Meaning of Plurals:

A Case from L1 Mandarin Chinese Speakers and

Mandarin Chinese Adult Learners of L2 English

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Abstract

This thesis investigates plurality and plurality interpretations in L2 English and L1 Chinese. It consists of an L2-English study and an L1-Chinese study. English bare plurals with overt plural marking are reported to have two possible interpretations: *exclusive* (i.e., more than one) and *inclusive* (i.e., one or more) (e.g., Tieu et al., 2014). Tieu et al. (2014) shows that native English adults tend to interpret English bare plurals exclusively in positive contexts and inclusively in negative contexts. By contrast, native English children tend to interpret English bare plurals inclusively in both contexts, computing exclusive readings less often than adults do. This finding is used to support the scalar implicature approach, in that plurality inferences (i.e., exclusive readings) are argued to be a type of scalar implicature. This approach is also supported by empirical evidence from other obligatory plural marking languages (e.g., Greek and Turkish). The current research extended the exploration to L2 English. Through a Truth Value Judgment Task (TVJT) adapted from Tieu et al. (2014), the current L2-English study investigated how native Chinese learners of English interpret bare plurals in L2 English, in order to test the universality of scalar implicatures and the effect of L1 transfer. The participants include 65 Chinese adults who learn/use English as a foreign/second language, as well as 50 English adults as a control group. To trace the potential effect of L1 transfer and find out what plurality interpretations are available in a non-obligatory plural marking language, the current L1-Chinese study was also conducted. Using a similar TVJT, three types of constructions that yield plural meanings in Mandarin Chinese were tested, including bare nouns, bare plurals associated with the optional plural marker *men* (i.e., *men* plurals), and mensural classifier constructions. The participants include 66 Chinese adults and 30 children (4-to-6-year old).

The results of the L2-English study show that Chinese EFL/ESL speakers tended to interpret English bare plurals at a similar level to native English speakers, no consistent evidence of L1 transfer through mapping from the plural morpheme -*s* in English to the plural marker -*men* or to null plural marking in Mandarin Chinese was identified, and no consistent influence from mensural classifier constructions was identified. The current finding supports the scalar implicature approach to plurality. The results of the L1-Chinese study revealed that Chinese adults' and children's preferences for exclusive/inclusive readings for *men* plurals are similar to English adults and children in Tieu et al. (2014). Therefore, the current research further proposes that plurality inferences associated with plural marking are universal across languages, no matter whether the plural marker is obligatory or optional, and no matter if they are computed in an L1 or L2.

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I dedicate this thesis to my dad, who successfully survived three heart attacks last year and is bravely changing his lifestyle. To me, he is a hero.

为共产主义奋斗终身！

Table of Contents

List of Abbreviations

ACC: accusative case
ADV: adverb
ASP: aspect
AUX: auxiliary
CL (for Greek examples): clitic
CL(s): classifier(s)
COMP: complementizer
DAT: dative
DECL: declarative mood
DEF: definite
DP(s): determiner phrase(s)
EFL/ESL: English as a foreign/second language
EPL: extrinsic plural
FEM: feminine
FLA: first language acquisition
GJT: grammaticality judgment task
L1s: first language(s)
L2s: second language(s)
M-CL(s): mensural classifier(s)
MOD: modal particle
NEG: negative
NEUT: neutrum
NOM: nominative
NS: negative singular
NP: negative plural
NP(s): noun phrase(s)
PAST: past tense
PL: plural
PRES: present
PS: positive singular
PP: positive plural
RC: relative clause
S-CL(s): sortal classifier(s)
SI(s): scalar implicature(s)
SG: singular
SLA: second language acquisition
SPRT: self-paced reading task
TOP: topic marker
TVJT(s): Truth Value Judgment Task(s)
3: Third person

List of Figures

List of Tables

Chapter 1 Introduction

The current research aims to explore the second language acquisition (SLA) of plurality and to contribute to the understanding of plurality across languages. Among the crosslinguistic exploration surrounding (English) plurals, there are two main strands of research. One is where plural marking is used as a diagnostic for the mass/count distinction and the second is investigating learners' suppliance of plural morphemes (such as -*s* in English). The research has been carried out from different perspectives, such as boundedness (Jackendoff, 1991; Langacker, 1999; Paradis, 2001), individuation (Barner and Snedeker, 2005; Papafragou, 2005; Li, et al., 2008; Cheung, et al., 2012; Grimm, 2012; Inagaki, 2014), vagueness (Chierchia, 2010, 2017), and atomicity (Choi et al., 2018; Lima, 2018). By contrast, the property *plurality* itself and the interpretations of plurality seem to have attracted less attention. Therefore, I take a step away from the aforementioned research focus and concentrate directly on plurality in this thesis. One way to investigate how first languages (L1s) and second languages (L2s) employ plurality is through possible interpretations embedded in bare plurals (Gil, 2019). Therefore, the current research examines the computation of English bare plurals in L2 English and the computation of Chinese bare plurals, along with another two constructions (bare nouns and classifier phrases) that can yield plural meanings, in L1 Mandarin Chinese. It explores plurality and its interpretations at the semantics-pragmatics interface. This chapter provides an overview of the main rationale of my thesis. It includes an introduction to the general research background, a brief discussion of the research aims, and the organisation of this thesis.

From the morphological perspective, "the plural is one of the instances of the inflectional category of number", whereas from the semantic perspective, *plurality* is more than the common "linguistic intuition that being plural expresses being more than one (Nouwen, 2016: p1). For example, in English and other languages with obligatory plural marking (e.g., Greek and Turkish), linguistic observation has shown that bare plurals are associated with two possible interpretations (Tieu et al., 2014; Renans et al., 2018; Renans et al., 2020). What is familiar to us is the plural meaning *more than one* (or *two or more*), which is known as exclusive reading. The other interpretation is the reading that includes *one*, such as *one or more*, and this is known as inclusive reading. For example, the positive sentence in (1.1) is normally paraphrased as (1.1a) with an exclusive reading *more than one giraffe*, rather than (1.1b) with an inclusive reading *one or more than one giraffe*.

(1.1) Positive context[1]: Emily fed giraffes.

    a. *Emily fed more than one giraffe.*   (exclusive)

    b. *Emily fed one or more than one giraffe.*   (inclusive)

                                            (adapted from Tieu et al., 2014: p.123-124)

Turning to the negative context, the sentence in (1.2) is normally interpreted as (1.2a) with an inclusive reading *(not) one or more giraffes*, meaning 'none', rather than (1.2b) with an exclusive reading *(not) more than one giraffe*.

(1.2) Negative context: Emily didn't feed giraffes.

    a. *Emily didn't feed one or more giraffe. = Emily didn't feed any giraffes.*   (inclusive)

    b. *Emily didn't feed more than one giraffe.*   (exclusive)

                                            (adapted from Tieu et al., 2014: p.123-124)

As shown above, English bare plurals associated with the plural marker *-s* (i.e., *s* plurals) tend to give rise to an exclusive reading in positive contexts. However, this exclusive reading tends to disappear in negative contexts, and instead, the inclusive reading is dominant. To explain the interpretative patterns shown above, previous research employed the scalar implicature approach and proposed that exclusive readings (i.e., plurality inferences) associated with bare plurals are scalar implicatures (SIs) (Sauerland, 2003; Sauerland et al., 2005; Spector, 2007; Tieu et al., 2014; Renans et al., 2018; Renans et al., 2020). Specifically, the semantic meaning of plural marking is the inclusive reading (*one or more than one x*), which is viewed as the base meaning of bare plurals. This exclusive reading (*more than one x*) is made possible by scalar implicature. This also indicates "the number-neutral nature of plurality" (Gil, 2019: p41). This proposal is based on the consistent findings between plurality inferences and other scalar implicatures associated with scalar terms, such as the quantifier *some* and the disjunction *or*, in terms of the nature of scalar implicatures and the comparison between children's and adults' sensitivity to them. In the following, I first briefly provide the notion of scalar implicatures, then present the major findings for them. Lastly, I will also explain how the scalar implicature approach to plurality inferences has been supported by previous research findings.

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[1] In (1.1) and (1.2), *context* refers to the sentence type, i.e., positive/negative sentences. This is the same throughout this thesis. (1.1a) and (1.1b) in italics are the possible interpretations of the positive sentence in (1.1). The same formatting holds for other similar examples in the following thesis. The examples for English bare plurals will be discussed in more detail in Section 2.1.

Grice (1975) states that when speakers construct conversations, they are expected to be rational and cooperate based on four main conversational maxims: quantity, quality, relevance, and manner. Specifically, being adequately informative, being true, being relevant, and being perspicuous. Flouting or exploiting a maxim or maxims will generate a conversational implicature. Scalar implicatures are normally generated by violating the quantity maxim, by using a relatively weaker term in an information scale, such as *some* in <some, all> and *or* in <or, and> (Horn, 1972; Levinson, 2000; Papafragou and Musolino, 2003). For example, (1.3) is a dialogue between a teacher and a student.

(1.3) Teacher: Have you finished your homework?

      Student: I have done some of my homework.

   → *I have done some but not all of my homework.*   (adapted from Zhao et al., 2021: p1)

The literal meaning of the student's reply in (1.3) is true no matter if the student did all or only part of their homework. However, as the student chose to use the scalar term *some* instead of saying 'I have done all of my homework', the implied meaning of the student's answer is that he/she did not finish all of his/her homework. This *some but not all* reading is viewed as a type of scalar implicature. From the investigation of the scalar implicatures associated with scalar terms as such, two major findings[2] have been reported in terms of the nature of scalar implicatures and children's insensitivity to SIs when compared to adults (e.g., Noveck, 2001; Papafragou & Musolino 2003; Spector, 2007; Barner et al., 2011, among others). First, scalar implicatures tend to appear in upward-entailing environments (e.g., positive contexts) and disappear in downward-entailing environments (e.g., negative contexts). For example, (1.4) is another dialogue that includes the scalar term *some*.

(1.4) John: Did you eat my cake?

      Mary: I ate some of it. → *I ate some but not all of it.* ≠ I ate all of it.

                                                    (adapted from Barner, et al., 2011: p.84)

In (1.4), Mary's response implies a meaning of *some but not all*, although *some* can be entailed by *all*. This is because if Mary ate the entire cake, her response would have been constructed in a more informative way, such as *I ate all of it*. The *not all* inference of *some* is viewed as a

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[2] This will be discussed in more detail in Section 2.4.

type of scalar implicature. Another example is the disjunction phrase *A or B*. It also normally gives rise to an exclusive reading *A or B but not both*, as in (1.5).

(1.5) Mary met Peter or Jack.

→ *Mary met Peter or Jack but not both.*   (adapted from Spector, 2007: p27-28)

However, this exclusivity disappears under negation, as shown in (1.6).

(1.6) I didn't eat the cake or the chocolate. → *I didn't eat any of them.*

In (1.6), the original sentence including the phrase *the cake or the chocolate* under negation tends to be interpreted inclusively, meaning *not the cake **and** not the chocolate*. This is because downward-entailing environments tend not to be affected by scalar implicatures.

Second and most importantly, children were found to be less sensitive to scalar implicatures than adults. For example, to investigate the role of scalar alternatives in child language acquisition of pragmatic inferences, Barner et al. (2011) reported that, unlike adults, four-year-old native speakers of English had difficulty computing the scalar implicature *some but not all* from sentences such as *some animals are sleeping*. They argue this was attributed to their lack of knowledge in generating scalar alternatives to the scalar item *some*.

Turning back to the scalar implicature approach to plurality inferences, experimental studies have tested both native children and adults on their computation of the readings associated with bare plurals in English, Greek, and Turkish (Tieu et al., 2014; Renans, et al., 2018; Renans et al., 2020). They found that, first, both age groups tend to interpret bare plurals with more exclusive readings in positive than in negative contexts. This suggests that exclusive readings associated with plural marking (i.e., plurality inferences) conform to the nature of scalar implicatures. Second, children overall tend to compute exclusive readings less often than adults in both contexts. This means that children are less sensitive to plurality inferences than adults. These findings are in line with what has been found with scalar implicatures as presented above, and thus support the scalar implicature approach to plurality.

To date, the investigation on plurality interpretations[3] associated with bare plurals has not been conducted in an L2. On one hand, much of the L2 research regarding the English

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[3] In this thesis, plurality interpretations refer to the exclusive or inclusive readings associated with the presence/absence of overt plural marking (bare plurals vs. bare nouns) and other constructions that yield plural meanings (e.g., some classifier constructions in Chinese).

plural has been mainly focused on the mass/count distinction and the suppliance of the plural marker -*s*. They show that L2-English speakers from non-obligatory plural marking languages tend to have difficulty with plural marking and that the effect of L1 transfer tends to be traceable (e.g., Hua and Lee, 2005; Inagaki, 2014; Jiang, 2007, 2011). On the other hand, SLA studies have tested scalar implicatures associated with scalar terms such as *some*. Their findings suggest that scalar implicatures tend to be universally available in both L1s and L2s, and L2 learners appear to have no difficulty computing scalar implicatures in their L2 (e.g., Slabakova, 2010; Snape and Hosoi, 2018). Taken together, the current study poses a research question – when language learners interpret bare plurals in their L2, will they resort to the universal pragmatic inferences (i.e., scalar implicatures) or will they be influenced by their L1 knowledge? If exclusive readings (i.e., plurality inferences) associated with overt plural marking are scalar implicatures as proposed in previous studies, L2 learners are expected to have no difficulty computing them due to the universality of scalar implicatures. However, considering the difficulties with plural marking that are faced by L2-English learners whose native languages only have optional plural marking, we should also consider whether or not, and how, their L1 knowledge influences their computations of bare plurals in their L2. Therefore, the current L2 study aims to address this research gap by obtaining novel data from native adult Chinese speakers who learn English as a foreign/second language (EFL/ESL). It seeks to examine the universality of scalar implicatures and the role of L1 transfer on the acquisition of plurality through observing how Chinese EFL/ESL learners interpret *s* plurals in positive and negative contexts. This is tested by means of a Truth Value Judgement Task (i.e., the English TVJT), adapted from the TVJT originally conducted by Tieu et al. (2014). It also considers the effect of L2 language proficiency and seeks to locate at which stage of language development L1 transfer, if any, cedes to standard pragmatic inferences.

To trace the potential effect of L1 transfer and analyse if it is reflected in the L2 performance shown by Chinese EFL/ESL learners, we also need to know what plural constructions are available and how they are computed in L1 Chinese. As can be seen from the discussion above, the L1 empirical research on the plurality interpretations associated with bare plurals has only been carried out in a limited group of languages (English, Greek, Turkish) with obligatory plural marking, and yet, studies to date have not explored languages such as Chinese, Korean, and Japanese, where plural marking is non-obligatory. For example, in Mandarin Chinese, both (1.7a) and (1.7b) can be used to express the plural meaning in (1.7).

