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Ne, ne?

The prosodic properties of the sentence final particle *ne* in Mandarin Chinese

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Abbreviations and conventions

2P.SG	second person singular
3P.SG	third person singular
3P.PL	third person plural
BA	*bǎ* from the *bǎ*-construction
CL	classifier
DUR	durative aspect marker *-zhe*
MA	yes/no question particle *ma*
NE	sentence final particle *ne*
NEG	negation *bù/bú* or *méi*
PRF	perfective marker *le*
SUB	subordinating particle *de*

1. Introduction[*]

The aim of this thesis is to investigate the prosodic properties of the sentence final particle *ne* in Mandarin Chinese. Over the past few decades, research on ne has increased remarkably. However, this research has mainly discussed the syntax and semantics, while the prosodic properties have been left unexamined. In this thesis, I examine *ne* from a prosodic point of view. I investigate the prosodic aspects – duration and frequency - of this element, and determine whether there is a single form of *ne*, or possibly multiple realizations. Given that ne is distributed in questions as well as in statements, sentence type was included as a factor in this research. In addition to determining the prosodic properties of *ne*, it would also be constructive to learn about the influence that this particle might have on the prosody of the preceding syllables. Two different experiments were designed, which I elaborate on in chapters 4 and 5. I compare the prosody of the sentences with and without *ne*, and afterwards I will analyze the results to determine whether *ne* influences the prosody of the preceding syllables.

In chapter 2, I review background literature on *ne*, which includes syntactic, semantic and prosodic aspects. Because it is necessary to learn more about sentence intonation when investigating a sentence final particle, I also review Mandarin Chinese intonation contours in the same chapter.

It is a well-known fact that Mandarin Chinese is a tone language. Because tones influence the pitch contours and duration of sentences and individual elements, tones also have to be taken into account in this thesis. In chapter 2, I discuss the tonal contours and tonal coarticulation. In chapter 3, I present my research questions. The production and perception experiments will be discussed in chapters 4 and 5. Finally, I present my concluding remarks in chapter 6.

2. Background

This chapter serves to provide background knowledge. In section 2.1, I will review literature on the sentence final particle *ne*; section 2.2 discusses sentence intonation in Mandarin. Lastly, section 2.3 explains tonal coarticulation.

2.1 Ne

Distribution. The particle *ne* is one of many sentence final particles in Mandarin Chinese (for a detailed overview, see Li Boya 2006). It can occur in declaratives and questions. (1a) and (1b) are examples of declaratives. As shown in (1a), the particle *ne* appears in a sentence final position, after the adjective *kāixīn* 'happy'.

(1) Examples of *ne* in questions and declaratives

a. *Tā hěn kāixīn ne.*
3P.SG very happy NE
'He's very happy.'

[*] I would like to thank my supervisor Stella Gryllia for her greatly appreciated advice on every aspect of this thesis, the numerous hours she invested in working together with me, and her warm and welcoming personality.

b. *Tā hái shì yi ge xiǎo háizi ne.*
3P.SG still be one CL small child NE
'He's still a small child.'

[Li and Thompson 1981]

c. *Nǐ xiǎng hē shénme ne?*
2P.SG want drink what NE
'What do you want to drink?'

d. *Zhāngsān míngtiān qù bú qù ne?*
Zhangsan tomorrow go NEG go NE
'Does Zhangsan go tomorrow or not?'

e. *Shì nǐ háishì Lǐ Sì bǎ bēizi nòng huài le ne?*
be 2P.SG or Li Si BA cup make broken LE NE
'Is it you or Li Si who broke the cup?'

From the data, it can be observed that *ne* can occur in several different types of questions. (1c) is a question with a question word, also called wh-questions. An A-not-A question can be seen in (1d), while (1e) shows a disjunctive question. In all of these cases, the particle *ne* is optional: it does not affect the grammaticality of the sentences. However, it does change the meaning of the sentence. The interpretation of *ne* has not been included in the translations, since the semantics of *ne* is discussed later on in this chapter.

Sometimes, *ne* can also occur at the end of a clause without a predicate, for example:

(2) *Ne* in nominal sentences

a. *Tā míngnián yào qù Zhōngguó, nǐ ne?*
3P.SG next.year want go China 2P.SG NE
'He is going to China next year, how about you?'

[Tiee 1986]

b. *Nǐ de shū ne?*
2P.SG SUB book NE
'Where's your book?'/ 'How about your book?'

[Chu 1998]

c. *Hòulái ne?*
later NE
'And afterwards?'

[Alleton 1981]

In the examples in (2), the particle *ne* is added to pronouns (2a), noun phrases (2b) or adverbs (2c), turning the sentence into a question. These types of sentences are called 'thematic questions' or 'nominal sentences'. It is hard to say where the interrogative force originates. It is arguable that *ne* actually functions as a question marker here, but since the sentences have to be accompanied by interrogative intonation, it is difficult to pinpoint the source of the question marking. In contrast to the sentences with predicates of (1), *ne* is not deletable in the

cases shown in (2), as pointed out by Alleton (1981: 99). If *ne* would be deleted, the sentences would be perceived unnatural, maybe even ungrammatical, in cases like (2a). The only exceptions I have found so far originate from children's speech. The function of *ne* in sentences such as these are discussed later on.

There are certain cases when *ne* is excluded, such as yes/no-questions. When *ne* is added to a question, it asks for more detailed information than simply an affirmative or negative response. Another environment where *ne* is excluded, is the discourse initial position. *Ne* has to connect with context previously available from the discourse, therefore it cannot occur at the beginning of a discourse (Li & Thompson 1981: 305).

The distribution of *ne* is very similar to the distribution of the sentence final particle *ma*. The latter particle is used to mark yes/no-questions, but does not appear in declaratives. Ne is sometimes seen as the wh-counterpart of *ma*. It is argued that *ma* marks yes/no-questions, while *ne* marks other types of questions (Aoun & Li 1993: 210). In (3a) and (3b), the difference between the sentence final particles *ma* and *ne* can be observed. While adding *ma* to a question always produces a yes/no question, adding *ne* to the same sentence yields an information-seeking interpretation.

(3) Comparing *ma* and *ne*

a. *Yǒu rén bù tóngyì ma?*
have people NEG agree MA
'Are there people who don't agree?'

b. *Yǒu rén bù tóngyì ne?*
have people NEG agree NE
'What if there are people who don't agree?'

[Alleton 1981]

Syntax. The analysis of *ne* as a question marker has been proposed by several linguists, including Li and Thompson (1981). In particular, it has been suggested that *ne* is a question marker for wh-questions: questions with question words (Aoun & Li 1993; Cheng 1991; Hu 2002). Other linguists such as Li (2006), Paul (2009), Sybesma and Li (2007) and Chauncey Chu (1998) object to this analysis. Li (2006) uses the following arguments: firstly, wh-questions can be formulated without *ne*. Any wh-question is perfectly grammatical with or without *ne*. Secondly, the purpose of *ne* seems to be adding semantic value to the sentence, instead of marking a question. Thirdly, *ne* is not allowed in a wh-question when the question is embedded (Li 2006: 14). To Li's line of reasoning, I would like to add that *ne* can also occur in declaratives, as was seen in (1a) and (1b). Chu agrees that *ne* does not mark a question on its own, and adds that the interrogative interpretation usually comes from context or phonetics: a rising intonation at the end (Chu 1998: 125).

Semantics. With respect to the semantics of *ne*, opinions of linguists differ greatly. There are so-called meaning maximalists and minimalists.[1] The maximalists give a very detailed description of the interpretation of every case, while the minimalists try to group these meanings under one name. Chao (1968), for example, is a meaning maximalist, and proposes seven different interpretations of *ne*, one of which is illustrated in (4):

(4) Continued State

[1] This is a term used by Li Boya (2006).

Hái méi dào shíhòur ne.
still NEG arrive time NE
'It isn't time yet.'

Shuō -zhe huà ne.
talk DUR speech NE
'They are talking, line busy.'

[Chao 1968]

Chao suggests that *ne* has a 'continued state' interpretations in these sentences. The crucial issue here, however, is that this progressive meaning may also find its source in other elements in the same utterance. As many linguists, including Li (2006) have pointed out before, this 'continued state'-meaning of *ne* can actually be attributed to other words in the same sentence. In the examples of (4), these words would be *hái* 'still', and the durative aspect marker *zhe*.

This is but one example of disagreement between linguists, although the case of the progressive interpretation of *ne* is a fairly straightforward problem to solve. Since the focus of this thesis lies on the prosodic properties of *ne*, I do not wish to discuss all of the possible interpretations. Instead, I sum up some semantic features of *ne* which have been presented most frequently, and present my own view as well.

In an ideal mapping between form and interpretation, each single element would have only one meaning. Because the meaning minimalists try to achieve this ideal for *ne*, I mainly consider their theories. Several interpretations of the particle *ne* have been put forward: response to expectation, appeal to listener's active participation, relevance particle, wh-question particle, inter-sentential or inter-clausal linking particle, and evaluative marker.

The interpretation 'response to expectation' has been argued by Li and Thompson (1981), who believe this is true for the *ne* used in declaratives. According to their theory, *ne* points out that the utterance to which it is added, is the speaker's "response to the hearer's claim, expectation or belief" (Li & Thompson 1981: 300). For example, this response could contain information that contradicts what the hearer has said, but it could also convey agreement. Furthermore, Li and Thompson claim that *ne* invites the hearer to pay closer attention to the utterance.

In the same year as the publication of Li and Thompson's book, Viviane Alleton (1981) presented her theory on the semantics of *ne*. Her conclusion is that *ne* appeals to the active participation of the hearer (Alleton 1981: 91). According to Alleton, *ne* suggests that the speaker has a particular interest in the information conveyed by the utterance, and invites the hearer to take part in his reasoning.

In addition to this, Alleton also mentions that sentences with *ne* can be uttered with interrogative, suspensive or assertive intonation. There are slight nuances when it comes to the semantic functions of said intonation contours, but the overall interpretation stays the same: the hearer is invited to pay more attention, and participate actively in the discourse. Furthermore, although *ne* is deletable in most cases, questions where *ne* is left out can be perceived as rude. This latter notion is more or less seconded by Tiee (1986: 232), who states that the addition of *ne* has the semantic function of making a question "mild in mood".

A couple of years later, Chauncey Chu (1984) proposed that *ne* is a particle that implies relevance. *Ne* is used to mark utterances as relevant to the rest of the discourse. If not marked by *ne*, the sentence might be perceived inappropriate or irrelevant (Chu 1984: 88).

(5) In response to someone claiming a certain family is very poor:[2]

Tāmen yǒu sān tiáo niú ne.
3P.PL have three CL cow NE
'They have three cows.'

[Li & Thompson 1981]

Consider the dialogue in (5). Chu claims that the response would not be appropriate if *ne* was not present. To illustrate the need for *ne* in this situation, I have constructed a similar discourse in English. Imagine the following conversation:

(6) A: "I've heard the Zhang family is very poor."
B: "They have three cows."

I believe I am not wrong in proposing that the discourse in (6) sounds slightly awkward at best. Something that links the two sentences together is missing. Without this element, we question the significance of B's response. According to Chu, this is exactly what the function of *ne* is. In this particular situation, *ne* could possibly be translated with 'but' to convey the same message.

Several linguists have put forward the idea that *ne* is a wh-question marker. As I have discussed above, there is a number of reasons why this is not very logical. Still, Li and Thompson (1981), Cheng (1991), and Hu (2002) all consider the particle *ne* to mark questions. Because of *ne*'s optionality in questions and occurrence in declaratives, among other reasons, I agree with Li (2006), Chu (1998) and Tiee (1986) in claiming that *ne* does not mark any type of question.

In 1998, Chu revised his original standpoint of *ne* being a marker of relevance, to claiming that it functions as an inter-sentential or inter-clausal linking particle. The argumentation is that *ne* needs some form of linguistic context to be found appropriate in the sentence. Chu claims that this new notion of linking can account for different interpretations linguists have mentioned so far: pause particle, highlighting background information, soliciting active participation, relevance, and rhetorical question. This reasoning resembles that of Alleton, who also states that *ne* plays a part in the "construction of utterances as linked to previous ones" (Alleton 1981: 109).

Finally, King (1986) and Li (2006) argue that *ne* is an evaluative marker. By using *ne*, the speaker deems the information conveyed in the utterance to be unusual, extraordinary or of exceptional importance (Li 2006: 12), thereby evaluating the sentence. Information that seems to deviate from the topic framework is considered extraordinary, and thus is marked with *ne*. This reasoning is actually very similar to Chu's explanation of relevance. Li acknowledges this, but explains that Chu's notion of 'relevance' was too general.

The view I propose is that *ne* in questions can be interpreted as requesting additional information. See (1c), (1d), (1e) and (2) for examples of this usage. It is imperative, however, that this question is not completely off-topic. A certain degree of relevance is required. In declaratives, *ne* conveys that the utterance is obvious, as well as relevant to the discourse. This *ne* can be used in utterances which contradict the hearer's point of view. See examples (1a), (1b), (4) and (5) for this usage.

The notion of relevance proposed by Chu (1984; 1985; 1998) still applies to both parts of my two-fold interpretation of *ne*, although in my view it is merely a prerequisite for the appropriateness of the utterance, and not really the interpretation of the particle. Additionally,

[2] This example sentence is taken from Li & Thompson (1981: 301). They propose several situations where this sentence could be uttered, one of which is when the response indicates contradiction, such as in 5.

I agree that *ne* is not a question marker of any kind; context is needed to justify the presence of *ne*; and that by using *ne*, the speaker marks the utterance as important.

All of the above interpretations apply to the cases where *ne* occurs in a sentence with a predicate. The nominal sentence or thematic question I have mentioned earlier, is a different matter entirely. Recall the examples from (2), where the sentence final particle *ne* was added to a noun phrase, pronoun or adverbial to formulate an interrogative phrase. In these cases, *ne* is functioning as a topic marker (Li 2006; Sybesma & Li 2007). Several linguists such as Tiee (1986), Li & Thompson (1981), have argued that these sentences are actually abbreviated or truncated forms. For example, they would claim that (7b) is the truncated form of (7a).

(7)

a. *Tā míngnián yào qù Zhōngguó, nǐ míngnián yào qù nǎr ne?*
   3P.SG next.year want go China 2P.SG next.year want go where NE
   'He is going to China next year, where are you going next year?'

b. *Tā míngnián yào qù Zhōngguó, nǐ ne?*
   3P.SG next.year want go China 2P.SG NE
   'He is going to China next year, how about you?'

If (7b) would be the abbreviated form of (7a), that would entail that both *ne* would have the same interpretation. However, this is not the case. For ne in (7a), it can be said that it conveys relevance or importance, while in thematic questions such as (7b), ne functions as a topic marker. It marks a new theme, and invites the hearer to provide a rheme of it according to the discourse context (Sybesma & Li 2007: 1758). Li (2006) claims that the thematic question-*ne* is a different particle than the *ne* occurring in declaratives and wh-/A-not-A/disjunctive questions. One of the reasons for this is that *ne* in thematic questions does not mark the content to be extraordinary.

That explains the case of *ne* attached to a pronoun or noun phrase, but it does not offer a valid interpretation for when *ne* is attached to an adverbial, since an adverbial can hardly serve as a topic. Another difference is that there is no question intonation in these cases. Instead of a topic marker, I agree with Chu (1998) who claims that *ne* here is a suspensive particle.

Prosody. While there is an abundance of literature on the semantics of *ne*, information on the prosodic properties is rare. Chu (1998: 125) notes that a *ne*-question has a rising intonation at the end, which is not unexpected given the fact that most questions in Mandarin Chinese end with a rise. Alleton (1981) discusses the phonology of *ne* in more detail, and claims that sentences with *ne* can be pronounced with either interrogative, suspensive[3] or assertive intonation.

Prosodically, I distinguish two different realizations of *ne*: the one used in declarative sentences, and the one used in questions. The results of the production experiment I carried out show that the two differ in both duration and pitch. I elaborate on this matter in chapter 4.

In this section, I have reviewed literature on the particle *ne*. I have discussed its distribution, syntax, semantics and prosodic properties. We have seen that *ne* occurs either at the end of a sentence, or at the end of a clause. The different syntactic functions and interpretations of the particle correlate with the distribution. It functions as a particle of evaluation or relevance when used at the end of a sentence. When used at the end of a non-predicative clause, it functions as a topic marker when added to a noun phrase, and it

[3] The term 'suspensive intonation' is used by Viviane Alleton to indicate the intonation contour regarding pauses.

functions as a suspensive particle when added to an adverbial. With respect to prosodics, two different realizations of *ne* can be distinguished, which will be explained in more detail in chapter 4.

2.2 Intonation

In order to study the prosodic properties of *ne* correctly, it is imperative to also take the intonation of the entire sentence into account. An important part of this thesis research is measuring the pitch flow of the stimuli used in the production experiment (see chapter 4). We can measure the pitch by examining the fundamental frequency (F0) through Praat software.

To establish which locations in the sentence are good points to measure F0, I consulted several articles regarding declarative and interrogative intonation in Mandarin Chinese.

In languages in general, there is usually a distinctive intonation pattern for questions and declaratives: questions end high while statements end at a low pitch level. According to Shen (1986: 172), there are actually three different intonation patterns for Mandarin Chinese. Statements start with a mid-key, rise until a mid-high key at the highest peak, and falls to a low register at the end. For questions, there are two different intonation patterns. For unmarked yes/no-questions and yes/no-questions with particles, the intonation starts at a mid-high level, whereafter it moves upward to a high key at the highest peak, and drops slightly before rising to a high or mid-high level at the end. For A-not-A questions, disjunctive questions, wh-questions, and other types of marked questions, it is slightly different. In these types of interrogative sentences, the intonation is the same as yes/no-questions up to the highest pitch peak in the sentence, but ends with a low key.

