

Mandarin *Wh*-Phrases and Prosody

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Abstract: It has been widely acknowledged that *wh*-phrases in Mandarin Chinese are ambiguous between interrogative and indefinite interpretations. As the conditions that license the latter reading have been identified (Li, 1992; Cheng, 1994), these conditions do not necessarily preclude *wh*-interrogative interpretations. While previous literature has placed emphasis on the syntax and semantics of *wh*-interrogatives and *wh*-indefinites, less attention has been paid to issues related to their ambiguity with respect to prosodic effects. Although previous studies have demonstrated that prosody interacts with *wh*-phrases in languages like Japanese (Ishihara, 2007; Kitagawa, 2007), Korean (Jun & Oh, 1996), and German (Truckenbrodt, 2012, 2013) in that *wh*-interrogatives manifest phonetic prominence whereas *wh*-indefinites do not, yet relevant studies in Mandarin *wh*-phrases are comparatively scarce. The paper thus aims to investigate whether Mandarin Chinese speakers would refer to prosodic cues in differentiating the ambiguities between *shénme*-interrogative (Q) and *shénme*-indef (inite), when occurring in syntactically identical situations in speech

contexts. Based on our production data and perception listening comprehension task, we conclude that the F-feature that is treated as lexically inherent to *wh*-words in Truckenbrodt (2012, 2013) is however claimed to be unspecified in “Mandarin Chinese.” In line with Cheng (1991), we maintain that *wh*-word interpretations are disambiguated depending on syntactic binding and licensing conditions, whereas prosody might serve a subsidiary role.

Keywords: *wh*-phrase; *wh*-indeterminant; prosody; focus

1. Introduction

It has been acknowledged that in Mandarin Chinese (MC) in addition to the in-situ *wh*-interrogatives as in (1a) (Huang, 1982; Huang et al., 2009 among many others), *wh*-words may be interpreted as indefinites, as exemplified in (1b); see Huang (1982), Cheng (1991, 1994), Li (1992), Lin (1998), Liao (2011), etc.

(1) a. Tā mǎi-le shénme (ne)? (*Wh*-interrogative)

she buy-ASP what Q-marker

“*What* did she buy?”

b. Tā méi mǎi shénme. (*Wh*-indefinite)

she not buy what

“She didn’t buy anything.”

In (1b), the *wh*-word *shénme* has an indefinite reading of “something” or “anything” here, in contrast to the interrogative “what” in (1a). The distribution of *wh*-words in their non-interrogative uses is more restricted when compared to their interrogative correlates. Treated as a polarity item (Li, 1992; Cheng, 1994), the *wh*-indefinite is licensed in non-vertical contexts (c-commanded by licensing operators as in Li, 1992, following Progovac, 1988) in which the truth-value of the propositions is uncertain or not fixed, e.g. Zwarts (1995), Giannakidou (1998). The non-veridical operators including negation as

in (1b), yes-no question particle *ma* as in (2), the conditional *rúguǒ/yàoshi* “if” as in (3), matrix non-factive verbs as in (4a)[vs. factive verb in (b)], and epistemic modals as in (5) denoting uncertainty and tentativeness.

(2) *Tā mǎi-le shénme ma?*

she buy-ASP what Q

“Did she buy anything/something?”

(3) *Rúguǒ tā mǎi-le shénme, wǒ huì hěn kāixīn.*

if she buy-ASP what, I will very happy

“If she had bought *anything/something*, I will be very happy.”

(4) a. *Wǒ yǐwéi [nǐ kàndào shénme].*

I think [you see what]

“I thought you saw something.”

b. **Wǒ bàoyuàn [nǐ kàndào shénme].* (Li, 1992: 129)

I complain [you see what]

“I **complained** that you saw **something**.”

(5) a. *Tā yěxǔ/ kěnéng xǐhuān shénme.* (Li, 1992: pp. 130-131)

she perhaps/probably like what

“She perhaps/probably likes *something*.”

b. *Tā (hǎoxiàng) mǎi-le (xie) shénme.*

she (seem) buy-ASP some what

“(It seems that) she bought *something*.”

The *wh*-words are intrinsically ambiguous unless there is overt question marking. The question marker *ne* in (6a) ensures the *wh*-interrogative reading and the marker *ma* in the yes-no question reading, as in (6b).

(6) a. *Tā mǎi-le shénme ne?* (*Wh*-question)

she buy-ASP what Q-particle

“What did she buy?”

b. *Tā mǎi-le shénme ma?* (Yes-no question)

she buy-ASP what Q-particle

“Did she buy *something*?”

Furthermore, despite the fact that the above licensing contexts are conditions for licensing indefinite interpretation, the more common *wh*-interrogative reading is not precluded in such contexts, except in sentences with question particle *ma*, which only denotes yes-no questions. Thus, we may assume that the *wh*-interrogative reading is the unmarked one, whereas the *wh*-indefinite reading *may* be triggered in non-veridical contexts, thus creating ambiguities in such contexts, e.g. *shénme* in the negative sentence (7), and in the conditional clause as in (8).

(7) Tā méi mǎi shénme.

she not.have buy what

a. “**What** didn’t she buy?”

b. “She didn’t buy **anything**.”

(8) Rúguǒ tā mǎi-le shénme, nǐ huì hěn kāixīn.

if she buy-ASP what, you will very happy

a. “**If** she had bought *what*, you will be very happy?”

b. “**If** she had bought *something*, you will be very happy.”

While previous literature has given prominence to the syntax and semantics of *wh*-phrases, less attention has been paid to issues related to their ambiguity with respect to the prosodic effects. As mentioned above, the *wh*-indefinite licensing conditions do not necessarily preclude *wh*-interrogative interpretations. The consequent question is raised as to how speakers/hearers would differentiate these ambiguities (*wh*-indefinites from *wh*-interrogatives) when they occur in syntactically identical situations in speech. Would prosody have effect on disambiguating the meanings? Thus, this paper aims to address the issue of whether or to what extent prosody would have effect on disambiguating sentences with *shénme*-interrogative (Q) and *shénme*-indef(inite). Based on our production data and perception listening comprehension task, we conclude that the F-feature that is treated as lexically inherent to *wh*-words in Truckenbrodt (2012, 2013) is however claimed to be unspecified in Mandarin Chinese. In line with Cheng (1991), we maintain that *wh*-word interpretations are disambiguated depending on syntactic binding and licensing conditions, whereas prosody might be served as a subsidiary role.

This paper is organized in the following. Section 2 reviews the literature on the

prosodic effects on *wh*-words in Japanese and Korean (§2.1), English and German (§2.2), and Mandarin Chinese (§2.3). Production data are presented in sections 3 and 4. In Section 3, data of four pairs of *shénme*-Q and *shénme*-indef sentences extracted from a spoken corpus are presented. In Section 4, we report the production data of elicited *shénme*-Q and *shénme*-indef in near minimal pairs of ambiguous sentences to verify if there exist differences in prosody for disambiguation. Section 5 illustrates the listening comprehension task, followed by a summary of our findings and discussion in Section 6.

2. *Wh*-words and prosodic effects

2.1 Focus prosody on *wh*-words in Japanese and Korean F-effects in interrogatives

It has been reported that *wh*-interrogatives in Japanese are prosodically focused with raised pitch accent (Ishihara, 2007; Kitagawa, 2007) as well as in Korean (Jun & Oh, 1996). Particularly, Ishihara (2003, 2007) has reported that when *Focus Intonation*/FI (prosodic focus) is intended in a sentence, the canonical prosodic phrasing under the prosodic hierarchy (Major Phrase^①, MaP, in Selkirk, 1986; Nespor & Vogel, 1986) is modified, and the focused element is marked by a raised F⁰-peak and a downdrift of the post-focal words. Ishihara (2003) has further observed the *wh*-interrogative as in (9b) displays an obvious spike disrupting the intonational contour MaP, as illustrated in (10), in contrast with a default intonational contour (MaP) without FI containing the *wh*-indeterminant in (9a).

(9) a. Náoya-ga **nánika**-o nomíya-de nónda (*Wh*-indeterminant)

Naoya-NOM something-ACC bar-LOC drank

“Naoya drank **something** at the bar.”

b. Náoya-ga **náni**-o nomiya-de nónda **no?** (*Wh*-interrogative)

Naoya-NOM what-ACC bar-LOC drank Q

“**What**_i did Naoya drink *t*_i?”

① The Major Phrase exhibits a sharp F⁰-lowering effect or a “downstep” motion induced by a H*L pitch accent in Ishihara (2003).

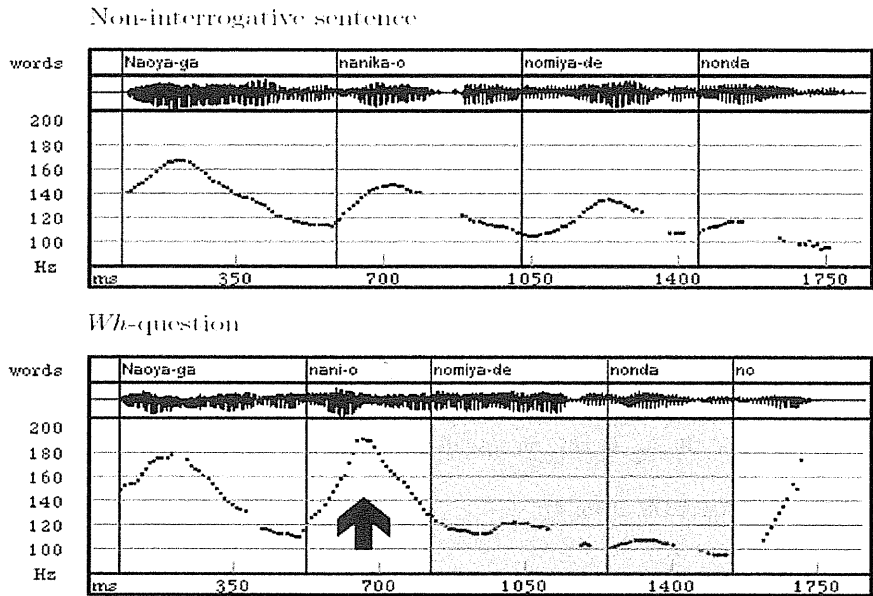


Figure 1: Intonational distribution of *nanika-o* (*wh*-indeterminant) and *nani-o* (*wh*-Q) (cited from Ishihara, 2003: 53 Figure 3-1)

Following Ishihara (2003), Truckenbrodt (2013) maintains that the Q(uestion)-related F-feature in *wh*-words “attracts the strongest stress in the scope-domain,” the domain of Q here.

A similar result is also reported in Korean by Jun & Oh (1996), who have observed that prosodic features are employed in distinguishing a yes-no question (10a) from *wh*-interrogative (10b). Their respective F^0 contours are reduplicated in (11), in which “B” is pre-*wh*-phrase F^0 , “C” and “D” are the *wh*-phrase F^0 , and “E” is the post-*wh*-phrase F^0 .

(10) a. atʃuməni-nin əntʃe atʃiləwə-jo (Yes-no question)

madam-TOP anytime dizzy-honorific ending

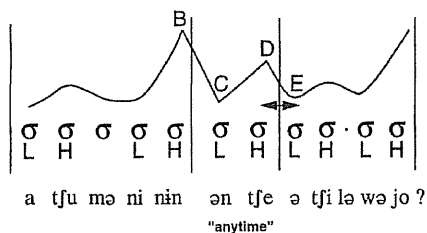
“Is there **any time** that you feel dizzy, madam?”

b. atʃuməni-nin əntʃe atʃiləwə-jo (*Wh*-question)

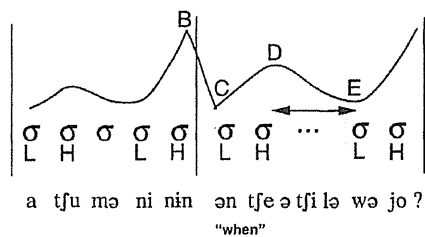
madam-TOP when dizzy-honorific ending

“**When** do you feel dizzy, madam?”