(1.7) Students are in the classroom⁴.

    a. Xuesheng-**men** zai   jiaoshi   li.

        student-s   ADV classroom inside

    b. Xuesheng zai   jiaoshi   li.

        student   ADV classroom inside

(1.7a) includes the bare plural *xuesheng-men* (student-s) combined with the plural marker *-men* (i.e., *men* plural), whereas (1.7b) includes the bare noun *xuesheng* (student) without *-men*. Both can deliver the plural meaning yielded by (1.7). This means that the plural marker *-men* is only optional to yield a plural meaning in Chinese. Therefore, I extend the given experimental findings from bare plurals in English, Greek, and Turkish to *men* plurals in Mandarin Chinese. By using a similar TVJT (i.e., the Chinese TVJT) to investigate the interpretations of *men* plurals in both positive and negative contexts, the current L1 study explores how Chinese speakers compute plurality in the absence of obligatory plural marking and what readings the use of optional plural marking can trigger. As previous experimental studies have provided support to the scalar implicature approach to plurality inferences from obligatory plural marking languages, the current research will test if this approach can also apply to an optional plural marking language (i.e., Chinese).

        In addition to the plural marker *-men*, which has limited distribution and can only be used with humans or personified individuals, there are other constructions that are more widely used to convey plurality in Chinese, such as bare nouns (e.g., (1.7b)) and some classifier phrases (e.g., (1.8) as below).

(1.8) Jiaoshi   li   you **yi qun**   **xuesheng**.

     classroom inside have one CL-group student

     "There is a group of students in the classroom"⁵

     → *There are multiple students in the classroom.*

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⁴ I am aware that the meaning of (1.7a) must be definite plural and (1.7b) is either singular or specific plural. This does not conflict with the discussion here. The English sentence (1.7) can be translated into Chinese as (1.7a) and (1.7b). The plural marker *-men* is not optional for a definite meaning, but it is optional for a plural meaning.
⁵ When presenting examples that are not in English (e.g., Chinese and Greek), the sentences in quotes are their literal translations to English, and the sentences in italics are their potential interpretations. This applies to the entire thesis.

As shown in (1.8), the (singular) classifier phrase *yi qun xuesheng* (one CL-group student) has the structure of "one+CL+Noun". It signifies a plural meaning *multiple students*.

From linguistic observations, bare nouns and some classifier constructions tend to be more frequently used than *men* plurals in Mandarin Chinese. Therefore, the current L1 study also tests bare nouns and classifier phrases using the same TVJT for *men* plurals. This will inform us as to what plurality interpretations are available in these constructions. In return, it will help us identify whether or not, and what, L1-Chinese knowledge is reflected in L2-English results, which is essential to the current L2 study. With the aforementioned three categories in Chinese, I adopted the mapping process from the Feature Reassembly Hypothesis (FRH) (Lardiere, 2008; 2009) to generate the L2 hypotheses regarding L1 transfer. In this case, the mapping possibilities are from the English plural marker *-s* to null plural marking in Chinese and the English plural marker *-s* to the Chinese plural marker *-men*. Accordingly, the effect of L1 transfer on second language acquisition of plurality will be analysed through the two mapping options. We also consider and analyse if there is any L1 influence from mensural classifier phrases that can express plurality in Chinese.

In sum, the current research consists of two parts: the L1-Chinese study and the L2-English study. The L1-Chinese study questions what plurality interpretations will be assigned to bare nouns, *men* plurals, and mensural classifier constructions in positive and negative contexts by native Chinese adults and children (4- to 6-year-old). It will not only enlighten the discussion on plurality inferences associated with the presence/absence of overt plural marking, but it will also provide implications for the current L2 research in terms of the effect of L1 knowledge. The L2-English study seeks to examine the universality of scalar implicatures and the role of L1 transfer in the L2 acquisition of plurality. This is conducted by observing how Chinese EFL/ESL learners interpret *s* plurals in positive and negative contexts in L2 English. The current research in general will shed light on the exploration of plurality and the interpretations of plurality by providing novel data from an optional plural marking language (L1-Chinese) and a second language (L2-English).

Organisation of the thesis

The subsequent chapters are organised as follows. Throughout Chapter 2, the research background of this thesis is presented. It reviews relevant experimental and theoretical studies in the domain of L1 and L2 research. By examining what research has done so far with the plurality interpretations associated with bare plurals in obligatory and optional plural marking languages, it spells out the motivations for both current L1 and L2 studies. Chapter 3 presents

the three main research questions raised in this thesis and their hypotheses. Chapter 4 presents the methodology of the current L1 study and the research methods of the L1-Chinese experiment. It reports both descriptive and inferential results of the L1-Chinese experiment. Following the same structure as Chapter 4, Chapter 5 introduces the L2-English study and presents its results and findings. Chapter 6 concludes this thesis by summarising the major findings, contributions, and limitations of the current research. It also points out the implications for future research.

Chapter 2 Literature Review

This chapter aims to present how plurality is employed and interpreted in English and Chinese by reviewing previous studies. It also explains the motivations for the current L1-Chinese study and L2-English study.

Language such as English, Greek, and Turkish have obligatory plural marking, meaning "whenever plural reference is intended, the plural must be used" (Haspelmath, 2013). By contrast, Chinese has non-obligatory or optional plural marking, meaning a plural marker is not necessarily needed to yield a plural meaning. Through reviewing L1 acquisition literature, this chapter first presents the plurality interpretations associated with bare plurals in English and other obligatory plural marking languages (e.g., Greek and Turkish). It points out that one successful way in previous experimental research to explain the interpretative patterns shown by child and adult speakers for bare plurals is the scalar implicature approach. The current L2 study will shed light on whether the scalar implicature approach to plurality will receive empirical support from L2 acquisition. Turning to languages with non-obligatory plural marking, this chapter then analyses Chinese bare nouns, *men* plurals, and classifier constructions in terms of plurality by reviewing both theoretical and experimental research on them. This provides an understanding of what plurality interpretations are available with constructions that can express plurality in Chinese. Together, the similarities and differences regarding plurality and plurality interpretations between the two languages (English vs. Chinese) are identified, helping to establish hypotheses for the current research.

For the L2-English study of this thesis, this chapter reviews second language acquisition research which explores scalar implicatures and plurality. Overall, previous research shows that scalar implicatures tend to be universal and pose no difficulties to L2 learners across different languages, whereas L2 learners of languages with optional plural marking (e.g., Chinese, Korean, Japanese) tend to have difficulties with plural morphology in English. This poses a research question: if plurality inferences associated with overt plural marking are scalar implicatures, will L1-Chinese L2-English adult speakers be influenced by their L1 knowledge and have difficulty computing the plurality inferences for *s* plurals, or will they have access to plurality inferences as scalar implicatures without any difficulty? This motivates the current research, that is, examining the universality of scalar implicatures and the role of L1 transfer on the L2 acquisition of the plurality interpretations associated with bare plurals in English. This chapter also briefly introduces the Feature Reassembly Hypothesis, as I adopted its mapping process to establish the L2 hypotheses concerning L1 transfer. Based on the three

categories of constructions that can deliver plural meanings in Chinese (bare nouns, *men* plurals, and classifier phrases), two mapping possibilities are proposed to predict L2 performance. They are: from the English plural marker *-s* to null plural marking in Chinese and from *-s* to the Chinese plural marker *-men*. The potential L1 influence from mensural classifier constructions will also be considered.

The current chapter will proceed as follows. Section 2.1 presents the interpretations of bare plurals in obligatory plural marking languages, with a focus on English. It also introduces the scalar implicature approach to plurality proposed in previous studies. Section 2.2 reviews the studies on how plural meanings are expressed in Mandarin Chinese. Bare nouns, *men* plurals, and classifiers are introduced. There is also a discussion on L1 acquisition of the aforementioned three categories, drawn from previous experimental evidence. The research gaps are further identified and summarised in Section 2.3, together with the motivations for the current L1 Chinese study. Section 2.4 reviews L2 research on scalar implicatures and plural morphology in English, shedding light on the motivations for the current L2 English study which will be discussed in Section 2.5. Section 2.6 concludes the chapter.

2.1 Plurality in obligatory plural marking languages

As introduced in Chapter 1, the interpretations associated with bare plurals in languages with obligatory plural marking take two forms: exclusive and inclusive readings. The discussion surrounding these two readings is not new, and there is a growing body of literature that addresses how they are derived (Sauerland, 2003; Sauerland et al., 2005; Spector, 2007; Tsoulas 2009; Zweig, 2009; Farkas and de Swart, 2010; Ivlieva, 2013; Kane et al. 2015; Mayr, 2015; Križ, 2017; Martí, 2020; among others). One of the accounts proposed for the derivation of exclusive readings is through the scalar implicature approach. The main idea is that bare plurals have an inclusive reading as their base meaning, and the plural meaning (i.e., exclusive reading) is computed as an implicature. This approach to plurality has recently received support from L1 acquisition experimental studies (Tieu et al., 2014; Renans et al., 2018; Renans et al., 2020). They discuss the interpretations of bare plurals shown by their native speakers (English, Greek, Turkish), accounting for the interpretative patterns from children and adults observed in their experiments. The next two subsections will discuss these three main experimental studies and further present how the scalar implicature approach has been employed to explain the derivation of plurality inferences (i.e., exclusive readings). As English is the target language in the current L2 study of this thesis, I will primarily focus on English. I will also provide a

detailed presentation of Tieu et al. (2014), because I replicated their study's procedure in the current L1 and L2 studies. To better present the crosslinguistic conclusions that were drawn from the languages with obligatory plural marking, I will provide a quick review of Renans et al. (2018) for Greek and briefly present the major findings of Renans et al. (2020) for Turkish.

2.1.1 English (Tieu et al., 2014)

The examples[6] for the possible interpretations of sentences that are combined with English bare plurals are shown as follows. In positive contexts, the sentence (2.1) contains the bare plural *giraffes* and can be potentially interpreted as (2.1a) and (2.1b).

(2.1) (positive) Emily fed giraffes.
      a. *Emily fed one or more than one giraffe.*   (inclusive)
      b. *Emily fed more than one giraffe.*   (exclusive)

(2.1a) has an inclusive reading, as it includes both a singular meaning 'one giraffe' and a plural meaning 'more than one giraffe'. (2.1b) has an exclusive reading, as it excludes the singular meaning 'one giraffe' and only suggests a plural meaning. As stated in Tieu et al. (2014), (2.1b) is a more common interpretation for the positive sentence (2.1) and is viewed as a plurality inference computed from (2.1). This plural inference arises from "a comparison of the plural and the singular, where the singular has already been enriched with its own scalar implicatures" (i.e., the *exactly one* reading) (Tieu et al., 2014: p123; see also Spector, 2007). Specifically, consider (2.1) that has the bare plural *giraffes* (repeated below as (2.2a)) and its singular counterpart (2.2b) that has a singular determiner phrase (DP) *a giraffe*. Both (2.2a) and (2.2b) have the same literal meaning as (2.2c).

(2.2) a. Emily fed giraffes.
     b. Emily fed a giraffe.
     c. Emily fed one or more than one giraffe.

At the same time, (2.2b) with the singular meaning is normally compared to (2.3a) with a plural meaning, yielding the enriched meaning *exactly one* as in (2.3b).

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[6] In Section 2.1.1, the examples (2.1) to (2.9) and Figures 1 and 2 are adapted from Tieu et al. (2014: p122-128).

(2.3) a. Emily fed more than one giraffe.

b. *Emily fed one but not more than one giraffe. = Emily fed exactly one giraffe.*

When (2.3b) is negated, the exclusive reading *more than one giraffe* arises as in (2.4).

(2.4) *Emily didn't feed one but fed more than one giraffe. = Emily fed more than one giraffe.*

(2.4) is viewed as the plurality inference of (2.2a) which contains the bare plural *giraffes.* And as explained above, this plurality inference is generated by negating the enriched reading *exactly one* of (2.2b) that has the singular DP *a giraffe*.

We now move on to negative contexts. When the bare plural *giraffes* is embedded under negation as in (2.5), it also has two possible interpretations, (2.5a) and (2.5b).

(2.5) (negative) Emily didn't feed giraffes.
a. *Emily didn't feed one or more giraffes. = Emily didn't feed any giraffes.*   (inclusive)
b. *Emily didn't feed more than one giraffe.*   (exclusive)

(2.5a) has an inclusive reading *(not) one or more than one*. Since it negates both the singular and the plural reading simultaneously, it has the meaning 'feeding none'. This is also viewed as the bare plural *giraffes* being computed at the sentence level, because this inclusive reading is the global meaning of the whole sentence. It is normally viewed as the preferred interpretation of (2.5). Another possible interpretation, (2.5b), has an exclusive reading, as it excludes the singular meaning and emphasises the plural meaning signified by the overt plural maker -*s*. It can be paraphrased as (2.6).

(2.6) *Emily didn't feed GIRAFFES (because she only fed one)!*   (exclusive)

In (2.6), the plural *GIRAFFES* in conversations is normally uttered with focal stress (Renans et al., 2020). However, it should be pointed out that this does not mean that when the plural is not pronounced with stress, speakers cannot interpret them exclusively with a *more than one* reading. This was evidenced by the results from Tieu et al. (2014), which will be presented in detail later. Although inclusive readings are the preferred interpretation in negative contexts, the exclusive reading as shown in (2.6) can also be explained by the scalar implicature, in that the bare plural *giraffes* is being computed as 'a local scalar implicature under the scope of

12

negation' (Tieu et al., 2014: p124). This means that the exclusive reading *more than one giraffe* is first computed from the bare plural *giraffes*, then *more than one giraffe* is negated, yielding the *not more than one giraffe* meaning (i.e., exactly one giraffe).

To sum up the discussion to this point, both exclusive and inclusive readings are available for bare plurals in English. However, an exclusive reading *more than one* is preferred in positive contexts but an inclusive reading *(not) one or more than one* is preferred in negative contexts. The exclusive readings (i.e., plurality inferences) have been proposed to be a type of scalar implicature (Tieu et al., 2014). To further test this proposal, Tieu et al. (2014) designed a Truth Value Judgment Task to examine how native English adults and children interpret English bare plurals in both positive and negative contexts. They sought to compare the participants' performance with the patterns found with other scalar implicatures, which are associated with scalar terms such as *some* as briefly presented in Chapter 1. As stated by Tieu et al. (2014), if plurality inferences associated with plural morphology are also scalar implicatures, two major interpretive patterns will be expected. First, plurality inferences will match the nature of scalar implicatures, that is, they appear in positive contexts and disappear in negative contexts. This will be shown from the adult participants' performance, in that exclusive readings are computed more often in positive than in negative contexts. Second, children's insensitivity to other scalar implicatures will also be expected with plurality inferences. This will be shown by the comparison between the child and adult results, where children overall compute exclusive readings less often than adults. These were tested through the TVJT in their experiment on 43 L1-English adults and 28 four- to five-year-old children.

