The two sides of Wh-indeterminates in Mandarin : a prosodic and processing account
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Citation

Version:	Not Applicable (or Unknown)
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Note: To cite this publication please use the final published version (if applicable).

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Universiteit Leiden

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Title: The two sides of Wh-indeterminates in Mandarin : a prosodic and processing account
Date: 2018-05-30

Chapter 7 General Conclusion

This dissertation investigates the clausal typing in Mandarin and the licensing of Mandarin *wh*-indeterminates (*wh*-interrogatives and *wh*-existentials), by presenting diverse empirical evidence ranging from fine-grained prosodic studies to online sentence processing. In this chapter, I address the two research questions put forth in Chapter 1 by summarizing the main findings in each chapter. In section 7.1, I propose an extended clausal typing hypothesis in Mandarin. In section 7.2, I discuss the licensing environments of *wh*-existentials and *wh*-interrogatives. In the final section, I conclude this dissertation and discuss the relevance and implications of the current research for the future work.

7.1 The clausal typing mechanism

7.1.1 The main findings about clausal typing in Mandarin

As a *wh*-in-situ language, Mandarin has no *wh*-movement or reliable *wh*-particles to type clauses and hence we investigate whether prosody can function as a clausal typer. We scrutinize the prosodic analysis of *wh*-questions and *wh*-declaratives, which are string identical [37]. The results of the production study (Chapter 2) demonstrate that prosody is utilized in differentiating the two clause types in Mandarin. To be specific, *wh*-declaratives differ from *wh*-questions in terms of prosodic properties already from the clause onset in duration. *Wh*-declaratives are prosodically longer than *wh*-questions in terms of word duration starting from the subject and the pattern reverses at the *wh*-word; *wh*-declaratives are lower in F0 and smaller in F0 range than *wh*-questions at the *wh*-word and there is a F0 range compression in the post-*wh*-word region in *wh*-questions. Furthermore, the results of the perception and the audio-gating study (Chapter 3) show that listeners not only make use of the prosodic cues to identify the two clause types accurately but also anticipate clause types by only listening to the clause onset (e.g. the gate only containing sentence subject). It suggests that the prosodic marking of different clause types functions like *wh*-particles or *wh*-movement, which we can count on in making an assessment and prediction about the clause types.

The findings about the effects of prosody on clausal typing are further supported by electrophysiological evidence found in the two auditory ERP studies on *wh*-questions and *wh*-declaratives and their manipulated incongruent conditions (Chapter 7). The (early) negative components found in the incongruent conditions (Declarative-Question) of both experiments confirm that the prosodic cues are

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[37] So far the findings that prosody can mark the clause type and thus listeners can identify and anticipate clause types are only based on the investigations of the ambiguous sentences, *wh*-questions and *wh*-declaratives respectively. One mighg wonder, will the same findings be extended to *wh*-questions and ordinary declarative containing noun phrases? Gryllia, Yang, Pablos, Doetjes & Cheng (submitted) has confirmed this by showing that prosody can differentiate *wh*-questions and declarative containing noun phrases and listeners can anticipate clause types based on prosody, just as in the case of *wh*-questions and *wh*-declaratives.

utilized in online sentence processing and play an important role in clausal typing. Furthermore, it provides evidence that even at the sentence beginning (i.e. subject), listeners can already detect the clause typing incongruity by utilizing the limited prosodic cues, confirming that the findings of the audio-gating studies in Chapter 3 about the clause type anticipation have a neural correlate basis.
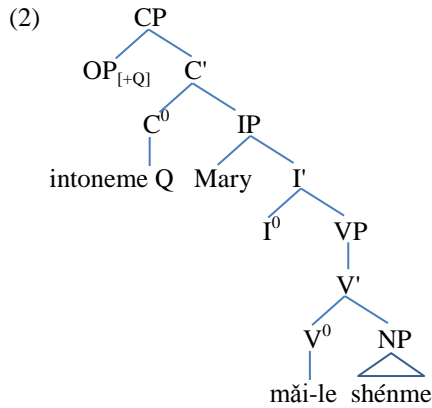
7.1.2 The extended clausal typing mechanism

According to Chomsky and Lasnik (1977: 445), "each clause must be identified as declarative (a declarative or relative clause) or interrogative (a direct or indirect question)." Given all the above findings on the effects of prosody on clausal typing in Mandarin, we make an extension based on the traditional Clausal Typing Hypothesis on *wh*-questions, repeated here "Every clause needs to be typed. In the case of typing a *wh*-question, either a *wh*-particle in C^0 is used or else fronting of a *wh*-word to the Spec of C^0 is used, thereby typing a clause through C^0 by spec-head agreement." (Cheng, 1991: 29). Our extended Clausal Typing Hypothesis is given in (1).

(1) **Extended clausal typing hypothesis**
Every clause needs to be typed. In the case of typing a *wh*-question, languages can have different ways to realize that. Languages can front a *wh*-word to the Spec of CP (*wh*-movement languages), or utilize a *wh*-particle (*wh*-in-situ languages with *wh*-particles), or/and utilize prosody to type the clause.

The above extended hypothesis raises another theoretical question. As prosody is often perceived as the PF level realization, how can it function as a clausal typer and be included in the early process before spell-out? We hypothesize that it is indeed in the process of narrow syntax that prosody starts to function and in this process, prosody is a relatively abstract concept that types the clause, without having all the details of the prosodic realizations as our production study shows. We term the clausal typer at this process as an "intonational Q-morpheme" following Cheng and Rooryck (2000) or simply an "intoneme" Q following Feng (2015) and Tang (2015). In the process of narrow syntax as represented in (2), we hypothesize that the intonational Q-morpheme/intoneme Q is inserted in C^0, and has Spec-head agreement with the interrogative operator at Spec-CP.