(11) a. Schematic representation of F^0 contours in a yes-no question



b. Schematic representation of F^0 contours in a *wh*-question



(Jun & Oh, 1996: 48).

As shown in (11a) with the *wh*-indeterminant “anytime” in the yes-no question, the accentual phrasing (AP) containing the *wh*-word (“C” and “D”) remains as separate AP with unlengthened pitch range, as indicated with “E”, the post-*wh*-phrase F^0 , resulting in three APs.

By contrast, in (11b) with *when wh*-question, the AP containing the *wh*-word (“C” and “D”) would exceed the boundary tone of the following AP lengthening its pitch range, as shown with “E.”

2.2 Prosodic F-effects in interrogatives

On account of the focus prosody effect in Japanese *wh*-words, Truckenbrodt (2012, 2013) in his prosodic, syntactic and semantic analysis of prosodic F-effects in interrogatives first distinguishes the prosodic effects on moved *wh*-phrases and *wh*-in-situ (echo questions, EC) in English and German. Assuming that the F-feature is inherent in the *wh*-word (the *wh*-morpheme), he observes that the F-feature of the *wh*-word in-situ in EC attracts the sentence stress, also in Reis (1992). As shown in (12), the sentence stress falls on the *wh*-word *wem* in EC in (a) (represented as double underlines). When it is a *wh*-phrase in-situ, the *wh*-word has to bear the sentence stress, rather than just bearing the phrasal stress (represented as a single underline) and

sentence stress on the lexical noun, as indicated by the ungrammatical (b).

(12) a. Peter hat wem die Zeitung vorgelesen?

Peter has whom the newspaper read

“Peter read the newspaper to whom?”

b. *Peter hat wem die Zeitung vorgelesen?

“Peter read the newspaper to whom?”

Truckenbrodt (2013: #48)^①

By contrast, Truckenbrodt states that moved *wh*-words are not inherently accented on a par with indefinite pronouns, e.g. *jemand* “someone.” Hence, in a context of eliciting new information, the sentence stress falls on the canonical sentence nuclear stress (right-most) position rather than *wer* “who,” as indicated in (13).

(13) A: Ich war am Bahnhof.

“I was at the train station.”

B: i. # Wer ist angekommen?/#Aha, jemand ist angekommen

who is arrived /PRT someone is arrived

“Who has arrived?/ I see, someone has arrived.”

ii. Wer ist angekommen?/ Aha, jemand ist angekommen

“Who has arrived?/ I see, someone has arrived.”

Truckenbrodt (2013: #60, 61)

Truckenbrodt also notes the accent-rejecting effect of English *wh*-Q patterns with that of German moved *wh*-Q (Haida, 2008), on a par with regular pronouns as shown in (14), in which *who* and *what* are not accented, also noted by Bresnan (1971).

(14) a. I know [who likes her]

b. I wonder [what she gave to you]

Consequently, Truckenbrodt proposes (15) to account for the inherent F-effect in in-situ *wh*-word in conjunction with sentence stress attraction in contrast with the moved *wh*-phrase, whose F-feature is percolated to the phrase to co-indexed with the Q in its domain via l(exical)-agreement.

① “#” refers to the number of the example.

(15) a. L-agreement: Connect Q with *wh*-phrases in English and German:

- overt movement of one F-marked phrase (here: *wh*-phrase)
- no application of FOCUS (attraction of sentence stress) to any F-marked phrase
- F-percolation to the phrase for all agreeing instances of F (all *wh*-phrases)

b. No l-agreement: Information structure F, alternative questions, Japanese *wh*-questions, echo questions:

- no overt movement of one F-marked phrase
- application of FOCUS (attraction of sentence stress to one F-marked phrase)
- no F-percolation

(Truckenbrodt, 2013: 154)

The percolation of the interpreted F-feature in *wh*-Q to the *wh*-phrase is shown in (16): the *wh*-word is represented as $wh_{[F,i]-o_i}$ with a referential index [i] and co-indexed feature complex [F, i].

(16) Percolation of the content of the *wh*-morpheme [F,i] in English and German:

$[wh_{[F,i]-ose_1} \text{ sister}] \rightarrow [whose_1 \text{ sister}]_{[F,i]}$

(Truckenbrodt, 2013: #95)

The Q in Comp has a referential index [Q, i] and lexical-agreement ensures that this “referential index is identical to the referential index of the *wh*-phrase and that this is the *wh*-phrase undergoing movement to Q-marker” (p. 158).

(17) L-agreement, referential co-indexing, and overt movement

The Q-marker of English and German *wh*-questions carries a single referential index: [Q,i].

L-agreement enforces sharing of this index with the [F, i] feature on an XP (i.e. a *wh*-phrase).

Sharing of this referential index entails overt movement to [Q, i]. [emphasis is mine]

(Truckenbrodt, 2013: #97)

The single-*wh*-question, however, is applied optional “F-deletion”: optionally, l-agreement with [Q,i], may instead turn [F,i] to [Q,i], deriving (18).

(18) Q₃ [who₃]_{Q,3} arrived

While the l-agreement pertains to moved *wh*-phrase, it is non-applicable to cases including English/German (E/G) EC and Japanese question.^① As in-situ *wh*-Q in Japanese (Ishihara, 2003; Haida, 2008) and E/G echo question (Reis, 1992) attract sentence stress, Truckenbrodt ascribes the sentence stress attraction to the *wh*-inherent F-feature in the *wh*-morpheme.

With respect to *wh*-words used as indefinites (e.g. Haspelmath, 1997), Truckenbrodt further states that “a lexical rule of German creates indefinites from certain *wh*-words by removing the feature [F,i]” (p.163); “[w]ithout the inherent F-feature, the semantic connection to interrogatives is lost”..., and “the prosodic F-effects are lost” (p. 164).

In short, the prosodic F-effect of Japanese in-situ *wh*-Q is treated on a par with that of E/G *wh*-in-situ in EC in Truckenbrodt’s analysis, which crucially hinges on the assumption of lexically inherent F-feature on *wh*-Q, the lack of F-percolation and no l-agreement with Q, hence no movement. That is, *wh*-indefinite is presumed by lexically removing the F-feature.

Despite this neat systematic analysis, questions arise as to his proposed parallel between Japanese in-situ *wh*-interrogative and E/G *wh*-in-situ EC. How is the Q interpretation rendered if there is no l-agreement, which otherwise motivates the *wh*-movement of *wh*-phrase to be interpreted as the question? Other questions concern whether the F-feature is lexically inherent in *wh*-words cross-linguistically and what motivates the lexical removal of F-feature in *wh*-indefinite if F-feature is lexically intrinsic.

The following section will review previous studies on the prosody of *wh*-words in Mandarin Chinese. A consequent question concerns whether Chinese *wh*-words pattern with Japanese *wh*-words, as *wh*-words are indeterminate (Kuroda, 1965) in these two languages.

① Other cases include information focus, alternative question, and intervening *wh*-phrase blocking l-agreement, will not be discussed here.

2.3 Prosody of *wh*-words in Chinese

Previous studies in Mandarin Chinese have observed the focus prosody in *wh*-words or interrogatives. Feng (2013: 131) states that *shénme* bears the narrow focus stress (*jiǎodiǎn zhòngyīn*), as indicated by the capitalized *shénme* below.

(19) Nǐ xǐhuan **shénme**?

you like what

“What do you like?”

Shen (1990) has reported that questions (*wh*-questions, as well as A-not-A questions, alternative questions) have a higher register at the starting point, more expanded pitch ranges and higher overall curves of intonation than those in statements; also see a similar report in Cheng (2017). It has also been suggested that in *wh*-questions, focus prosody is more likely to occur on the *wh*-words, especially when used as nouns, and concluded the close adjacency between interrogative meaning and focus prosody. Liu & Xu (2005) have further reported the productions of focus-intended items (including *wh*-words) with an overt raised/expanded pitch followed by suppression effects on the post-focus words, regardless of the different sentence types^① or lexical tones by native “Beijing Mandarin” speakers. Moreover, in their perception experiment, nearly 90% of the different sentence types along with the intended focus locations were identified accurately despite that statements with final focus are the least easy to recognize and tended to be identified as statements with neutral focus.

In line with these studies but with a question-answer dialogue format, Hu (2002) reported a prosodic difference by northern MC speakers (Beijing and Shandong) in *wh*-words and the corresponding VPs in different question types: *wh*-questions, yes-no questions, and ECs. In the production test, two target *wh*-words, *shuí* “who” and *shénme* “what”, occur

① Sentence types include statements, yes-no questions, particle questions, *wh*-questions, rhetorical questions, and confirmation questions.

either at sentence initial (20a), medial (20b), or final (20c), as replicated below:^①

(20) a. **Shuí lái-le.**

Who/anyone come-ASP

b. Nǐ kàn-jàn **shuí lái-le.**

You watch-see **who/anyone** come-ASP

c. Zhāngsān mǎi-le **shénme.**

Zhang San buy-ASP **what/anything**

(Hu, 2002: 1)

The results show that in *wh*-questions, *wh*-words are focused with retained/reinforced tone and a higher pitch (F^0), while the corresponding VPs are weakened in tone and have a lower pitch. In contrast, in yes-no questions, *wh*-indefinites are unfocused while VPs are focused. Thus, Hu concluded two possible tendencies of *wh*-words: they are prosodically focused when used in *wh*-questions than in yes-no questions, and no consistent data has been found for duration with regards to focus/non-focus distinction.

The prosody focus effects on *wh*-Q from previous studies in MC seem to pattern nicely with those in Japanese (Ishihara) and the *wh*-in-situ in EC in English and German (Truckenbrodt). According to Truckenbrodt, (i) moved *wh*-Q does not attract sentence stress (though it may bear phrasal accent), but percolates F-feature to the whole *wh*-phrase, (ii) *wh*-in-situ in EC does not percolate F-feature to the whole *wh*-phrase and can attract the sentence stress, and (iii) F-feature in *wh*-indefinite is lexically deleted. However, questions arise upon closer scrutiny. Firstly, the lexical approach to the F-feature in MC *wh*-words awaits further study. Note that a *wh*-word can co-occur with *dōu* (“all”) to be interpreted as a free choice (Cheng, 1991, etc.). If the *wh*-interrogative and *wh*-indefinite were to be lexically distinguished by the F-feature, it is not clear what distinguishes the free choice *wh*-word from the other two types.

① Each question was repeated 6 times (namely, *wh*-Q, *wh*-Q+ne, yes-no, yes-no+ma, echo Type 1 and echo Type 2. Participants read the questions based on the given dialogues that trigger different sentence types. The two types of echo questions are distinguished depending on whether the listener was certain of what the speaker had uttered: uncertain for echo Type 1 and certain but surprised for echo Type 2.

(21) Tā shénme dōu bàoyuàn.

he SHENME all complain

“He complains everything.”

Moreover, it has been widely acknowledged that the *wh*-words occurring in these contexts are syntactically licensed. Namely, in addition to the licensing conditions for *wh*-indefinites, *wh*-free choice is licensed by the quantifier *dōu* to its right (Lin, 1998; Cheng, 2009, among others). Truckenbrodt’s lexical approach seems to run counter to the Economy Principle in the Minimalist Program (Chomsky, 1995, etc.).

