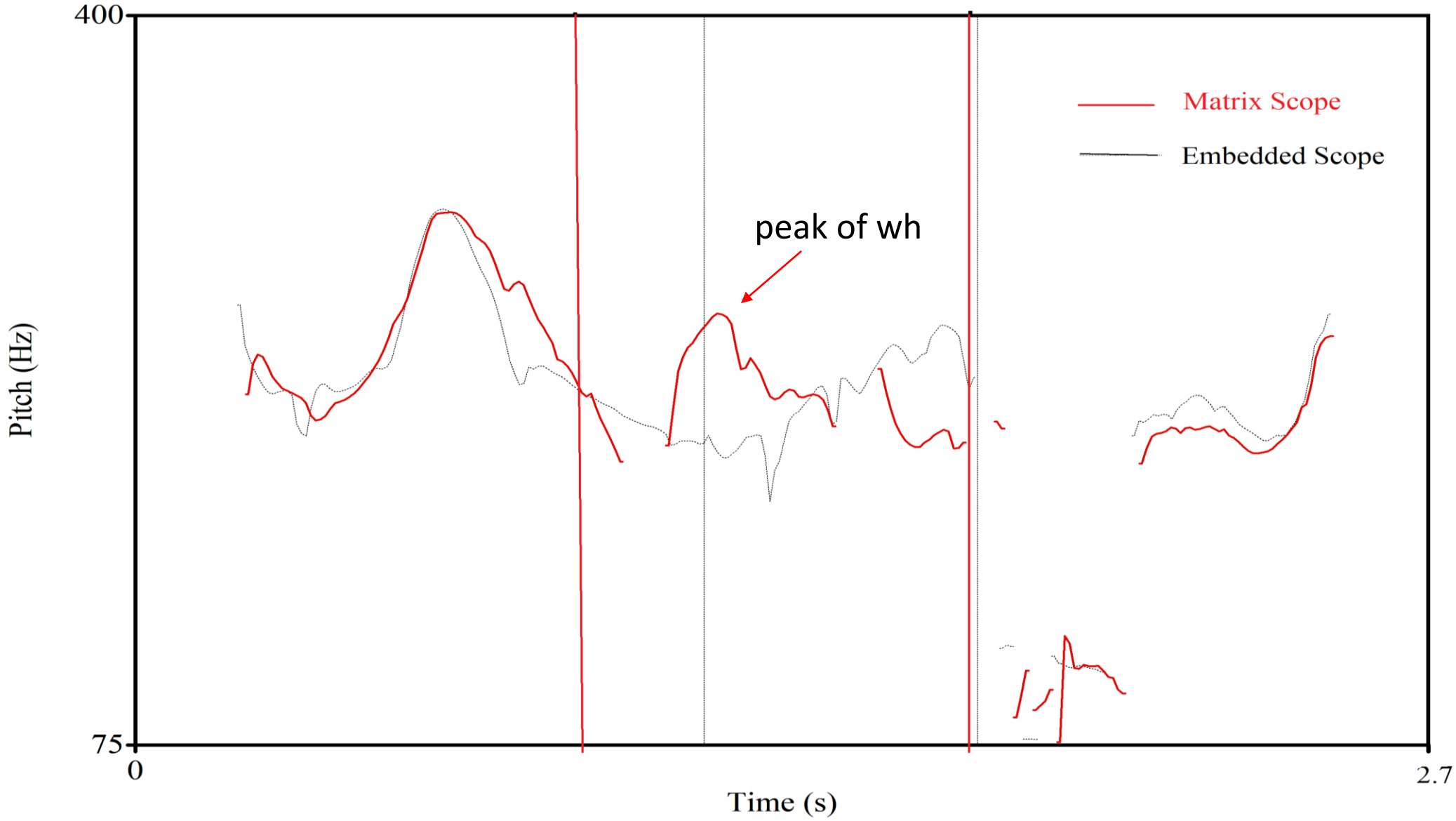
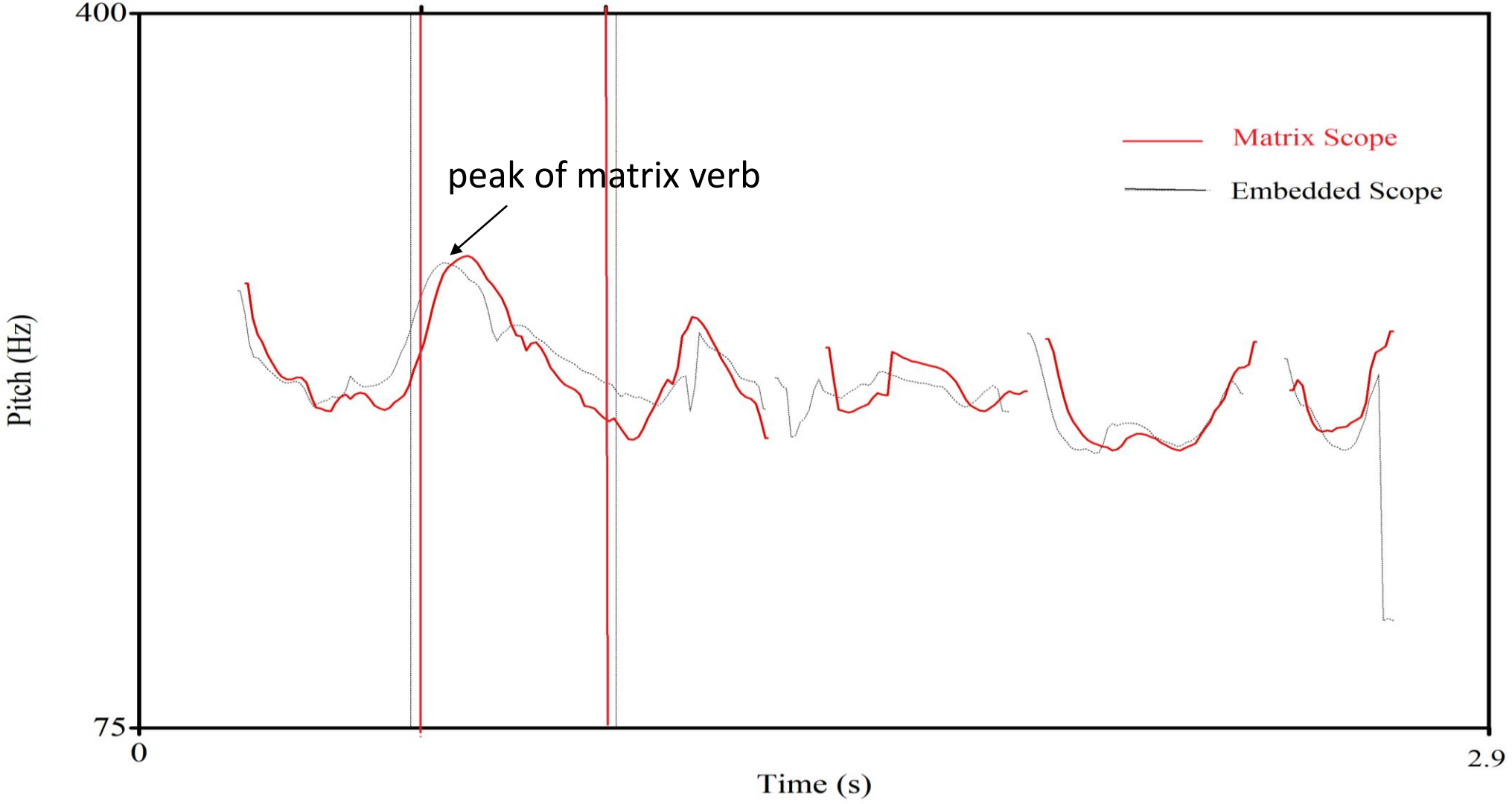