Lee (2005: 90) echoes this by claiming that there is a wider intonation range in unmarked questions than in marked questions. In unmarked questions such as yes/no-questions without any particles, there is no syntactic cue to show the interrogative nature of the sentence. In those cases, there is more need for an intonational cue then in marked questions, where there is a syntactic cue present.

The study by Xu and Liu (2005) contains detailed information on pitch flows of different question types in Mandarin. In dataset (8), several of their used sentences are shown.

(8) a. *Bù shì Zhāng Wēi dānxīn Xiāo Yīng kāi chē fāyūn ma?*
NEG be Zhang Wei worry Xiao Ying drive car get.dizzy MA
'Isn't it *ZhangWei* who worries that *XiaoYing* will get *dizzy* while driving?'

b. *Shì bù shì Zhāng Wēi dānxīn Xiāo Yīng kāi chē fāyūn?*
be NEG be Zhang Wei worry Xiao Ying drive car get.dizzy
'Is it the case that *ZhangWei* worries that *XiaoYing* will get *dizzy* while driving?'

c. *Shuí dānxīn Xiāo Yīng kāi chē fāyūn?*
who worry Xiao Ying drive car get.dizzy
'*Who* worries that *XiaoYing* will get *dizzy* while driving?'

[Xu & Liu 2005]

The results from their study showed that the pitch raises more in yes/no questions and rhetorical questions (8a) than in confirmation questions (8b) and wh-questions (8c). However, their wh-questions differ from the wh-questions used in my study. The difference lies in the position of the wh-word in the sentence: Xu and Liu used questions where the wh-word was

positioned at the beginning of a sentence, functioning as the subject. An example is shown in (8c). The wh-words in wh-questions I used were at the end of a sentence, occupying the object position. I believe that the difference in position is rather significant, mostly because the focus lies on the wh-word. Shifting the focus to the other end of the sentence would create a completely different pitch flow. Because of this, I cannot apply the results of Xu and Liu's study to the wh-questions I used.

Their study also included particle questions, but as they only included *ma* as a particle, the results cannot be applied to sentences with *ne*. Since I cannot make use of Xu and Liu's information about the pitch flow in questions, I follow Shen's descriptions of the frequency, stated above.

Yuan (2006) explains the difference in intonation between declaratives and questions in Mandarin by proposing three different mechanisms. He also takes the different tonal contours into account. The first mechanism is a phrase curve mechanism, which entails that the F0 and intensity of the question intonation are higher than statement intonation. The second is a strengthening mechanism, which causes the F0 and intensity difference between the two types to be larger toward the end of the sentence. Lastly, he proposes a tone dependent mechanism, which flattens the fall of a falling tone but strengthens a rising tone. Because of this last mechanism, question intonation is easier to identify if the final tone is falling, because it will be slightly adapted. It is however quite hard to distinguish between the two sentence types if the last tone is rising.

Furthermore, Yuan's (2006) study shows that statement intonation is easier to identify than question intonation. Statement intonation is the unmarked, or default, form of intonation. Listeners think they are hearing a statement when there are not enough cues for question intonation. Question intonation is on the other hand marked by one of the mechanisms described above.

With respect to duration, Yuan (2006) found that syllables in question intonation are shorter than those in statement intonation. This was true for every position except sentence final; the last syllable is longer in question intonation. According to Yuan this can be explained by the strength mechanism.

The lexical tones used in Mandarin Chinese complicate the analysis of intonation levels. It is generally agreed upon that a language has either intonation or lexical tones, and cannot have both. This is called the functional view, i.e. "if some phonetic dimension is exploited in one area of the grammar, e.g. lexical tones, it will not be used to the same extent in another part of the phonology, e.g. sentence intonation" (Liang & Van Heuven 2007: 2). Results from Liang and Van Heuven's experiment support this view. In their experiment, it was proven that native speakers from a non-tonal language were more sensitive to intonation, while native speakers from a tonal language were more sensitive to lexical tones, and less sensitive to intonation.

In this section, I have reviewed literature on sentential intonation in Mandarin Chinese. Shen (1986) and Lee (2005) have claimed that there is a difference in intonation between unmarked and marked questions. Unmarked questions have no syntactic cue for interrogativeness, thus they will rely more on intonation, and end with a higher key than marked questions. Questions with particles will also end higher, according to Shen's findings. In my experiments, I will be using wh-questions with and without the particle *ne.* If what Shen claims is true, than the wh-questions without *ne* will end at a lower key than the questions which make use of the particle *ne*. Liang and Van Heuven's (2007) support for the functional view suggest that the difference in intonation between questions and declaratives is slim. Their findings lead me to expect that the prosodic differences between declaratives and questions will be greater in terms of duration than in terms of frequency. In chapter 4 I examine whether this hypothesis is true.

2.3 Coarticulation in Tones

Tonal contours can vary when several tones follow each other. According to Xu (1997), carry-over effects as well as anticipatory effects can be observed when looking at contextual tonal contour variation in Mandarin. Carry-over effects apply when the tonal contour of the preceding syllable has influence on the tonal contour of the following syllable. This can be seen as a progressive influence. In Figure 1, carry-over effects are shown for all 16 combinations of the four lexical tones: 1st tone (high level), 2nd tone (rising), 3rd tone (low), and the 4th tone (falling).

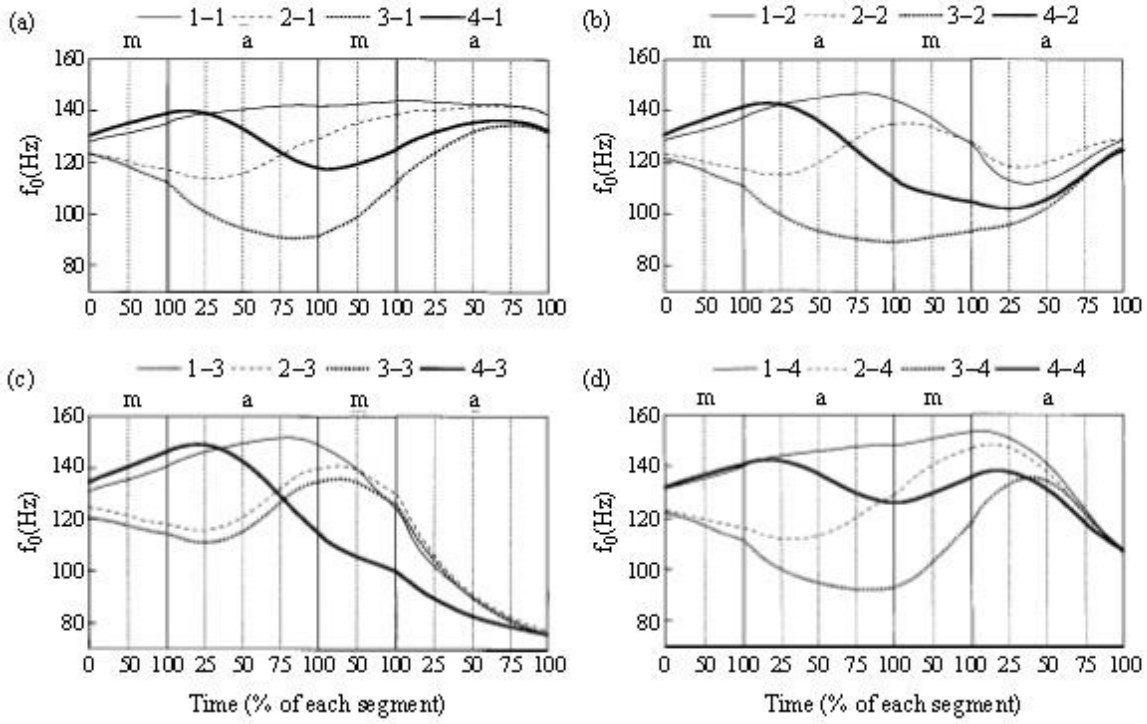

Figure 1. Charts by Xu (1997) which show the 16 possible tonal contours of the first and second syllable in the disyllabic word *mama*.

The graphs in Figure 1 all show the word *mama*, realized with different lexical tones. The first half of each graph shows the pitch flower of the first syllable, and the pitch flow of the second syllable is presented in the second half of the graph. Also consult the letters above the graph for convenience. The numbers above each graph stand for the tonal combinations. The graphs are grouped by the lexical tone of the second syllable.

When looking at the second syllable, it can be noticed that the pitch contour of the previous syllable still lingers when the following syllable begins, and it's only later that the tonal contour of the second syllable is applied.

Anticipatory effects occur when the following syllable has influence on the tonal contour of the previous syllable. This can be seen as a regressive influence.

Although both the carry-over effects and anticipatory effects influence the tonal contours of the neighboring syllable, they do this in different ways. In Mandarin, carry-over effects are assimilatory[4], meaning that the F0 of the following syllable becomes more similar to the F0 of the previous syllable. Contrastingly, anticipatory effects are dissimilatory[5]: the tonal contour of the preceding syllable becomes less like the tonal contour of the following

[4] Xu (1997), p74.
[5] Xu (1997), p78.

syllable. For example, a syllable with a low tonal onset raises, rather than lowers, the F0 of the preceding tone.

The influence of a carry-over effect can be detected at least two thirds into the following tone, according to Xu (1997). This type of effect is more explicit than the anticipatory effects. I take this into account when placing F0 measuring points in the data during the analysis, which I will elaborate on in chapter 4.

3. Research Questions

Based on the background literature I have constructed several research questions I would like to explore in this thesis. First, I investigate the particle *ne*: What are the prosodic properties of *ne*? Is there a different realization of *ne* depending on the sentence type? Secondly, I would like to inspect the following aspects: Does the sentence final particle *ne* influence the prosodic properties of the preceding word? If so, is it a change with respect to duration, namely does the word preceding *ne* get longer or shorter? Or is this change related to frequency? Are the possible effects the same in questions and declaratives? Furthermore, if there are any differences attested between sentences with and without *ne,* are these differences perceivable by native speakers?

To explore these questions, I have designed a production experiment and a perception experiment. Since previous literature (Ruijgrok 2012) suggests that there is a difference between Taiwanese and Mainland speakers with respect to the prosodic realization of sentences that contain the particle ne, speakers from both groups were included in both experiments. In the first experiment, native speakers produce a number of sentences. With the data resulting from this experiment, the prosodic properties of the different sentence types can be examined. Ideally, the results would show that there is a difference between all four kinds of sentences. In the perception experiment, native speakers listen to the first part of a sentence, and are asked to predict the sentence type.

4. Production Experiment

To investigate the prosodic properties of the sentence final particle *ne*, I compared the prosody of *ne* in declaratives and questions. To achieve this goal I designed a production experiment. The aim of the experiment is to determine whether there are different prosodic realizations of the particle ne. The secondary purpose was to explore the possible effect of *ne* on the prosody of other elements in the same sentence.

In the results section, I explore the following questions: 1) does the duration or frequency of *ne* in questions differ significantly from the duration of *ne* in declaratives? 2) Does *ne* affect the duration or frequency of the word preceding it? 3) Does *ne* affect the duration or pitch flow of other elements in the utterance? 4) If there are any changes, do they occur in both questions and declaratives? The answers to these questions are presented in the discussion.

4.1 Methods

4.1.1 Stimuli

To measure the prosodic properties of *ne*, interrogative and declarative sentences which contain *ne* were included in the stimuli. For the secondary goal, i.e. investigating the possible prosodic effect *ne* has on the rest of the sentence, questions and declaratives without *ne* were added as well. By including these sentences, the frequency and duration of all parts of speech can be compared in sentences with and without the particle.

All of the interrogatives were wh-questions, using the wh-words *shéi* 'who' or *shénme* 'what'. I devised 16 different sets for 'who', and 16 different sets for 'what', adding up to a total of 128 target stimuli. In the declarative forms, the wh-words were replaced with noun phrases. See (9) and (10) for examples of both types of sets. (9a) and (10a) show examples of wh-questions where the *ne* particle is used. In (9b) and (10b), the same wh-questions can be observed, this time without the particle. Likewise, (9c) and (10c) show declaratives with *ne*, while (9d) and (10d) are declaratives which do not contain *ne*.

(9) Examples 'who' Stimuli Production Experiment

a. Question + ne	*Mǎ Dīng bang-le yíxià shéi ne?* Ma Ding help-PRF a.while who NE 'Who did Ma Ding help-NE?'
b. Question	*Mǎ Dīng bang-le yíxià shéi?* Ma Ding help-PRF a.while who 'Who did Ma Ding help?'
c. Declarative + ne	*Mǎ Dīng bang-le yíxià Yú Yáng ne.* Ma Ding help-PRF a.while Yu Yang NE 'Ma Ding helped Yu Yang-NE.'
d. Declarative	*Mǎ Dīng bang-le yíxià Yú Yáng.* Ma Ding help-PRF a.while Yu Yang 'Ma Ding helped Yu Yang.'

(10) Examples 'what' Stimuli Production Experiment

a. Question + ne	*Lù Yíng hē -le yidiǎn shénme ne?* Lu Ying drink-PRF some what NE 'What did Lu Ying drink-NE?'
b. Question	*Lù Yíng hē -le yidiǎn shénme?* Lu Ying drink-PRF some what 'What did Lu Ying drink?'
c. Declarative + ne	*Lù Yíng hē -le yidiǎn niúnǎi ne.* Lu Ying drink-PRF some milk NE 'Lu Ying drank some milk-NE.'

d. Declarative *Lù Yíng hē -le yidiǎn niúnǎi.*
Lu Ying drink-PRF some milk
'Lu Ying drank some milk.'

The Chinese names used in the experiment were constructed by a native speaker and myself. The native speaker suggested surnames and given names which mostly used sonorant consonants, of which I explain the importance later in this paragraph. Each of the surnames had the syllable structure of CV, meaning one consonant and one vowel; the structure of the given names was: CVC, with the last consonant always being the nasal coda [ŋ].

It is important to note that the questions and declaratives belonging to a single set were not meant to serve as question-answer sets, and were not displayed that way during the experiment. The format of every stimulus is the same: Subject+Verb+PRF+Object(+ne). Mandarin is a wh-in-situ language, which means that the wh-word can occupy the same position as an object normally would. Because of this, the sentence structure for both declaratives and questions can be the same. As stated above, in interrogative stimuli the object position is filled by a wh-word, and in declarative stimuli a noun phrase is used.

The length of the different parts of speech was controlled as much as possible. The subjects and objects, except for the wh-word *shéi* 'who', consisted of two syllables each, and all verbs were only one syllable long. Sentences were perceived more natural when *yidiǎn* 'some' or *yixie* 'several' was added. However, these adverbials could only be used in sentences of which the objects denote things. To make the sentences with a human object balanced, the adverbial *yíxià* 'a while' was added. Generally the interpretation of *yíxià* 'a while' is weakened, and is not translated at all. Its purpose lies in softening the tone of the sentence, making it more polite and less harsh.

In addition to the 128 target stimuli, 64 filler sentences were added. The purpose of the filler sentences was to distract the participant from the goal of the experiment. The 64 filler sentences used the same verbs and objects as the stimuli. See (11) and (12) for the filler sentences of the sets displayed in (9) and (10). Examples (11a) and (12a) show filler questions, which were based on the declarative sentences from (9) and (10). The sentence final particle *ma* was added to divert the attention from the sentence final particle *ne*. In (11b) and (12b), filler declaratives are shown, which were formed using the wh-questions from (9) and (10). In these declaratives, the other interpretation of wh-words are used, namely the existential interpretation. For example, here *shéi* does not mean 'who', but 'someone'.

(11) Examples 'who' Filler Sentences Production Experiment

a. Filler Question *Mǎ Dīng bang-le yíxià Yú Yáng ma?*
Ma Ding help-PRF a.while Yu Yang MA
'Did Ma Ding help Yu Yang?'

b. Filler Declarative *Mǎ Dīng bang-le yíxià shéi.*
Ma Ding help-PRF a.while. who
'Ma Ding helped someone.'

(12) Examples 'what' Filler Sentences Production Experiment

a. Filler Question *Lù Yíng hē-le yidiǎn niúnǎi ma?*
Lu Ying drink-PRF some milk MA
'Did Lu Ying drink some milk?'

b. Filler Declarative *Lù Yíng hē-le yidiǎn shénme.*
Lu Ying drink-PRF some what
'Lu Ying drank something.'

There was an even distribution of questions and declaratives among the filler sentences. As stated above, the 32 questions were formed by taking the declarative sentence without *ne* of the existing sets, and adding the yes/no question marker *ma*. The 32 declaratives were formed by taking the wh-question without *ne* from the existing sets, and displaying it as a declarative by replacing the question mark with a period.

In the process of designing the stimuli, special attention was paid to avoid obstruents as much as possible, and use sonorant consonants instead. Sonorant consonants, in contrast to for example plosives and fricatives, are produced with a constant and non-turbulent airflow. Examples are [m, n, l]. They are important for this experiment because sonorant consonants can carry pitch, and thus, tone. In contrast, the pitch flows of fricatives and other obstruents cannot be measured by Praat. Since the attaining of the goal of this experiment involves measuring pitch heights, it was best not to use obstruents.

All of the stimuli as well as the filler sentences were checked on grammaticality by a native speaker. After some adjustments, all of the sentences were found to be correct. The participants of the experiment were also asked if they thought the sentences were natural. Most of them agreed with the judgement of the native speaker we consulted, although some native speakers had comments about the Chinese names and the incompatibility of *yíxià* 'a while' with some verbs.

The full list of the constructed stimuli and filler sentences can be found in Appendix A and B.