Another question concerns the I-agreement with the Q-marker, which pertains to moved *wh*-Q in Truckenbrodt’s analysis, but inapplicable to the E/G *wh*-in-situ in EC, and Japanese canonical in-situ *wh*-Q. In the latter type, “the F attracts the strongest stress in its scope-domain [the domain of ~ (i.e. Rooth’s (1985, 1996) focus alternative semantics) or of Q or of EQ]” (Truckenbrodt, 2013: 147, in line with the A accent in Jackendoff, 1972). By contrast, the moved *wh*-question (either F-percolated *wh*-phrase, or single *wh*-Q word) does not attract sentence accent, but applies I-agreement to copy the Q-marker onto the agreeing F-feature, turning [F, i] to [F_Q, i]. In addition, I-agreement with [Q, i], may optionally turn [F, i] to [Q, i], and consequently F-deletion is applied (p. 159), given the fact that moved *wh*-Q does not display focus effect that is manifested in alternative focus and *wh*-in-situ’s. Namely, if the I-agreement holds between the lexical element Q and the lexical F-feature of *wh*-words, but does not apply to a non-lexical scope-marker (e.g., EQ in echo question) in this analysis, then it is not clear as to how the relation between Japanese-type Q-marker (e.g., -ko) and the in-situ *wh*-word is held. If Truckenbrodt circumvents this by saying that Japanese-type in-situ *wh*-word does not contain lexical F-feature, thus inapplicable to I-agreement, then this contradicts his original assumption that the F-feature is lexically inherent.

We would like to propose that the prosodic related F-feature is lexically unspecified in Mandarin Chinese in-situ *wh*-words. The tripartite interpretations (*wh*-Q, *wh*-indefinite, and free choice) are syntactically licensed or facilitated, rather than being lexically and prosodically inherent. In the following sections, we will present production data (in sections 3 and 4) and a perception, listening comprehension task (Section 5) to further support this view.

3. Utterances from a spoken corpus

In this section we present four pairs of *shénme*-Q and *shénme*-indef uttered by four speakers extracted from a spoken corpus collected by Yu-Fang Wang. The oral corpus involves conversations between “Taiwan Mandarin” adult speakers, including students, university colleagues and housewives. The situations occurred at home, at a dormitory and at work with the total recording length of 73 hours, 10 minutes and 4 seconds, and the data were taped via audio cassettes and transcribed into intonation units, see Wang et al. (2014). We managed to find four pairs of the post-verbal interrogative and indefinite *shénme* uttered by respectively the same speakers.

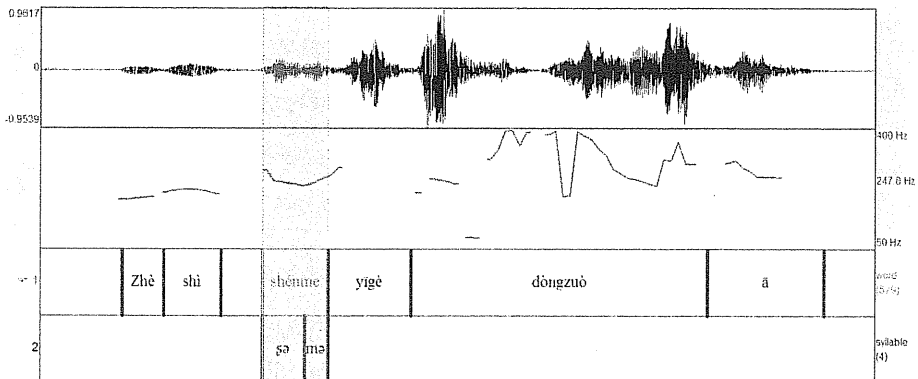
In the first pair, comparing the pitches of *shénme* below produced by Huang Ping, we can see *shénme*-Q in (22a) has a higher pitch than *shénme*-indef in (22b). This contrast, however, may also be affected by its position in that utterance. In (22b), *shénme*-indef occurs toward the end of the utterance, a downdrift effect.

(22) a. *shénme*-Q with Q particle (5:42m–5:44m)

Zhè shì *shénme* yīgè dòngzuò ā?

This be what a.CL action/move PART

“What is this move?”

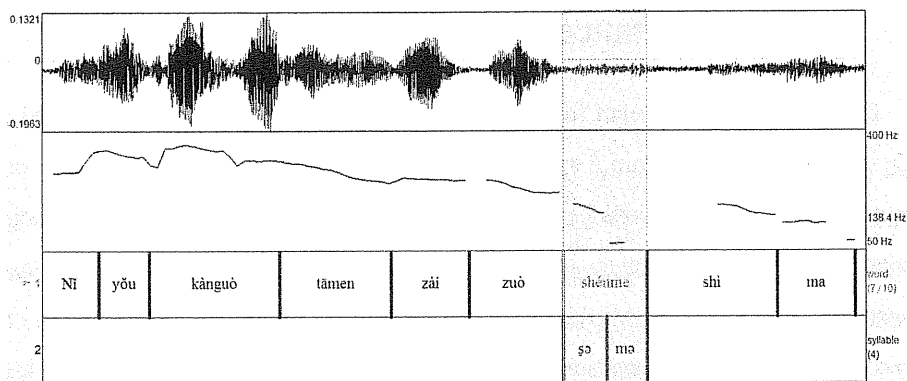


b. *shénme*-indef with Q particle (9:50m–9:52m)

...tāmen zài zuò *shénme* shì ma?

they at do what thing PART

“What are they doing?”



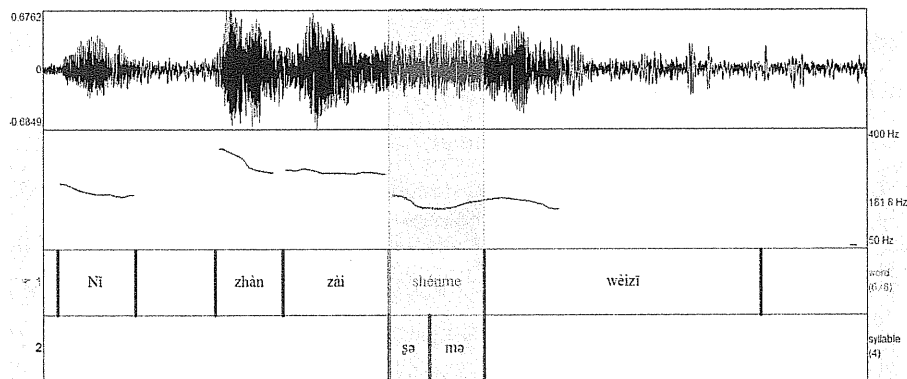
In the second pair, there is a slight contrast between *shénme-Q* in (23a) and *shénme-indef* in (23b) in Yu Chen's utterances. Again, there may be other factors intervening, such as their relative position in an utterance.

(23) a. *shénme-Q* without Q particle (22:49m–22:53m)

Nǐ zhàn zài **shénme** wèizī?

You stand at what position

“What position are you standing at?”



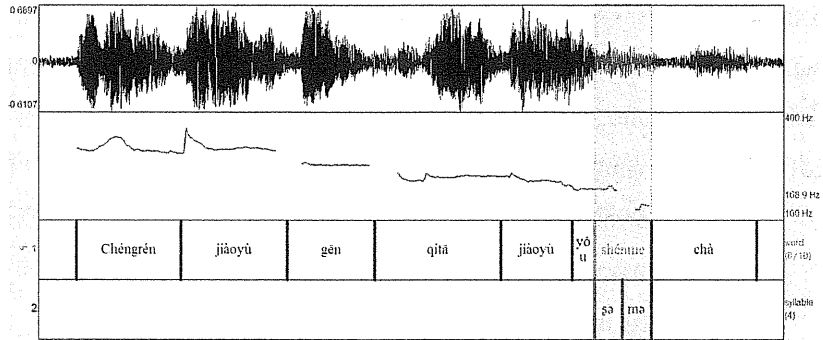
b. *shénme-indef* without Q particle (32:04m–32:07m)

Chénggrén jiàoyù gēn qítā jiàoyù yǒu **shénme** chà?

adult education with other education have what difference

“Is there a difference between adult education and other education?”

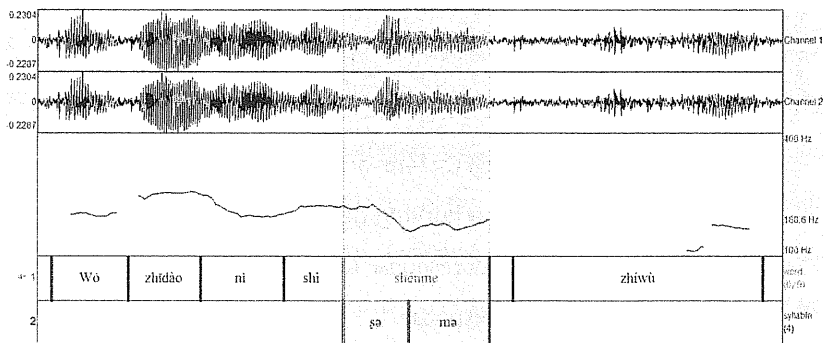
In the third pair from Yu Chen's utterances, it seems that the *shénme-Q* in (24a) sentence has a slightly sharper contour (followed by a downdrift) than that of *shénme-indef* in (24b).

(24) a. Embedded indirect *shénme*-Q (13:18m–13:20m)

Wǒ zhīdào nǐ shì **shénme** zhíwù.

I know you are what occupation

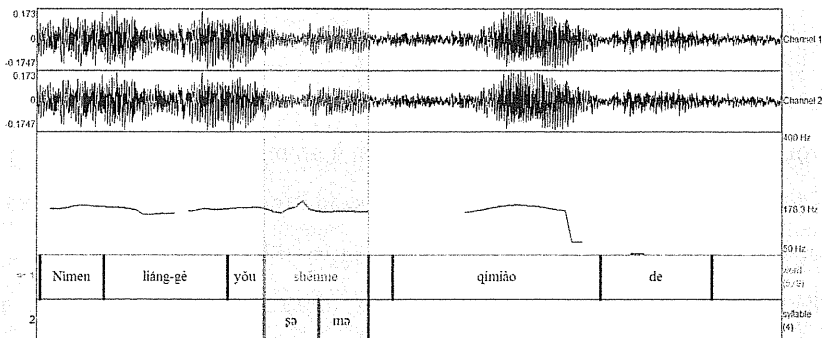
“I know what occupation you have.”

b. *shénme*-indef (6:50m–6:53m)

Nǐmen liǎng-gè yǒu **shénme** qímiào de.

you both have what interesting PART

“You both have any interesting stuff!”



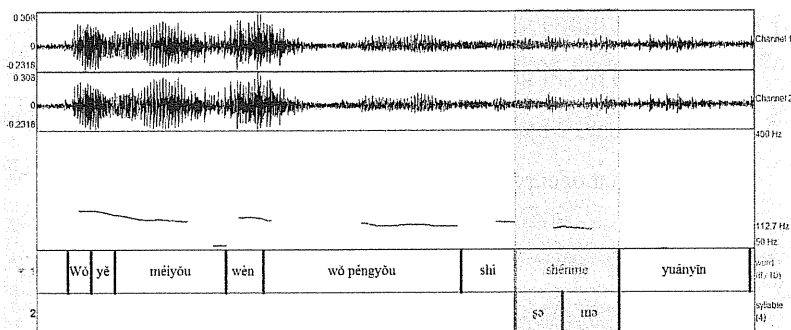
In the fourth pair, *shénme-Q* in (25a) functions as an indirect question in the environment of negation. The contour shapes of *shénme-Q* and *shénme-indef* in Shu Hua's utterances are quite flat, in which both pitches are relatively low.