(2)

```
                        CP
                   ╱         ╲
              OP[+Q]          C'
                         ╱          ╲
                       C⁰            IP
                  ╱        ╲      ╱      ╲
           intoneme Q    Mary          I'
                                    ╱       ╲
                                  I⁰         VP
                                              │
                                             V'
                                          ╱       ╲
                                        V⁰         NP
                                     măi-le     shénme
```

But only at the interface level (syntax-prosody), the rules coming from phonology will interact with the information syntax conveys (including intonational Q-morpheme /intoneme Q), leading to the well-formed PF realization/prosodic markings. Further studies are needed for the complete theoretical analysis on the intonational Q-morpheme/intoneme Q before spell-out.

7.2 The licensing of *wh*-existentials and *wh*-interrogatives

Wh-words in Mandarin Chinese are "*wh*-indeterminates" as they can have interrogative, existential, universal, or free choice interpretations. The interpretations of *wh*-words are restricted to certain contexts where there is a licensor that can license the specific interpretations. In this dissertation, I mainly investigate the licensing environments and licensing evidence of two frequently used interpretations of Mandarin *wh*-words, *wh*-existentials and *wh*-interrogatives respectively, and the results are summarized as below.

7.2.1 The licensing of *wh*-existentials in Mandarin

With respect to licensing of *wh*-indeterminates, Mandarin has no reliable particles like Japanese and Korean to license *wh*-indeterminates. Previous studies claim that Mandarin *wh*-existentials are only licensed by nonveridical contexts such as contexts containing negation or epistemic modality (Lin, 1998; Xie, 2007; Lin, Weerman & Zeijlstra, 2014; Huang, 2017). We provide evidence in Chapter 4 that *wh*-existentials can also be licensed in nonveridical contexts under certain conditions. To be specific, in Chapter 4 we find that if a *wh*-word in a sentence can be licensed as a *wh*-existential, the sentence normally has the following environments:

(3) i. Either the sentence contains a nonveridical operator (negation, questions, conditionals and epistemic modalities) that can license the *wh*-existential.
or ii. When the nonveridical contexts (i.e. containing future environments) are not able to license *wh*-existential or when the sentence is simply veridical, it needs a last resort licensor like *diănr*. *Diănr* provides the existential force in licensing the *wh*-existential in the VP when *diănr* cliticizes to the verb.

7.2.2 The licensing of *wh*-interrogatives in Mandarin

In Mandarin, when there is no overt licensor/operator, a sentence containing a *wh*-word is a *wh*-question with the in-situ *wh*-word licensed by the null interrogative operator (Q) at Spec-CP or C^0, and thus obtains the interrogative force. This covert dependency between the null interrogative operator (Q) and the in-situ *wh*-word is investigated in Chapter 5, in which three self-paced reading studies on Mandarin *wh*-questions as compared with declaratives with indefinite noun phrase are reported. By comparing *wh*-questions containing simplex *wh*-phrases ('who') with declaratives containing indefinites ('someone'), and by comparing *wh*-questions containing complex *wh*-phrases ('which x') with declaratives containing indefinites ('an x'), we provide processing evidence of constructing a covert dependency between the in-situ *wh*-word and the interrogative operator (Q) at Spec-CP or C^o. The higher processing cost we find in *wh*-questions than in declaratives support the hypothesis that a covert dependency is needed between the *wh*-phrase and the interrogative operator (Q) at Spec-CP or C^o.

7.3 Conclusions and future work

This dissertation explores the licensing of *wh*-indeterminates in Mandarin, with a focus on the clausal typing of sentences containing *wh*-existentials and *wh*-interrogatives and the licensing of them, from the perspective of prosody and processing. The results of the production study and audio-perception/gating studies demonstrate that prosody can mark and type *wh*-questions, and listeners can anticipate clause types by utilizing prosody since the clause onset. Moreover, this dissertation uses electrophysiological measurement to investigate the fine-grained time course of clausal typing based on prosody during online sentence processing, the results of which show that prosodic information is immediately utilized in detecting clause type incongruities. On the basis of the empirical evidence, we propose an extended clausal typing hypothesis, explicitly recognizing the role of prosody in clausal typing and hence making the original clausal typing hypothesis more complete, cross-linguistically speaking.

   With respect to the licensing of *wh*-existentials, this dissertation challenges the general assumption in previous studies that *wh*-existentials are licensed in nonveridical contexts only (Lin, 1998; Xie, 2007; Lin et al., 2014; Huang, 2017); we provide evidence and analysis that *wh*-existentials can be licensed in veridical contexts, when the preceding licensor of *diǎnr* (or *gè*) cliticizes to the verb as a clitic group. Regarding the licensing of *wh*-interrogatives/question words, the higher processing cost in reading *wh*-questions as compared with declaratives containing indefinites provides empirical evidence that a covert dependency is required between the *wh*-interrogative and the interrogative operator (Q) at Spec-CP (or C^o), in processing a *wh*-in-situ question in Mandarin. Cross-linguistically speaking, a dependency is always needed in interpreting a *wh*-question, be it a *wh*-in-situ question like in Mandarin or a *wh*-movement question like in English.

   For future studies, it is important to investigate whether prosody also plays a role in the clausal typing of *wh*-questions in other *wh*-in-situ languages (e.g. Bangla,

Vietnamese, among others). It is also important to give a detailed theoretical analysis about how intonational Q-morpheme/intoneme Q takes part in the derivation process before the spell-out of a sentence. Furthermore, although this dissertation investigates the licensing of *wh*-existentials and *wh*-interrogatives, the methodology and the research perspective (prosody and processing) can be extended to the licensing of other interpretations of *wh*-indeterminates (e.g. universal and free-choice interpretations).