4.1.2 Procedure

All of the 12 participants were recorded individually in a sound isolated booth in the Phonetics Laboratory at Leiden University.[6] The participants were seated in front of a computer screen, on which the stimuli are presented to them, one sentence at a time. A Sennheiser MKH416T microphone was placed on a table in front of them. There was an intercom system through which the participant could hear me, I paid special attention to turn off my own microphone to avoid background noise in the recording. The software Audacity was used to record the files.

Before the experiment, I asked the participant to pronounce the sentences naturally in terms of speed. I also requested to first read the sentences before speaking, since this would minimize the errors they could make. In case of mispronouncing a sentence, the participants were asked to pronounce the sentence one more time from the beginning. They were also informed that although each sentence is presented in isolation, some of the sentences need context to be found natural.

There were two rounds of recording for each speaker, each of the rounds taking around 12 minutes. They were allowed to pause inbetween sentences, and a break was offered inbetween the two recordings. I myself sat at outside of the recording room in front of another computer, on which I could see exactly the same as the participant was seeing. Each time the speaker finished reading a sentence, I would click forward to the next stimuli. The stimuli were presented in a random order, although it sometimes occurred that sentences belonging to

[6] I am very grateful for all the help Jos Pacilly has offered me, from helping me understand the equipment in the Phonetics Laboratory to designing Praat scripts.

the same set followed each other. However, because the stimuli were presented one at a time on the screen, it was most unlikely that a participant interpreted these rare cases as dialogues.

The sentences were displayed in simplified Chinese characters. Although the Taiwanese speakers are more accustomed to traditional characters, this posed no problem or inconvenience for them. Only one Taiwanese speaker was fairly unfamiliar with simplified characters, but after reviewing them once before the experiment, this speaker performed perfectly. If the characters were too small, the size was adjusted to the preference of the speaker.

After the experiment, the participants were asked to fill out a short questionnaire, containing questions about their background and about their opinion on the sentences used in the experiment. The results of this questionnaire can be observed in Table 1 in the following section. For the original questionnaire, please consult appendix C.

4.1.3 Participants

In total, 12 native speakers of Mandarin Chinese participated in the experiment, of which 10 were females and 2 were males. Table 1 shows more information on the language background of each participant.

Table 1. Native Speaker Background Information

Speaker	Gender	Age	Origin	Region	Mother Language	Dialect
01	F	22	Taiwan	Taipei	Mandarin	Taiwanese
02	M	29	Mainland	Jinan	Jinan dialect	Jinan dialect
03	F	26	Taiwan	Taipei	Mandarin	Southern Min
04	F	25	Mainland	Qufu	Jining dialect	Jining dialect
05	F	28	Mainland	Beijing	Mandarin	-
06	F	30	Taiwan	Kaohsiung	Mandarin	Taiwanese
07	F	24	Mainland	Sichuan	Chongqing dialect	Chongqing dialect
08	F	28	Taiwan	Taipei	Mandarin	Taiwanese
09	M	27	Mainland	Yanggu	Yanggu dialect	Yanggu dialect
10	F	26	Mainland	Shenyang	Mandarin	Northeast dialect
11	F	26	Mainland	Luoyang	Mandarin	-
12	F	24	Mainland	Shanghai	Mandarin	Shanghai dialect

Participants were asked what their mother language is and if they speak a Chinese dialect, among other things. As shown in Table 1, the dialect is also the participant's mother language in some cases. In other cases, the participant does not speak any dialect at all.

Of all participants, Mandarin Chinese was the language they used most of the time, which was a prerequisite for participating in the production experiment.

Figure 2. Origin Participants

In Figure 2, the origin of the participants is presented. As shown, four participants come from Taiwan, while the hometown of the other eight participants are distributed across the northern and western part of mainland China.

4.2 Analysis

In the production experiment, 192 utterances were recorded per speaker, resulting to 2304 files in total. Only the target stimuli were further analyzed; the total of to be analyzed utterances amounted to 1536 (128 target stimuli × 12 speakers). I first inspected the data with respect to naturalness. I decided to exclude two stimuli where the speaker had failed to produce the intended meaning from any further analysis. For example, when a stimulus that was intended to be a question[7] was uttered by the speaker in a similar fashion as questions are pronounced, it was excluded from further analysis.

After encoding each separate stimulus, there was a manual labeling and segmentation of each target utterance into syllables. Segment boundaries were determined by visual and audio information. I consulted the spectrogram as well as the oscillogram. Finally I listened to

[7] Recall that stimuli were presented to the participants in written form, and that the sentence type was made clear by adding punctuation: a full stop or a question mark.

the separated segments to verify the correct segment boundaries. Conventional segmentation guidelines were followed (Peterson & Lehiste, 1960).

The next step of the analysis was to determine F0 measuring points. Recall that tonal contours can vary when several tones follow each other. As established in section 2.3, there are carry-over as well as anticipatory effects. The tonal contour of the syllable is most similar to its desired shape approximately halfway into the syllable, as shown in Figure 1. This is why it is not advisable to place F0 measuring points on the syllable boundaries. Instead, I decided to place the F0 measuring points on either the maximum or the minimum F0 of the syllable. I strived to have similar placement of measuring points throughout all of the stimuli. In general, there would be seven measuring points, of which the placement is presented in Figure 3.

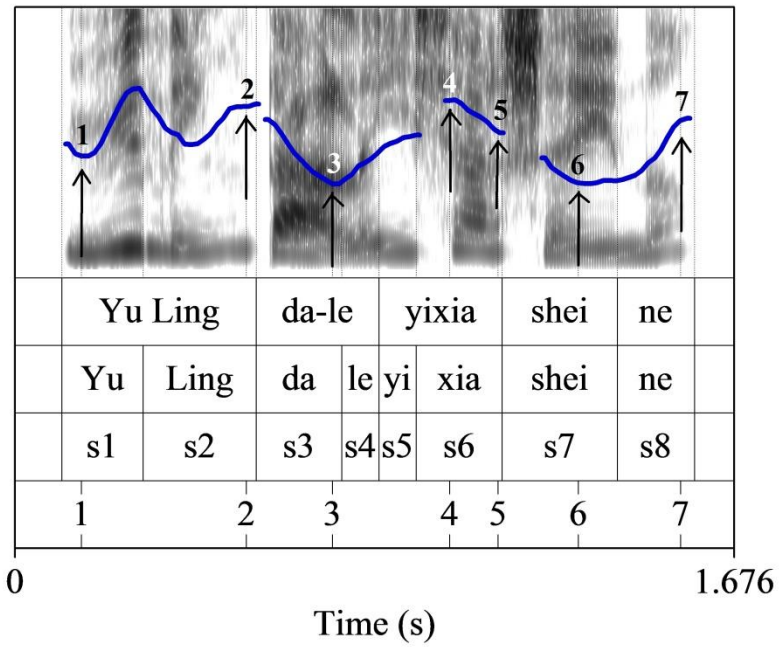

Figure 3. Placement F0 measuring points.

As shown in Figure 3, the first point was placed on the beginning of the first syllable. In most utterances, this was a low frequency. There were a few sentences of which the initial syllable had a high onset lexical tone; in these cases the first point was placed on the highest frequency. The second point corresponded to the highest point of the second or third syllable, regardless whether the initial syllable had a high or low onset. The third point marked the low point in the verbal phrase, which was usually in the fourth syllable. In the example from Figure 3, it is placed on the third syllable, the verb *dǎ* 'hit'. The fourth and fifth point were used to mark the beginning and end of the pitch fall of the adverbial, which in the case of Figure 3 was *yíxià* 'a while'. The sixth and seventh point were placed on the start and end of the final rise. Here, the seventh point was placed on the particle *ne*. In cases where *ne* was absent, both the sixth and seventh point would be positioned on the wh-word or noun phrase.

Since the focus of this research lies on the prosodic properties of *ne*, a separate script was run to measure the F0 minimum and maximum within the particle, and to determine which one of the two comes first. By doing this, it can be calculated whether there is a rise or fall within *ne*. It was more appropriate to design a separate script for this part of the analysis, rather than placing more points on *ne* in the first script, and thus creating an unequal amount of point throughout the data.

Special attention was given to creakiness of the voice. In Mandarin, the low tone is accompanied by creaky voice, which interrupts the pitch flow in Praat. The lowest point of the low tone had to be measured, but sometimes the creaky voice made the pitch flow illegible. In order to compensate for this, the measuring points were placed on the nearest visible F0 measurement.

After running Praat scripts[8], measurements of frequency and duration for each separate segment of the utterances were collected. Using the software SPSS, I have examined the data resulting from these scripts. Graphs and paired samples T-tests were carried out, which are presented and discussed in the following section.

For the analysis of frequency data, the F0 values in Hz were converted into semitones to reduce cross-speaker variation. The formula in Figure 4 was used to recalculate the data.[9]

$$F = 12log_2\left(\frac{f}{100}\right)$$

Figure 4. Convert Hz to ST

4.3 Results

Firstly, the results for the duration data are discussed; secondly, frequency (F0) results are presented. For both duration and frequency, the primary focus lies on the properties of *ne* itself. Additionally, I investigate whether *ne* affects the rest of the elements in the utterance it occurs in.

4.3.1 Duration

Figure 5 presents the mean duration of *ne* in questions and declaratives.

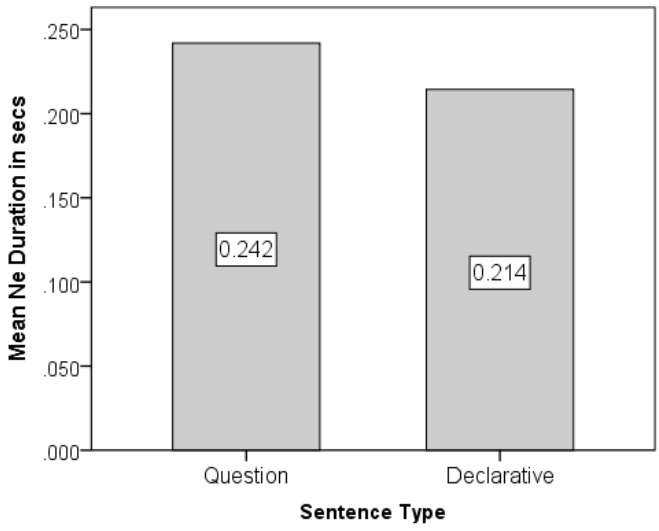

Figure 5. Duration of NE in seconds broken down by sentence type.

As Figure 5 shows, the duration of *ne* in questions (0.242 seconds) is longer than the duration of *ne* in statements (0.214 seconds). The difference between the two is statistically significant, as indicated by a paired samples T-test, see Table 2. With respect to the origin of the speakers,

[8] Jos Pacilly's help with the scripts was greatly appreciated.
[9] This formula originates from Chen and Gussenhoven (2008).

a difference in duration of *ne* in questions was found between Mainland speakers (M=0.224, SD=0.031, N=256) and Taiwanese speakers (M=0.278, SD=0.047, N=127). However, it was not found if this difference was significant; this would be interesting for future research to elaborate on. Concerning duration of *ne* in declaratives, there was only a difference of several milliseconds between data from Mainland and Taiwanese speakers.

Table 2. Comparing the duration of ne in questions and declaratives; Results of a Paired Samples T-test.

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Duration of Ne in Questions vs. Ne inDeclaratives	0.027422	0.057011	0.002913	9.413	382	0.000

The paired samples T-test in Table 2 shows that there was a significant difference in duration of ne between questions (M=0.242, SD=.045, N=383) and declaratives (M=0.215, SD=.042, N=383); t(382)=9.41, p=0.000. In short, the difference in duration of *ne* in questions and declaratives was found to be significant, which entails that there is a difference in the prosodic properties of *ne* in different sentence types.

After establishing that the prosodic properties of *ne* differ in questions and declaratives with respect to duration, the next step is to investigate whether *ne* has any effect on the duration of the word preceding it. In order to examine this, sentences with and without *ne* have been analyzed. The word preceding *ne* is either a wh-word or a noun phrase; I collected the duration data from these elements in a separate variable. Firstly, I examined the wh-words only. Since *shénme* 'what' has two syllables, and *shéi* 'who' only has one, the data of the two wh-words were separated for the test, in order to get reliable results. In Figure 6, the duration of the wh-words is displayed.

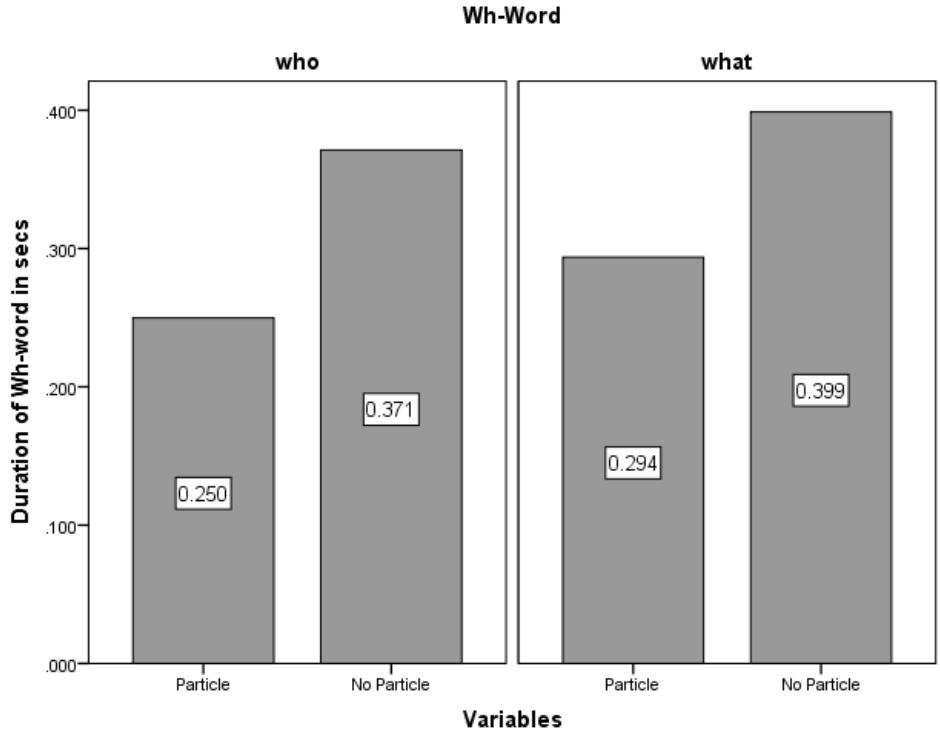

Figure 6. Length of Wh-word in Questions

As shown, the duration of the wh-word *shéi* 'who' is 0.25 seconds in a question with *ne*, and 0.371 seconds in a question without the particle. Where the particle is used, the wh-word is 0.121 seconds shorter. When we examine the wh-word *shénme* 'what', of which the results are pictured on the right, we can observe similar results. In questions with *ne*, the duration of *shénme* 'what' is 0.294 seconds, while the same word is 0.399 seconds in a question without *ne*. This is a difference of 0.105 seconds in duration.

Figure 7 shows the results of the same test for the declaratives. In these graphs, the duration of the noun phrases are presented. Note that the noun phrases are still grouped by the wh-word used in their interrogative counterparts. In the graphs labeled with 'who', the mean duration of noun phrases which indicate human entities is shown. In the graphs labeled with 'what', duration of inanimate objects is presented. Both types of objects consist of two syllables.

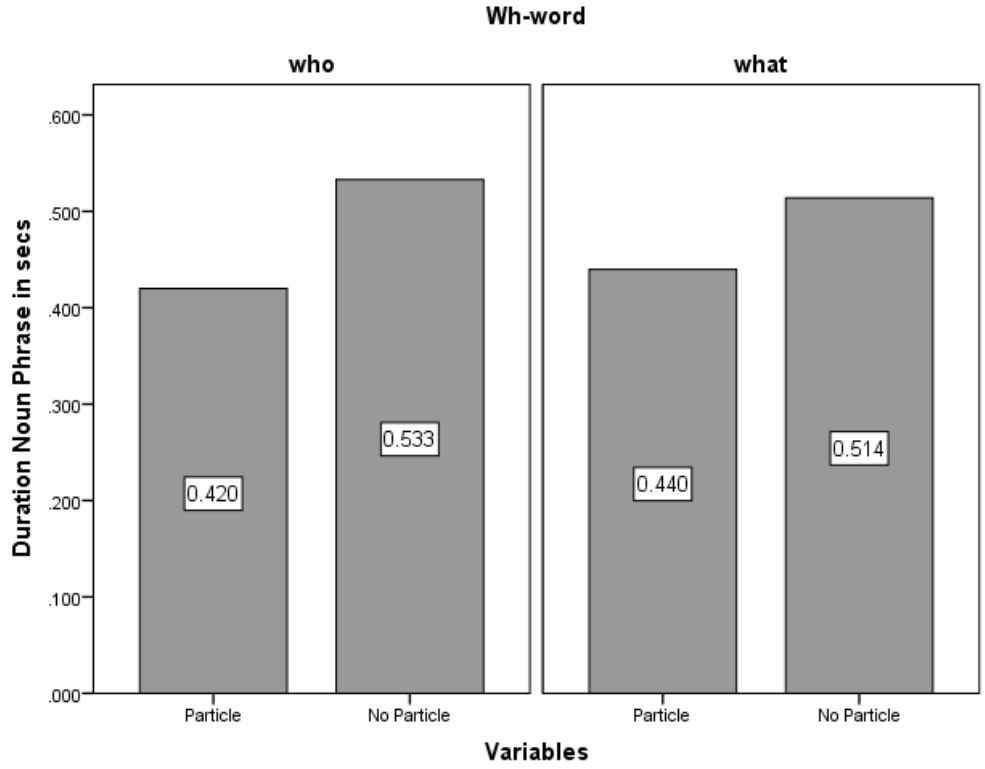

Figure 7. Length of the Object in Declaratives

In Figure 7 it is shown that noun phrases which denote human entities are 0.420 seconds long in declaratives with *ne*, and 0.533 seconds long in declaratives without *ne*. The noun phrases which denote inanimate objects are 0.440 seconds long in declaratives with the particle, and 0.514 seconds in declaratives where the particle is absent. There is a difference of 0.113 and 0.074 seconds, respectively.