(25) a. **Negation (indirect *shénme-Q*)** (36:27m–36:31m)

Wǒ yě méiyǒu wèn wǒ péngyǒu shì *shénme* yuányīn.

I also not.have ask my friend be what reason

“I didn’t ask my friend what reason it was.”

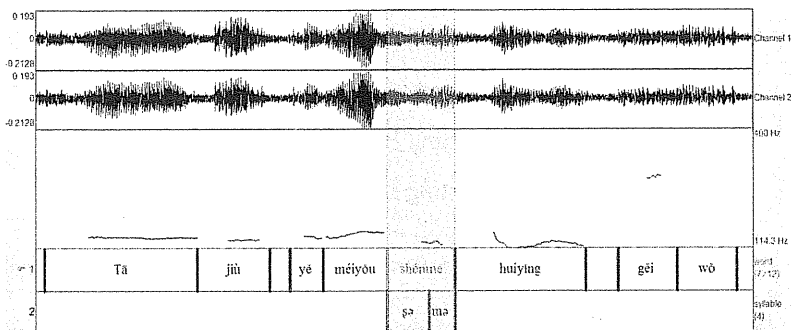


b. **Negation (*shénme-indef*)** (5:14m–5:18m)

Tā jiù yě méiyǒu *shénme* huíyìng gěi wǒ.

he then also not.have what response to me

“He didn’t give me any response.”



From the above preliminary descriptive data, it seems that the prosodic focus effect of *wh*-interrogative is not as prominent as expected (e.g. cf. with that in Japanese). Nonetheless, we acknowledge that the conclusion is still premature as there are many variables that should be taken into account. Thus, more systematic analyses are needed in the future to further examine the spontaneous spoken data.

4. Task 1: Production

In this section, we present our production task aiming to elicit intended shénme-Q and shénme-indef readings under identical syntactic environments from eight “Taiwan Mandarin” adult speakers. There are two parts: a pretest (*Distinguishing Stress*) and the main experiment (*Completing Short Conversation*).

4.1 Task 1-1: Distinguishing stress

The pretest was included to ensure whether our participants would prosodically distinguish emphasized words from neutral ones, including the target word shénme. Participants were asked to pronounce the sentences in (26) containing the target words (a) and (b): the bold-faced words are to be pronounced with more emphasis, but the regular words without stress or with neutral prosody. A total of 8 (4 females and 4 males) randomly selected native “Taiwan Mandarin” speaking college students in Southern Taiwan participated in this task.^① Subjects were individually taken to and situated in a quiet room. Before the experiment, the researcher reconfirmed with the subjects of their consent and also ensured them that their personal information and recordings would only be used for academic purposes. A handout was given to them and they were notified that the entire experiment lasted for 20 minutes. Each sentence was recorded individually by the researcher. Subjects could ask to repeat their recordings when there was a misreading or mispronunciation. The production was manually recorded in an enclosed room by the researcher with Apple’s iPod Touch (5th generation) that can record sound waves up to 44100 Hz.

① A word of caution should be made concerning the +F intended here. As noted by an anonymous reviewer, the NPs in our (26) contain three layers of “focus”: (i) the attracted focus in the NP in (a)’s after the eliciting frame “Wǒ shuō”, (ii) the two contrastive NPs in each examples, (iii) the intended superimposed [+F] feature in this task. We would assume that the first type of focus is related to clause neutral stress, which is not of the current concern. In addition, the second type (contrastive focus) may be related to the assumed superimposed [+F]. We acknowledge the potential problem of unnaturalness in laboratory speech.

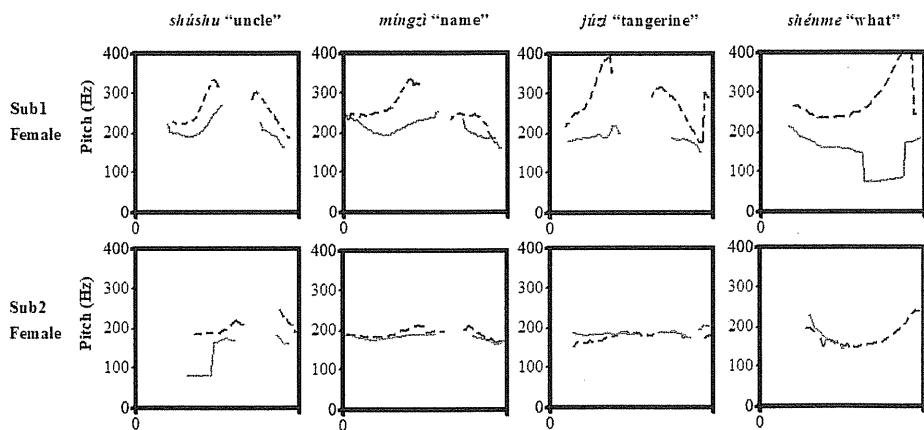
(26)

1. Wǒ shuō (a) *míngzì* (-F) tā shuō (b) *shúshu* ^① (+F).“I say *name*; he/she says *uncle*.”2. Wǒ shuō (a) *míngzì* (+F) tā shuō (b) *shúshu* (-F).“I say *name*; he/she says *uncle*.”3. Wǒ shuō (a) *júzi* (-F) tā shuō (b) *shénme* (+F).“I say *tangerine*; he/she says *what*.”4. Wǒ shuō (a) *júzi* (+F) tā shuō (b) *shénme* (-F).“I say *tangerine*; he/she says *what*.”

Results

Pitch (F^0)

Figure 2 illustrates pitches of each trial of the participants, in which +F (emphasized production) is shown as in dotted line and -F (neutral production) in solid line. In general, most subjects adopted raised pitch, whether moderate or distinctive, to pronounce +F words. Among the 8 subjects, pitch contrast is better observed in Subjects(Subs) 1, 3, 4, 5 and 7. For Subs 6 and 8, minute contrast has been detected. In terms of the four trials, except for Subject(Sub) 6 and Subject(Sub) 8, trial 1 *shúshu* “uncle” and 4 *shénme* “what” showed a comparable pitch difference for the +F/-F counterparts.



① We acknowledge that 叔叔 is pronounced as *shūshu* in “Beijing Mandarin”, but *shúshu* in “Taiwan Mandarin”. Since the subjects in our experiment are “Taiwan Mandarin” speakers, this word is chosen because it bears the same “2nd tone+neutral tone” pattern as that in *shénme*. Other examples in this article are also based on the pronunciation of “Taiwan Mandarin”.

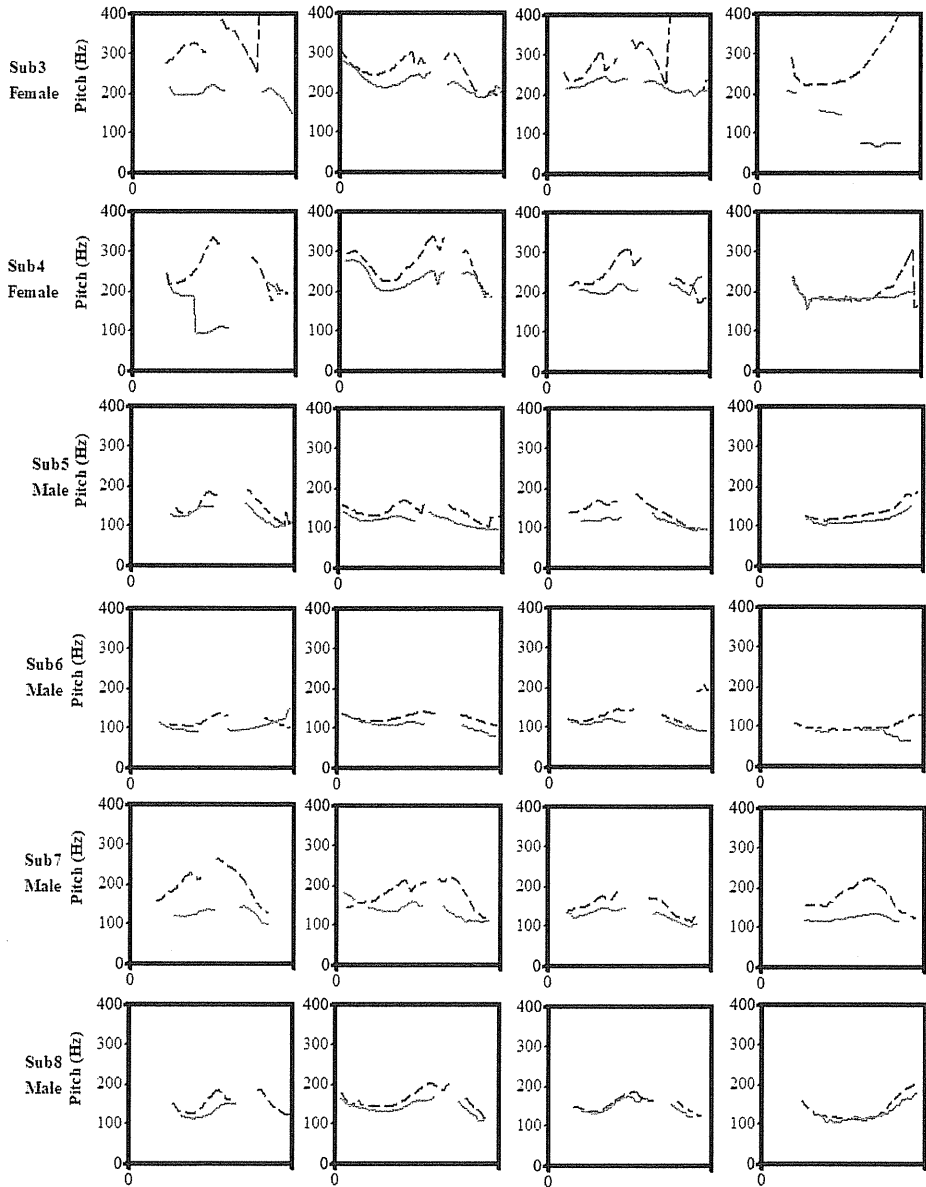


Figure 2: +F (in dotted line) and -F (in solid line) pitch contrast of the four respective trials.

Duration (F^0)

The duration of the target words (in secs) of +F/-F pairs of each trial is summarized in Table 1, and their paired differences ((+F)-(-F)) are plotted in Figure 3. Wilcoxon signed-rank test was then performed to compare the paired differences. The results show that the +F/-F significant differences appear in the first two pairs: shúshu ($Z(8) = -2.52$,

$p=0.01^*$), and míngzi ($Z(8)= -2.03, p=0.04^*$), whereas no significant differences in the pairs of júzi ($Z(8)= -1.332, p=0.183$), and shénme ($Z(8)= -1.402, p=0.161$).