In their experiment, participants were introduced to a puppet who would interact with them via the webcam. They were then shown short test stories with animations. After each test story, the puppet appeared and was asked by the experimenter to reply to a question about the story. The participants were then asked to rate the puppet's response, based on its acceptability according to what happened in the story. Child participants were asked to put a stamp in the 'happy face' column on the answer sheet if they thought the puppet's response was right; otherwise, they would put a stamp in the 'sad face' column on the answer sheet. It was the same with adults, but they were asked to use checkmarks instead of stamps. The puppet's answers were pre-recorded and were played at different time points during the test by the experimenter. This made the puppet look like it was interacting with the participants live.

The TVJT in Tieu et al. (2014) includes six test stories and eight control stories. Three of the test stories are combined with a positive plural or singular sentence, and the other three with a negative plural or singular sentence. I will present the examples and predictions of

responses for them in what follows. It should first be noted that when presenting the predictions/results of the TVJT, I use *rejecting* a test sentence to refer to the situation where the participants placed a stamp/checkmark in the 'sad face' column on the answer sheet, and use *accepting* a test sentence to refer to placing a stamp/checkmark in the 'happy' face column.

For positive contexts, the test story (2.7) and test sentences (2.7a) and (2.7b) which were spoken by the puppet are shown as follows.

(2.7) Story: Emily is visiting the pig farm today. It's lunchtime for the pigs. Emily has an apple, and that's just enough to feed the first pig! Oh no! What about the other pigs? The farmer says, "That's okay, Emily! I'll feed the others later!" So, in the end, Emily only fed this pig! EXPERIMENTER: Hey Ellie, what happened in the story?
PUPPET:
a. Emily fed pigs!
b. Emily fed a pig!

Figure 1 The last image of the animation for the story (2.7)
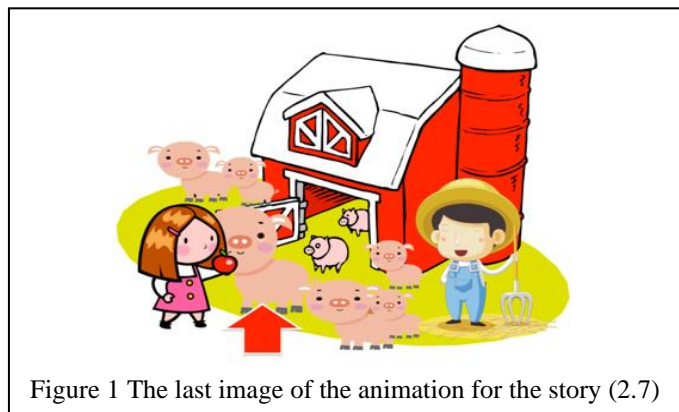
The story in (2.7) and Figure 1 show that Emily only fed one pig. The participants were asked to make judgments on the positive sentences (2.7a) and (2.7b) which contain the bare plural *pigs* and the singular DP *a pig* respectively. If they computed the plurality inference for *pigs* and interpreted (2.7a) with an exclusive reading, they were expected to reject the sentence (2.7a). This is because it conflicts with the fact that Emily only fed one pig. On the other hand, the participants were expected to accept (2.7b), as it has the meaning of 'feeding one pig' and is consistent with what happened in the story.

For negative contexts, the test story (2.8) and test sentences (2.8a) and (2.8b) were shown below.

(2.8) Story: Emily is visiting the zoo today. It's lunchtime for the animals. Emily has just enough food to feed this very tall giraffe! Oh no! What about the other giraffes? The zookeeper says, "That's okay, Emily! I'll feed the others later!" So, in the end, Emily only fed this giraffe! EXPERIMENTER: Hey Ellie, what happened in the story?

PUPPET:

a. Emily didn't feed giraffes!

b. Emily didn't feed a giraffe!

Figure 2 The last image of the animation for the story (2.8)
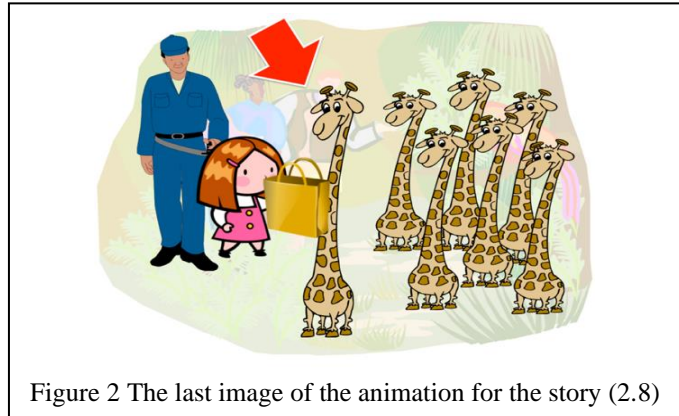
The story in (2.8) and Figure 2 show that Emily only fed one giraffe. The participants were asked to make judgments on the negative sentences (2.8a) and (2.8b) which contain the bare plural *giraffes* and the singular DP *a giraffe* respectively. Participants were expected to reject (2.8a), because plurality inferences were predicted to disappear in negative contexts and therefore the bare plural *giraffes* under negation would be interpreted inclusively. Participants were also expected to reject (2.8b), as it conflicts with the fact that one giraffe was fed by Emily.

In addition, Tieu et al. (2014) also predicted that a number of participants would accept negative sentences such as (2.8a). In this case, the bare plural *giraffes* is computed locally under the scope of negation as a local inference (2.6), repeated in (2.9).

(2.9) *Emily didn't feed GIRAFFES (because she only fed one)!*

The result for the test sentences containing *s* plurals is shown in Figure 3. The computation of plurality inferences in this figure refers to rejecting the test sentences, such as (2.7a), in positive contexts and accepting the test sentences, such as (2.8a), in negative contexts.
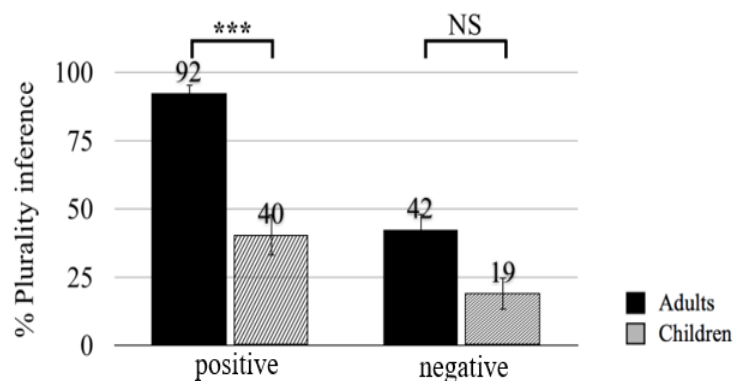
Figure 3 Computation of plurality inferences by adults and children
in positive and negative contexts (Tieu et al., 2014: p130)

As shown in Figure 3, the participants across the two age groups overall computed more plurality inferences in positive contexts than in negative contexts. This is confirmed by their ANOVA analysis on the computation of plurality inferences, which revealed a significant main effect of *context*[7] (positive vs. negative) (*p<.001*). Comparing the results between the two age groups, in positive contexts, adults interpreted significantly more plurality inferences than children (*p<.001*). While adults computed plurality inferences more than 90% of the time, children only computed them 40% of the time. This means that in positive contexts, adults overall tend to interpret *s* plurals exclusively, whereas children overall tend to interpret them inclusively. In negative contexts, although there was no statistically significant difference in the computation of plurality inferences by adults and children (*p>.1*), the observable difference means that adults (42%) still computed more plurality inferences than children (19%). This suggests that although both age groups tend to interpret *s* plurals inclusively in negative contexts, adults still interpreted them exclusively under negation as local inferences (e.g., (2.9)) more often than children.

As for the test sentences containing singular DPs (e.g., (2.8b) and (2.9b)), the results show that there is no significant difference in the responses between children and adults: they generally accepted (2.8b) but rejected (2.9b). This means that both children and adults could understand and distinguish between singular and plurals meanings signified by test stories accurately.

Turning back to the proposal that plurality inferences associated with bare plurals are scalar implicatures, Tieu et al. (2014) stated that the results of their experiment supported this scalar implicature approach to plurality based on two main reasons. First, their results show that both children and adults computed plurality inferences more often in positive than in negative contexts. This interpretive pattern is in line with the nature of scalar implicatures, that is, they tend to occur in upward-entailing environments (i.e., positive contexts) but disappear in downward-entailing ones (i.e., negative contexts). Second, their results show that in both positive and negative contexts, children computed fewer plurality inferences than adults. This interpretive pattern mirrors previous findings that children tend to be less sensitive to scalar implicatures than adults (e.g., Noveck, 2001; Papafragou & Musolino, 2003; Barner et al., 2011; Zhao et al., 2021). Therefore, as evidenced by the results discussed above, they draw the conclusion that plurality inferences associated with English bare plurals are scalar implicatures.

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[7] Tieu et al. (2014) used *monotonicity* to refer to the sentence types (positive vs. negative). To be consistent with the current research, I use *context* in this case throughout the thesis.

The next subsection discusses the plurality inferences associated with bare plurals in Greek and Turkish, starting with Greek.

2.1.2 Greek (Renans et al., 2018) and Turkish (Renans et al., 2020)

The plurality inferences associated with pluralised count nouns in English are also referred to as multiplicity inferences, which are parallel to abundance inferences that are associated with pluralised mass nouns in other obligatory plural marking languages, such as Greek (Tsoulas, 2009; Alexiadou, 2011; Kane et al., 2015; Renans et al., 2018). Renans et al. (2018) investigated both multiplicity and abundance inferences in Greek by conducting a Truth Value Judgement Task on four- to seven-year-old L1-Greek children and adults. They observed how the L1-Greek speakers interpreted Greek bare count and mass plurals in positive and negative contexts, following the same task design as the TVJT in Tieu et al. (2014). In the following, I present multiplicity and abundance inferences in Greek and report the results from Renans et al. (2018), starting with multiplicity inferences.

As in English, the positive sentence (2.10)[8] with the bare plural *ghurunia* (pigs) can be interpreted with an inclusive reading as in (2.10a) and with an exclusive reading as in (2.10b).

(2.10) I tighri taise **ghurunia**.
    DEF.FEM.SG.NOM tiger fed   pig.PL
    'The tiger fed pigs.'
    a. *The tiger fed one or more than one pig.*   (inclusive)
    b. *The tiger fed more than one pig.*   (exclusive)

Between the two possible interpretations (2.10a) and (2.10b), Renans et al. (2018) reported a different preference for adults and children. Specifically, Greek children tend to prefer the inclusive interpretation (2.10a), whereas Greek adults tend to prefer the exclusive interpretation (2.10b). This is similar to what is found in English. The exclusive interpretation (2.10b) is viewed as a multiplicity inference.

Turning to negative contexts, the sentence in (2.11) can also be interpreted with an inclusive reading as in (2.11a) and with an exclusive reading as in (2.11b).

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[8] In Section 2.1.2, the Greek examples (2.10) to (2.16) are adapted from Renans et al. (2018: p4-6).

(2.11) I tighri dhen taise **ghurunia**.
    DEF.FEM.SG.NOM tiger NEG fed pig.PL
    'The tiger didn't feed pigs.'
    a. *The tiger didn't feed one or more than one pig.*   (inclusive)
       = *The tiger didn't feed any pigs.*
    b. *The tiger didn't feed more than one pig.*   (exclusive)
       = *The tiger didn't feed PIGS (because it only fed one).*

Unlike the interpretive pattern shown in positive contexts, Renans et al. (2018) reported that both children and adults overall tend to prefer the inclusive interpretation (2.11a), rather than the exclusive interpretation (2.11b).

We will now consider the abundance inferences. Unlike in English, where plural morphology is mainly applied to count nouns,[9] mass nouns in Greek can be pluralised and interpreted with both exclusive and inclusive readings. The plurality inference (i.e., exclusive reading) associated with Greek bare mass plurals is named *abundance inference* as 'there is a lot of the relevant substance' (Renans et al., 2018: p1). For example, consider the positive sentence (2.12) which contains the bare mass plural *zahares* (sugars) and its two possible interpretations (2.12a) and (2.12b).

(2.12) Tis zebras tis epesan **zahar-es**.
    DEF.FEM.SG.DAT zebra CL.FEM.SG.DAT fell.3PL sugar-PL
    *'The zebra dropped sugars.'[10]
    a. *The zebra dropped a little or more than a little sugar.*   (inclusive)
    b. *The zebra dropped a lot of sugar.*   (exclusive)

(2.12) can be interpreted with an inclusive reading *a little or more than a little sugar* as in (2.12a) and with an exclusive reading *a lot of sugar* as in (2.12b). Renans et al. (2018) reported

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[9] Mass bare plurals do exist in English. For example, the pluralised substance-mass noun *coffees* in (a) below refers to three kinds of coffee. As English mass bare plurals are only restricted to specific contexts and are not relevant to the current research, this thesis will not discuss this in detail.
(a) I love three coffees: Cappuccino, Americano, and Latte.
[10] The asterisk (*) here means that this sentence is the literal translation from Greek to English, meaning it does not follow the English grammar, but its original sentence is grammatical in Greek. This notation (*) also applies to other examples (such as for Chinese) in this thesis.

that while Greek children tend to prefer the inclusive interpretation (2.12a), adults tend to prefer the exclusive interpretation (2.12b), which is viewed as the abundance inference.

Turning to the negative context, the sentence (2.13) can also be interpreted with an inclusive reading as in (2.13a) and with an exclusive reading as in (2.13b).

(2.13) Tis   zebras dhen tis   epesan **zahar-es**.
DEF.FEM.SG.DAT zebra   NEG CL.FEM.SG.DAT fell.3PL sugar-PL
*'The zebra didn't drop sugars.'
a. *The zebra didn't drop a little or a lot of sugar.*   (inclusive)
   = *The zebra didn't drop any sugar.*
b. *The zebra didn't drop a lot of sugar.*   (exclusive)
   = *The zebra didn't drop SUGARS (because it only dropped a little).*

Renans et al. (2018) reported that both age groups tend to prefer the inclusive interpretation (2.13a) to the exclusive one (2.13b).