Note that there is a similar trend to the results shown in Figure 6. The objects in declaratives with particles are shorter than the objects in declaratives where no particle is present.

A paired samples T-test was carried out to investigate the significance of these findings, of which the results can be found in Table 3.

Table 3. Comparing the duration of the wh-word and object in sentences with and without the particle; Results of a Paired Samples T-test.

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Shei Ne- Shei	-.12112	.04502	.00326	-37.179	190	0.000
Shenme Ne – Shenme	-.10500	.04107	.00296	-35.422	191	0.000
Object Ne - Object	-.09371	.072628	.003711	-25.251	382	0.000

In the paired samples T-test, several pairs were tested, of which the results are shown in Table 3. The duration of the wh-word *shéi* 'who' compared in questions with and without the particle, the wh-word *shénme* 'what' in the same conditions, and the duration of the object in declaratives with and without *ne*.

For *shéi*, the test shows that the difference in duration of the element in questions with *ne* (M= 0.250, N=191, SD= 0.027) and questions without *ne* (M=0.371, N=191, SD=0.423) was statistically significant: t(190)=-37.179, p=0.000.

For *shénme*, the results show a statistically significant difference as well between the duration of the element in questions with *ne* (M= 0.294, N=192, SD= 0.0337) and questions without *ne* (M=0.399, N=192, SD=0.380): t(191)= -35.422, p=0.000.

With respect to the objects, the difference in duration of this element in declaratives with *ne* (M= 0.430, N=383, SD= 0.547) and declaratives (M=0.523, N=383, SD= 0.709) was also found statistically significant: t(382)= -25.251, p=0.000.

In short, the paired samples T-test shows that the difference in duration between the wh-words and objects in sentences with and without *ne* is significant in all cases. From these results and the graphs in Figure 6 and 7, my analysis is that *ne* significantly shortens the duration of the word preceding it.

After confirming that *ne* influences the duration of the preceding word, I investigated whether *ne* has some influence on the rest of the sentence as well. In order to do this, the total duration of every sentence was calculated in SPSS. In cases where *ne* was present, this word was cut off from the sentence. By doing so, the sentences can be compared correctly. The results of this comparison can be observed in Figure 8.

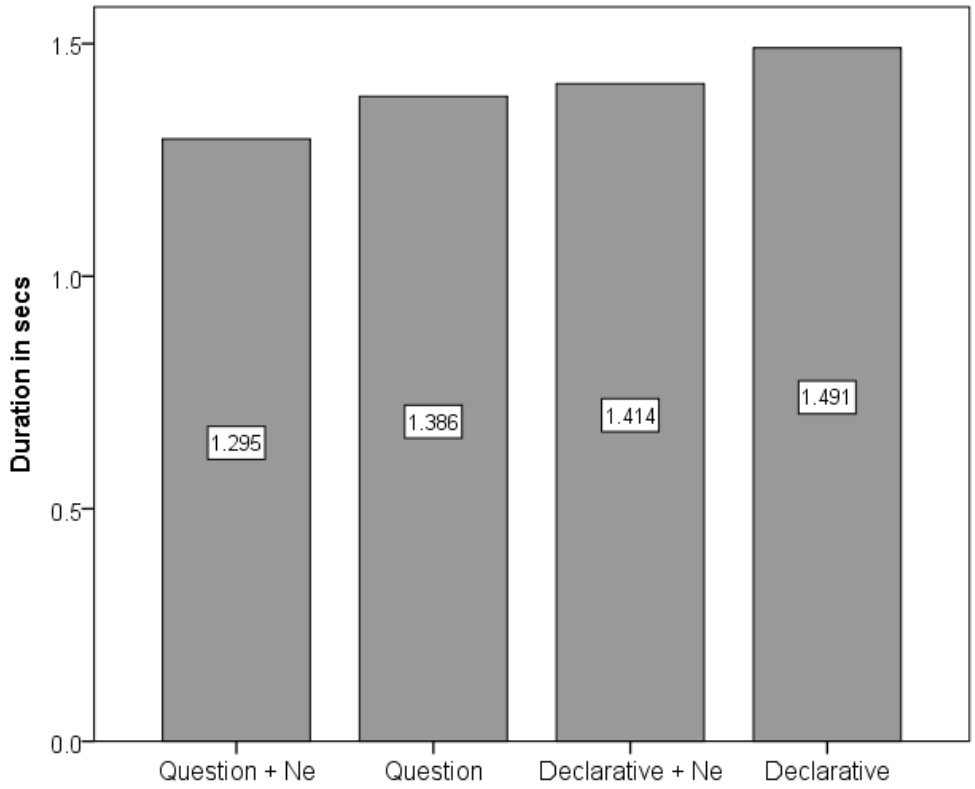

Figure 8. Total Duration minus *ne*

Note that again, sentences preceding *ne* are shorter than sentences without *ne*. In questions where the particle is added, the syllables up to the particle add up to a mean duration of 1.30 seconds; while sentences without *ne* are 1.39 seconds long: a difference of 0.09 seconds. In declaratives, the particle-less sentences have a mean duration of 1.41 seconds, and the declaratives with *ne* last for an average of 1.50 seconds: a difference of 0.08 seconds. Interestingly, but beside the point, is that declaratives are longer than questions in Mandarin. Contrastingly, the last syllable of a question is longer than the last syllable of a declarative. This was also attested in Yuan's (2006) results, which I can now confirm.

From the graphs in Figure 8, it does seem that *ne* has an effect on the total duration of sentences. However, since this difference in duration is almost the same as the difference in duration of the wh-words and objects shown in Figures 6 and 7, it is possible that *ne* only influences these words. In order to confirm this, I looked at the combined duration of the subject, the verbal phrase and the adverbial, thus leaving out the wh-word or object and the particle, if present. These results are presented in Figure 9.

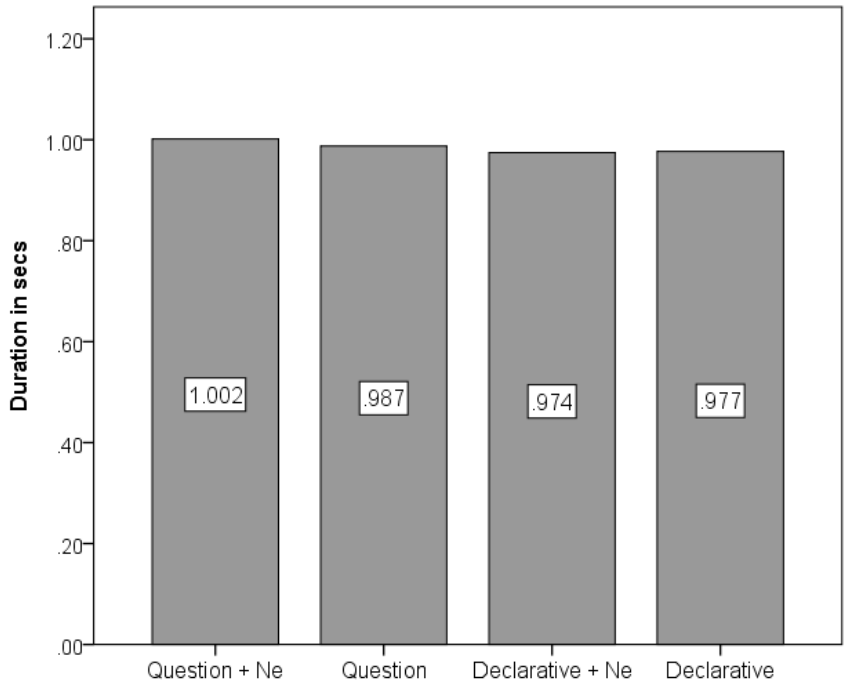

Figure 9. Total Duration Minus Wh-word/Object and Particle

From the graph in Figure 9, it is evident that there is no significant difference between questions and declaratives with or without *ne*. To confirm this, a paired samples T-test was executed, of which the results can be seen in Table 4.

Table 4. Total Duration Minus Wh-word/Object and Particle; Results from a Paired Samples T-test.

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Questions + Ne vs. Questions	0.01663	0.11061	0.00798	2.084	191	0.038
Declaratives + Ne vs. Declaratives	-0.00250	0.11934	0.00864	-0.289	190	0.773

Table 4 shows that the difference in duration between questions with *ne* (M=1.003, N= 192, SD=0.157) and questions without *ne* (M= 0.986, N= 192, SD= 0.157) is not statistically significant: t(191)= 2.084, p= 0.038. In declaratives, the difference between declaratives with *ne* (M= 0.974, N=191, SD= 0.163) and declaratives without *ne* (M=0.977, N=191, SD=0.169) is even less significant: t(190)= -0.289, p=0.773.

From the paired samples T-test, we can conclude that the differences in duration of the syllables leading up to the wh-word or object between the cases with and without *ne* are not significant. This suggests that *ne* only influences the word directly preceding it, and does not influence the syllables earlier in the same sentence.

4.3.2 Frequency

After examining the duration data resulting from the production experiment, the next step is to investigate the frequency data of the same experiment. The construction of this section is the

same as the previous one. First, the frequency of *ne* itself is presented, after which we move on to the word preceding *ne*, and lastly the entire sentence. The results are shown in semitones (ST) rather than in Hertz, the reason for this being that data represented in semitones does not show any distortions when data of males and females are mixed.

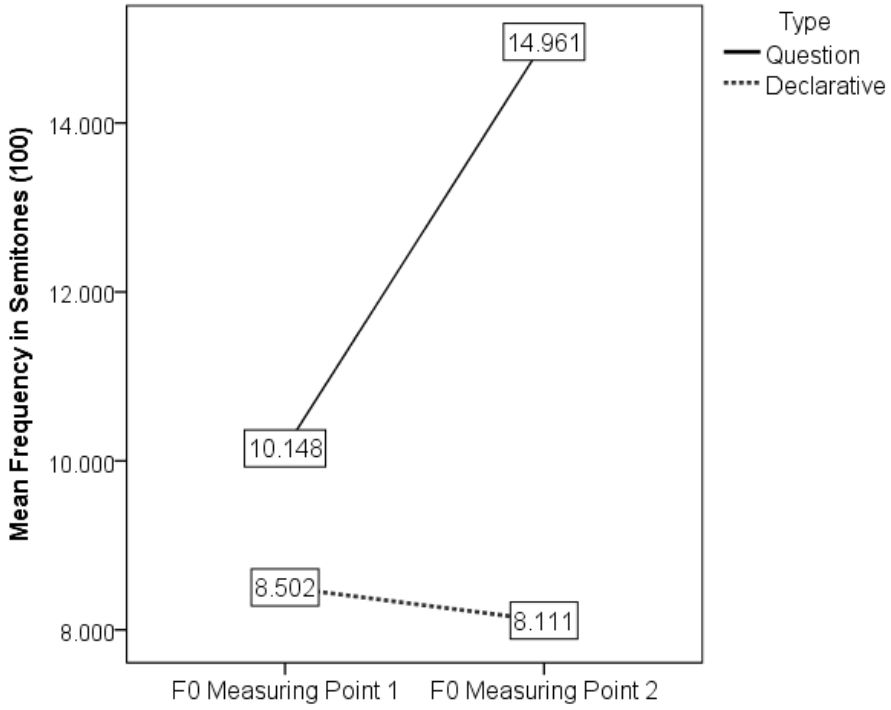

Figure 10. **Pitch Contour of *ne*.**

Figure 10 shows the pitch contour of *ne*. As stated in the analysis, a script was run to determine the minimum and maximum F0 within the particle. This script also calculated which of the two points came first. These points are presented in Figure 10: the first F0 measuring point is on the left, while the second and last F0 measuring point can be found on the right-hand side.

The uninterrupted line represents the pitch contour in questions, and the dotted line represents the pitch contour in declaratives. From a first glance, we see that there is a salient difference between the two pitch flows. As expected from the background literature on intonation in section 2.2, there is a rise in questions and a declination in statements. The particle *ne* starts at 10.148 ST in questions, and continuing to rise until 14.961 ST. In declaratives, *ne* begins at 8.502 ST, and lowers slightly to 8.111 ST.

The frequency of *ne* was inspected for both Mainland and Taiwanese speakers. For Taiwanese speakers, the frequency range of *ne* in questions was smaller. Averagely, the frequency raised from 12,447 ST to 15,150 ST for Taiwanese speakers, and from 9.013 ST to 14.867 ST for speakers from Mainland China. A slight difference in declaratives was also measured. Since in my research there were not an equal number of Taiwanese and Mainland speakers, further research will have to prove whether this difference in frequency is significant.

Table 5. Comparison of F0 measuring points in Questions and Declaratives; Results from Paired Samples T-test.

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
F0 Point 1 in Questions vs. Declaratives	1.46751	8.30786	0.47262	3.105	308	0.002
F0 Point 2 in Questions vs. Declaratives	6.77816	8.84674	0.50327	13.468	308	0.000

A paired samples T-test in Table 5 was executed to examine whether the difference between the frequency of the F0 points of questions and declaratives was significant. The discrepancy of the first F0 measuring point in questions (M=9.970, N= 309, SD=4.384) and declaratives (M=8.503, N= 309, SD=7.085) was found to be statistically significant at the five percent level: t(308)= 3.105, p=0.002. The difference of the second F0 measuring point in questions (M=14.889, N=309, SD=5.435) and declaratives (M=8.110, N=309, SD=7.348) was also tested to be statistically significant: t(308)= 13.468, p=0.000.

The results from Table 5 show that there is a significant difference in the prosody of the particle *ne* in questions and declaratives, with respect to frequency.

The next step is to investigate the frequency level of the word preceding *ne*, to construct a picture of the possible influence *ne* has on the preceding syllables. In Figure 11, the frequency of the lowest point of the wh-word or noun phrase is displayed in semitones.

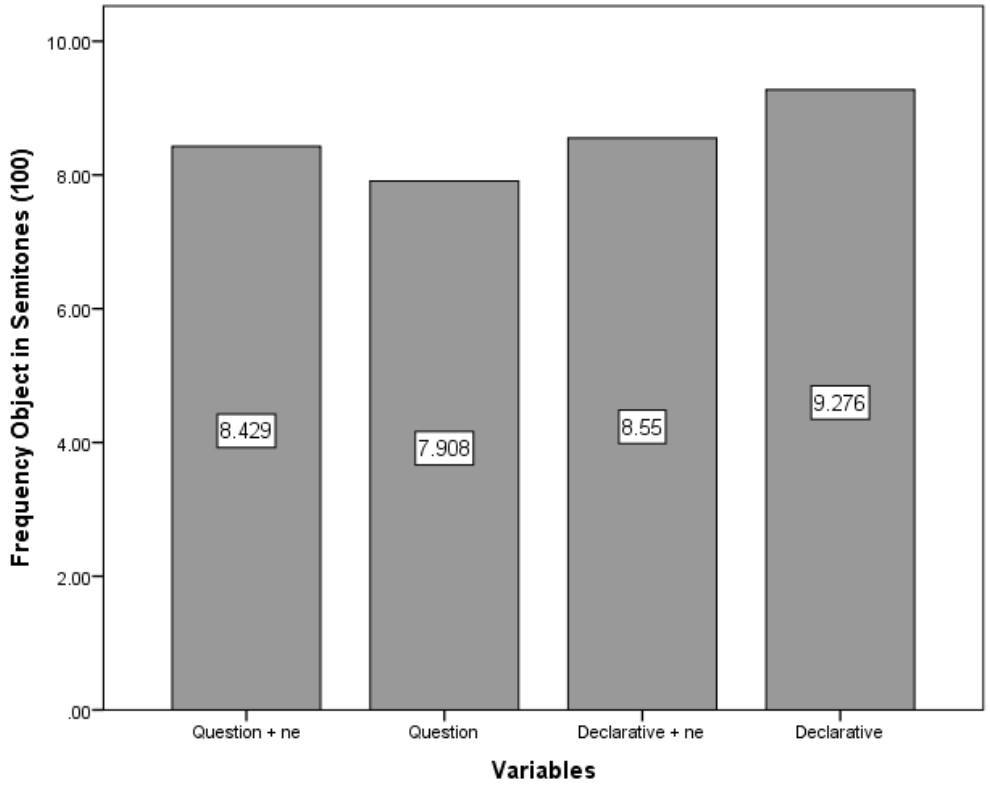

Figure 11. Frequency of word preceding *ne* in semitones

Recall that I placed several F0 measuring points in the sentences during the analysis, which were explained in section 4.2. Figure 11 shows the frequency of the sixth measuring point, which was placed on the start of the final rise: the low point in wh-words and objects.

The mean frequency of wh-words is 8.429 ST in questions with *ne*, and 7.908 ST in questions without *ne*: a difference of 0.521 ST. In cases where *ne* is present, the frequency of the wh-word is higher. The mean frequency of objects in declaratives with *ne* is 8.55 ST, while it is 9.276 ST in declaratives where *ne* is not present: a difference of 0.726 ST. Here, interestingly, the frequency of the object is lower when *ne* occurs in the same sentence.

In Table 6 below, results of a paired samples T-test show the significance of the difference in frequency between wh-words and objects in sentences with and without the sentence final particle *ne*.