Table 1: The duration of the eight words produced by the eight subjects

	shúshu +F	shúshu -F	míngzi +F	míngzi -F	júzi +F	júzi -F	shénme +F	shénme -F
1	0.89	0.71	0.89	0.61	0.93	0.53	0.48	0.81
2	0.52	0.48	0.43	0.39	0.53	0.43	0.51	0.35
3	0.51	0.39	0.53	0.61	0.48	0.49	0.47	0.36
4	0.72	0.58	0.67	0.54	0.59	0.63	0.66	0.53
5	0.69	0.61	0.57	0.47	0.55	0.44	0.73	0.43
6	0.77	0.62	0.62	0.52	0.65	0.57	0.61	0.44
7	0.57	0.55	0.53	0.45	0.45	0.47	0.69	0.54
8	0.65	0.55	0.59	0.53	0.49	0.48	0.75	0.62
Mean	0.67	0.56	0.60	0.52	0.58	0.51	0.61	0.51
sd	0.13	0.10	0.14	0.08	0.15	0.07	0.11	0.15

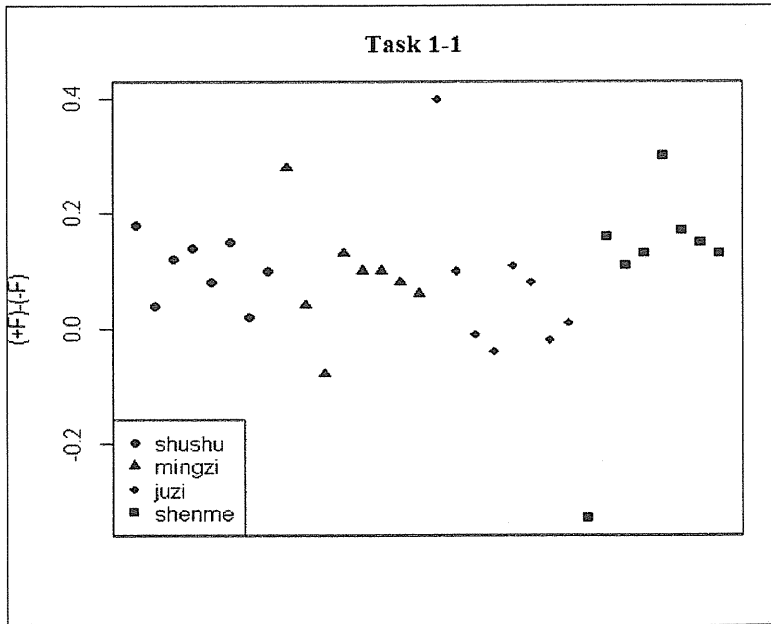


Figure 3: Scatterplot of the duration paired differences in Task 1-1

4.2 Task 1-2: Completing short conversations

Task 1-2 was designed in such a way that *shénme* occurs in minimal pairs of sentences rendering either *shénme-Q* or *shénme-indef* interpretations, as summarized in Table 2. Each target sentence was preceded by a scenario. Participants first listened (also provided with the printed scripts) to the recorded scenario with a male or female speaker talking to them, and then asked to produce the given target sentence.

Table 2: Test items in *Completing Short Conversations Task*

Syntactic Cue	Intended Reading
Type-1 1. <i>Wh</i> -question marker 2. Yes-no question	<i>shénme-Q</i> <i>shénme-indef</i>
Type-2 3. Modal auxiliary 4. Epistemic adverb	<i>shénme-Q</i> <i>shénme-indef</i>
Type-3 5. Conditionals + <i>ne</i> 6. Conditionals + <i>ma</i>	<i>shénme-Q</i> <i>shénme-indef</i>
Type-4 7. Q-particle <i>ne</i> 8. Q-particle <i>ma</i>	<i>shénme-Q</i> <i>shénme-indef</i>
Type-5 9. Determiner <i>diǎn</i> 10. Determiner <i>diǎn</i>	<i>shénme-Q</i> <i>shénme-indef</i>

Take Type 4 in (27) for an example. After listening to Xiaoming's inquiry, the participants produced (28) for the trial of the intended *shénme-Q* interpretation, marked by Q-particle *-ne* (row 7 in Table 2). The same scenario was played to elicit the intended *shénme-indefinite* (30) production with the Q-particle *-ma* (row 8).

Type-4

(27) A: Xiǎomíng: Wǒ děng-děng yào chū-qù mǎi xiǎo-yè, yǒu shuí xiǎng chī de ma?

I wait-wait want go out buy snacks have who want eat DE Q

“Later, I will go out to buy snacks. Does anyone want something to eat?”

(28) **Subject:** Nǐ kěyǐ bāng wǒ mǎi **shénme** dōngxī ne? (S7: shénme-Q)

you can help I buy what thing Q

“**What** can you buy for me?”

(29) **Subject:** Nǐ kěyǐ bāng wǒ mǎi **shénme** dōngxī ma? (S8: shénme-indef)

“Can you buy **something** for me?”

The target sentences of the remaining types are also shown below.

Type-1

(30) **Subject:** Nǐ juéde tā de bàogào quē-le **shénme** dōngxī? (S1: shénme-Q)

you think he DE paper lack-ASP what thing

“**What** do you think his paper is lacking?”

(31) **Subject:** Nǐ juéde tā de bàogào quē-le **shénme** dōngxī? (S2: shénme-indef)

“Do you think his paper is lacking **something**?”

Type-2

(32) **Subject:** Tā yīnggāi xiě-le **shénme** dōngxī (ràng lǎoshī hěn gāoxìng)?

he should write-ASP what thing let teacher very happy

“**What** should have he written (to make the teacher so happy)?”

(S3: shénme-Q)

(33) **Subject:** Tā yīdìng xiě-le **shénme** dōngxī (ràng lǎoshī hěn gāoxìng).

he must write-ASP what thing let teacher very happy

“He must have written **something** (to make the teacher so happy).”

(S4: shénme-indef)

Type-3

(34) **Subject:** Wǒmen de tóunǎo bù-huì biàn bèn rúguǒ zǎocān chī-le yīxiē **shénme** dōngxī ne? (S5: shénme-Q)

we DE brain not-will become stupid if breakfast eat-ASP some what thing Q

“Our brains will not become stupid if we eat **what** for breakfast?”

(35) **Subject:** Wǒmen de tóunǎo bù-huì biàn bèn rúguǒ zǎocān chī-le yīxiē **shénme** dōngxī ma? (S6: shénme-indef)

“Our brains will not become stupid if we eat **something** for breakfast?”

Type-5

(36) **Subject:** ...tā cā-le diǎn shénme dōngxī (ne)? (S9: shénme-Q)

he apply-ASP some what thing Q

“...**What** did he apply (on his hand)?”

(37) **Subject:** ...tā cā-le diǎn shénme dōngxī. (S10: shénme-indef)

“...**He** applied **something** (on his hand).”

This interactive method allowed the subject to be placed in a situation and to respond in an authentic communicative conversation. Repeated recordings were allowed for misreading or mispronunciation. There were five scenarios, each as a minimal pair, including four fillers (total $5 \times 2 + 4 = 14$ trials). Fillers were evenly distributed and included to avoid question-fatigue and an existing pattern.

Results: Completing short conversations

- Pitch (F^0)

The pitch contours of the 5 minimal pairs are illustrated accordingly in Figure 4 for the whole VPs, and in Figure 5 with only *shénme* extracted. Preliminary segmentation and annotation of the individual sound files were performed under Praat. To account for any potential pre-/post-prosody effect of *shénme*, pitch contours of the entire VP (V + *shénme* + *dōngxī*) were extracted and aligned with respect to their minimal pairs for more apparent comparisons.

As indicated by the intended *shénme*-Q (in dotted line) and *shénme*-indef (in solid line) contour curves, in general most subjects individually produced near identical pitch contours of either sentence. Only in very few cases where *wh*-Q sentences were pronounced with higher pitches than those in their *wh*-indefinite counterparts: S(subject)-1 for Type 3, S-2 for Types 1, 3 & 5, and S-3 for Type 1. Even the *wh*-Q sentences had higher pitches, the contour shapes in each pair do not seem to vary much. Moreover, in certain cases, the *wh*-indefinite sentences were even produced with higher pitch contour than *wh*-Q sentences: S-3 for Type 3, S-5 for Type 3, S-7 for Type 1, which is contrary to our expectation.

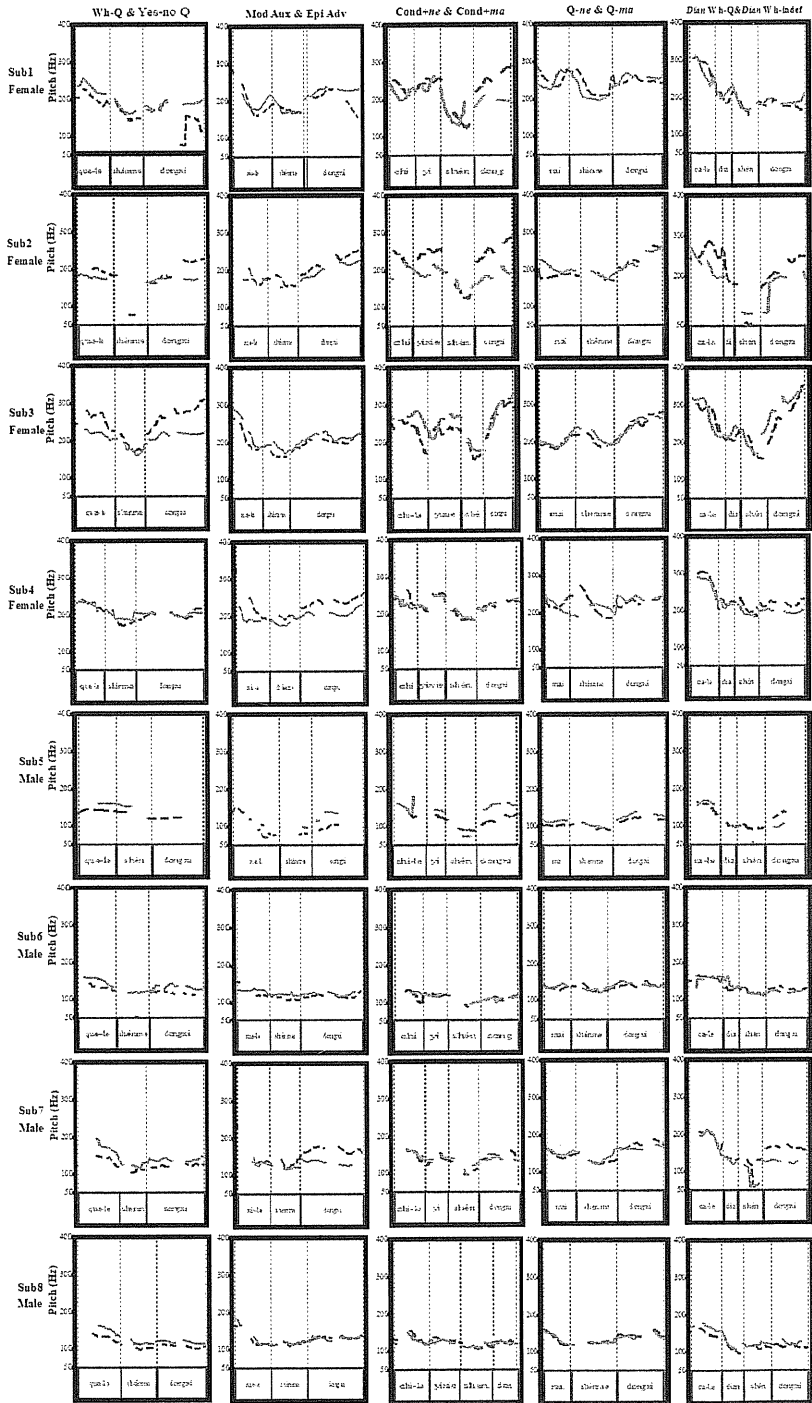


Figure 4: Pitch and pitch contours of VPs containing shénme-Q (in dotted line) and shénme-undef (in solid line)

Second, as shown in Figure 5, the pitch contour shapes for most shénme-Q and shénme-indef had lowering contours (concave shape). More apparent examples are shown in subjects 1, 3, 4 and 8. The remaining ones have more leveled contours. Thus, the results indicate that the productions of the intended shénme-Q did not clearly show higher pitches than those of shénme-indef. The eight subjects produced shénme-Q and shénme-indef almost with near identical pitch heights, and with similar pitch contour shapes (concave shape or leveled contour).