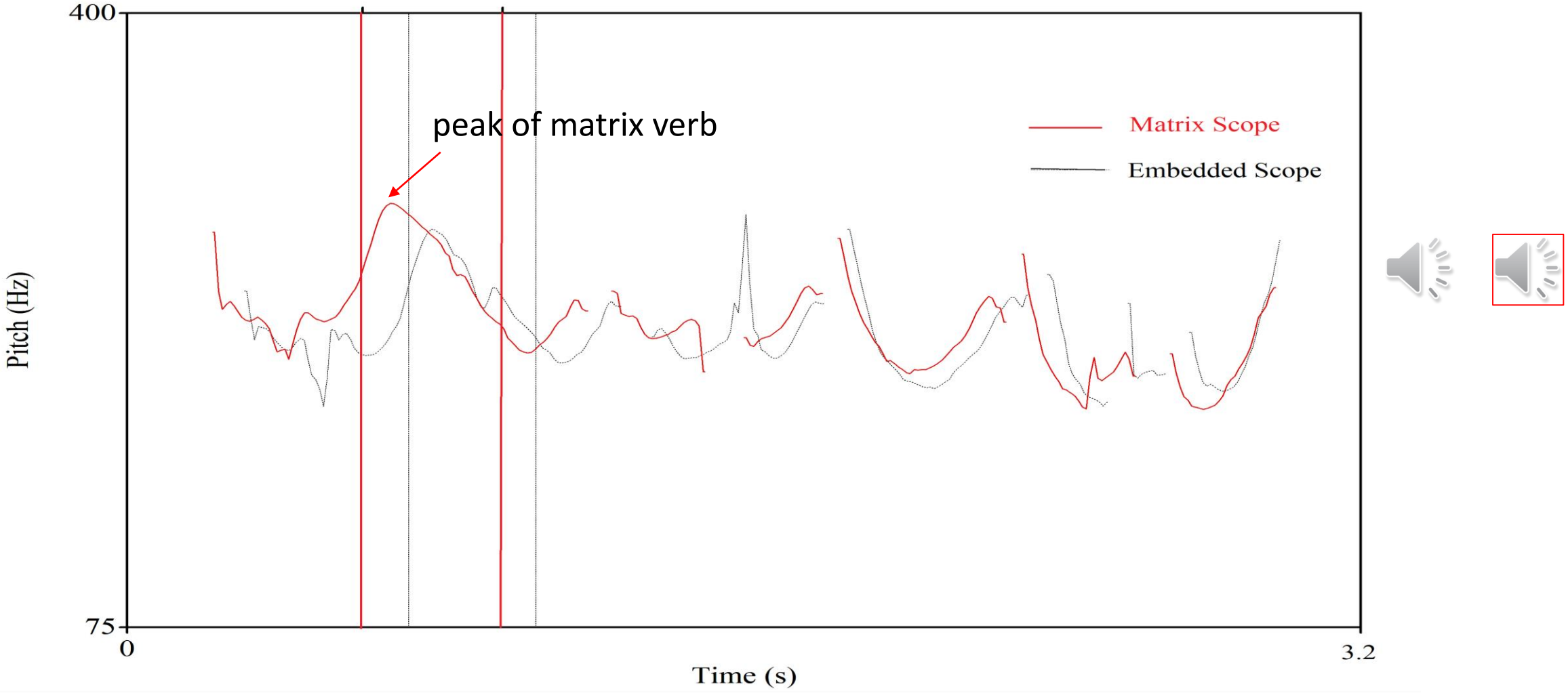
Wh-phrase