Table 6. Comparison of Frequency of Wh-word/Object in questions and declaratives with and without *ne*; Results of a Paired Samples T-test.

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Questions with Ne vs. Questions without Ne	.39620	2.57967	.13540	2.926	362	.004
Declaratives with Ne vs. Declaratives without Ne	-.72369	3.91853	.20102	-3.600	379	.000

In the paired samples T-test, the significance of the difference in frequency was calculated. For questions, the frequency of wh-words in questions with *ne* (M=8.296, N=363, SD= 4.377) and questions without *ne* (M=7.900, N=363, SD= 4.513) was found statistically significant: t(362)=2.926, p=0.004. For declaratives, the frequency level of objects in declaratives with *ne* (M=8.558, N=380, SD= 4.980) and declaratives without *ne* (M=9.281, N=380, SD= 5.734) was also found statistically significant: t(379)= -3.600, p=0.000.

The results in Table 6 show that *ne* significantly influences the frequency of the wh-word or object.

Since it is now proven that the particle affects the prosody of the preceding word, it is possible that *ne* influences the frequency of the rest of the sentence as well.

Figure 12 presents the pitch flow of the entire sentence. All of the utterances were included: the figure shows tonal contours of questions with and without *ne*, and the frequency of declaratives with and without *ne*.

As shown in the legend, frequency measurements of questions are presented in uninterrupted lines, while the frequency of declaratives is shown with a dotted line. Sentences with *ne* are shown in black, and sentences without the particle are shown in grey.

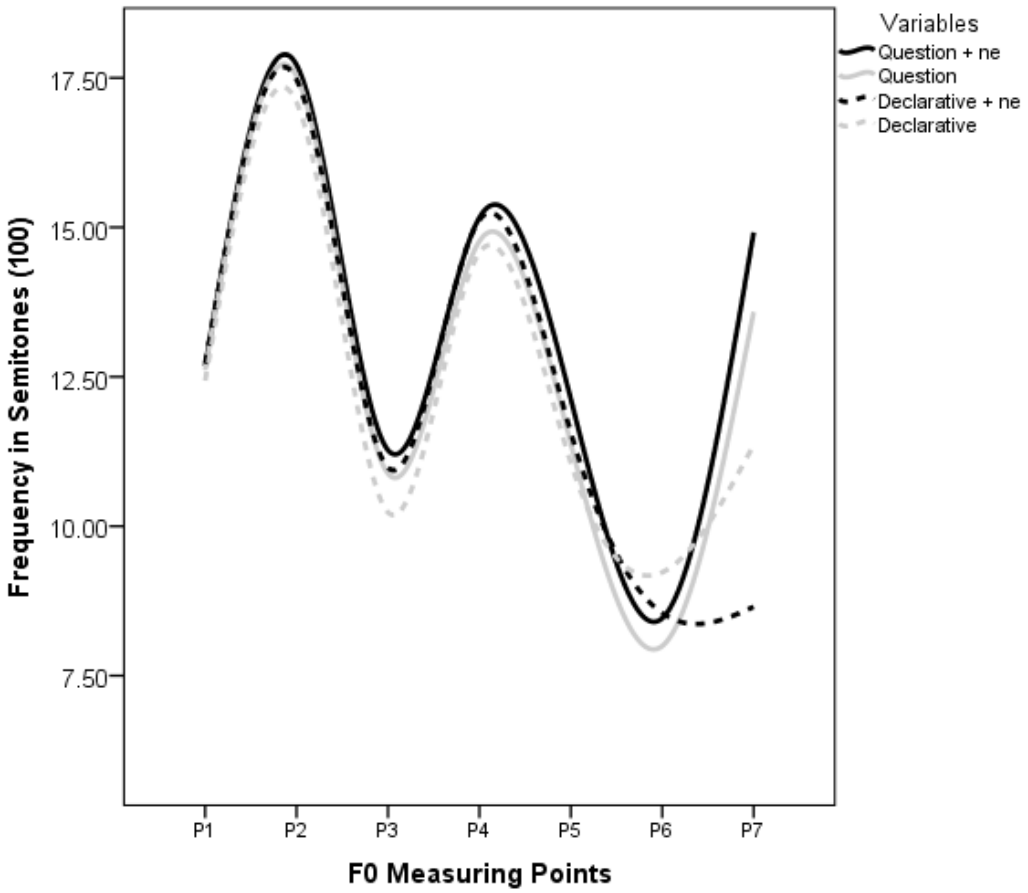

Figure 12. Frequency at F0 measuring points throughout the entire sentence.

At a first glance, it is evident that while the sentences start at a similar frequency, the sentence endings are all very distinct. The unmarked sentences, i.e. without a particle, end on a mid or mid-high key. When *ne* is added, the question ends much higher while the declarative is much lower in the end.

Other than the final part of the sentence, it can be noticed that from the third F0 measuring point on, the unmarked sentences are slightly lower in frequency than the sentences marked with *ne*.

A one-way Anova (Table 7) was carried out to test whether there were any significant differences between the frequency levels of the four different variables.

Table 7. Comparison of F0 points throughout the sentences; Results from a one-way Anova

		Sum of Squares	df	Mean Square	F	Sig.
P1	Between Groups	12.645	3	4.215	.204	0.893
	Within Groups	31176.579	1512	20.619		
	Total	31189.224	1515			
P2	Between Groups	48.757	3	16.252	.823	0.481
	Within Groups	29849.440	1511	19.755		
	Total	29898.198	1514			
P3	Between Groups	173.448	3	57.816	2.507	0.057
	Within Groups	34773.986	1508	23.060		

	Total	34947.434	1511			
P4	Between Groups	83.111	3	27.704	1.309	0.270
	Within Groups	31649.694	1496	21.156		
	Total	31732.806	1499			
P5	Between Groups	195.574	3	65.191	2.435	0.063
	Within Groups	40261.254	1504	26.769		
	Total	40456.828	1507			
P6	Between Groups	356.565	3	118.855	4.910	0.002
	Within Groups	36477.430	1507	24.205		
	Total	36833.995	1510			
P7	Between Groups	8436.804	3	2812.268	102.469	0.000
	Within Groups	41167.651	1500	27.445		
	Total	49604.455	1503			

The one-way Anova shows that the difference in frequency get more and more significant towards the end of the sentence. Point 6 F(3, 1507)= 118.86, p= 0.002, and 7 F(3, 1500)= 102.47, p=0.000, are the most significant. Recall that these points were placed on respectively the start and end of the final rise. Point 3 also shows a difference that is significant at the 10% level, F(3, 1508)= 57.82, p=0.057, as well as point 5, F(3, 1504)= 65.19, p=0.063, although not significant at the five percent level. In the discussion I will explain the cause for these results.

In this chapter I have presented the results from the analysis of sentences with and without the sentence final particle *ne,* with respect to the prosodic properties: frequency and duration. Paired samples T-tests have shown that the duration and frequency of *ne* in questions and declaratives differ significantly from eachother. In addition, the particle has a significant influence on the duration and frequency of the word preceding it, but less so on the rest of the sentence. These results are discussed in more detail in the following chapter.

4.4 Discussion

In this chapter, I discuss the results presented in section 4.3, and examine how they relate to the research questions posed at the beginning of chapter 4. The main goal of the production experiment was to investigate whether the particle *ne* has different realizations in terms of duration and frequency in questions and declaratives. The results have shown that there is a significant difference of *ne* present in interrogative and in declarative sentences, both in duration (see Table 2), and frequency (see Table 5). *Ne* is longer in questions than it is in declaratives, as also shown in Figure 5. Concerning the frequency, Figure 10 shows a significant rise for *ne* in questions, and a declination of *ne* in declaratives. The frequency was measured at the beginning and end of *ne*; the differences in the results were found significant by the paired samples T-test in Table 5.

Secondly, I investigated the prosodic properties of the word preceding *ne*, and if those properties were different when the element was placed in the environment without the particle, namely the unmarked sentences. The word in question was a wh-word or a noun phrase. Tests were run separately for the two wh-words, since they differ in length. The results in Table 3 show that when the wh-word or noun phrase is followed by the particle *ne*, the word is significantly shorter than in the unmarked environment, proving that *ne* does in fact influence

the duration of the preceding word. Here, the effect of *ne* is the same in questions and statements; in both conditions, the preceding word is shortened.

When looking at the frequency, we find again that *ne* significantly influences the preceding word. However, here the effects on questions and declaratives are not parallel (see Figure 11). In questions, the wh-word is higher when *ne* is present, while in declaratives, the noun phrase is lower in this condition. Both differences in frequency were found to be significant by the paired samples T-test in Table 6. Nonetheless, the fact that *ne* heightens preceding words in questions and lowers preceding words in declaratives does not have to be a complication. In fact, it can be stated that *ne* strengthens the natural pitch flow of the sentence. Recall that in the background section on intonation (section 2.2), it was stated that unmarked questions and particle questions rise at the end, while there is a declination in declaratives. With the presence of *ne*, this final rise and declination is enhanced.

With respect to the frequency of the wh-words and noun phrases, another question was raised by looking at Figure 11. If questions are higher than declaratives, then why are the wh-words lower in frequency than the noun phrases? The reason for this is most likely that as we know, in questions, the end is rising. In order to make the rise salient, the element preceding the rise is lowered in frequency. As a result, the frequency at measuring point 6 is low, but high at the end of the sentence. In declaratives, there is no rise at the end, but a declination instead. Because of this, the frequency of declaratives is higher at point 6 than at point 7.

Lastly, the duration and frequency of the utterance as a whole was investigated. Sentences with and without the presence of *ne* were compared. To measure the difference in duration, possibly influenced by *ne*, correctly, the particle was cut off to ensure that the syllable count was equal amongst the sentences. Sentences with the wh-word *shéi* 'who' were analyzed separately, since these sentences were one syllable shorter than the others.

In terms of duration, it was shown that although *ne* significantly shortens the duration of the preceding word, no significant effects were measured in the rest of the sentence. Figure 9 shows that the syllables preceding the wh-word or noun phrase were all of approximately the same length.

Concerning the frequency, the one-way Anova of which the results were presented in Table 7, suggested that the differences between sentences with and without *ne* grows more and more significant towards the end of the sentence, which was also the case in duration. The frequency results show that all types of sentences were of a similar frequency at the beginning (point 1), but at the end of the sentence (point 7), all types had very distinct realizations. Unmarked questions and declaratives end at a mid-high and mid key, respectively. Marked questions end much higher, while marked statements end much lower. Difference in frequency was tested to be significant at point 6 and 7, which were placed on the begin and end of the final rise.

From the second measuring point until the sixt measuring point, unmarked sentences have a lower frequency than sentences with *ne*, although this difference does not become significant until F0 measuring point 6. At points 3 and 5, this difference is tested to be relatively significant compared to point 4, for example. The difference in frequency of point 3 can be attributed to the different lexical tones which were used for the verb, where point 3 was placed. The slight significance of F0 measuring point 5 can be explained by taking the different adverbials into account. Points 4 and 5 were placed on the start and end of the fall within the adverbial. Three adverbials were used, of which the pitch level was falling in all cases, either by lexical tone or by declination. However, in cases where the next syllable starts with a high key, the fall of the adverbial would not be as steep.

To conclude the discussion of the results from the production experiment I carried out, and to answer the research questions for this experiment: 1) yes, *ne* has different realizations in terms of duration and frequency in questions and declaratives. The particle is longer and

higher in questions, while shorter and lower in declaratives. 2) Yes, *ne* influences both the duration and frequency of the preceding word. The preceding word is shortened when *ne* is present. The frequency of the preceding word in questions is heightenend, while the frequency of the preceding word is lowered in statements. 3) No, *ne* does not influence the duration of the rest of the sentences. With respect to frequency, similarly, the differences in the area preceding the wh-word or noun prhase are not statistically significant. 4) If there were any significant differences present, they were attested in both questions and declaratives. Recall that with respect to the influence of the frequency of the word preceding *ne*, there was an enhancing effect which caused the results in questions and declaratives to be dissimilatory.

In this chapter, I have answered all of the research questions I aimed to explore with the production experiment. In the next chapter, I introduce the perception experiment I carried out, and explore the last research question: namely if the attested differences were perceptible by native speakers.

5. Perception experiment

The results from the production experiment show that there are different realizations of *ne* in declaratives and questions, which help to identify the type of the sentence. Results also proved that *ne* influences the duration and frequency of the preceding syllables, especially the syllables directly preceding the particle.

In this perception experiment, the aim is to investigate whether *ne* influences the sentences in such a way, that the type is easier to be identified by native speakers.

In the following experiment, native speakers will be presented with stimuli where the sound is cut before the object. This is crucial, since the sentence type can be correctly identified by knowing nature of the object (wh-word or noun phrase). The stimuli are explained more elaborately in the following section. Stimuli include sentences with and without *ne*. This way, I can examine whether there are any perceptible cues for sentence type identification, and see how that correlates to the presence or absence of *ne*.

While it was attested in the previous chapter that *ne* has the most influence on the syllables directly preceding the particle (the noun phrase or wh-word), the object is not included in the stimuli in this perception test. I am aware that the most significantly influenced part of the sentence is not included in the stimuli. However, it is imperative to exclude it, since otherwise the sentence typing test would not be logical, because the type would be obvious if the object is present. Since the elements preceding the object were not significantly influenced by *ne*, according to the various tests in section 4.3, my hypothesis is that it will not be easier to identify the sentence when *ne* is present.

5.1 Methods

5.1.1 Stimuli

The stimuli of this experiment were constructed by using selected sound files produced during the production experiment. As stated before, the syntactic structure of the sentences produced during the first experiment matched the following: Subject + Verb + Perfective marker + Adverbial + Object (+NE).

In this experiment, the gating principle was used, meaning that the stimuli were cut at different positions, in order to know at which point the participant can guess the sentence type

correctly. There would be two parts, preceded by a few examples. In the first part, the stimuli consisted of the subject, verb and the perfective marker. In the second part, the adverbial was added. The listener would not get to hear the entire utterance afterwards. See Table 8 for an example of each part of the experiment.

Table 8, Example Perception Stimuli

a	Example Part I		
	Mǐ Lóng wán le	*A) yíxià shénme?*	'What did Mi Long play?'
		B) yixià diànnǎo.	'Mi Long played on the computer.'
b	Example Part II		
	Lù Yíng hē le yidiǎn	*A) shénme?*	'What did Lu Ying drink?'
		B) niúnǎi.	'Lu Ying drank some milk.'

The original sound files were cut using Praat software. In order to not confuse the participants, data of only one native speaker were used to build the experiment. To balance out the stimuli, an even number of sound files were used from each of the four sentence types presented in the production experiment: questions with *ne*, questions without *ne*, declaratives with *ne*, and declaratives without *ne*. While sentences with the particle *ne* were included in the sound files, the continuations did not include *ne*. The purpose of this experiment was to find out if the sentence type was easier to recognize with or without the presence of *ne*. It was of no significance for this experiment whether the listeners can identify the presence of *ne*, therefore I decided not to include the particle in the continuations. All of the target stimuli used for this experiment as well as their continuations can be found in Appendix D.

Before carrying out the experiment, it was tested on a native speaker who would not be a part of the actual perception experiment. This speaker pointed out that at the end of the adverbial phrase some kind of phonetic cue for the correct continuation could be heard in some cases. For example, one of the adverbials used is *yíxià*. It seems that a difference can be heard in the vowel [a] of this word, depending on the following consonant. To avoid participants making use of these acoustic cues instead of prosodic cues, the sound files were cut a bit more to ensure that the acoustic cues were no longer present. I paid special attention to not shorten the stimuli too much, to prevent the adverbial from becoming less recognizeable.

5.1.2 Procedure

The experiment was carried out in the silent room of the East Asian Library of Leiden University. The perception experiment was conducted over a PC, using MFC Praat. Participants used headphones during the experiment.

Written instructions appeared on the computer screen and participants could spend as much time as they needed to read them. Once ready, participants started the experiment. Upon mouse-clicking, a stimulus was played and the two possible sentence continuations appeared on the screen; participants had to complete the main clause they heard by selecting one of the two possible continuations. The continuations were presented in simplified Chinese characters. For an example of the stimuli and the two continuations, recall the examples in Table 8. The order of the appearance of the two possible continuations was counterbalanced, so as not to bias the participant. During the experiment, the stimuli were randomized. Each participant heard all 64 stimuli.

Before the actual experiment began, several examples were presented to prepare the participants. The examples were not randomized. As previously, in the first part of the

experiment they would hear a sentence up to the end of the verbal phrase, which includes the perfective marker. In the second experiment, they could hear up to the end of the adverbial.

After the first part, the participants could take a break if they wanted to, before proceeding with the second part of the experiment. The experiment was self-paced and lasted approximately 10 minutes.

5.1.3 Participants

Ten native speakers participated in the perception experiment, eight females and two males. All native speakers belonged to the same age group (age range from 22 to 30). None of them reported any hearing disorders. All speakers but one had also participated in the production experiment. I also excluded the participant whose recordings were used to construct the target stimuli from participation. The time difference between the two experiments was 42 days[10]. The profile of the new participant is given in Table 9. For convenience, I have repeated the background data of the other participants.