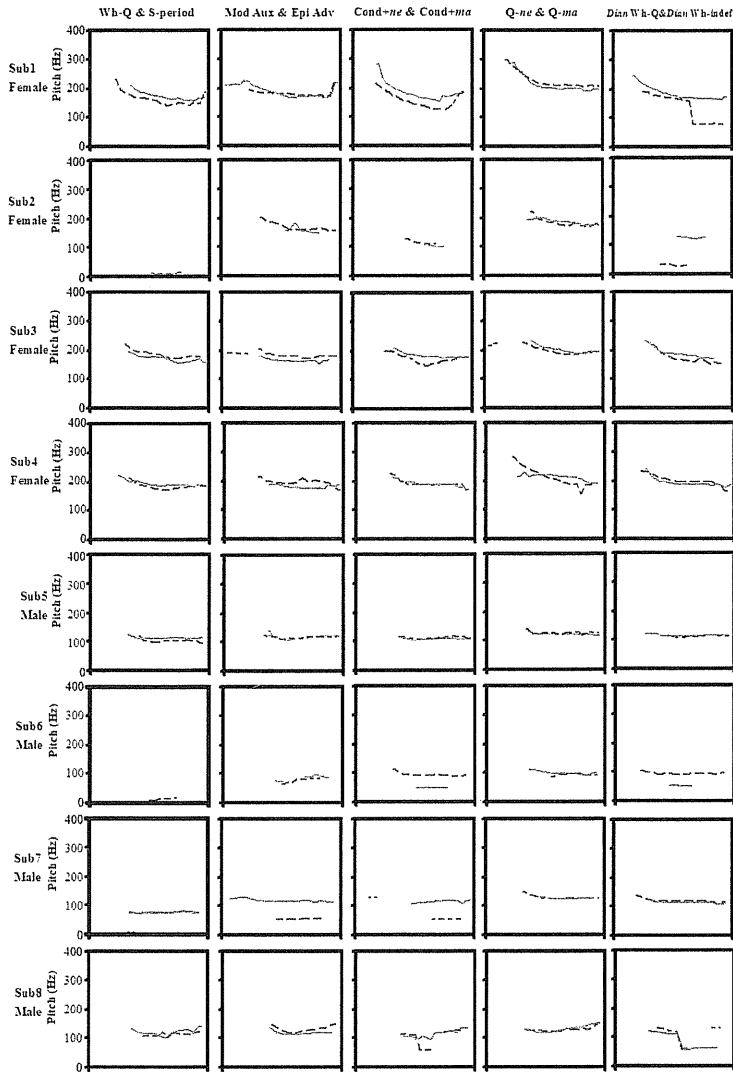


Figure 5: Pitch and pitch contours of shénme-Q (in dotted line) and shénme-indef (in solid line)

Duration

The durations (in seconds) of the target word *shénme* in the five minimal pairs are summarized in Table 3, and their paired differences are plotted in Figure 6. Wilcoxon signed rank test results indicate that only the fourth pair (Q-ne vs. Q-ma) exhibit difference ($Z(8) = -1.975, p = 0.048^*$), while others do not. This suggests that the sentence final particle may feed the prosodic distinction of *shénme* between the *wh*-interrogative (ne) and the yes-no question (ma).

Table 3: The duration of *shénme* in ten sentences produced by the eight subjects

	<i>Wh</i> -Q marker	Yes- no Q	Mod Aux	Epi Adv	Con <i>ne</i>	Con <i>ma</i>	Q- <i>ne</i>	Q- <i>ma</i>	<i>Dian</i> <i>Wh</i> -Q	<i>Dian</i> <i>Wh</i> -ind
1	0.31	0.26	0.25	0.26	0.26	0.28	0.27	0.28	0.28	0.25
2	0.21	0.23	0.21	0.16	0.19	0.15	0.22	0.18	0.21	0.22
3	0.27	0.28	0.24	0.21	0.27	0.28	0.23	0.24	0.25	0.25
4	0.31	0.27	0.25	0.31	0.34	0.28	0.25	0.23	0.35	0.25
5	0.22	0.22	0.26	0.26	0.26	0.3	0.25	0.21	0.23	0.21
6	0.25	0.27	0.19	0.21	0.26	0.36	0.22	0.21	0.24	0.23
7	0.19	0.23	0.24	0.19	0.26	0.26	0.27	0.22	0.25	0.21
8	0.26	0.25	0.22	0.26	0.26	0.27	0.25	0.23	0.24	0.27
Mean	0.25	0.25	0.23	0.23	0.26	0.27	0.25	0.23	0.26	0.24
sd	0.04	0.02	0.02	0.05	0.04	0.06	0.02	0.03	0.04	0.02

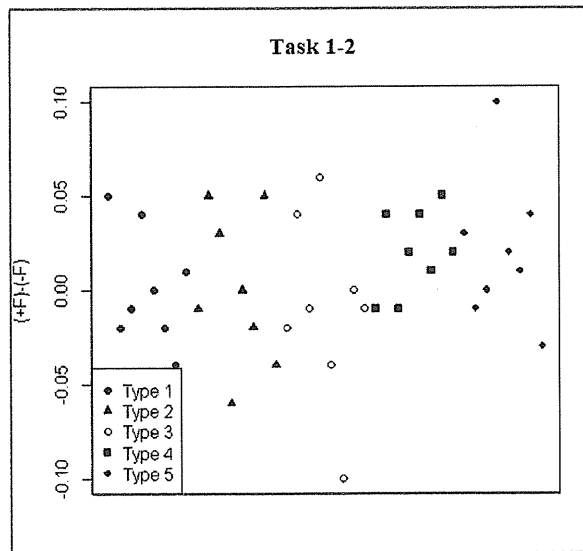


Figure 6: Scatterplots of the duration paired differences in Task 1-2

4.3 Discussion of Task 1

Contrast in pitch ranges and duration?

In the pretest of the production task (Task 1-1), our results showed that six out of eight subjects produced relatively higher pitches for intended emphasis trials (coded as +F), in contrast with the neutral prosody (-F) counterparts. These results are consistent with those in the literature (Shen, 1990; Xu, 1999; Liu & Xu, 2005, among others), though two subjects did not produce much contrast in their productions. In addition, as longer duration has been observed to be an influential cue on focus (Liu & Xu, 2005; Xu, 1999; Xu & Xu, 2005, among others), duration effect is marginally manifested in two pairs of words (*shúshu* and *míngzi*) in Section 4.1.1. This suggests that our participants might utilize raised pitch ranges and longer durations to differentiate emphasized (+F) from neutral words.

By contrast, as shown in Figures 4 & 5 above, the participants did not show much pitch difference in producing *shénme-Q* and *shénme-indef* in Task 1-2. In addition, the pitch contour shapes were either of concave shape or leveled. The durations of *shénme* did not significantly differ from each other except in the fourth pair of producing *shénme-Q* in sentences containing SFP *ne* and *shénme-indef* in sentences containing SFP *ma*. However, this difference is contrary to our expectation in that *shénme-indef* was produced even longer than *shénme-Q* by speakers 1 and 3.

Thus, although participants may distinguish emphasized and non-emphasized words in their productions of the words in Task 1-1, they did not use this prosodic cue to distinguish the intended *shénme-Qs* from *shénme-indefinites* consistently. What is more surprising is that they tended to produce both with similar pitch heights and pitch contour shapes. Not only the intended focus and non-focus pitch contrasts were not observed, they were both produced with the neutral prosody. One reason for the lack of obvious pitch and duration focus effects may be ascribed to the juxtaposition of the syntactic cues (e.g., question markers or modals) that facilitate disambiguating the interpretations. It is thus reasonably to assume that the syntactic cue or the contextual information may outweigh the prosodic focus effect, which is thus minimized in disambiguating the meaning.

5. Task 2: Listening comprehension task

This section reports our comprehension-based task, which aims to tackle whether different focus prosody would help disambiguate intended shénme-Q from shénme-indef readings occurring in identical syntactic contexts. The design was structured in such a way that shénme occurs in minimal pairs of sentences, including ambiguous positive non-veridical sentences, negative sentences, and unambiguous sentences overtly marked with -ne and -ma. There are two parts in this task: a pretest (*Identifying Stress*) and the main experiment (*Completing Short Conversations*).

5.1 Materials and design

Pretest: Identifying Stress

The pretest was intended to ensure whether the participants could realize and identify words that were pronounced with more emphasis in an assertion. There are four pairs of lexical words, one of which is emphasized, including words like míngzi “name”, shúshu “uncle”, júzi “tangerine”, and rénmen “people”, as shown in (38). They all share the same surface tones with shénme (second and neutral tone). Each trial was played once.

(38) Wǒ shuō (a) míngzi ($\pm F$), tā shuō (b) shúshu ($\pm F$).

“I say *name*; he/she says *uncle*.”

There were 50 randomly selected native “Taiwan Mandarin” college students (36 females and 14 males) from a university in Southern Taiwan participating in Task 2, none of whom self-reported any hearing disorders or language dysfunctions. In the pretest, they were asked to identify the focused items by marking their answers, (a) or (b), on the answer sheet.

Main Experiment: Completing Short Conversations

As discussed above, there are identical syntactic environments where *wh*-words are ambiguous between interrogative and indefinite readings, in positive non-veridical contexts, negative sentences [as in (7)], and conditional clauses [as in (8)], and non-ambiguous reading overtly marked Q-particles -ne or -ma[(1a), (2).] Consequently,

we designed these three types of target sentences in response to their corresponding discourse contexts. As illustrated in (39), the participants listened to the pre-recorded dialogues that revolved around university campus life between two speakers (a male and a female), followed by a target sentence with the target word *shénme* in B's response. The target word *shénme* in (40B) accommodates both *shénme-Q* and *shénme-indef* interpretations that are distinguished by intended +F/-F emphasis, respectively.

(39) *Positive Sentence Type*

A. Xiǎomíng: Shàng lǐbài Xiǎohuá qǐng wǒmen bāng tā kàn-yīxià tā de xuéqǐ
bàogào.

last week Xiaohua ask us help him take-a-look he DE term paper

“Last week, Xiaohua asked us to help him look at his term paper.”

Wǒ juéde tā zhè yī-fèn bàogào méiyǒu hěn wánzhěng āi!

I think his this one-C1 paper not have very complete PRT

“I think his paper is not complete!”

B. Nàà: Suǒyǐ... nǐ juéde tā de bàogào quē-le **shénme** dōngxī^①.

so you think he DE paper lack-ASP what thing

“So... you think his paper is lacking [**what/something**]”

Xiǎomíng: ...

(a) Jiégòu ba!

(b) Shì ā!

structure PRT

right PRT

“Structure!”

“Right!”

Based on the perceived intended readings, the participants completed the conversation by choosing from the two provided answers (a) or (b), one of which serves as a follow-up answer for the intended *shénme-Q* [e.g., choice (a) in (39B), corresponding to (40i)], while the other is a confirmation that best follows the intended *shénme-indef* sentences or yes-no questions [e.g., choice (b) in (39B), corresponding to (40ii)].

① Although *dōngxī* “thing” in *shénme dōngxī* is usually omitted in ordinary conversation, it was included so as to avoid *shénme* being in the sentence-final position that undergoes a sentence-final falling/rising intonation. This consistency was also retained throughout the remaining tasks.

(40) Suǒyǐ... nǐ juédé tā de bàogào quē-le **shénme** dōngxī?

(i) shénme-Q (+F) “So... *what* do you think his paper is lacking?”

(ii) shénme-indef (-F) “So... you think his paper is lacking *something*.”

(iii) shénme-Q + ne (+F) “So... *what* do you think his paper is lacking?”

(iv) shénme-indef+ ma (-F) “So... do you think his paper is lacking *something*?”