400
75
0
2.7
Pitch (Hz)
Time (s)
Matrix Scope
Embedded Scope
peak of wh

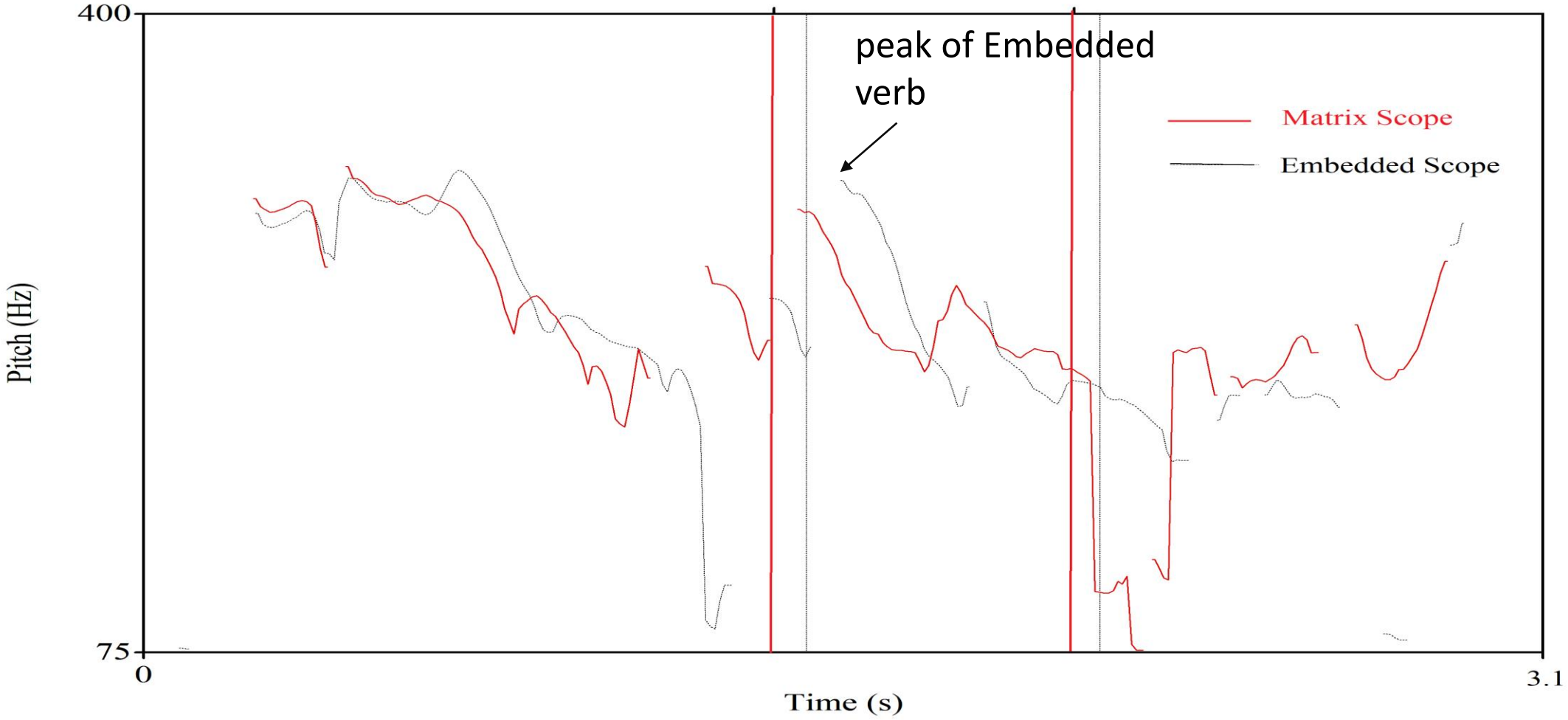
Matrix Verb_ default construction



Matrix Verb_ A not A construction



Embedded Verb_ D-linked Wh



Embedded Verb_ Regular Wh