Table 9. Native Speaker Background Information

Listener	Gender	Age	Origin	Region	Mother Language	Dialect
01	F	22	Taiwan	Taipei	Mandarin	Taiwanese
02	M	29	Mainland	Jinan	Jinan dialect	Jinan dialect
03	F	26	Taiwan	Taipei	Mandarin	Southern Min
06	F	30	Taiwan	Kaohsiung	Mandarin	Taiwanese
07	F	24	Mainland	Sichuan	Chongqing dialect	Chongqing dialect
08	F	28	Taiwan	Taipei	Mandarin	Taiwanese
09	M	27	Mainland	Yanggu	Yanggu dialect	Yanggu dialect
11	F	26	Mainland	Luoyang	Mandarin	-
12	F	24	Mainland	Shanghai	Mandarin	Shanghai dialect
13	F	28	Mainland	Tianjin	Mandarin	-

5.2 Analysis

A total of 640 responses (10 listeners × 32 stimuli × 2 blocks) were analyzed. I first inspected participants' responses and decided to exclude listener 2, as he chose a question continuation as a response only once during the entire experiment.

The data were imported to SPSS and analyzed from there. The results are displayed and discussed in the following section.

[10] I am aware of the fact that this is not an ideal experimental setting, but it was a necessary compromise due to time limitations. However, I would also argue that the time between the two experiments (42 days) is enough in order to make any unwanted effects due to their participation in the production experiment disappear.

5.3 Results

For the accuracy results of the first part of the experiment, i.e. the part where participants could hear the subject and the verbal phrase, please consult Table 10.

Table 10. Part I Accuracy broken down by listener

			Accuracy	
			Correct	Incorrect
Listener	1	Count	15	17
		% within listener	46.9%	53.1%
	3	Count	22	10
		% within listener	68.8%	31.3%
	6	Count	16	16
		% within listener	50.0%	50.0%
	7	Count	17	15
		% within listener	53.1%	46.9%
	8	Count	21	11
		% within listener	65.6%	34.4%
	9	Count	15	17
		% within listener	46.9%	53.1%
	11	Count	20	12
		% within listener	62.5%	37.5%
	12	Count	14	18
		% within listener	43.8%	56.3%
	13	Count	16	16
		% within listener	50.0%	50.0%
Total		Count	156	132
		% within listener	54.2%	45.8%

In Table 10, the mean accuracy of the listeners is 54.2%. There are only three listeners who perform exceptionally well, and guessed more than 60% correctly. The other participants chose about half of the continuations accurately, which suggest that it was a random choice for them.

Figure 13 provides more information regarding the response, broken down by the presence of the particle. It shows the sentence type of the stimuli, and the sentence type of the continuation that was chosen in the response. The results for stimuli where *ne* was present in the original soundfiles are given in the left column; the results for stimuli where *ne* was absent in the original soundfiles are given in the right column. The number of cases is shown beneath the percentage.

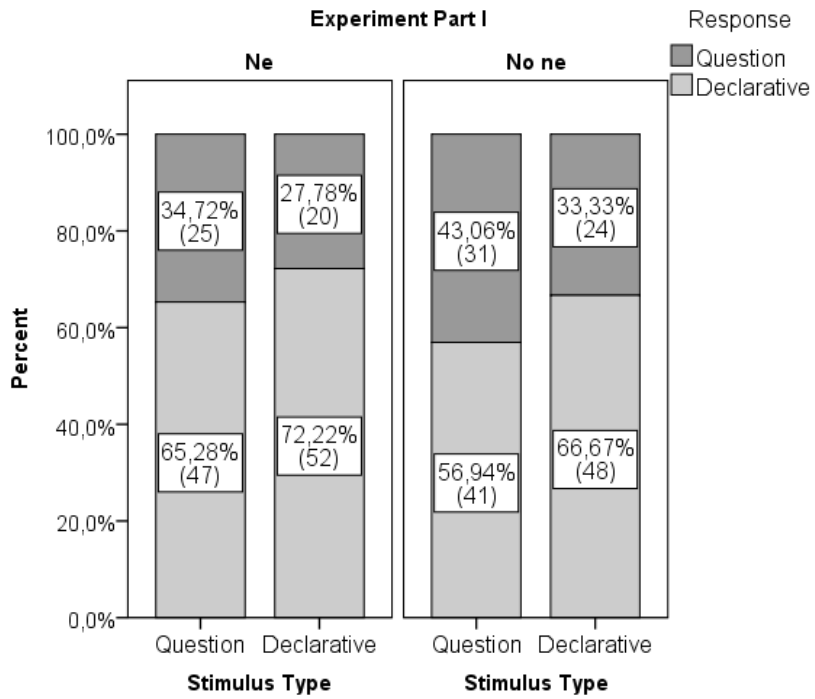

Figure 13. Stimulus Type and Response Experiment I.

In Figure 13, it can be observed that in the sentences where *ne* was present, a question was identified correctly in 34.72% of the cases, while declaratives were identified correctly in 72.22% of the cases. Note that in the cases where *ne* was not present, provided in the righthand column, a question was identified correctly as a question in 43.06% of the cases, which is 8.34% more than in situations with *ne*. When a declarative stimulus was presented, of which the original soundfile did not contain *ne*, a correct response was given in 66.67% of the cases, which is a decline of 5.55% compared to the data with *ne*.

Notice that regardless of *ne*, it is easier for the listeners to correctly identify a statement, than to correctly identify a question.

I also ran a binary logistic regression for the first part of the experiment, having the response as a dependent variable, and including sentence type (two values) and particle (two values) as predictors. The results show that neither sentence type (B= -0.371, Wald= 2.210, $p > 0.05$) nor particle (B= 0.310, Wald= 1.540, $p > 0.05$) were good predictors with respect to participants' responses.

Concerning part II of the experiment, one would expect that because the stimuli are longer, that this would aid the participant in choosing the correct sentence type. The accuracy of the second part is shown in Table 11.

Table 8, Part II Accuracy broken down by listener

			Accuracy	
			Correct	Incorrect
Listener	1	Count	15	17
		% within listener	46.9%	53.1%
	3	Count	18	14
		% within listener	56.3%	43.8%
	6	Count	17	15

		% within listener	53.1%	46.9%
	7	Count	17	15
		% within listener	53.1%	46.9%
	8	Count	24	8
		% within listener	75.0%	25.0%
	9	Count	20	12
		% within listener	62.5%	37.5%
	11	Count	19	13
		% within listener	59.4%	40.6%
	12	Count	24	8
		% within listener	75.0%	25.0%
	13	Count	20	12
		% within listener	62.5%	37.5%
Total		Count	174	114
		% within listener	60.4%	39.6%

As shown, in the second part of the experiment, 60.4% of the continuations were chosen correctly, which is an improvement of 6.2%. In the first part, three listeners performed above average. In part two of the experiment, five listeners had an accuracy rate of higher than 59%. Still, most of the listeners gave correct responses half of the time, from which we can deduct that their choice is arbitrary. However, listeners 8 and 12 got 75% of the continuations right, which is the highest accuracy rate we have seen so far.

The sentence type of the stimulus and the corresponding chosen continuation is given in Figure 14. Again, the results are broken down by the presence of the particle. On the left-hand side, results of stimuli where the particle was present in the original soundfiles are given. On the right-hand side, the results of the stimuli of which the original soundfiles did not contain *ne* are given. The number of cases is shown beneath the percentage.

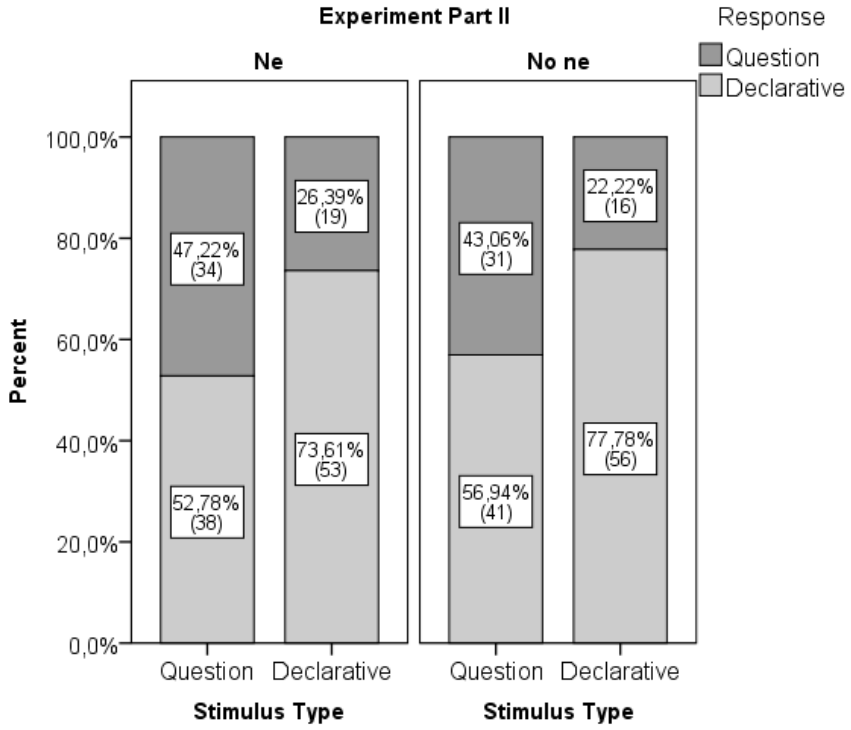

Figure 14. Stimulus Type and Response Experiment II.

The results in Figure 14 show that when *ne* is present, the listeners correctly identified a question in 47,22% of the cases, which is an improvement of 12,5% compared to the first experiment. When presented with a declarative with *ne*, the correct continuation was chosen in 73,61% of the cases, which is a slight improvement of 1,39%.

Of the stimuli where there was no particle in the original uncut soundfiles, questions were identified correctly in 43,06% of the cases, which is surprisingly exactly the same as during the first experiment. Declaratives were identified correctly in 77,78% of the cases, which is an increase of 11,11%.

Similar to the first half of the experiment, listeners were more inclined to choose a declarative continuation, regardless of the stimulus type nor the presence of the particle.

For the second part of the experiment, I ran a binary logistic regression as well, having the response as a dependent variable, and including sentence type (two values) and particle (two values) as predictors. The results show that the particle was not a good predictor with respect to participants' responses (B= -0.193, Wald= 0.579, $p > 0.05$). The results also showed that sentence type was a good predictor with respect to participants' responses (B= -0.943, Wald= 13.482, p=0.000).

Recall that Table 10 and 11 showed that several participants performed better than others, some even reaching an accuracy rate of 75% in the second half of the experiment. Out of curiosity, I selected the top four listeners by comparing the results of Part I and II together. The top four participants were listeners 3, 7, 8 and 11. The stimuli type and the listeners' responses for part I are given in Figure 15.

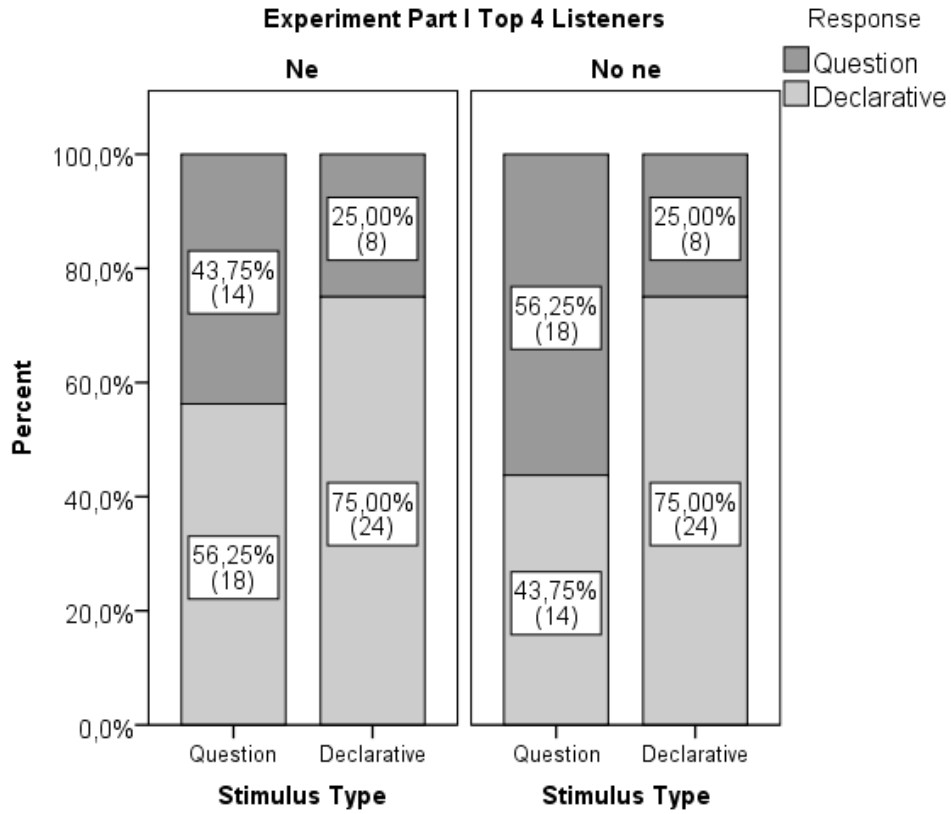

Figure 15. Experiment Part I Results from Top 4 Participants.

The results in the figure show that regardless of the presence of the particle, listeners chose 75% of the declarative continuations correctly. Just like the other participants, the top listeners find questions more difficult to identify. In cases where the uncut soundfile contains *ne*, they guess 43,75% of the questions correctly, and in cases where the uncut soundfile did not contain *ne*, 56,25% of the questions were correctly identified as questions. In all cases except the questions with ne, these results are an improvement of approximately 10% when compared to the results of all participants of Part I.

Figure 16 shows the results of the same top four participants for the second half of the experiment. As was to be expected, the listeners performed even better in this part of the perception experiment.

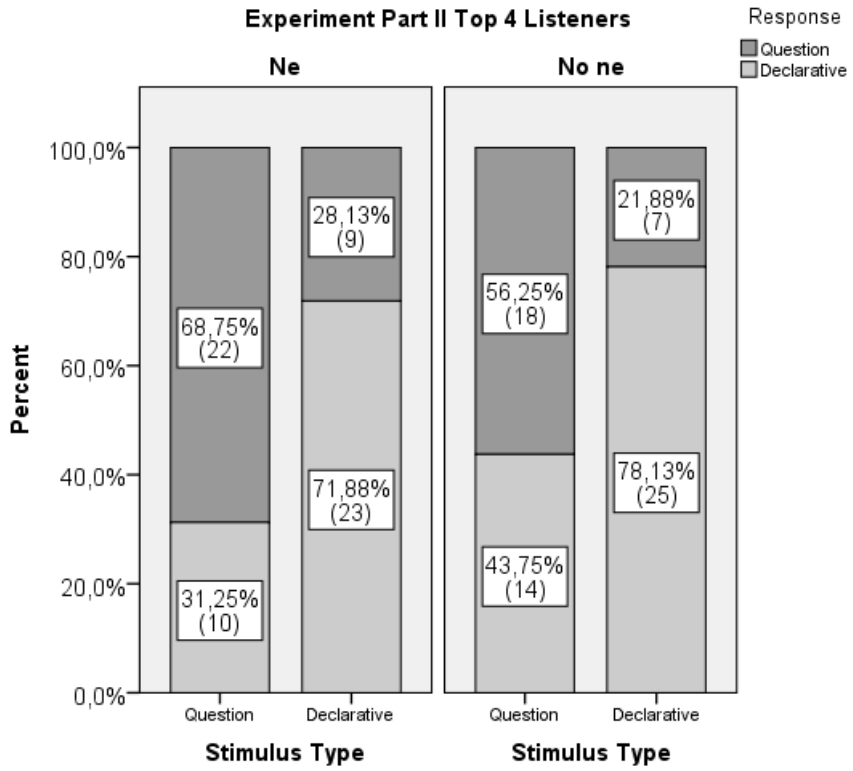

Figure 16. Experiment Part II Results from Top 4 Participants.

When we observe the correctly chosen declarative continuation in this part of the experiment, it is 71,88% in the case of stimuli with *ne*, and 78,13% in the case of stimuli without *ne*. Although the participants' performance with respect to declaratives improved in the cases without *ne* by 3,13%, the 71,88% of correctly chosen continuations in cases with *ne* is actually a decrease of 3,12%. This figure is even lower than the mean of all participants for these cases, which is very unexpected. With respect to the continuations of questions, in cases with *ne* 68,75% were chosen correctly, while 56,25% were chosen correctly in cases without the particle. The first figure is a huge improvement of 25% compared to the results of top listeners in Part I, while the second figure is exactly the same in both parts. Both are improvements of respectively 21,53% and 13,19% when compared to the cumulative results of all participants in Part II.

In this section, I have presented the results of the perception experiment. Not unexpectedly, listeners performed better in the second half of the experiment, where the stimuli were longer than in the first half of the experiment. For the first half, the average accuracy of the listeners was 54,2%, while it was 60,4% in the second part. In the next section, these results are discussed.

5.4 Discussion

In this section I discuss the results given in the previous section, and aim to explain some of the discrepancies in the results.

In the first part of the experiment, Figure 13 showed that when *ne* was present in the original soundfiles of the stimuli, participants performed better when identifying questions, but did not complete the test as successfully with respect to the identification of declaratives.

This can be explained if we take the frequency data of *ne* into account. Recall that participants of the first part of the perception experiment do not hear any further than the verbal phrase. In Figure 12 , the F0 measuring points and the mean pitch flow were given. Notice that at point 3, which is the last point the listeners can hear in part one of the experiment, both types of sentences are higher when the particle is present. This would explain why it is easier to identify questions, because one would expect a high intonation and under influence of *ne*, this frequency is higher at point 3. Concerning declaratives, however, the raised pitch level hinders the identification of the stimulus as a statement.