In addition to (39B) type (40i, ii), sentence-final question particles are added to syntactically differentiate *wh*-interrogative [with *ne* marker as in (40iii)] from *wh*-indef reading [with *ma* marker as in (40iv)]. In other words, for the intended interrogative reading (40i, iii), *shénme* is pronounced with emphasis, coded as +F, whereas the intended indef *shénme* is pronounced with neutral tone in sentences either without (40ii) or with (40iv) final question particles (coded as -F). The scenarios were carefully designed to accommodate four target sentences with possible ambiguous *shénme*'s. The same pattern also applies to negative target sentences, as shown in (41B). Nana's reply of (41a) is intended to answer a *wh*-Q, whereas (41b) to answer a *wh*-indef sentence.

(41) *Negative Sentence Type*

A. Nàna: Xīngqíwǔ Xiǎo-huá yào shàngtái bàogào le.

Friday Xiaohua will up.stage report PART,

Tā shuo tā zhè lǐbài yǒu hěnduo shìqíng, méi shénme shíjiān.

he say he this.week have many thing, not some time

“This Friday, Xiaohua will have his oral presentation.

He said he has been busy this week, and didn't have time.”

B. Xiǎomíng: Shì o! Tā hái méi zuò hǎo **shénme** shìqíng.

really PART he still not.have do well [what/something] thing

“Really! He still hasn't done [what/something] thing?”

Nàna: ...

(a) Bàogào de nèiróng hé cǎogǎo.

report GEN content and draft

(b) Duì ā! Tā zhèyàng yídìng láibují la!

right PART he this.way must too.late PART

“Right! He definitely will not make it.”

Again, there are four possibilities in (42) on a par with those in (40).

(42) Tā hái méi zuo hǎo **shénme** shìqíng.

- | | |
|-----------------------------------|--|
| (i) shénme-Q (+F) | “ <i>What</i> thing hasn’t he done?” |
| (ii) shénme-indef (-F) | “...He hasn’t done <i>something</i> .” |
| (iii) shénme-Q + <i>ne</i> (+F) | “ <i>What</i> thing hasn’t he done?” |
| (iv) shénme-indef+ <i>ma</i> (-F) | “Hasn’t he done <i>something</i> ?” |

Example (42B) illustrates the target conditional sentence, in which only two trials without incorporating Q-particles are tested, as shown in (43).^① It was because that the sentence-final Q-particles in these cases will not be construed with the intended embedded clause containing *shénme*, but with the main clause, which is irrelevant to our design.

(43) *Conditional Sentence Type*

A. Nà:nà: Wǒ tīng-shuō chī zǎocān bùjǐn néng bǔchōng fēngfù

I hear about eat breakfast not only can supplement rich
de yíngyǎng, yě néng tígāo zhìshāng.

DE nutrition also can improve IQ

“I’ve heard that eating breakfast not only can supplement rich nutrition, but also improve IQ.”

B. Xiǎomíng: Zhèyàng o! Rúguǒ zǎocān chī-le yīxiē **shénme** dōngxī.

as such PART if breakfast eat-ASP CL what thing

wǒmen de tóunǎo bùhuì biàn bèn.

our DE brain not will become stupid

“Really?! If we eat [**what/something**] for breakfast, our brain will not become stupid.”

Nà:nà: ...

a) Xiàng shì hétáo huò zhēngǔǒ. b) Méicuò! Wǒmen jiù cóng jīntiān
kāishǐ ba!

① Assuming the *wh*-argument is not sensitive to adjunct island, provided with no violation of Generalized Control Theory (Huang, 1982, 1989), we include the *wh*-interrogative in the conditional clause occurring before the main clause.

like BE walnut or hazelnut	right we at once from today start PART
“Like walnut or hazelnut.”	“Right! Let’s start from today!”

(44) (i) shénme-Q (+F)

“Really?! If we eat *what* for breakfast, our brain will not become stupid?”

(ii) shénme-indef (-F)

“Really?! If we eat *something* for breakfast, our brain will not become stupid.”

As shown above, there are four variations in positive and negative sentence types, but two variations in conditional sentences. Each type of sentences are embedded in two different scenarios; thus there are in total 16 target sentences in the positive and negative target sentence types [2 positive scenarios + 2 negative scenarios) * 4 trials = 16], and four sentences in conditionals (2 scenarios * 2 = 4). All the 20 test sentences were pseudo-randomized to ensure that the same scenario did not appear in a sequence.

5.2 Recording and controlling the audio files

Each dialogue, uttered by the male researcher and a female volunteer of both “Taiwan Mandarin” speakers, was manually recorded in an enclosed room with Apple’s iPod Touch (the 5th generation) that can record sound waves up to 44100 Hz. Audacity (audio software) was used to edit audios, clean background noise, and remove speech clicks.

The recordings were controlled in two particular ways: (i) trials of the same scenario came from one set of recording, and (ii) all the target words shénme were analyzed and measured (in hertz) under Praat to assure a difference in +F/-F prosody. As summarized in Table 4, both male and female speakers overall produced relatively higher mean pitches for intended shénme-Q (+F) in contrast with the shénme-indef (-F) counterparts. More overtly, in the Praat diagrams, regardless of male or female, a reoccurring pattern was observed: shénme-Q (+F) had a pitch rising contour (convex shape) in contrast with a lowering contour (concave shape) as in the shénme-indef (-F) counterpart. Thus, in terms of pitch and contour shape, both shénme-Q and shénme-indef were distinguished with observable differences.

Table 4: The male and female +F/-F prosodic difference of shénme

		Xiaoming (Male)						Nana (Female)			
		Intended <i>Wh</i> -Q (+F) Shénme		Intended <i>Wh</i> - Indef (-F) Shénme				Intended <i>Wh</i> -Q (+F) Shénme		Intended <i>Wh</i> - Indef (-F) Shénme	
		/ʃə-/	/-mə/	/ʃə-/	/-mə/			/ʃə-/	/-mə/	/ʃə-/	/-mə/
Pos Ss	#3	134.5	142.3	112.3	106.1	#4	195	204.3	174.3	164.3	
	#3	130.8	148.3	107.4	100.5	#4	193.1	203.1	171.9	150.5	
Neg Ss	#2	130.7	142.2	90.1	68.2	#1	225.8	258.1	187.5	147.9	
	#2	137.3	139.9	103	100.1	#1	215	249.5	186.1	163.1	
Con Ss	#5	136.6	149.8	112.3	101.4						
	#6	137.5	158.4	100.2	100.9						
Average		134.6	146.8	104.2	96.2		207.2	228.8	180	156.5	

The 50 participants were situated apart in a quiet room with a provided answer sheet. The researcher reconfirmed the participants' consent and ensured that their personal details would be kept confidential. Participants were notified that the entire experiment would last for 15 minutes. Directions (also printed on the answer sheet) were explained by the researcher in Mandarin. All the respective questions were pre-edited into a single audio file with five-second intervals between questions and were played consecutively. All the participants listened to and answered all the twenty stimuli scenarios and target sentences. No fillers were included in the experiment for the purpose of shortening the test time.

5.3 Results

All the trials of parts 1 and 2 had two answer choices (a) and (b), and only one of them was the intended response. If the participant's answer matched the intended response, a "1" was coded for that trial (e.g. the intended +F matches with choice answer); otherwise, a "0" was coded in Excel for later statistical analysis.

Pretest: Identifying Stress

As shown in Table 5, the 50 participants were consistently successful in answering the four trials in the pretest, which indicate that they could differentiate the +F/-F contrast with high precision.

Table 5: A summary of the four trials in *Identifying Stress*

(N = 50)	1. shúshu “uncle”	2. míngzi “name”	3. rénmen “people”	4. júzi “tangerine”
“1’s”	50 (100%)	50 (100%)	50 (100%)	50 (100%)
“0’s”	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Main Experiment: Completing Short Conversations

As shown in Table 6, the results of the three sentence types were categorized into intended shénme-Q (+F) in the second and third columns, and shénme-indef (-F) in the fourth and fifth columns. Each trial (as indicated with a hashtag “#”) is shown with the sum of the items that match the intended reading “1s” (with a total of 50 participants, N = 50, 2 scenarios for sentence types 1 and 2), and final sub-total percentages were provided for better references.

Table 6: Raw scores of the three sentence types in *Completing Short Conversations* task

	Intended +F (F-1)	Shénme-Q Sub-total	Intended -F (F-2)	Shénme-indef Sub-total
(ST-1) Negative Ss (SFP-1) with Q	43 (#1) 48 (#3)	91 (91%)	28 (#13) 19 (#11)	47 (47%)
(SFP-2) w/o Q	41 (#5) 48 (#7)		17 (#9) 10 (#15)	27 (27%)
(ST-2) Positive Ss (SFP-1) with Q	35 (#10) 49 (#12)	84 (84%)	17 (#6) 20 (#8)	37 (37%)
(SFP-2) w/o Q	36 (#14) 44 (#16)	80 (80%)	2 (#2) 0 (#4)	2 (2%)
Conditionals	38 (#17) 45 (#20)	83 (83%)	42 (#18) 28 (#19)	70 (70%)
Total		427/500 (85%)		183/500 (37%)

(SFP = sentence final particle; ST = sentence type; with Q = overtly marking Q-particle; w/o Q = not overtly marking Q-particle)

Logistic mixed effect model (M+ 5.0) was employed to analyze the three main factors of the within subject design: (i) ST (sentence types: ST-1 negative and ST-2 positive sentences), (ii) F indicating focus factor (F-1 for +F, and F-2 for -F type), and (iii) SFP (sentence final particle, SFP-1 with final particle, but SFP-2 without final particle).^① The statistic results in Table 7 show that only factor F (+/-F) exhibits a significant difference ($b=-1.57$, $p<0.01$), indicating that the participants tended to favor answers to shénme-interrogatives, which were designed to correlate with more prominence prosody (+F) in the recording. The intended judgment of the focused shénme-interrogatives outweighed that of the non-focused shénme-indefinites by a rate of 21% (odds ratio=0.21). Other than this significant difference, there are no other factors showing significant differences. Likewise, there is no significant mixed effect among the pairs (i) ST (negative/positive sentences)*F (+/-F), (ii) ST * SFP (+/-SFP), (iii) F * SFP, and (iv) ST*F*SFPs. This indicates that the observed results do not tend to be affected by the interaction of the three factors.

Table 7: Results of the *Completing Short Conversations* task^②

	b	Standard Error	t-Value	P-Value	Odds Ratio
Level 1					
ST (Neg, Pos)	-0.97	0.51	-1.88	0.06	0.38
F (+/-F)	-1.57	0.53	-2.99	0.003*	0.21
SFP (+/-SFP)	-0.30	0.60	-0.50	0.61	0.74
ST * F	0.06	0.60	0.101	0.91	1.06
ST * SFP	0.40	0.69	0.58	0.56	1.48
F * SFP	-0.61	0.81	-0.75	0.45	0.54
ST * F * SFP	-2.01	1.11	-1.81	0.07	0.13
Level 2					
Mean ("0"/"1")	-1.815	0.408	-4.453	0	
Variations ("0"/"1")	0.000173	0.001	0.173	0.862	

① We owe a great debt of gratitude to Dr. I-hsian Wang (王议贤) for his assistance in the statistics consultation, and also Prof. Mei-Hui Guo and Hai-Tang Chiou in Applied Mathematics Department for their clarification of statistical models.

② The formulae of the employed logistic mixed effect model is shown below:

Level 1: $Y_{ij} = \beta_0 + \beta_1 * ST + \beta_2 * F + \beta_3 * SFP + \beta_4 * ST * F + \beta_5 * ST * SFP + \beta_6 * F * SFP + \beta_7 * ST * F * SFP + \gamma_{ij}$

Level 2: $\beta_0 = \gamma_{00} + \mu_{0j}$. As shown in Table 4, γ_{00} as the intercept has the result of $b = -1.815$, $p < 0.01$, and μ_{0j} with $b = 0.000173$, $p = 0.862$.