To sum up the discussion above, both Greek bare count and mass plurals can be interpreted with exclusive and inclusive readings. From the results reported by Renans et al. (2018), we can see that both multiplicity and abundance inferences in Greek tend to appear in positive contexts and disappear in negative contexts, evidenced by the Greek adult results. It is also clear that Greek children tend not to be sensitive to neither multiplicity nor abundance inferences, as they tend to interpret bare count and mass plurals in Greek inclusively in both positive and negative contexts.

In addition to Greek bare count and mass plurals, Renans et al. (2018) also tested the constructions containing the scalar term *merika* (some) in positive contexts. For example, consider the sentence (2.14) and its possible interpretations (2.14a) and (2.14b).

(2.14) To   liontaraki kuvalise **merika** apo ta   mila!
DEF.NEUT.SG.NOM lion   carried   SOME of   DEF.NEUT.PL.ACC apples
'The lion carried some of the apples!'
a. *The lion carried all of the apples.*
b. *The lion carried some but not all of the apples.*   (scalar implicature)

As shown in (2.14), compared to the reading *all* signified by (2.14a), (2.14b) yields a *some but not all* reading, which is viewed as a scalar implicature computed from *merika* (some). The

results from Renans et al. (2018) show that adults computed more scalar implicatures than children. This observation is in line with what has been found with multiplicity and abundance inferences in the same task in Renans et al. (2018).

Taken together, based on the consistent interpretive patterns found in the three categories presented above, Renans et al. (2018) argue that their findings support the scalar implicature approach to plurality. They propose that the multiplicity inferences associated with Greek bare count nouns and the abundance inferences associated with Greek bare mass nouns are the same as the plurality inferences associated with English bare plurals, and they are all scalar implicatures.

Renans et al. (2018) also explained why the alternative approach to plurality, the ambiguity approach (Farkas and de Swart, 2010) cannot account for the interpretative patterns shown by their Greek child and adult participants whose native language has obligatory plural marking like English. To be specific, the ambiguity approach argues for the *Strongest Meaning Hypothesis for Plurals* (Dalrymple et al., 1998; Winter, 2001; cited in Renans et al., 2018: p8), as shown below:

The Strongest Meaning Hypothesis for Plurals: for a sentence involving a plural nominal, prefer that interpretation of plural which leads to the stronger overall interpretation for the sentence as a whole, unless this interpretation conflicts with context of utterance.

This means for positive sentences like (2.10), repeated below as (2.15), which are ambiguous between two possible meanings (2.15a) and (2.15b), the stronger one (2.15b) is favoured over the weaker (2.15a).

(2.15) I   tighri taise **ghurunia**.
     DEF.FEM.SG.NOM tiger fed   pig.PL
     'The tiger fed pigs.'
     a. *The tiger fed one or more than one pig.*   (inclusive, **weak**)
     b. *The tiger fed more than one pig.*   (exclusive, **strong**)

As shown above, in upward-entailing contexts (i.e., positive sentences), (2.15b) with an exclusive reading is stronger than (2.15a) with an inclusive reading, "where 'strong' and 'weak' refer to entailment patterns (the strong meaning asymmetrically entails the weak one)" (Renans,

et al., 2018: p7). On the other hand, for downward-entailing contexts (i.e., negative sentences), (2.11) (repeated below as (2.16)) is also ambiguous between two meanings, (2.16a) and (2.16b).

(2.16) I   tighri dhen taise **ghurunia**.
　　　DEF.FEM.SG.NOM tiger NEG fed   pig.PL
　　　'The tiger didn't feed pigs.'
　　　a. *The tiger didn't feed one or more than one pig.*   (inclusive, **strong**)
　　　b. *The tiger didn't feed more than one pig.*   (exclusive, **weak**)

(2.16a) is favoured by the Strongest Meaning Hypothesis over (2.16b), giving rise to the strong inclusive reading for (2.16).

　　　As shown above, the ambiguity approach predicts an exclusive interpretation in positive contexts and an inclusive interpretation in negative contexts, which is line with what was shown by the Greek adult participants in their research. However, this approach cannot account for the child participants' performance, as they preferred the weak inclusive reading for both positive and negative contexts. Therefore, Renans et al. (2018) argued that their data provided support to the scalar implicature approach and posed a challenge for the ambiguity approach.

　　　Similar findings are also reported in Turkish by Renans et al. (2020). They carried out a TVJT on L1-Turkish children and adults following the same process. Their results show that Turkish-speaking adults tend to interpret bare plurals in Turkish exclusively in the positive context, and tend to interpret them inclusively and exclusively roughly 50/50 in the negative context. This means that although inclusive readings tend not to be dominant in negative contexts, adults still interpreted plurality inferences more often in positive than in negative contexts. As for Turkish children, they overall interpreted Turkish bare plurals inclusively in both positive and negative contexts. This means that Turkish adults overall interpreted more plurality inferences than children. Based on the results, Renans et al. (2020) calls for Turkish bare plurals to be treated the same as English bare plurals, since the bare plurals in both languages can be interpreted with both exclusive and inclusive readings. Despite the difference in adult results between Renans et al. (2020) and Tieu et al. (2014), the findings from Turkish bare plurals are still in line with the implicature approach to plurality.

　　　In sum, the interpretive patterns of plurality in Greek and Turkish, in terms of the nature of scalar implicatures and children's insensitivity to SIs, are consistent with what has been found in English. Through Section 2.1, I have presented the major findings from Tieu et al. (2014), Renans et al. (2018), and Renans et al. (2020). What these studies have in common is

that the languages under investigation are those that have obligatory plural marking. The next section focuses on Mandarin Chinese, a language with non-obligatory plural marking, and discusses what plurality interpretations optional plural marking and other Chinese plural constructions can trigger.

2.2 Plurality in Chinese

The discussion in the preceding section has shown that exclusive and inclusive readings are both available with bare plurals in languages with obligatory plural marking (English, Greek, Turkish). Plural marking in those languages tends to give rise to plurality inferences (i.e., exclusive readings) in positive contexts. However, this inference tends to disappear under negation, where the bare plurals are mainly interpreted with inclusive readings.

The L1 study of this thesis extends the research from obligatory plural marking languages to those with optional plural marking. In Mandarin Chinese, *-men* is not a productive marker for plurality. It is most natural to realise plural meanings with bare nouns, thus making Chinese a language with optional plural marking. In addition, other expressions are also commonly used for plurality, such as some classifier phrases (e.g., mensural classifier constructions). Therefore, the current L1 study investigates the computation of bare nouns, *men* plurals, and some classifier constructions by Chinese children and adults, seeking to observe what plurality interpretations are available with expressions for plurality in Chinese. As mentioned in Chapter 1, this will also help us establish the L2 hypotheses regarding L1 transfer through mapping.

In the current section, I present what previous research has shown regarding plurality interpretations for the constructions that yield plural meanings in Chinese. They include bare nouns, *men* plurals, and mensural classifier constructions. The next subsection starts with bare nouns, it also provides background information for *men* plurals that are discussed in Section 2.2.2. Section 2.2.3 discusses some classifier constructions that yield plural meanings. Section 2.2.4 reviews the literature on L1 acquisition of the aforementioned three categories. Throughout the discussion in Section 2.2, the rationale of the current L1-Chinese study will also be discussed.

2.2.1 Bare nouns

It is first worth noting that bare nouns in Mandarin Chinese can denote a generic reading or an existential reading, such as in (2.17) and (2.18) respectively.

(2.17) Wo xihuan **mao**.

      I   like   cat

      'I like cats'

(2.18) Ta   zai   wei **mao**.

      She/he AUX feed cat

      a. 'She/he is feeding a cat'   (indefinite, **singular**)

      b. 'She/he is feeding some cats'   (indefinite, **plural**)

      c. 'She/he is feeding the cat'   (definite, **singular**)

      d. 'She/he is feeding the cats'   (definite, **plural**)

In (2.17), the bare noun *mao* (cat) refers to a specific type of animal, denoting a generic reading. On the other hand, (2.18) has four possible interpretations and the bare noun *mao* (cat) in (2.18) can refer to one or more cats that are being fed by the person in context (either indefinite or definite), signifying an existential reading. The current research will only focus on declarative sentences like (2.18). As noted by Huang et al. (2009), Chinese bare nouns can be indefinite or definite ((2.18a-b) vs. (2.18c-d)) and singular or plural ((2.18a-c) vs. (2.18b-d)). In this experimental research, we only provided definite test stories so that we can focus on the comparison between singular and plural meanings and the potential plurality interpretations of bare nouns. In the following discussion, we concentrate on the *number-neutral* property of bare nouns, which is directly related to singular and plural meanings.

Chinese bare nouns are argued to be number neutral[11] (Krifka, 1995; Cheng & Sybesma, 1999; Rullmann & You, 2006; Zhang, 2014; Li, 2020), and "they are neither singular nor plural, but … "unspecified" for number" (Rullmann & You, 2006: p1). This means that they can refer to one or multiple entities and can be used for expressing both singular and plural meanings. For example, consider the positive sentence that contains the bare noun *shu* (book) in (2.19).

(2.19) Zuotian   wo mai le   shu

      yesterday I   buy ASP book

      *'Yesterday, I bought book.' → *Yesterday, I bought one or more books.*

                                                 (adapted from Rullmann & You, 2006: p1)

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[11] This is also called "general number" in some studies, such as Rullmann and You (2006) and Zhang (2014). To be consistent, I use "number neutral" throughout this thesis.

In (2.19), the bare noun *shu* can refer to one or multiple books, and therefore has a meaning of 'one or more books'. It is compared to (2.20) and (2.20b) below.

(2.20) a. Zuotian   wo mai le   yi **ben**   shu.

       yesterday I   buy ASP one S-CL book

       'Yesterday, I bought a/one book.'

    b. Zuotian   wo mai le   yi **xie**   shu.

       yesterday I   buy ASP one M-CL book

       'Yesterday, I bought a few/some books.'

<div align="right">(adapted from Rullmann & You, 2006: p2)</div>

(2.20a) contains the singular sortal[12] classifier DP[13] *yi ben shu* (one S-CL book, 'a/one book'), denoting a singular meaning. By contrast, (2.20b) has the singular[14] mensural classifier DP *yi xie shu* (one M-CL, 'some books'), signifying a plural meaning. In comparison, the bare noun *shu* (book) in (2.19) does not have either a singular meaning as in (2.20a) or a plural meaning as in (2.20b). Instead, it tends to have an inclusive reading *one or more*. This can also be seen from the model shown in Figure 4, with which Rullmann & You (2006) compared the denotations of a singular/plural noun in English and the denotation of a bare noun in Chinese.
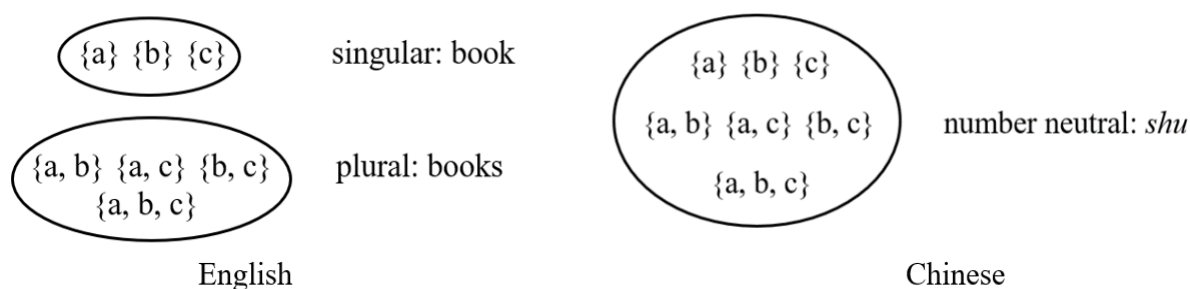

Figure 4 Denotations of book, books, and shu
(adapted from Rullmann & You, 2006: p5)

As shown above, in English (on the left), the bare singular *book* encodes singular atoms {a}, {b}, and {c}. Its corresponding plural form *books* encodes "the set of all pluralities that can be built out of the atoms" (p5), that is, {a, b}, {a, c}, {b, c}, and {a, b, c}. Compared with English,

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[12] Sortal classifiers (S-CLs) and mensural classifiers (M-CLs) will be discussed in detail in Section 2.2.3.

[13] Some studies argue that there is no DP in Chinese. In this thesis, I only use DPs to refer to expressions that contain classifiers or other constructions, without considering the debate on whether there exist DPs in Chinese or not.

[14] 'Singular' here refers to the numeral *one* (i.e., *yi*) in this mensural classifier DP, and it does not mean the DP has a singular meaning.

the bare noun *shu* (book) in Chinese (on the right) denotes 'a complete semi-lattice generated by a set of atoms' (p5), including both singular atoms and their sums. This means that bare nouns in Mandarin Chinese tend to have inclusive readings. We will now examine them in positive and negative contexts, starting with the positive context as shown in (2.21).

(2.21) Zhuozi shang you   **pingguo**.

       table   on   have apple

       'There is/are apple on the table.' → There is one or more than one apple on the table.

The bare noun *pingguo* (apple) in (2.21) can be interpreted with an inclusive reading, meaning *one or more than one apple*. Turning to the negative sentence (2.22) below.

(2.22) Zhuozi shang mei you   **pingguo**.

       table   on   not have apple

       'There is/are not apple on the table'

       → *There is not one or more apples on the table. = There are no apples on the table.*

When the bare noun *pingguo* (apple) is embedded under negation, it also tends to have an inclusive interpretation, meaning 'none'.

    As shown in (2.21) and (2.22), bare nouns in Chinese tend to have inclusive readings in both positive and negative contexts. This is in line with the argument that Chinese bare nouns in general 'do not trigger scalar implicatures related to number' (Rullmann & You, 2006: p23). Now we compare this with numeral classifier DPs. First, consider the positive sentence (2.23) and its possible interpretation.

(2.23) Zuotian   wo mai le   **shu**, zhunque de   shuo, wo mai le   **wu ben shu**.

       yesterday I   buy ASP book, exactly   MOD say   I   buy ASP five S-CL book

       *'Yesterday, I bought book. To be exact, I bought five books.'

       → *Yesterday, I bought one or more books. To be exact, I bought five books.*

                                  (adapted from Rullmann & You, 2006: p23)

The first clause in (2.23) contains the bare noun *shu* (book) and denotes an inclusive reading, whereas, in the second clause, the numeral classifier DP *wu ben shu* (five books) gives rise to a plural meaning. This suggests that the plurality inference of (2.23) is derived as scalar

implicature by the numeral classifier DP in the second clause of the sentence, rather than the bare noun in the first. This also means that Chinese bare nouns do not give rise to plurality inferences in positive contexts.