It was very interesting to observe that while during the first experiment, questions were identified more easily if the uncut stimuli did not contain *ne*, while in the second experiment, it was easier for the listeners to identify a question in cases where *ne* was included. With respect to declaratives, participants found them harder to identify if *ne* was present, which was also the case in the first part of the experiment. This can again be explained by looking at the pitch flow chart in Figure 12. In Part II, participants can hear up to the end of the adverbial, which correlates to measuring point 5 in the pitch flow graph. The frequency measurements of point 5 do not show a considerable difference in the graph. Notice that, however, in point 4 the differences between the sentences are very distinct. Similar to the frequency levels of point 3, questions and declaratives with *ne* are higher than the sentences without *ne*. Again, the heightened frequency facilitates the correct identification of questions, and correlates to an more difficult identification of declaratives.

In conclusion, the presence of *ne* in the uncut stimuli aids the correct identification of questions in both parts of the experiment, but impairs the correct identification of declaratives in both parts of the experiment. Recall that, however, declarative continuations were chosen correctly more often than questions. This also applies to the entire experiment. These results confirm the claim by Yuan (2006), who stated that the intonation of declaratives is unmarked and is thus the default choice of participants. The question intonation is, on the other hand, marked and thus needs some kind of cue to be perceptible. When this cue is absent, the participants choose declarative continuations. (Yuan 2006: 22)

The question to be answered by the results from this perception experiment was if the prosodic influences of *ne* can be perceived by native speakers. Since the stimuli of the perception experiment did not include the most significantly influenced element, I expected not to find any significant differences in stimuli with and without the particle. This proved to be the case. Binary logistic regression tests showed that the particle was not a good predictor with respect to participants' responses in both parts of the perception experiment. However, the sentence type of the stimuli was found to be a good predictor of the participants' responses, although only for the second half of the experiment.

6. Conclusion

In this thesis, I have studied the prosodic properties of the sentence final particle *ne* in detail. Previously unknown data such as the duration and frequency of *ne* in different environments have been contributed. In addition, prosodic information regarding the syllables preceding *ne* was given, which was also not included in the preceding literature.

The motivation for this thesis was brought about by an observation that until this day there is no consensus on the interpretation of *ne*. Different theories by several linguists have been presented and discussed in chapter 2. The main reason for there not being a consensus on the interpretation of this particle, is that there seem to be many different meanings which can all be attributed to *ne*. By studying the particle from a prosodic point of view, I have endeavored to investigate whether there are multiple prosodic realizations of *ne*.

Two experiments have been carried out: a production experiment and a perception experiment. During the production experiment, 2304 utterances with and without *ne* were collected, of which 1536 stimuli were subjected to further analysis. From the results it was clear that there are two different prosodic realizations of *ne*̩ in terms of duration and frequency. In interrogative sentences, the particle is realized with a high rising frequency, while also being longer. In declaratives, the particle has a lower tonal contour with a subtle but audible declination, and the duration is shorter. The same results also demonstrated that the prosody of *ne* influences the prosody of preceding elements in the sentence, although this influence does not travel further back than the object. This was attested for both duration and frequency data. Regarding duration, the preceding word is shortened when *ne* is present. The frequency of the preceding word in questions is heightenend, while the frequency of the preceding word is lowered in statements.

A perception experiment was carried out to investigate whether *ne* facilitates the identification of the sentence type. However, I could not include the most significantly influenced element, i.e. the object, in the stimuli, since this would give away the correct sentence type. Because of this, no significant differences in identification with respect to the presence of the particle were expected. Results from the perception experiment demonstrate that the particle is not a good predictor with respect to the listeners' responses, which confirmed my expectations. With this last result, every research question I posed in chapter 3 has been answered.

Having established that there are two different prosodic realizations of *ne*, which correlate to the sentence type, another analysis is possible for the semantic properties of *ne*. *Ne* in questions could be analyzed separately from *ne* in declaratives, since in this thesis I have provided prosodic evidence to support this view. I invite others to possibly rethink their semantic analysis of *ne*, based on the prosodic properties presented in this thesis.

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Appendices

Appendix A – Stimuli Production Experiment

The stimuli are first grouped by wh-word. Stimuli containing 'who' can be found in 1-16, those containing 'what' are presented in 17-32. The stimuli are further grouped by adverb. Numbers 1-21 make use of the adverb *yíxià* 'a while', in 22-27 use *yidiǎn* 'some', and sentences 28-32 use the adverb *yīxiē* 'some'. For each stimulus, the sentence type is given. Q stands for 'question', and D stands for 'declarative'.

Nr.	Sentence Type	Stimuli and Translation
1	Q	*Mǎ Míng mà le yixià shéi?* 'Who did Ma Ming scold ?'
	Q+ne	*Mǎ Míng mà le yixià shéi ne?* 'Who did Ma Ming scold ?'
	D	*Mǎ Míng mà le yixià Yú Lóng.* 'Ma Ming scolded Yu Long.'
	D+ne	*Mǎ Míng mà le yixià Yú Lóng ne.* 'Ma Ming scolded Yu Long.'
2	Q	*Yú Líng dǎ le yixià shéi?* 'Who did Yu Ling hit?'
	Q+ne	*Yú Líng dǎ le yixià shéi ne?* 'Who did Yu Ling hit?'
	D	*Yú Líng dǎ le yixià Mǎ Méng.* 'Yu Ling hit Ma Meng.'
	D+ne	*Yú Líng dǎ le yixià Mǎ Méng ne.* 'Yu Ling hit Ma Meng.'
3	Q	*Mǎ Dīng bang le yixià shéi?* 'Who did Ma Ding help?'
	Q+ne	*Mǎ Dīng bang le yixià shéi ne?* 'Who did Ma Ding help?'
	D	*Mǎ Dīng bang le yixià Yú Yáng.* 'Ma Ding helped Yu Yang.
	D+ne	*Mǎ Dīng bang le yixià Yú Yáng ne.* 'Ma Ding helped Yu Yang.'
4	Q	*Wú Yǐng wěn le yixià shéi?* 'Who did Wu Ying kiss?'
	Q+ne	*Wú Yǐng wěn le yixià shéi ne?* 'Who did Wu Ying kiss?'
	D	*Wú Yǐng wěn le yixià Yú Lóng.* 'Wu Ying kissed Yu Long.'
	D+ne	*Wú Yǐng wěn le yixià Yú Lóng ne.* 'Wu Ying kissed Yu Long.'

5	Q	*Mǎ Yīng bào le yixià shéi?* 'Who did Ma Ying hug?'
	Q+ne	*Mǎ Yīng bào le yixià shéi ne?* 'Who did Ma Ying hug?'
	D	*Mǎ Yīng bào le yixià Wú Líng.* 'Ma Ying hugged Wu Ling.'
	D+ne	*Mǎ Yīng bào le yixià Wú Líng ne.* 'Ma Ying hugged Wu Ling.
6	Q	*Wú Dīng zhǎo le yixià shéi?* 'Who did Wu Ding look for?'
	Q+ne	*Wú Dīng zhǎo le yixià shéi ne?* 'Who did Wu Ding look for?'
	D	*Wú Dīng zhǎo le yixià Bó Yáng.* 'Wu Ding looked for Bo Yang.'
	D+ne	*Wú Dīng zhǎo le yixià Bó Yáng ne.* 'Wu Ding looked for Bo Yang.'
7	Q	*Lù Yáng tī le yixià shéi?* 'Who did Lu Yang kick?'
	Q+ne	*Lù Yáng tī le yixià shéi ne?* 'Who did Lu Yang kick?'
	D	*Lù Yáng tī le yixià Mǐ Míng.* 'Lu Yang kicked Mi Ming.'
	D+ne	*Lù Yáng tī le yixià Mǐ Míng ne.* 'Lu Yang kicked Mi Ming.'
8	Q	*Bó Míng lā le yixià shéi?* 'Who did Bo Ming pull?'
	Q+ne	*Bó Míng lā le yixià shéi ne?* 'Who did Bo Ming pull?'
	D	*Bó Míng lā le yixià Lù Yíng.* 'Bo Ming pulled Lu Ying.'
	D+ne	*Bó Míng lā le yixià Lù Yíng ne.* 'Bo Ming pulled Lu Ying.'
9	Q	*Mǐ Líng fú le yixià shéi?* 'Who did Mi Ling help up?'
	Q+ne	*Mǐ Líng fú le yixià shéi ne?* 'Who did Mi Ling help up?'
	D	*Mǐ Líng fú le yixià Lù Míng.* 'Mi Ling helped Lu Ming up.'
	D+ne	*Mǐ Líng fú le yixià Lù Míng ne.* 'Mi Ling helped Lu Ming up.'
10	Q	*Wú Yáng kàn le yixià shéi?* 'Who did Wu Yang stare at?'
	Q+ne	*Wú Yáng kàn le yixià shéi ne?* 'Who did Wu Yang stare at?'
	D	*Wú Yáng kàn le yixià Yú Méng.* 'Wu Yang stared at Yu Meng.'
	D+ne	*Wú Yáng kàn le yixià Yú Méng ne.* 'Wu Yang stared at Yu Meng.'

11	Q	*Mǎ Lóng niē le yixià shéi?* 'Who did Ma Long pinch?'
	Q+ne	*Mǎ Lóng niē le yixià shéi ne?* 'Who did Ma Long pinch?'
	D	*Mǎ Lóng niē le yixià Lǐ Méng.* 'Ma Long pinched Li Meng.'
	D+ne	*Mǎ Lóng niē le yixià Lǐ Méng ne.* 'Ma Long pinched Li Meng.'
12	Q	*Lǐ Lóng pèng le yixià shéi?* 'Who did Li Long run into?'
	Q+ne	*Lǐ Lóng pèng le yixià shéi ne?* 'Who did Li Long run into?'
	D	*Lǐ Lóng pèng le yixià Yú Yáng.* 'Li Long ran into Yu Yang.'
	D+ne	*Lǐ Lóng pèng le yixià Yú Yáng ne.* 'Li Long ran into Yu Yang.'
13	Q	*Lù Míng piàn le yixià shéi?* 'Who did Lu Ming deceive?'
	Q+ne	*Lù Míng piàn le yixià shéi ne?* 'Who did Lu Ming deceive?'
	D	*Lù Míng piàn le yixià Mǐ Yáng.* 'Lu Ming deceived Mi Yang.'
	D+ne	*Lù Míng piàn le yixià Mǐ Yáng ne.* 'Lu Ming deceived Mi Yang.'
14	Q	*Lǐ Yáng zàn le yixià shéi?* 'Who did Li Yang praise?'
	Q+ne	*Lǐ Yáng zàn le yixià shéi ne?* 'Who did Li Yang praise?'
	D	*Lǐ Yáng zàn le yixià Wú Míng.* 'Li Yang praised Wu Ming.'
	D+ne	*Lǐ Yáng zàn le yixià Wú Míng ne.* 'Li Yang praised Wu Ming.'
15	Q	*Lú Méng zhuā le yixià shéi?* 'Who did Lu Meng grab?'
	Q+ne	*Lú Méng zhuā le yixià shéi ne?* 'Who did Lu Meng grab?'
	D	*Lú Méng zhuā le yixià Mǐ Yáng.* 'Lu Meng grabbed Mi Yang.'
	D+ne	*Lú Méng zhuā le yixià Mǐ Yáng ne.* 'Lu Meng grabbed Mi Yang.'
16	Q	*Bó Méng fá le yixià shéi?* 'Who did Bo Meng punish?'
	Q+ne	*Bó Méng fá le yixià shéi ne?* 'Who did Bo Meng punish?'
	D	*Bó Méng fá le yixià Lǐ Dīng.* 'Bo Meng punished Li Ding.'
	D+ne	*Bó Méng fá le yixià Lǐ Dīng ne.* 'Bo Meng punished Li Ding.'

17	Q	*Mǐ Lóng wán le yixià shénme?* 'What did Mi Long play?'
	Q+ne	*Mǐ Lóng wán le yixià shénme ne?* 'What did Mi Long play?'
	D	*Mǐ Lóng wán le yixià diànnǎo.* 'Mi Long played on the computer.'
	D+ne	*Mǐ Lóng wán le yixià diànnǎo ne.* 'Mi Long played on the computer.'
18	Q	*Bó Yáng nòng le yixià shénme?* 'What did Bo Yang make?'
	Q+ne	*Bó Yáng nòng le yixià shénme ne?* 'What did Bo Yang make?'
	D	*Bó Yáng nòng le yixià biǎodān.* 'Bo Yang fixed the documents.'
	D+ne	*Bó Yáng nòng le yixià biǎodān ne.* 'Bo Yang fixed the documents.'
19	Q	*Yú Lóng dǎ le yixià shénme?* 'What did Yu Long play?'
	Q+ne	*Yú Lóng dǎ le yixià shénme ne?* 'What did Yu Long play?'
	D	*Yú Lóng dǎ le yixià lánqiú.* 'Yu Long played basketball.'
	D+ne	*Yú Lóng dǎ le yixià lánqiú ne.* 'Yu Long played basketball.'
20	Q	*Mǎ Yáng gǎi le yixià shénme?* 'What did Ma Yang change?'
	Q+ne	*Mǎ Yáng gǎi le yixià shénme ne?* 'What did Ma Yang change?'
	D	*Mǎ Yáng gǎi le yixià mìmǎ.* 'Ma Yang changed the password.'
	D+ne	*Mǎ Yáng gǎi le yixià mìmǎ ne.* 'Ma Yang changed the password.'
21	Q	*Yú Yáng bǔ le yixià shénme?* 'What did Yu Yang mend?'
	Q+ne	*Yú Yáng bǔ le yixià shénme ne?* 'What did Yu Yang mend?'
	D	*Yú Yáng bǔ le yixià kǒudài.* 'Yu Yang mended the pocket.'
	D+ne	*Yú Yáng bǔ le yixià kǒudài ne.* 'Yu Yang mended the pocket.'
22	Q	*Bó Dīng chī le yidiǎn shénme?* 'What did Bo Ding eat?'
	Q+ne	*Bó Dīng chī le yidiǎn shénme ne?* 'What did Bo Ding eat?'
	D	*Bó Dīng chī le yidiǎn mángguǒ.* 'Bo Ding ate some mango.'
	D+ne	*Bó Dīng chī le yidiǎn mángguǒ ne.* 'Bo Ding ate some mango.'

23	Q	*Lù Yíng hē le yidiǎn shénme?* 'What did Lu Ying drink?'
	Q+ne	*Lù Yíng hē le yidiǎn shénme ne?* 'What did Lu Ying drink?'
	D	*Lù Yíng hē le yidiǎn niúnǎi.* 'Lu Ying drank some milk.'
	D+ne	*Lù Yíng hē le yidiǎn niúnǎi ne.* 'Lu Ying drank some milk.'
24	Q	*Mǐ Míng ná le yidiǎn shénme?* 'What did Mi Ming take?'
	Q+ne	*Mǐ Míng ná le yidiǎn shénme ne?* 'What did Mi Ming take?'
	D	*Mǐ Míng ná le yidiǎn miànbāo.* 'Mi Ming took some bread.'
	D+ne	*Mǐ Míng ná le yidiǎn miànbāo ne.* 'Mi Ming took some bread.'
25	Q	*Mǎ Líng juān le yidiǎn shénme?* 'What did Ma Ling donate?'
	Q+ne	*Mǎ Líng juān le yidiǎn shénme ne?* 'What did Ma Ling donate?'
	D	*Mǎ Líng juān le yidiǎn yīfú.* 'Ma Ling donated some clothes.'
	D+ne	*Mǎ Líng juān le yidiǎn yīfú ne.* 'Ma Ling donated some clothes.'
26	Q	*Mǎ Méng zhǔ le yidiǎn shénme?* 'What did Ma Meng boil?'
	Q+ne	*Mǎ Méng zhǔ le yidiǎn shénme ne?* 'What did Ma Meng boil?'
	D	*Mǎ Méng zhǔ le yidiǎn yùmǐ.* 'Ma Meng boiled some corn.'
	D+ne	*Mǎ Méng zhǔ le yidiǎn yùmǐ ne.* 'Ma Meng boiled some corn.'
27	Q	*Lú Lóng mài le yidiǎn shénme?* 'What did Lu Long sell?'
	Q+ne	*Lú Lóng mài le yidiǎn shénme ne?* 'What did Lu Long sell?'
	D	*Lú Lóng mài le yidiǎn mángguǒ.* 'Lu Long sold some mango.'
	D+ne	*Lú Lóng mài le yidiǎn mángguǒ ne.* 'Lu Long sold some mango.'
28	Q	*Lǐ Méng dìng le yīxiē shénme?* 'What did Li Meng order?'
	Q+ne	*Lǐ Méng dìng le yīxiē shénme ne?* 'What did Li Meng order?'
	D	*Lǐ Méng dìng le yīxiē wùpǐn.* 'Li Meng ordered several items.'
	D+ne	*Lǐ Méng dìng le yīxiē wùpǐn ne.* 'Li Meng ordered several items.'

29	Q	*Yú Méng mǎi le yīxiē shénme?* 'What did Yu Meng buy?'
	Q+ne	*Yú Méng mǎi le yīxiē shénme ne?* 'What did Yu Meng buy?'
	D	*Yú Méng mǎi le yīxiē lǐwù.* 'Yu Meng bought some presents.'
	D+ne	*Yú Méng mǎi le yīxiē lǐwù ne.* 'Yu Meng bought some presents.'
30	Q	*Lǐ Yíng yìn le yīxiē shénme?* 'What did Li Ying print?'
	Q+ne	*Lǐ Yíng yìn le yīxiē shénme ne?* 'What did Li Ying print?'
	D	*Lǐ Yíng yìn le yīxiē biǎodān.* 'Li Ying printed some documents.'
	D+ne	*Lǐ Yíng yìn le yīxiē biǎodān ne.* 'Li Ying printed some documents.'
31	Q	*Wú Líng guà le yīxiē shénme?* 'What did Wu Ling hang?'
	Q+ne	*Wú Líng guà le yīxiē shénme ne?* 'What did Wu Ling hang?'
	D	*Wú Líng guà le yīxiē yóuhuà.* 'Wu Ling hung a few oil paintings.'
	D+ne	*Wú Líng guà le yīxiē yóuhuà ne.* 'Wu Ling hung a few oil paintings.'
32	Q	*Wú Lóng fā le yīxiē shénme?* 'What did Wu Long send?'
	Q+ne	*Wú Lóng fā le yīxiē shénme ne?* 'What did Wu Long send?'
	D	*Wú Lóng fā le yīxiē yóujiàn.* 'Wu Long sent a few emails.'
	D+ne	*Wú Lóng fā le yīxiē yóujiàn ne.* 'Wu Long sent a few emails.'