The conditionals were not included in running the mixed effect model due to the imbalanced cells: lacking the factor of SFP. It is because that the sentence final particle, as a main clause phenomenon, is not construed with the embedded clause. As shown in Table 6, both intended shénme-Q (+F) and shénme-indef (-F) were rated with relatively high correction rates (83% & 70% respectively), suggesting that in the conditional clause, prosodic cues may facilitate disambiguation.

5.4 Discussion

Default shénme-Q

In Task 2, we have shown in Tables 6 and 7 that overall the participants tended to treat shénme as an interrogative based on their choices of the interrogative answers. The preference for choosing shénme-Q with +F is not affected by sentence types (positive or negative sentences) or the absence/occurrence of sentence final particle (*ne* or *ma*), as exhibited by the lack of interaction effects in Table 7. Although answers in response to shénme-indef with -F in negative sentences seems to be judged descriptively more often than that in positive sentences (74 tokens, 37% over 39 tokens, 19%), there is no significant difference between them, as indicated by the first row of SFP ($p = 0.61$) in Table 7. The above results suggest that shénme-Q may be a default pattern across the board, regardless of +F or -F prosody. The sentence final particles (SFP) do not seem to significantly contribute to the differentiation of the shénme-Q and shénme-indef either.

The preponderance of judging shénme as an interrogative regardless of its prosody does not really explicate that the participants were sensitive to the presence or the lack of prosodic prominence, except in the conditional clauses. If they were sensitive to the prosodic cues, they would have had equal judgments with respect to the two shénme's, contrary to the results. As shénme tends to be treated as a default interrogative regardless of +/-F of the sentence types, the syntactic environments that have been claimed to facilitate the indefinite reading, such as negation [the indefinite syntactic licensing conditions discussed in Li (1992); Cheng (1994)] may require contextual cues to better trigger the intended reading. Seeing that the rates of correct judgments are higher in conditionals than those in negative or sentence with final particles, a

consequent question is whether there exist different degrees of shénme-indefinite trigger, an issue to be further explored in the future.

6. Overall discussion

The prosodic effects on *wh*-interrogative in *wh*-in-situ languages such as Japanese (Ishihara, 2003, 2007) and Korean (Jun & Oh, 1996) do not seem to be readily manifested in our “Taiwan Mandarin” counterparts both in our production data (sections 3 and 4), vs. Hu (2002); nor is the focus effect utilized to serve interpretative disambiguation in our listening comprehension task 2 (Section 5). Particularly in Task 2-2, the preponderating responses to intended shénme-Q (marked +F) and the low response rate of the intended shénme-indefinite (marked -F) indicate that the speakers treat shénme-interrogative as the default interpretation. This makes them prefer to answer the shénme-Qs even in the intended shénme-indef contexts. This raises a question of adopting Truckenbrodt’s (2012, 2013) inherently lexical F-feature in *wh*-word to that in “Taiwan Mandarin.” It is thus suggested that F-feature is unspecified in *wh*-words at least in “Taiwan Mandarin.” Adopting Cheng’s (1994) binding and triggering requirements for *wh*-word interpretations, we maintain that *wh*-words are bound by either a Q-operator or existential closure; indefinite reading surfaces when the licensing requirements are met (Li, 1992). Moreover, the operator-binding requirement preempts the licensing condition, as the interrogative interpretation is not precluded from the cases where indefinite licensing is granted. As the F-feature is unspecified in *wh*-words, it serves as subsidiary function. Thus, more research is needed to verify if *wh*-in-situ does attract sentence stress particularly in “Taiwan Mandarin,” as the way it does in Japanese, English and German discussed in Truckenbrodt.

Empirically, we may conjecture that the “Taiwan Mandarin” participants tended not to utilize prosodic focus effect to mark *wh*-interrogatives, in contrast with the Beijing and Shandong speakers (northern accents) in Hu’s (2002) study. A similar result has been reported by Chang’s (2001) production and perception study of “Taiwan Mandarin” speakers, in which there were no overt differences in pitch (F^0)

and duration with regard to the lexically ambiguous *jǐ*: *jǐ-wh*-questions “how many” and *jǐ*-declaratives “several”. Particularly, both *jǐ*'s had a similar falling pitch contour in their productions of 12 target sentences (6 each and repeated three times). In her perception test, Chang divided it into an identification test (where subjects identified the sentence type: question or declarative) and a discrimination test (where subjects judged ambiguous pairs as the same or different), with stimuli from the recordings from the earlier production test. Results for the identification test showed that subjects were more likely to identify both *jǐ*-questions and *jǐ*-declaratives as questions, regardless of the different intended readings. Results of the discrimination test further reinforced the idea that the two types of phrases were not discriminated by prosody. Our current results thus echo Chang's results in the sense that interrogative usage is more dominant than the indefinite reading, and the prosodic cues may not be obviously employed by “Taiwan Mandarin” speakers.

The suggestion of dialectal variations is further supported by previous studies that report the variations between these two groups. Tseng (2004) has demonstrated that “Taiwan Mandarin” (“*Guoyu*”) does not have a high register as that in “Beijing Mandarin” (*Putonghua*) and the downdrift phenomenon is more obvious in “Taiwan Mandarin” than that in “Beijing Mandarin.” Moreover, in their comparison of prosodic properties of intonation in “Beijing Mandarin” and “Taiwan Mandarin”, Kuang & Kuo (2011) identify their prosodic differences in the boundary cues and use of pitch in their production of the story of “Little Red Riding Hood” (four speakers from Beijing and four from Taiwan). Particularly, “Taiwan Mandarin” has no intensity reduction and “Beijing Mandarin” has a high boundary tone; pitch declination occurred after nuclear-accented *wh*-words in “Taiwan Mandarin” but not in “Beijing Mandarin.” In addition, not only there exist differences in prosodic studies of Mandarin Chinese native speakers from different regions, Visceglia et al. (2012) further report differences in producing English narrow focus between “Beijing Mandarin” and “Taiwan Mandarin” speakers. Based on the speech data extracted from the Taiwan AESOP (Asian English Speech Corpus Project) corpus, their results demonstrate that “Taiwan Mandarin” speakers “produced a smaller increase in mean F^0 and amplitude for on-focus constituents and

much smaller decrease in mean F^0 and amplitude on post-focus constituents than L1 English speakers did, whereas ‘Beijing Mandarin’ speakers produced no increase in mean F^0 in on-focus constituents, and the smallest decrease in mean F^0 on post-focus constituents, but a 35% higher post-focus compression of intensity than ‘Taiwan Mandarin’ speakers did.” It is not novel to see how closely related languages/dialects (such as “Taiwan Mandarin” and “Beijing Mandarin”) reported phonological variations (Torgerson, 2005), if not different ways of realizing focus (Chen et al., 2009). By all means, more research is needed to verify the correlation between prosody and *shénme* disambiguation in these dialects.

6.1 Limitations of the study

In the tasks, target sentences and situated scenarios were generated based on theoretical framework in syntax. The fundamental reason was to account for more exhaustive variations with regard to different sentence types. Concerning these limitations, we conducted a pilot survey of the designed scenarios and target sentences to verify their naturalness and authenticity before executing the tasks. Nonetheless, it is suggested that future research may retrieve sentences and scenarios from available corpus (perhaps more than a single corpus), in consideration of various sentence types.

In each task, the participants took the same questionnaires without fillers included. The results thus might be askew due to the practice/order or fatigue effect. We thus suggested that future works should be better designed (e.g., by the use of Latin square list design) to minimize potential limitations.

In the production test, target sentences were only produced once by our subjects. As shown in previous literature (Chang, 2001; Hu, 2002; among others), production tests often require subjects to repeat a target sentence for 3–5 times for a more conclusive result. However, we weigh this idea with question fatigue and unnatural repetitions. One of our main motives behind the production test was to record subjects’ response as spontaneous as possible. If repetitions were required, subjects would have been more likely repeating the provided test sentence rather than responding with a single response. Thus, in concerning these facts, a re-recording of any test sentences was allowed for

participants who misread or were unsatisfied with their recordings. These re-recordings most benefited anxious and nervous subjects.

Since the participants of the tasks are all Southern Taiwan residents, they may not employ prosodic focus as a primary cue to disambiguate these two shénme's. As mentioned above, the phonetic variations between Southern "Taiwan Mandarin" and "Northern Mandarin" may be a factor. Therefore, more research is called for to verify the differences between the two dialects of Mandarin.

Another limitation pointed out by James Tai (personal communication) and Randy LaPolla (personal communication) is that prosodic cue is not the sole factor that disambiguates meanings; rather, other communicative factors, such as facial expressions, gestures, etc. should be taken into consideration. It is thus suggested that future research integrate factors at different levels in meaning disambiguation.

6.2 Conclusion

This study explores the issue of whether "Taiwan Mandarin" speakers/listeners would employ prosodic cues to disambiguate intended shénme-Q and shénme-indef readings of *wh*-words under identical syntactic environments. The production task (Task 1) has clearly indicated that the eight participants did not utilize prosodic cues to distinguish shénme-Q and shénme-indef in different contexts. In Task 2 (listening comprehension), we have demonstrated that shénme-Q is perceived as the default choice for interrogatives, without much hint of the prosodic focus cue, though prosodic cues might facilitate disambiguation in conditional clauses. The preponderance for the shénme-Q is tilted by the factors of sentence types (positive or negative sentences) or the occurrence of sentence final particles. One might wonder how shénme indefinite interpretation can obtain in these contexts. While the negation and sentence final particle contexts do not significantly contribute to the rendition of shénme-indefinite in the results from Task 2, the conditional environment seems to outperform them. Therefore, this suggests that syntactic environments plus contextual information could foster the interpretation of shénme, while prosodic cues do not show a primary effect.

The results of the study further bear on a less investigated issue concerning the

efficacy of prosodic cue in disambiguation. While the stressed/unstressed contrasts have been widely attested in the literature and without much doubt, whether prosodic cues serving as predominant cues for sentence/context disambiguation (e.g., Shyu, 2010) still remains much to be investigated, particularly in comparing those between tonal and non-tonal languages. In addition, dialectal variations may contribute another factor that awaits future study.

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汉语疑问词与韵律

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摘要 人们普遍认为,在普通话 *wh*-词组里,对疑问和不定解释是模糊的。由于人们认可了不定解读的条件(Li, 1992; Cheng, 1994),这些条件不一定妨碍人们解释 *wh*-词组。尽管先前的文献侧重于 *wh*-的疑问句和不定句的句法和句义,很少有人关注他们在韵律效果方面的歧义性。先前的研究表明韵律和 *wh*-词组会在日语(Ishihara, 2007; Kitagawa, 2007)、韩语(Jun & Oh, 1996)和德语(Truckenbrodt, 2012, 2013)等语言中相互作用。例如,在 *wh*-的特殊疑问句中语音突显,而 *wh*-的不定句中则不是这样。在普通话中,对 *wh*-词组的相关研究比较少。本文旨在探讨讲台湾“国语”的人是否会参考韵律上的提示,来区分在演讲时句法相同的情况下,以“什么”引导的疑问句(表疑问)和以“什么”引导的不定句的歧义。根据我们得出的数据以及感知听力练习,我们的结论是 Truckenbrodt 把 F-feature 在词法上内在地与 *wh*-词语等同对待,但在台湾“国语”中被认定为未指定的(unspecified)。根据 Cheng (1991) 的研究,我们主张对 *wh*-词语的解释要依据句法上的结合和许可的条件,但韵律可能扮演一个辅助性角色。

关键词 疑问词 疑问不定词 韵律 焦点

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