Now we turn to negative contexts. Recall that for English bare plurals under negation, exclusive readings only surface as a local inference, and inclusive readings tend to be dominant. The examples are repeated as (2.24) below:

(2.24) Emily didn't feed pandas.
     a. *Emily didn't feed one or more pandas. = Emily didn't feed any pandas.*   (inclusive)
     b. *Emily didn't feed PANDAS (because she only feed one).*   (exclusive)
       = Emily didn't feed more than one panda.

For the negative sentence in (2.24), although (2.24a) with an inclusive reading tends to be the dominant interpretation by both English children and adults, there are still a number of exclusive interpretations (2.24b) computed by both age groups (Tieu et al., 2014). However, this is not the case in Chinese. Sentences in the same structure as (2.24b) tend to be ungrammatical in Chinese. For example, consider (2.25).

(2.25) *Wo bushi mai le   **shu**, ershi mai le   **yi ben shu**.
    I   not   buy ASP book but   buy ASP one S-CL book
    *'I didn't buy book, but I bought one book'

The first clause in (2.25) contains the bare noun *shu* (book). Without overt plural marking, the bare noun cannot give rise to an exclusive reading, and thus only has an inclusive reading, meaning 'none'. On the other hand, the second clause in (2.25) contains the numeral classifier DP *yi ben shu* (one S-CL book, 'a/one book'), denoting a singular meaning. Therefore, the first and second clauses in (2.25) conflict with each other, and (2.25) is viewed as ungrammatical in Chinese. This suggests that Chinese bare nouns under negation cannot be interpreted exclusively as a local inference as in English and they only yield inclusive readings.

To sum up, from previous studies presenting the number neutrality of bare nouns, we can see that bare nouns in Mandarin Chinese tend to have inclusive readings only. No matter whether they are embedded in positive or negative sentences, they cannot give rise to plurality inferences either as scalar implicatures or local inferences, which is different from English bare plurals. In the current L1 study, we will test the interpretations of bare nouns with L1-Chinese

adults and children, in order to explore if the aforementioned assumptions about bare nouns manifest in their responses. We will also compare the interpretations of bare nouns with that of bare plurals in languages with obligatory plural marking, seeking to gain a better understanding of plurality cross-linguistically.

In the next subsection, we will move on to *men* plurals.

2.2.2 *Men* plurals

The particle -*men* has been argued to be a plural marker[15] that denotes plural meanings in Chinese (e.g., Li, 1999; Jiang, 2017; Kim & Melchin, 2018; Li, 2020). However, there are some differences between Chinese *men* plurals and English *s* plurals in English, a language with obligatory plural marking. First, Chinese *men* plurals contain the [+human]/[+animate] feature and have limited distribution. For example, consider (2.26).

(2.26) Yesterday, I bought books.

    a. Zuotian   wo mai le   **shu**.

      yesterday I   buy ASP book

    b. *Zuotian   wo mai le   **shu-men**.

      yesterday I   buy ASP book-PL

To express the plural meaning in (2.26) in Chinese, (2.26a) with the bare noun *shu* (book) is a grammatically correct sentence, instead of (2.26b) with the bare plural *shu-men* (book-s). This is because *men* plurals are only permitted with humans (2.27a) or personified entities (2.27b):

(2.27) a. laoshi-men zai   bangongshi li.

      teacher-PL   ADV office   in

      'The teachers are in the office'   (definite, **plural**)

    b. Hudie-men zai   changge.

      butterfly-PL present progressive sing

      'The butterflies are singing'   (definite, **plural**)

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[15] In some studies, -*men* is also argued to be a collective marker that refers to the whole (see Iljic, 1994, 2001; Cheng & Sybesma, 1999). The current research does not focus on this debate and will only follow the viewpoint stated above.

As shown above, (2.27a) has the bare plural *laoshi-men* (teachers), whereas (2.27b) has the bare plural hudie-*men* (butterflies). Both sentences are grammatically correct.

Second, even when -*men* is permissible (e.g., (2.27a) and (2.27b)), it can still be optional for a plural meaning, because bare nouns can also be interpreted with plural meanings, such as (2.28a) and (2.28b).

(2.28) laoshi   zai   bangongshi li. [16]

      teacher   ADV office   in

      a. 'The teachers are in the office'   (definite, **plural**)

      b. 'Some teachers are in the office'   (indefinite, **plural**)

The bare noun *laoshi* (teacher) can be used to express the definite plural meaning (2.28a), which is the same as (2.27a) with the *men* plural *laoshi-men*. However, this optionality of -*men* is only for a plural meaning, not for a definite meaning. In other words, when -*men* is present, a definite plural meaning is generated, but when -*men* is absent, the plural meaning can be either definite (2.28a) or indefinite (2.28b). Another example is shown below.

(2.29) a. Wo qu zhao haizi-men.

       I   go find   child-PL

     'I will go find the children'   (definite, **plural**)

    b. Wo qu zhao haizi.

      I   go find   child

     'I will go find the/some children'   (definite/indefinite, **plural**)

                                       (adapted from Li, 1999: p78)

As shown above, both the *men* plural *haizi-men* (2.29a) and the bare noun *haizi* (2.29b) can be used to express the plural *children*, but (2.29a) has a definite meaning while (2.29b) can have either a definite or indefinite meaning.

To sum up the discussion above, *men* plurals are associated with [+plural], [+human]/[+animate], and [+definite] features. In the current research, I focus on the [+plural] feature and the plurality interpretations of *men* plurals. The linguistic observations show that -

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[16] This sentence can also be interpreted as 'The teacher is in the office' with a definite and singular meaning, and 'A teacher is in the office' with an indefinite and singular meaning, as discussed in the previous subsection. Here, we focus on its possible plural interpretations. This applies to Example (2.29).

men is not necessarily required to generate a plural meaning in Chinese and *men* plurals are much less productive than their bare forms (i.e., bare nouns).

In the following, I examine the potential exclusive/inclusive readings associated with *men* plurals in both positive and negative contexts, starting with positive contexts. As presented in Section 2.2.1, Chinese bare nouns tend to have inclusive readings only. When the plural marker *-men* is added to a bare noun, an exclusive reading seems to appear. For example, compare the positive sentences (2.30a) and (2.30b).

(2.30) a. **Xuesheng** zai   jiaoshi   li.

      student   ADV classroom in

      'The student/students is/are in the classroom.'   (definite, **singular/plural**)

      'A student/some students is/are in the classroom.'   (indefinite, **singular/plural**)

      → *One or more than one student is in the classroom.*   (inclusive)

    b. **Xuesheng-men** zai   jiaoshi   li.

      student-PL   ADV classroom in

      'The students are in the classroom.'   (definite, **plural**)

      → *More than one student is in the classroom.*   (exclusive)

(2.30a) contains the bare noun *xuesheng* and thus has a *one (singular) or more than one (plural)* meaning, no matter whether it is interpreted definitely or indefinitely. This suggests an inclusive reading. In comparison, when overt plural marking appears as in the bare plural *xuesheng-men*, a plural interpretation arises for (2.30b), denoting an exclusive reading.

When it comes to negative contexts, the interpretations of *men* plurals under negation seem to not have received enough discussion in previous studies. However, there is an observation that with a definite context, *men* plurals can be compatible with negation. For example, (2.31) is an exchange between a teacher and a student, where the teacher asked the student to tell their classmates in the classroom to come to the corridor.

(2.31) Teacher: Qing   rang jiaoshi   li de   tongxue-men dao zoulang shang lai.

               please let   classroom in AUX classmate-PL to   corridor on   come

               'Please ask your classmates in the classroom to come to the corridor'

Student: ??[17] Jiaoshi   li mei you tongxue-**men**, zhi you Xiaoming yi ge ren   zai!

classroom in not have classmate-s   only have Xiaoming   one S-CL person ADV

'There is not more than one classmate in the classroom. There is only Xiaoming'

In (2.31), the teacher and the student share the same information that the bare plural *tongxue-men* (classmate**s**) refers to the student's classmates, signifying a definite meaning. As a reply to the teacher, the student used the bare plural *tongxue-men* (classmate**s**) to imply that there is not more than one but only one student in the classroom. In this case, the bare plural *tongxue-men* has an exclusive reading under negation. Other similar examples will be shown in Chapter 4 when presenting the Chinese TVJT in the current research. As shown above, *men* plurals can be used in negative sentences when provided with a definite context, and they tend to denote an exclusive reading under negation.

To sum up, the discussion above has shown that the particle *-men* in Chinese is limited in its distribution and is only optional for a plural meaning. From both previous literature and linguistic observations, we can see that *men* plurals tend to have exclusive readings in both positive and negative contexts. Therefore, we expect that *men* plurals will be interpreted with exclusive readings more often than with bare nouns in both positive and negative contexts. On the other hand, if *men* plurals are the same as bare plurals in obligatory plural marking languages, we could also expect them to be interpreted exclusively in positive but inclusively in negative contexts. This is because according to the scalar implicature approach to plurality, plurality interpretations associated with overt plural marking arise as scalar implicatures in positive contexts and disappear in negative contexts. The interpretations of *men* plurals will be tested with the L1-Chinese adults and children in the current L1 study, to observe what plurality interpretations *men* plurals will obtain.

As mentioned previously, Chinese also has some classifier constructions which can express plurality and their distribution is more widely available than *men* plurals. Therefore, we also consider their uses and potential plurality interpretations, which will be presented in the next subsection.

2.2.3 Classifier constructions

Numeral classifiers are widely employed to quantify or make reference to entities in classifier languages such as Chinese. According to Cheng & Sybesma (1999), "classifiers in

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[17] This sentence may be viewed as grammatically incorrect, but according to the native Chinese informants, this sentence is acceptable with provided context, although "it sounds a bit odd".

Chinese appear to be involved in expressing number" (p535). They are constructed in the form of "numeral + classifier + nominal" and can roughly be divided into two major categories: sortal classifiers and mensural classifiers[18]. In the following, before discussing the potential plurality interpretations of mensural classifier constructions, I will first briefly present sortal classifiers, as this will help to better understand the exclusive/inclusive readings associated with mensural classifiers.

Sortal classifiers identify 'natural quantificational units' (Li et al., 2010: p208) for entities regarding their properties, such as size and shape. For example, consider the examples in (2.32) below.

(2.32) a. yi **ba** yusan

 one S-CL umbrella

 'one umbrella'

  b. yi **mian** qiang

 one S-CL wall

 'one wall'

  c. yi **zhang** zhuozi

 one S-CL table

 'one table'

Ba in (2.32a) is generally used with entities that have a handle, such as an umbrella. *Mian* in (2.32b) is normally used with flat and smooth surface entities, such as a wall. *Zhang* in (2.32c) can be used with flat entities, such as a table. As can be seen from the examples, sortal

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[18] They are also called count classifiers and mass classifiers respectively in some studies, such as Cheng & Sybesma (2005). To be consistent, this thesis uses sortal and mensural classifiers throughout the discussion, because the terminology *count/mass classifier* focuses on the count or mass state of the nouns following the classifiers and is closely related to the mass/count distinction, whereas *sortal/mensural classifier* addresses the state and property of the classifiers. It may be argued that the classifier constructions tested in this research should be called "measure words". Following the discussion in de Vries and Tsoulas (to appear), measure words express quantities of objects using "standard units of measurement" (p1), such as (i) several litres of water. This is different from the container classifier construction (ii) *yi lan quiz* (lit. one basket orange) and the collective classifier construction (iii) *yi qun xiaoxiong* (lit. one group bear), where "the units are not naturally present but created by the classifier" (p2). Hence, constructions like (ii) and (iii) were classified into the same category as *mensural classifiers* in this thesis (see also p.32). This is also because when sortal and mensural classifier constructions are in the form of *yi (one) CL x*, sortal classifier constructions denote singular meanings, whereas mensural classifier constructions refer to multiple *x* (see the discussion in this section). Therefore, the current thesis acknowledges that there are different names, definitions, and classifications for *classifiers*, and "mensural classifier" in general may not be the best choice for the classifiers mentioned above ((ii) and (iii)), but this terminology works in the current thesis because it highlights the contrast between its plural meaning and the singular meaning signified by sortal classifier constructions.

classifiers 'name the unit that the semantic representation of the noun naturally provides' (Cheng & Sybesma, 2005: p11), and they do not normally have equivalent words in English.

Moreover, sortal classifiers can be combined with the number *yi* (one) to denote a singular meaning and with numbers larger than one (such as *san*, 'three') to denote a plural meaning, as shown in (2.33a) and (2.33b) respectively.

(2.33) a. yi ben   zidian
　　　　　 one S-CL dictionary
　　　　　 'one dictionary'
　　　 b. san　 ben　 zidian
　　　　　 three S-CL dictionary
　　　　　 'three dictionaries'

The sortal classifier DP (2.33a) containing the number *yi* (one) refers to a singular representation of dictionaries, whereas (2.33b) containing the number *san* (three) refers to multiple (i.e., three) dictionaries.

On the other hand, mensural classifiers create a non-inherent condition of entities for counting or measuring. Based on the classification of mensural classifiers in previous studies (Vinet & Liu, 2008; Cheng, 2012; Wu, 2019; Her & Tang, 2020), the current research considers three main types of classifiers, as follows:

  i.　 collective classifiers, such as *qun* (crowd/group/herd), *tao* (set), and *dui* (pile)
 ii.　 container classifiers, such as *xiang* (box), *lan* (basket), and *wan* (bowl)
iii.　 the plural classifier *xie* (some/a few)

The three types of classifiers are viewed as mensural classifiers (see Footnote 18) and will be illustrated respectively below, exploring what exclusive/inclusive readings are associated with them. We start with collective classifiers, with *qun* (group) as an example shown below:

(2.34) a. yi **qun**　 ren
　　　　　 one M-CL person
　　　　　 'one group of people' → *more than one person*　　　　　 (plural)
　　　 b. yi　 **ge**　 ren
　　　　　 one S-CL person
　　　　　 'one person'　　　　　　　　　　　　　　　　　 (singular)

As in (2.34a), the singular mensural classifier DP *yi qun ren* (one group (of) people) yields a plural meaning. This is compared to the singular sortal classifier DP *yi ge ren* (a/one person) in (2.34b), denoting a singular meaning. Turning to container classifiers, the example is shown in (2.35).

(2.35) a. yi **lan** pingguo
   one M-CL apple
   'one basket of apples' → *more than one apple*   (plural)
   b. yi **ge** pingguo
   one S-CL apple
   'one apple'   (singular)

As in (2.35a), the singular mensural classifier DP *yi lan pingguo* (one basket (of) apples) also yields a plural reading. This is different to the singular sortal classifier DP *yi ge pingguo* (one apple) in (2.35b).