Appendix B – Filler Sentences

1	Q	*Mǎ Míng mà le yixià Yú Lóng ma?* 'Did Ma Ming scold Yu Long ?'
	D	*Mǎ Míng mà le yixià shéi.* 'Ma Ming scolded someone.'
2.	Q	*Yú Líng dǎ le yixià Mǎ Méng ma ?* 'Did Yu Ling hit Ma Meng ?'
	D	*Yú Líng dǎ le yixià shéi.* 'Yu Ling hit someone.'
3.	Q	*Mǎ Dīng bang le yixià Yú Yáng ma ?* 'Did Ma Ding help Yu Yang?'
	D	*Mǎ Dīng bang le yixià shéi.* 'Ma Ding helped someone.'
4.	Q	*Wú Yǐng wěn le yixià Yú Lóng ma ?* 'Did Wu Ying kiss Yu Long?'
	D	*Wú Yǐng wěn le yixià shéi.* 'Wu Ying kissed someone.'
5.	Q	*Mǎ Yīng bào le yixià Wú Líng ma?* 'Did Ma Ying hug Wu Ling?'
	D	*Mǎ Yīng bào le yixià shéi.* 'Ma Ying hugged someone.'
6.	Q	*Wú Dīng zhǎo le yixià Bó Yáng ma?* 'Did Wu Ding look for Bo Yang
	D	*Wú Dīng zhǎo le yixià shéi.* 'Wu Ding looked for someone.'
7.	Q	*Lù Yáng tī le yixià Mǐ Míng ma?* 'Did Lu Yang kick Mi Ming?'
	D	*Lù Yáng tī le yixià shéi.* 'Lu Yang kicked someone.'
8.	Q	*Bó Míng lā le yixià Lù Yíng ma?* 'Did Bo Ming pull Lu Ying?'
	D	*Bó Míng lā le yixià shéi.* 'Bo Ming pulled someone.'
9.	Q	*Mǐ Líng fú le yixià Lù Míng ma?* 'Did Mi Ling help Lu Ming up?'
	D	*Mǐ Líng fú le yixià shéi.* 'Mi Ling helped someone up.'
10.	Q	*Wú Yáng kàn le yixià Yú Méng ma?* 'Did Wu Yang stare at Yu Meng?'
	D	*Wú Yáng kàn le yixià shéi.* 'Wu Yang stared at someone.'
11.	Q	*Mǎ Lóng niē le yixià Lǐ Méng ma?* 'Did Ma Long pich Li Meng?'
	D	*Mǎ Lóng niē le yixià shéi.* 'Ma Long pinched someone.'
12.	Q	*Lǐ Lóng pèng le yixià Yú Yáng ma?* 'Did Li Long run into Yu Yang?'

	D	*Lǐ Lóng pèng le yixià shéi.* 'Li Long ran into someone.'
13.	Q	*Lù Míng piàn le yixià Mǐ Yáng ma?* 'Did Lu Ming deceive Mi Yang?'
	D	*Lù Míng piàn le yixià shéi.* 'Lu Ming deceived someone.'
14.	Q	*Lǐ Yáng zàn le yixià Wú Míng ma?* 'Did Li Yang praise Wu Ming?'
	D	*Lǐ Yáng zàn le yixià shéi.* 'Li Yang praised someone.'
15.	Q	*Lú Méng zhuā le yixià Mǐ Yáng ma?* 'Did Lu Meng grab Mi Yang?'
	D	*Lú Méng zhuā le yixià shéi.* 'Lu Meng grabbed someone.'
16.	Q	*Bó Méng fá le yixià Lǐ Dīng ma?* 'Did Bo Meng punish Li Ding?'
	D	*Bó Méng fá le yixià shéi.* 'Bo Meng punished someone.'
17.	Q	*Mǐ Lóng wán le yixià diànnǎo ma?* 'Did Mi Long play on the computer?'
	D	*Mǐ Lóng wán le yixià shénme.* 'Mi Long played something.'
18.	Q	*Bó Yáng nòng le yixià biǎodān ma?* 'Did Bo Yang fix the documents?'
	D	*Bó Yáng nòng le yixià shénme.* 'Bo Yang made something.'
19.	Q	*Yú Lóng dǎ le yixià lánqiú ma?* 'Did Yu Long play basketball?'
	D	*Yú Lóng dǎ le yixià shénme.* 'Yu Long played something.'
20.	Q	*Mǎ Yáng gǎi le yixià mìmǎ ma?* 'Did Ma Yang change the password?'
	D	*Mǎ Yáng gǎi le yixià shénme.* 'Ma Yang changed something.'
21.	Q	*Yú Yáng bǔ le yixià kǒudài ma?* 'Did Yu Yang mend the pocket?'
	D	*Yú Yáng bǔ le yixià shénme.* 'Yu Yang mended something.'
22.	Q	*Bó Dīng chī le yidiǎn mángguǒ ma?* 'Did Bo Ding eat some mango?'
	D	*Bó Dīng chī le yidiǎn shénme.* 'Bo Ding ate something.'
23.	Q	*Lù Yíng hē le yidiǎn niúnǎi ma?* 'Did Lu Ying drink some milk?'
	D	*Lù Yíng hē le yidiǎn shénme.* 'Lu Ying drank something.'
24.	Q	*Mǐ Míng ná le yidiǎn miànbāo ma?* 'Did Mi Ming take some bread?'

	D	*Mǐ Míng ná le yidiǎn shénme.* 'Mi Ming took something.'
25.	Q	*Mǎ Líng juān le yidiǎn yīfú ma?* 'Did Ma Ling donate some clothes?'
	D	*Mǎ Líng juān le yidiǎn shénme.* 'Ma Ling donated some clothes.'
26.	Q	*Mǎ Méng zhǔ le yidiǎn yùmǐ ma?* 'Did Ma Meng boil some corn?'
	D	*Mǎ Méng zhǔ le yidiǎn shénme.* 'Ma Meng boiled something.'
27.	Q	*Lú Lóng mài le yidiǎn mángguǒ ma?* 'Did Lu Long sell some mangos?'
	D	*Lú Lóng mài le yidiǎn shénme.* 'Lu Long sold something.'
28.	Q	*Lǐ Méng dìng le yīxiē wùpǐn ma?* 'Did Li Meng order some products?'
	D	*Lǐ Méng dìng le yīxiē shénme.* 'Li Meng ordered something.'
29.	Q	*Yú Méng mǎi le yīxiē lǐwù ma?* 'Did Yu Meng buy some presents?'
	D	*Yú Méng mǎi le yīxiē shénme.* 'Yu Meng bought something.'
30.	Q	*Lǐ Yíng yìn le yīxiē biǎodān ma?* 'Did Li Ying print some documents?'
	D	*Lǐ Yíng yìn le yīxiē shénme.* 'Li Ying printed something.'
31.	Q	*Wú Líng guà le yīxiē yóuhuà ma?* 'Did Wu Ling hang some oil paintings?'
	D	*Wú Líng guà le yīxiē shénme.* 'Wu Ling hung something.'
32.	Q	*Wú Lóng fā le yīxiē yóujiàn ma?* 'Did Wu Long send some emails?'
	D	*Wú Lóng fā le yīxiē shénme.* 'Wu Long sent something.'

Appendix C – Production Experiment Questionnaire

Chinese Phonetic Experiment Questionnaire

Name/Initials	
Gender	M/F
Age	
Place of birth	
Region/Place where you have lived most of your life:	
Mother language	
Which language do you use most of the time?	

Proficiency in other languages

Please mark in the first box whether you speak the following languages, and indicate your level of proficiency.

	Mandarin Chinese	Native – fluent – good – average – poor
	Chinese dialect: ……..	Native – fluent – good – average – poor
	English	Native – fluent – good – average – poor
	German	Native – fluent – good – average – poor
	French	Native – fluent – good – average – poor
	Dutch	Native – fluent – good – average – poor
	Korean	Native – fluent – good – average – poor
	…….	Native – fluent – good – average – poor
	……	Native – fluent – good – average – poor

Did you find the sentences used in the experiment natural? 1= totally unnatural, 5= very natural
1 2 3 4 5

How natural do you find the following sentences? Please give each sentence a number from 1 to 5.
1= totally unnatural 5= very natural

1 马明骂了一下谁**呢**. 1 2 3 4 5
2 于玲打了一下谁呢. 1 2 3 4 5
3 马丁帮了一下谁呢. 1 2 3 4 5
4 吴颖吻了一下谁呢. 1 2 3 4 5
5 马英抱了一下谁呢. 1 2 3 4 5
6 **吴丁找了一下**谁呢. 1 2 3 4 5
7 **路**杨踢了一下谁呢. 1 2 3 4 5
8 **薄明拉了一下**谁呢. 1 2 3 4 5

9 **米玲扶了一下**谁呢. 1 2 3 4 5
10 **吴洋看了一下**谁呢. 1 2 3 4 5
11 马龙捏了一下谁呢. 1 2 3 4 5
12 **李**龙碰了一下谁呢. 1 2 3 4 5
13 **路明**骗了一下谁呢. 1 2 3 4 5
14 **李**杨赞了一下谁呢. 1 2 3 4 5
15 卢蒙抓了一下谁呢. 1 2 3 4 5
16 **薄蒙**罚了一下谁呢. 1 2 3 4 5
17 **薄丁吃了一点什么**呢. 1 2 3 4 5
18 **路**营喝了一点什么呢. 1 2 3 4 5
19 **米**龙玩了一下什么呢. 1 2 3 4 5
20 **米明拿了一点什么**呢. 1 2 3 4 5
21 **薄羊弄了一下什么**呢. 1 2 3 4 5
22 **余**龙打了一下什么呢. 1 2 3 4 5
23 **李萌**订了一些什么呢. 1 2 3 4 5
24 **余蒙**买了一些什么呢. 1 2 3 4 5
25 **李**营印了一些什么呢. 1 2 3 4 5
26 马玲捐了一点什么呢. 1 2 3 4 5
27 马蒙煮了一点什么呢. 1 2 3 4 5
28 马扬改了一下什么呢. 1 2 3 4 5
29 **吴玲挂了一些什么**呢. 1 2 3 4 5
30 **于洋**补了一下什么呢. 1 2 3 4 5
31 **吴**龙发了一些什么呢. 1 2 3 4 5
32 卢龙卖了一些什么呢. 1 2 3 4 5

Your answers will be treated as confidential information. In my thesis, your data will be anonymous. Please sign this questionnaire to confirm that you've participated in this experiment out of your own free will.

Appendix D - Stimuli Perception Experiment

The stimuli for the perception experiment are presented on the left-hand side, and their continuations are shown on the right-hand side. For a translation of the stimuli, please consult the stimuli in Appendix A, which are numbered identically.

1	a	*Mǎ Míng mà le*	*yíxià shéi?*
			yixià Yú Lóng.
	b	*Mǎ Míng mà le yixià*	*shéi?*
			Yú Lóng.
2	a	*Yú Líng dǎ le*	yíxià shéi?
			yixià Mǎ Méng.
	b	*Yú Líng dǎ le yixià*	shéi?
			Mǎ Méng.
3	a	*Mǎ Dīng bang le*	*yíxià shéi?*
			yixià Yú Yáng.
	b	*Mǎ Dīng bang le yixià*	*shéi?*
			Yú Yáng.
4	a	*Wú Yǐng wěn le*	*yíxià shéi?*
			yixià Yú Lóng.
	b	*Wú Yǐng wěn le yixià*	*shéi?*
			Yú Lóng.
5	a	*Mǎ Yīng bào le*	*yíxià shéi?*
			yixià Wú Líng.
	b	*Mǎ Yīng bào le yixià*	*shéi?*
			Wú Líng.
6	a	*Wú Dīng zhǎo le*	*yíxià shéi?*
			yixià Bó Yáng.
	b	*Wú Dīng zhǎo le yixià*	*shéi?*
			Bó Yáng.
7	a	*Lù Yáng tī le*	*yíxià shéi?*
			yixià Mǐ Míng.
	b	*Lù Yáng tī le yixià*	*shéi?*
			Mǐ Míng.
8	a	*Bó Míng lā le*	*yíxià shéi?*
			yixià Lù Yíng.
	b	*Bó Míng lā le yixià*	*shéi?*
			Lù Yíng.
9	a	*Mǐ Líng fú le*	*yíxià shéi?*
			yixià Lù Míng.
	b	*Mǐ Líng fú le yixià*	*shéi?*
			Lù Míng.
10	a	*Wú Yáng kàn le*	*yíxià shéi?*
			yixià Yú Méng.
	b	*Wú Yáng kàn le yixià*	*shéi?*
			Yú Méng.
11	a	*Mǎ Lóng niē le*	*yíxià shéi?*
			yixià Lǐ Méng.
	b	*Mǎ Lóng niē le yixià*	*shéi?*
			Lǐ Méng.
12	a	*Li Lóng pèng le*	*yíxià shéi?*
			yixià Yú Yáng.
	b	*Li Lóng pèng le yixià*	*shéi?*

			Yú Yáng.
13	a	*Lù Míng piàn le*	*yíxià shéi?*
			yixià Mǐ Yáng.
	b	*Lù Míng piàn le yixià*	*shéi?*
			Mǐ Yáng.
14	a	*Lǐ Yáng zàn le*	*yíxià shéi?*
			yixià Wú Míng.
	b	*Lǐ Yáng zàn le yixià*	*shéi?*
			Wú Míng.
15	a	*Lú Méng zhuā le*	*yíxià shéi?*
			yixià Mǐ Yáng.
	b	*Lú Méng zhuā le yixià*	*shéi?*
			Mǐ Yáng.
16	a	*Bó Méng fá le*	*yíxià shéi?*
			yixià Lǐ Dīng.
	b	*Bó Méng fá le yixià*	*shéi?*
			Lǐ Dīng.
17	a	*Mǐ Lóng wán le*	*yíxià shénme?*
			yixià diànnǎo.
	b	*Mǐ Lóng wán le yixià*	*shénme?*
			diànnǎo.
18	a	*Bó Yáng nòng le*	*yíxià shénme?*
			yixià biǎodān.
	b	*Bó Yáng nòng le yixià*	*shénme?*
			biǎodān.
19	a	*Yú Lóng dǎ le*	*yíxià shénme?*
			yixià lánqiú.
	b	*Yú Lóng dǎ le yixià*	*shénme?*
			lánqiú.
20	a	*Mǎ Yáng gǎi le*	*yíxià shénme?*
			yixià mìmǎ.
	b	*Mǎ Yáng gǎi le yixià*	*shénme?*
			mìmǎ.
21	a	*Yú Yáng bǔ le*	*yíxià shénme?*
			yixià kǒudài.
	b	*Yú Yáng bǔ le yixià*	*shénme?*
			kǒudài.
22	a	*Bó Dīng chī le*	*yidiǎn shénme?*
			yidiǎn mángguǒ.
	b	*Bó Dīng chī le yidiǎn*	*shénme?*
			mángguǒ.
23	a	*Lù Yíng hē le*	*yidiǎn shénme?*
			yidiǎn niúnǎi.
	b	*Lù Yíng hē le yidiǎn*	*shénme?*
			niúnǎi.
24	a	*Mǐ Míng ná le*	*yidiǎn shénme?*
			yidiǎn miànbāo.
	b	*Mǐ Míng ná le yidiǎn*	*shénme?*
			miànbāo.
25	a	*Mǎ Líng juān le*	*yidiǎn shénme?*
			yidiǎn yīfú.
	b	*Mǎ Líng juān le yidiǎn*	*shénme?*
			yīfú.

26	a	*Mǎ Méng zhǔ le*	*yidiǎn shénme?*
			yidiǎn yùmǐ.
	b	*Mǎ Méng zhǔ le yidiǎn*	*shénme?*
			yùmǐ.
27	a	*Lú Lóng mài le*	*yidiǎn shénme?*
			yidiǎn mángguǒ.
	b	*Lú Lóng mài le yidiǎn*	*shénme?*
			mángguǒ.
28	a	*Li Méng dìng le*	*yīxiē shénme?*
			yīxiē wùpǐn.
	b	*Li Méng dìng le yīxiē*	*shénme?*
			wùpǐn.
29	a	*Yú Méng mǎi le*	*yīxiē shénme?*
			yīxiē lǐwù.
	b	*Yú Méng mǎi le yīxiē*	*shénme?*
			lǐwù.
30	a	*Li Yíng yìn le*	*yīxiē shénme?*
			yīxiē biǎodān.
	b	*Li Yíng yìn le yīxiē*	*shénme?*
			biǎodān.
31	a	*Wú Líng guà le*	*yīxiē shénme?*
			yīxiē yóuhuà.
	b	*Wú Líng guà le yīxiē*	*shénme?*
			yóuhuà.
32	a	*Wú Lóng fā le*	*yīxiē shénme?*
			yīxiē yóujiàn.
	b	*Wú Lóng fā le yīxiē*	*shénme?*
			yóujiàn.