   To sum up the discussion so far, singular classifier DPs containing collective classifiers (e.g., (2.34a)) and container classifiers (e.g., (2.35a)) denote a plural meaning *more than one*, which are different to singular sortal classifier DPs that signify singular meanings. We now move on to the last type of classifier constructions of interest in the current research, *yi xie*.

   Xie can be used with demonstratives *zhe* (this) and *na* (that) to express a plural meaning, such as in (2.36b).

(2.36) a. zhe/na   'this/that'
      b. zhe-xie/ na-xie   'these/those'

Li (1999) pointed out that *xie* in (2.36b) is different from *xie* in *yi xie* (some), shown in (2.37).

(2.37) a. ta dui **zhexie ge ren**   mei hao   yinxiang.
      he to these CL person not good impression
      'He does not have good impression of these people'
   b. *ta dui **yixie ge ren**   mei hao   yinxiang.
      he to   these CL person not good impression
      'He does not have good impression of some people'

Zhexie can be used with a classifier such as *ge* in (2.37a), whereas *yi xie* cannot as in (2.37b), indicating that *xie* in *yi xie* is a classifier. Wu (2019) further argues that *xie* is a plural classifier, and the function of which is to "restrict bare nouns to plural entities"; it is different to singular sortal constructions that "restrict bare nouns to singular entities" (p11). This is illustrated below.

(2.38) a. yi xie   shu

    one M-CL book

    'some books' → *more than one book*   (plural)

  b. yi ben shu

    one S-CL book

    'one book'   (singular)

As in (2.38a), the singular mensural classifier DP *yi xie shu* (some books) refers to multiple books, yielding a plural meaning. By contrast, in (2.38b), the singular sortal classifier DP *yi ben shu* (one book) has a singular meaning. In addition, as noted by Cheng (2012), in numeral classifier DPs, *xie* can only be used with the number *yi* (one) for quantification, as in (2.38a), rather than with numbers that are larger than one, such as *liang* (two) or *san* (three) as shown in (2.39).

(2.39) a. *liang xie   shu

    two   CL book

    *'two some book'

  b. *san xie   ren

    three CL person

    *'three some person'

Both (2.39a) and (2.39b), combining *xie* with numerals larger than one, are ungrammatical in Mandarin Chinese.

Thus far, the discussion above has shown that mensural classifier DPs containing collective CLs (e.g., *qun* (group)), container CLs (e.g., *lang* (basket)), and the plural classifier *xie* (some) tend to have plural meanings. Now we consider the constructions embedded in positive and negative sentences and analyse their potential exclusive and inclusive readings, using *yi xie* as an example. First, consider the positive sentence (2.40) and its possible interpretation.

(2.40) Ta   zhong le   yi xie   hua.

he/she plant   AUX one M-CL flower

'He/she planted some flower'

→ *He/she planted more than one flower.*   (exclusive)

(2.40) contains the classifier DP *yi xie hua* (some flowers) and denotes an exclusive reading. Turning to negative contexts, an example is shown in (2.41).

(2.41) Ta   meiyou zhong yi   xie   hua

he/she not   plant   one M-CL flower

*'He/she didn't plant some flower.'

→ *He/she didn't plant some flowers (because she/she only planted one).*   (exclusive)

(2.41) is combined with *yi xie hua* (some flowers) and can be interpreted with an exclusive reading. This inclusive interpretation can be expressed in Chinese as (2.42).

(2.42) Ta   meiyou zhong yi **xie**   hua,   yinwei ta   zhi zhong le   yi **duo**.

he/she not   plant one M-CL flower because he/she only plant   AUX one S-CL

'He/she didn't plant some flowers because he/she only planted one'   (exclusive)

The mensural classifier DP *yi xie hua* in the main clause yields an exclusive reading, which is different to the singular meaning signified by the singular sortal classifier DP *yi duo hua* (one flower) in the subordinate clause.

To summarise, mensural classifier constructions tend to have exclusive readings in both positive and negative contexts. To test this assumption, we will conduct the L1-Chinese experiment with Chinese children and adults, observing if the interpretive patterns shown by them match the judgments made about mensural classifiers above.

From Section 2.2.1 to Section 2.2.3, the linguistic assumptions for the potential exclusive/inclusive readings associated with bare nouns, *men* plurals, and mensural classifier constructions have been made based on previous theoretical analyses and linguistic observations. Now we turn to experimental studies and discuss the extent to which the three categories have been examined regarding their plurality interpretations in first language acquisition (FLA) research.

2.2.4 L1 acquisition studies

This section reviewed some related experimental studies in order to show how the three categories of constructions have been approached in the domain of L1 acquisition. I will present them in the following three parts and discuss the rationale of the current L1-Chinese research.

Bare nouns

There have been a few experimental studies on bare nouns in Mandarin Chinese in the domain of first language acquisition, and yet, they have mainly focused on how native Chinese speakers distinguish between bare count and mass nouns and how they count or quantify bare nouns in Chinese. For example, to investigate whether Chinese bare nouns individuate, Huang & Lee (2009) and Cheung et al. (2010) tested whether native Chinese speakers quantify bare nouns based on number or volume. To investigate the mass/count distinction in Chinese, Lin & Schaeffer (2018) also examined the quantity judgments on Chinese bare nouns by both native Chinese adults and children. The discussion on bare nouns in Section 2.2.1 showed that Chinese bare nouns tend to have inclusive readings in both positive and negative contexts. However, this assumption, drawn from theoretical analyses and linguistic observations, seems not to have been tested empirically on L1-Chinese speakers, nor has it been tested on a possible difference between native Chinese adults and children regarding their plurality interpretations for bare nouns. Therefore, the current L1-Chinese study attempts to fill this gap in the research area of first language acquisition. This will not only contribute to our understanding of bare nouns, but it will also help us understand what different plurality interpretations the presence/absence of plural marking can trigger through the comparison between bare nouns and *men* plurals.

Men **plurals**

There have been very few studies that investigated *men* plurals specifically regarding their plurality interpretations. Therefore, I will look to review one of the closely related studies on Korean plurality, as Korean is also a language with non-obligatory plural marking. Recent research by Liter et al. (2017) and Liter et al. (2018) created an artificial language that has a Korean-like number system. Like Korean, this language has bare nouns as well as singular and optional plural morphemes. To investigate the interpretation of the plural in downward-entailing environments, Liter et al. (2018) trained 16 adult English speakers to use this language and tested them with a number morphology task. In this task, the participants were asked to make judgments on whether the test sentence they heard matched what they saw in the pictures (with either singular or plural referents) shown on the screen. The test sentences included noun

phrases (NPs) marked with a plural morpheme. Their results show that the participants interpreted plural morphology exclusively under the scope of negation. This finding is used to show support for a crosslinguistic pattern that the optional plural markers in Korean, Japanese, and Mandarin Chinese only allow exclusive readings.

The finding above appears to be consistent with what has been discussed in Section 2.2.2, which suggests that *men* plurals tend to have exclusive readings in both positive and negative contexts. Therefore, if this is on the right track, we can predict that the L1-Chinese participants in the current L1 study will show similar interpretations for *men* plurals. Summarising the findings so far, it is evident that *men* plurals tend to have exclusive readings only, regardless of context. This assumption will be tested in the current research with native Chinese children and adults, observing what exclusive/inclusive readings they interpret with *men* plurals in both positive and negative contexts. This will not only enlighten us on plurality in Chinese, but it will also help us draw crosslinguistic conclusions on plurality interpretations through the comparison between obligatory and non-obligatory plural marking languages.

Mensural classifiers

As discussed in Section 2.2.3, mensural classifier constructions in Chinese tend to have exclusive readings only, regardless of context (positive vs. negative). This assumption has not been tested in first language acquisition research, and thus the current L1 study aims to provide novel data for this inquiry. In the current section, I will briefly present what questions have been addressed regarding mensural classifiers in previous studies and explain their implications for the current research.

Much experimental research on mensural classifiers was conducted to investigate how Mandarin Chinese encodes the mass/count distinction. For instance, some studies tested whether or not Chinese adults and children can distinguish between sortal classifiers and mensural classifiers (Chien et al., 2003; Li et al., 2008; Li et al., 2010). Li et al. (2008) examined if native Chinese adults and 4- to 6-year-old children can match classifiers with their referents based on the entities' shape (e.g., solid vs. nonsolid) and status (e.g., individuals, unindividuated stuff, or groups of individual things). For example, the sortal classifier *gen* (rod) should be matched to a solid rod-shaped thing, such as pencils. The mensural classifier *dui* (pile) should be matched to a pile of a non-solid substance such as sand, or a pile of individuals such as sponge pieces. Their findings show that adults used sortal classifiers to select individuals and used mensural classifiers to select 'portions of stuff or sets of individuals' (p7). By contrast, children did not distinguish sortal and mensural classifiers at the adultlike level.

Li et al. (2008) argues that this finding supports that the mass/count distinction is encoded at the classifier level in Chinese. Li et al. (2010) also investigated how native Mandarin-speaking adults and children (2 to 5 years old) understand classifiers and if they can combine the correct entities corresponding to the properties specified by the classifier. The findings suggest that from the age of 3, children started to notice that many classifiers often select referents by the shapes' similarities, but children under the age of 4 overall understood little about most mensural classifiers. Their results also show that adults did not have difficulty distinguishing between sortal and mensural classifiers.

Summarising the discussion above, although the rationale of the two studies reviewed above is not the same as the current research, they still have implications for the current L1 study. First, it seems that 4 is the age when children start to understand mensural classifiers, although the children tested in the two studies overall did not show adult-like performance. Therefore, the target child participants of the current L1 study are native Chinese children that are four and above. Second, different performances were reported for native Chinese adults and children in the two studies. While adults tend to have no difficulty with mensural classifiers, children tend not to interpret them at an adult-like level. Therefore, in the current L1-Chinese experiment, we can predict that different interpretive patterns for the interpretations of mensural classifier constructions will be shown by Chinese-speaking children and adults.

In Section 2.2.3, we have seen from previous research that the classifier construction *yi xie x* has the literal meaning *some/a few*. In Mandarin Chinese, another similar construction, *you xie*, also has the same literal meaning as *yi xie*. Previous studies have analysed *you xie* as a scalar term on the <some, all> scale and argue that it gives rise to a *some but not all* implicature (Su & Su, 2015; Zhao et al., 2021). This has been tested in a number of studies. For example, to investigate native Chinese children's ability to compute pragmatic inferences, Zhao et al. (2021) tested whether native Chinese children can compute scalar implicatures for *you xie* from the perspective of pragmatic development. 225 native Chinese Mandarin-speaking children with an age range from 4 to 8 and 54 adults as the control group were tested through a referent selection task. In the task, the participants were first presented with picture stimuli. Then, they heard test sentences that described the pictures and were asked to judge the test sentences. For example, consider Figure 5.
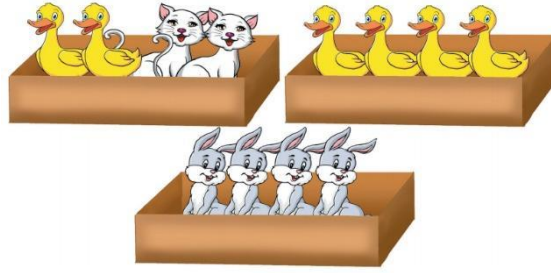
Figure 5 An example of picture stimuli in Zhao et al. (2021, p7)

As shown in Figure 5, each picture stimulus has three boxes in it. One box (top left) contains two animals (e.g., 2 ducks) and two other animals (e.g., 2 cats), whereas the other two boxes (top right and bottom) only contain one type of animal (e.g., four ducks and four rabbits, respectively). After seeing the picture, participants heard a test sentence, which was the description for one of the three boxes. Then participants were asked if the described box was among the boxes in the picture. If the answer was 'yes', they would need to point this box out, and only one box was allowed to be selected. The test sentences are combined with the scalar term *you xie*, such as in (2.43).

(2.43) Wode hezi li   **youxie** shi yazi.

      my   box inside some   be duck

      'Some of the animals in my box are ducks.'

      → *Some, but not all, animals in my box are ducks.*

(adapted from Zhao et al., 2021: p11)

The test sentence (2.43) yields the scalar implicature *some but not all*. If children can compute this implicature, they will choose the box on the top left in Figure 5. But if they cannot compute the scalar implicature *some but all*, they will choose the box on the top right of Figure 5.

    The findings of Zhao et al. (2021) show that 4- to 5-year-old children tend not to compute the scalar implicatures associated with *youxie* (some). Between the age of 5 and 6, children start to compute SIs. At the age of 6, children can consistently compute SIs and at the age of 8, children appear to compute SIs at a similar level to adults. If the mensural classifier *yi xie* is comparable to the scalar term *you xie*, we might see our child participants (4- to 6-year-old) in the current L1 study show different interpretive patterns from adults for the interpretation of *yi xie*. This is because our child participants would be under the age of 8, when they still appear to not compute scalar implicatures for *you xie* at an adultlike level, as shown in Zhao et al. (2021). Moreover, by comparing children's computation of *yi xie* and the other

two mensural classifiers in the current research, and *you xie* in Zhao et al. (2021), it will also enlighten us as to whether *yi xie* should be treated as a mensural classifier or a scalar term.

As presented in Section 2.1, plurality inferences associated with overt plural marking in obligatory plural marking languages have been argued to be scalar implicatures. This means we can also compare the variations and similarities in the results between *men* plurals in the current L1-Chinese experiment and the findings of Zhao et al. (2021). This will inform us whether the plurality inferences associated with optional plural marking are also scalar implicatures. In addition, Zhao et al. (2021) also pointed out that there are only a limited number of experimental studies on the computation of SIs in Chinese (Wu and Tan, 2009; Su, 2013; Katsos et al., 2016). Thus, the current L1 research will also shed light on the discussion surrounding scalar implicatures in Chinese, if the plurality inferences associated with *men* plurals are also shown to be scalar implicatures by the current L1 study.

In summary, Section 2.2.4 has briefly presented how bare nouns, *men* plurals, and mensural classifiers have been tested in previous L1 acquisition research. It pointed out several research gaps identified in this area. First, research so far has not directly explored the plurality interpretations of bare nouns and mensural classifier constructions in Mandarin Chinese. Second, although there is experimental research suggesting that Chinese *men* plurals allow exclusive interpretations only, they did not investigate *men* plurals empirically, and there is a lack of experimental research on the exclusive/inclusive readings associated with *men* plurals in general. The discussion in Section 2.2 has touched upon the rationale and motivations for the current L1 study, which will be summarised in the next section.

2.3 Motivations for the L1-Chinese study

The L1-Chinese study investigates how native Chinese children and adults interpret bare nouns, *men* plurals, and mensural classifier constructions in positive and negative contexts. This serves two main purposes in this thesis. First, it will inform us as to how plurality is computed in the absence of obligatory plural marking and what plurality interpretations optional plural marking can trigger. This contributes to the exploration of plurality and its interpretations across languages with obligatory and non-obligatory plural marking. By comparing Chinese adults and children in L1 Chinese, it also informs us whether and to what extent their knowledge of plurality is subject to the SIs in the same way as in previous studies (e.g., Zhao et al., 2021). Second, by exploring what plurality interpretations are available in Chinese, L2 hypotheses regarding L1 transfer can be established to predict what interpretive

patterns L1-Chinese L2-English speakers will show when interpreting English bare plurals. In the following, I will explain these two purposes in more detail.

As discussed in Section 2.1, the observations in languages with obligatory plural marking (English, Greek, Turkish) have shown that exclusive and inclusive interpretations are both available for their bare plurals. Previous studies (e.g., Tieu et al., 2014; Renans et al., 2018; Renans et al., 2020) have provided evidence from acquisition for the scalar implicature approach to the plurality inferences associated with the obligatory plural morphology. On the other hand, as pointed out in Section 2.2, similar research has not been conducted in languages with non-obligatory plural marking (e.g., Chinese, Japanese, Korean), where plural markers are only optional and plural meanings are not only triggered by plural morphology. In Mandarin Chinese, the plural marker *-men* is not always permitted but is still optional for a plural meaning in permissive situations. By contrast, bare nouns and mensural classifier constructions appear to be more widely used to realise plural meanings. Therefore, several questions arise, as to if in Mandarin Chinese, a language that does not always encode plural information with its plural morphology, the inclusive and exclusive readings of obligatory plural morphology will still be available for *men* plurals. How will the presence and absence of plural marking influence the computation of plurality? Are bare nouns and mensural classifier constructions also subject to the same interaction with scalar implicatures as plural morphology? The current research aims to extend the research from obligatory plural marking to non-obligatory plural marking languages, providing additional insight into the exploration of plurality and plurality interpretations.

By conducting the Chinese TVJT on native Chinese children and adults, we will observe if the plurality interpretations change when plural morphology is present (*men* plurals) or absent (bare nouns). By comparing the results from the three categories, we seek out the similarities and variations among the readings associated with mensural classifiers and optional plural morphology. By comparing the results between Chinese adults and children, we seek to see if there is evidence leading to plurality inferences (i.e., scalar implicatures). This will test whether the scalar implicature approach to plurality inferences also applies to optional plural morphology. As such, the current L1 study will advance our understanding of how plurality is employed and interpreted in Mandarin Chinese, and help us draw crosslinguistic conclusions on plurality by providing novel data from a non-obligatory plural marking language. With respect to the implications from previous research for the methodology, the current L1-Chinese experiment follows similar research methods and process that have been presented in Section 2.1 (i.e., Tieu et al., 2014). This will be explained in detail in Chapter 4.

In addition, as presented in Section 2.2.4, although L1 experimental studies have examined bare nouns, *men* plurals, and mensural classifier constructions in Chinese, attention has mainly been paid to the mass/count distinction. The plurality interpretations of bare nouns, *men* plurals, and mensural classifiers remain unclear. This also highlighted an overall lack of experimental studies on plurality and plurality interpretations. This thesis conducts, for the first time, an experimental analysis of this specific topic in Chinese.

We now turn to the implications for the present L2 study. By exploring what plurality readings native Chinese speakers can access in their first language, the current L1 research enables us to examine if L1 interpretive patterns are reflected in L2 results as manifestations of L1 transfer through mapping. The mapping possibilities in the current research include from the English plural marker *-s* to null plural marking in Chinese and the English plural marker *-s* to the Chinese plural marker *-men*. This will be discussed in more detail in Section 2.4.3. Based on the two mapping possibilities and the potential L1 influence of mensural classifier constructions, the hypotheses regarding the role of L1 transfer in second language acquisition of plurality will be established to predict the L2 participants' interpretations of English bare plurals.

To sum up, this L1-Chinese study will add novel data to the existing research on plurality and plurality inferences from a non-obligatory plural marking language, and contribute to the investigation of the interpretations of plural constructions in Chinese. It will also inform the exploration of L1 transfer in second language acquisition of plurality by helping establish L2 hypotheses in terms of the two mapping possibilities. In the next section, we turn to L2 acquisition studies and discuss the extent to which previous research has explored plurality and plural marking, and scalar implicatures.

2.4 L2 acquisition studies

The primary goal of this thesis is to investigate the universality of scalar implicatures and the role of L1 transfer in second language acquisition of plurality, through examining Chinese EFL/ESL learners' interpretations of English bare plurals. As introduced in Chapter 1 and the beginning of this chapter, if plurality inferences associated with *s* plurals are SIs as proposed in previous L1-English research, Chinese adult participants are expected to have no difficulty computing them as required by different contexts. However, since previous research has also shown that L2 English learners of optional plural marking languages tend to face difficulties with the plural suffix *-s*, we should also consider whether or not and how our

Chinese participants' L1 knowledge influences their computations of *s* plurals in L2 English. Therefore, in this section, I will review previous related SLA studies from two aspects: scalar implicatures in Section 2.4.1, as well as plurality and plural marking in Section 2.4.2. Through Section 2.4, research gaps from prior work will be identified as motivation for the current L2-English study.

2.4.1 Scalar implicatures[19]

As discussed in Section 2.1, the plurality inferences associated with plural morphology in languages with obligatory plural marking have been proposed to be scalar implicatures (Tieu et al., 2014; Renans, et al., 2018; Renans et al., 2020). This proposal has also received experimental support from these aforementioned L1 acquisition studies. The current L2-English study extends this research to the domain of SLA and tests whether the scalar implicature approach to plurality also applies to a second language. If plurality inferences are scalar implicatures, parallel patterns will be expected among Chinese EFL/ESL adult speakers in the current L2-English experiment. This is because scalar implicatures have been argued to be universally available, independently of L1, for L2 adult speakers (e.g., Slabakova, 2010; Snape and Hosoi, 2018). In the following, I will present some of the major findings reported from previous SLA studies, which support this viewpoint.

To investigate the second language acquisition of scalar implicatures and explain the performance displayed by L2 learners in computing SIs, Slabakova (2010) tested how L1-Korean L2-English speakers computed the scalar term *some* in English in two experiments.

According to Slabakova (2010), *etten* and *ilbu* are the counterparts of *some* in Korean. While *etten* can have either a partitive or non-partitive reading, *ilbu* only has a partitive reading, as shown below:

(2.44) **Etten** salam-tul-un   khi-ka   khu-ta.
      some person-PL-Top heigh-Nom tall-DECL
      a. *Some people are tall.*   (non-partitive)
      b. *Some of the people are tall.*   (partitive)
                                                    (adapted from Slabakova, 2010: p2451)

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[19] I am aware that there are other plural forms and scalar terms that are directly related to scalar implicatures, such as *dou* (all) in Chinese. The current research considered one kind of scalar implicature (i.e., plurality inference) and its relationship with the presence and absence of plural marking. Experimental studies on *some* were reviewed because this scalar term was directly tested and compared to bare plurals in previous experimental studies, such as *merika* (some) in Greek. Therefore, the current thesis does not aim to review everything about scalar implicatures but to concentrate on the scalar implicatures associated with *some*, which can be directly compared to the plurality inferences associated with English bare plurals.

In (2.44), the sentence containing *etten* has two possible interpretations: (2.44a) with a non-partitive reading *some people* and (2.44b) with a partitive reading *some of the people*. Turning to *ilbu* in (2.45):

(2.45) **Ilbu**   salam-tul-un khi-ka   khu-ta.
         one part person-PL-Top heigh-Nom tall-DECL
         a. *Some of the people are tall.*   (partitive)
                                                   (adapted from Slabakova, 2010: p2451)

In (2.45), the sentence containing *ilbu* can only be interpreted with a partitive reading *some of the people* as (2.45a).

       To examine whether L1-transfer through mapping from *some* in English to *etten/ilbu* in Korean is reflected in L2-English learners' computation of SIs associated with *some*, Slabakova (2010) tested four groups of participants. Two groups of L1-Korean L2-English speakers (intermediate vs. advanced) and native English speakers took the tests in English, whereas native Korean speakers took the tests translated in Korean. In the experiments, if the participants interpreted *some* with the *some and possibly all* meaning, it was viewed as a logical response. If they interpreted *some* with the *some but not all* meaning, it was viewed as a pragmatic response (Slabakova, 2010: p2456). Slabakova (2010) examined the participants' acceptance of the two types of interpretation. In Experiment 1, participants were asked to read test sentences and respond with *Agree* (i.e., accept) or *Disagree* (i.e., reject). The test sentences included two main types (felicitous vs. infelicitous), as shown in (2.46).

(2.46) a. **Some** books have color pictures.   (logically true and pragmatically felicitous)
        b. **Some** elephants have trunks.   (logically true but pragmatically infelicitous)
                                                   (adapted from Slabakova, 2010: p2452)

The statement (2.46a) is viewed as logically true and pragmatically felicitous, as not all books have colour pictures. Whereas (2.46b) is viewed as logically true and pragmatically infelicitous, as all elephants have trunks. Accepting (2.46a) and rejecting (2.46b) indicates that *some* is computed with the implicature *some but not all*.

       The results of Experiment 1 show that L1-Korean L2-English speakers overall accepted felicitous sentences (e.g., (2.46a)), which was the same as native English and Korean speakers. However, they rejected infelicitous sentences (e.g., (2.46b)) more often than native English and

44

Korean speakers. No significant difference was identified in the results between the two L2 proficiency groups (intermediate vs. advanced) across the test sentence types, showing no developmental pattern with increased proficiency. This means that L2 participants overall provided more pragmatic responses (i.e., interpreting *some* as *some but not all*) than native English and native Korean speakers. The findings suggest that L2 learners have no difficulty computing the scalar implicatures associated with *some* (i.e., *some but not all*), and that the SIs appear to be more common in an L2 than in L1s.

To verify that the results shown in Experiment 1 could not be explained by chance, Experiment 2 was conducted. Compared to Experiment 1, in Experiment 2, participants were provided with context-enriched test material. They were first presented with a story, which was shown through a series of pictures with descriptions. Then, the participants were asked whether or not they agreed with the test sentence which was shown in the picture. For example, the pictures and their descriptions show that the main character, Charlotte, ate all three candies on the table, and she was asked by her mum what she had been doing with the candies. Charlotte's reply was the test sentence on which the participants made judgments, as seen in (2.47).

(2.47) Story: Charlotte ate three out of three candies.

     a. I've eaten **some** of the candies.   (pragmatically infelicitous)

                                (adapted from Slabakova, 2010: p2454-2455)

(2.47a) is viewed as infelicitous, as Charlotte ate all of the candies, and thus *some* in this sentence has a *some and possibly all* meaning. Rejecting (2.47a) indicates computing *some* with the scalar implicature *some but not all*. Another type of test story and test sentence in Experiment 2 is shown in (2.48).

(2.48) Story: Charlotte ate two out of three candies.

     a. I've eaten **some** of the candies.   (pragmatically felicitous)

                                (adapted from Slabakova, 2010: p2454-2455)

In (2.48), the story shows that Charlotte only ate two out of three candies. (2.48a) is viewed as felicitous, as Charlotte indeed did not eat all of the candies and thus *some* in this sentence has a *some but not all* meaning. Accepting (2.48a) indicates the computation of scalar implicatures associated with *some*.

The results of Experiment 2 revealed that L1-Korean L2-English speakers rejected infelicitous sentences (e.g., (2.47a)) more often than native English and Korean speakers. This

means they provided more pragmatic responses to infelicitous sentences in their L2 than L1 speakers in their L1s. By contrast, L2 speakers overall accepted felicitous sentences (e.g., (2.48a)), the same as L1 speakers. This means that they computed SIs for *some* in felicitous sentences in their L2 at the same level as L1 speakers in their L1s. In addition, no significant difference in the responses between proficiency groups (intermediate vs. advanced) was identified across sentence types. The results show that L1-Korean L2-English speakers interpreted *some* with the implicature *some but not all* more often than native English and Korean speakers, which is consistent with the results of Experiment 1.

Taken together, the findings from both Experiment 1 and Experiment 2 show that L1-Korean L2-English learners tend not to have difficulty computing the scalar implicature associated with *some*, regardless of proficiency level. This is used as evidence for the argument that "linguistic pragmatic principles are universal" in L1s and L2s (Slabakova, 2010: p2444). Slabakova (2010) also argues that L2 learners compute more pragmatic interpretations than L1 speakers because they lack processing resources to undo scalar implicatures.

Similar findings were also reported from L1-Japanese L2-English speakers in Snape and Hosoi (2018), which also investigated the second language acquisition of scalar implicatures. Using a truth value judgement task, they tested the computation of SIs associated with *some* by L1-Japanese L2-Engslih speakers (intermediate vs. advanced). As noted by Snape and Hosoi (2018), the constructions containing *some* in their research are in the form of *some of the x*, such as *some of the bananas*. In the task, the participants were first presented with pictures containing a red plastic circle and toy fruits. Then, they were asked to make judgements on the pictures by replying with *yes/no* to the test questions. For example, (2.49) shows the descriptions of three pictures that were shown to participants (a, b, and c) and the test question for these three pictures.

(2.49) Question: Are **some of the oranges** in the red circle?

　　　a. 7 out of 8 oranges are outside the red circle and 1 orange is in the red circle

　　　b. 6 out of 8 oranges are outside the red circle and 2 oranges are in the red circle

　　　c. 8 out of 8 oranges are in the red circle

(adapted from Snape and Hosoi, 2018: p19)

As seen above, participants were shown pictures as described in (2.49a), (2.49b), and (2.49c), and were asked the question in (2.49), which contains the construction *some of the oranges*.

The task's results show that although no significant difference was identified either in the responses between L1-Japanese L2-English and L1-English speakers, or between the two proficiency groups for L2-English speakers (intermediate vs. advanced), L2-English speakers tended to interpret *some* with the scalar implicature *some but not all* more often than native English speakers. Snape & Hosoi (2018) speculates this is because L2 learners prefer pragmatic to logical interpretations, as the former costs less than the latter in processing.

To sum up the discussion so far in this subsection, based on the scalar implicature approach to plurality inferences, and assuming the universality of scalar implicatures as presented above and in Section 2.1, we can predict that our Chinese EFL/ESL participants in the current research have no difficulty computing the plurality inferences for English bare plurals. Specific hypotheses regarding this will be presented in Chapter 3.

Cho (2021) pointed out the aforementioned two studies only focused on the quantifier *some*, and it is not clear whether the L2 learners' targetlike performance is a result of scalar implicatures in general or quantifiers only. To address this, Cho (2021) investigated how L1-Korean L2-English speakers compute the implicatures associated with the English demonstrative determiner *that* in referring expressions.

In English, both *that* and the definite determiner *the* can denote uniqueness, as in (2.50).

(2.50) John just bought a car. He drove **the** car / **that** car to work.

<div align="right">(adapted from Cho, 2021: p7)</div>

However, using *that* instead of *the* can indicate that its referent is "implicitly contrasted" with others (Cho, 2021: p9) as in (2.51a), which has the implication (2.51b).

(2.51) a. John just bought a car yesterday. He drove **that** car to work today.

    b. *John drove the car in question but not the other cars that he could have driven.*

<div align="right">(adapted from Cho, 2021: p8)</div>

We now turn to Korean. According to Cho (2021), in Korean, there is no equivalent of the English definite determiner *the*. The Korean determiner *ku* translates into *that* and it sits between *that* and *the* on the uniqueness scale, shown in Figure 6.
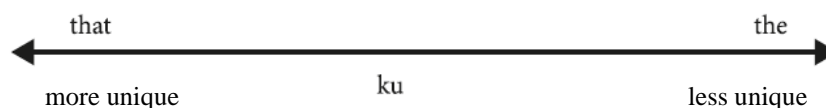
Figure 6 *ku* on the uniqueness scale with *the* and *that* (adapted from Cho. 2021: p12)

Cho (2021) explains that *ku* sits in the middle of the scale for two reasons. First, *ku* can behave like *the* in definite contexts as an anaphoric, such as in (2.52) below.

(2.52) Chey khan-kwen-ul sassta. **Ku** cheyk-un   pissass-ta.

     book one-CL-ACC bought **ku** book-TOP expensive was

     'I bought a book. The book was expensive.'

                                (adapted from Ahn, 2017: p40; cited in Cho, 2021: p10)

As in (2.52), *ku* tends to have the same function as the definite determiner *the* in English. Second, *ku* can also behave like *that* "when the entity is unique in the immediately salient situation" as a demonstrative determiner (p12). Consider the example (2.53).

(2.53) yeca   hanmyeng-i mwutay oynccok-eyse tulewassta.

     woman one-NOM   stage   left-from   entered

     'A woman entered from stage left.'

     talun   yeca   hanmyeng-I mwutay olunccok-eyse tulewassta.

     different woman one-NOM   stage   right-from   entered

     'Another woman entered from stage right.'

     ku yeca-nun   kkoch pakwuni-lul tulko   issessta.

     ku woman-TOP flower basket-ACC carry-COMP was

     'That woman was carrying a basket of flowers.'

                                      (adapted from Cho, 2021: p12)

As shown in (2.53), *ku* refers to the woman who entered from stage right rather than the one who entered from stage left, giving rise to a contrastive reading. Cho (2021) also noted that in the case of (2.46), *ku* is preferred to a bare noun, in order to show the contrast between the two women.

     With the differences between the Korean *ku* and English *the/that* presented above, Cho (2021) predicted that L1-Korean L2-English speakers will compute implicatures associated with *that* less often than native English speakers. To examine the effect of L1 transfer on the implicature computation for *that*, Cho (2021) conducted an acceptability judgment task on L1-Korean L2-English speakers and compared their results to native English speakers. In the task,

the participants were asked to make judgments on test sentences such as (2.54a) and (2.54b).

(2.54) a. Joshua adopted a dog and a cat last month. He trained **the** dog and taught it tricks.

   b. Joshua adopted a dog and a cat last month. *He trained **that** dog and taught it tricks.

(adapted from Cho, 2021: p15)

(2.54a) contains the definite determiner *the* and is viewed as pragmatically felicitous. By contrast, (2.54b) contains the demonstrative *that* and is viewed as infelicitous, because *that* in the given context cannot give rise to a contrastive reading between the dog and the other dogs.

The results show that, unlike for native English speakers, there was no significant difference in the L2 learners' rating between (2.54a) and (2.54b). In other words, the L2 participants provided similar ratings to both pragmatically felicitous and infelicitous sentences, meaning they did not compute the contrastive implicature for *that*. This suggests that the L1-Korean L2-English speakers had difficulty computing the implicatures associated with the demonstrative determiner *that*. This finding is contrary to previous findings reported from scalar implicatures associated with *some* (Slabakova, 2010; Snape and Hosoi, 2018). Cho (2021: p24) argues that "crosslinguistic influence plays out selectively in L2 scalar implicatures", and therefore when there is no or not an entire overlap in semantic scales between an L1 and L2, L2 speakers will appear to face difficulty with implicature computation. If this is the case, we might also see our Chinese EFL/ESL participants interpret plurality inferences for English bare plurals at a non-targetlike level, due to the potential difference between the meanings of English *s* plurals and Chinese *men* plurals: *s* plurals have both exclusive and inclusive readings but *men* plurals have exclusive readings only.

Section 2.4.1 reviewed three major SLA studies on (scalar) implicatures. Although much previous research has shown the universality of scalar implicatures across L1s and L2s (e.g., Slabakova, 2010; Snape and Hosoi, 2018), a recent study (Cho, 2021) pointed out that the difference in semantic scales[20] between an L1 and L2 may pose difficulties for L2 learners to compute implicatures. Given the discussion above, our research attempts to inform the investigation of second language acquisition of scalar implicatures, by testing plurality inferences associated with English bare plurals on Chinese EFL/ESL. We will compare the L2 participants' results to native English and native Chinese speakers, and seek to identify whether or not the universality of scalar implicatures and the role of L1 transfer will manifest in their

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[20] Regarding possible semantic scales in terms of plurality, this will be discussed in Section 6.4.2.

performance. This will contribute to our knowledge of implicatures, such as the plurality inferences in question, which have not been widely explored in L1 or directly explored in L2. In the next subsection, we will review previous research on the second language acquisition of English plurals.

2.4.2 Plurality and plural marking

Much of the previous research testing English plurals pays particular attention to the mass/count distinction and the suppliance of the plural marker -*s*, rather than the readings associated with English (bare) plurals. Despite the fact that their rationales are different, the findings of this body of research in general show that L2-English speakers whose native languages have optional plural marking (Chinese, Japanese, Korean) tend to face difficulties with English plurals, no matter whether the source of difficulties was argued to be due to L1 transfer or some universal semantic properties. The goal of Section 2.4.2 is to present how plurality and plural marking have been approached in L2 studies and identify research gaps in the domain of SLA. It reports some common difficulties that have been reported with English plurals for L2-English speakers and the potential role of L1 transfer. In the studies discussed in this subsection, the L2 learners were not limited to native Chinese Mandarin speakers; other optional plural marking language (Japanese and Korean) speakers were also included. By analysing the languages which have similar number systems to Chinese, we can predict what difficulties Chinese EFL/ESL speakers may face with English plural morphology and plurality interpretations and consider whether L1 transfer plays a role in the interpretation of English bare plurals. Through the discussion in this subsection, I will also show the implications of previous work for the current research.

The mass/count distinction

Some studies examined how EFL learners distinguish count and mass nouns in L2-English (e.g., Hua and Lee, 2005; Inagaki, 2014; Choi et al., 2018; MacDonald and Carroll, 2018). For example, to investigate the second language acquisition of the mass/count distinction, Hua and Lee (2005) tested if Chinese adult EFL learners are sensitive to *the singular count noun rule* in English, and if they can distinguish between count and mass nouns in English. The singular count noun rule in their study refers to "count nouns must either be plural or be preceded by a determiner; bare singular count nouns are prohibited" (p139).

The experiments in Hua and Lee (2005) consisted of three parts. Part 1 is a grammaticality judgment task. It tested if the participants have the knowledge that English

count nouns occur with the quantifier *many* and cardinal numerals but not with *much*, whereas mass nouns occur with *much* but not with *many* or numerals. In the task, the participants were asked to judge test sentences containing count/mass nouns, which were associated with *many/much/*numerals. The count nouns were either concrete (e.g., computer) or abstract (e.g., sentence), whereas the mass nouns were concrete (e.g., water), abstract (e.g., work), or collective (e.g., stationery). The results show that the Chinese EFL/ESL learners of higher proficiency displayed a similar performance to native English speakers. They tended to accept concrete and abstract count nouns being used with *many* and numerals, and accept concrete, abstract, and collective mass nouns being used with *much*. By contrast, L2 learners of lower proficiency showed a lower acceptance of the aforementioned situations than those of higher proficiency, suggesting the effect of proficiency. As for the test sentences where count and mass nouns were used in incompatible situations (i.e., count nouns combined with *much* and mass nouns combined with *many* or numerals), although L2 learners of all proficiency levels overall showed a low acceptance for them, there was a statistically significant difference in their results between concrete and abstract nouns. They tended to be more accurate with concrete nouns than with abstract nouns.

Part 2 of their experiment tests whether Chinese EFL/ESL learners are sensitive to the singular count noun rule in English, using a judgment task. In this task, the participants were asked to judge test sentences containing indefinite DPs or bare singular DPs in either the subject position or object position. For example, consider (2.55).

(2.55) (subject position:)

    a. **<u>A computer</u>** stands on the top of the office desk, with the screen showing a beautiful painting.
    b. *<u>**Computer**</u> stands on the top of the office desk, with the screen showing a beautiful painting.
    (object position:)
    c. Yesterday, John bought **<u>a computer</u>** that is just as powerful as a desktop, with respect
       to speed and storage capacity.
    d. *Yesterday, John bought **<u>computer</u>** that is just as powerful as a desktop, with respect
       to speed and storage capacity.

(adapted from Hua and Lee, 2005: p145)

In (2.55), the DPs are either in the subject or object position of the test sentences. In subject position, (2.55a) containing the indefinite DP *a computer* is grammatically correct, whereas (2.55b) containing the bare singular DP *computer* is grammatically incorrect. In object position,

(2.55c) containing *a computer* is grammatically correct, whereas (2.55d) containing *computer* is grammatically incorrect. The test sentences for abstract count nouns were formulated in the same structure. The results show that the L2 participants of lower proficiency overall did not show a significant difference in their results across subject/object positions or concrete/abstract noun types. This means that they had not learned the singular count noun rule in English. As for L2 participants of higher proficiency, the results suggest that they tended to apply the singular count noun rule better in the object position than subject position, and better with concrete count nouns than with abstract count nouns.

Part 3 tested whether Chinese EFL/ESL learners could correctly use mass/count flexible nouns, using a forced-choice task. In the task, the participants were asked to choose the correct DP for test sentences, such as in (2.56). The DPs in bold are the target answers.

(2.56) (count context:)

    a. **A thought/*Thought** came to the student's mind as he listened to the professor lecturing in the room.

    (mass context:)

    b. Whether **thought/***A thought depends on language seems to be an issue that has interested many philosophers, linguists, and psychologists.

<div align="right">(adapted from Hua and Lee, 2005: p147)</div>

The test sentence (2.56a) shows a count context where 'the nominal denotes an individuated object' (Hua and Lee, 2005: p147), and therefore the indefinite DP *a thought* is the target answer, rather than the bare singular *thought*. In comparison, (2.56b) shows a mass context where the nominal denotes a generic reading, and therefore, the bare singular *thought*, instead of *a thought*, is the target answer. The results show that L2 participants of higher proficiency were able to distinguish between the count/mass contexts and choose the correct DPs as required by their contexts. L2 participants of lower proficiency overall showed less accuracy than them for the test sentences.

The overall findings of Hua and Lee (2005) revealed a developmental pattern, as the Chinese EFL/ESL learners of higher proficiency overall provided more accurate responses than the learners of lower proficiency across the three tasks. The difficulties faced by L1-Chinese L2-English learners included distinguishing between mass and count nouns, and knowing and applying the rule that bare singular count nouns are not permitted in English.

From the perspective of syntax-semantics mappings, Inagaki (2014) also reported the difficulties L2 learners encountered with the mass/count distinction in their L2 English. They investigated how Japanese EFL learners make quantity judgments on count/mass nouns in English, in order to observe if they can use syntactic cues to distinguish them. The nouns tested include four types: count nouns (e.g., shoes), object-mass nouns (e.g., furniture), substance-mass nouns (e.g., mustard), and mass/count flexible nouns (e.g., string(s)). Their syntactic cues include count nouns being used with count syntax (e.g., *more shoes* and *more strings*) and mass nouns being used with mass syntax (e.g., *more furniture/mustard* and *more string*). This was tested with quantity judgment tasks on L1-Japanese L2-English speakers and L1-English speakers in English and L1-Japanese speakers in Japanese.

In the task, they were first presented with pictures showing two cartoon characters, who either had two large objects/portions of a substance or six tiny objects/portions of a substance. The participants were then asked to reply to the question *Who has more NP(s)*. For example, consider Figure 7 for count nouns and object/substance mass nouns, including the pictures with their descriptions and questions.

| Farmer Brown and Captain Blue have some shoes. Who has more **shoes**? | Farmer Brown and Captain Blue have some furniture. Who has more **furniture**? | Farmer Brown and Captain Blue have some mustard. Who has more **mustard**? |

Figure 7 Examples for count nouns, object-mass nouns, substance-mass nouns
(adapted from Inagaki, 2014: p469-470)

As shown in the picture above, for count nouns (left), the comparison is between two large shoes vs. six tiny shoes. For object-mass nouns (middle), the comparison is between six tiny pieces of furniture vs. two large pieces of furniture. If the participants made their judgments based on number, they were expected to choose six tiny shoes over two large shoes, and choose six tiny pieces over two large pieces of furniture. As for substance-mass nouns (right), the comparison is between two large portions of mustard vs. six tiny portions of mustard. If they made their judgments based on volume, they were expected to choose two large portions over six tiny portions of mustard.

The results showed that the participants overall accurately quantified count nouns and object-mass nouns based on the number of them, and quantified substance-mass nouns based on their volume. There was no significant difference in the results across the three language groups (L2-English, L1-English, L1-Japanese). This means that the L-Japanese L2-English speakers tended to interpret count and object mass nouns "as referring to individuals", and substance-mass nouns "as referring to non-individuals", similar to the L1-English and L1-Japanese speakers in their L1s (Inagaki, 2014: p474). Inagaki (2014) speculated that this was attributed to L1 transfer. Specifically, there are some Japanese nouns that can individuate without count syntax and L1-Japanese L2-English speakers know the semantic notion of *individuation.* Therefore, when they were tested with the three categories of English nouns shown in Figure 7, they mapped them to their counterparts in Japanese and correctly made quantity judgments based on number/volume.

Inagaki (2014) also tested the participants on mass/count flexible nouns (Figure 8).

| Farmer Brown and Captain Blue have some string. Who has more **string**? | Farmer Brown and Captain Blue have some chocolates. Who has more **chocolates**? |
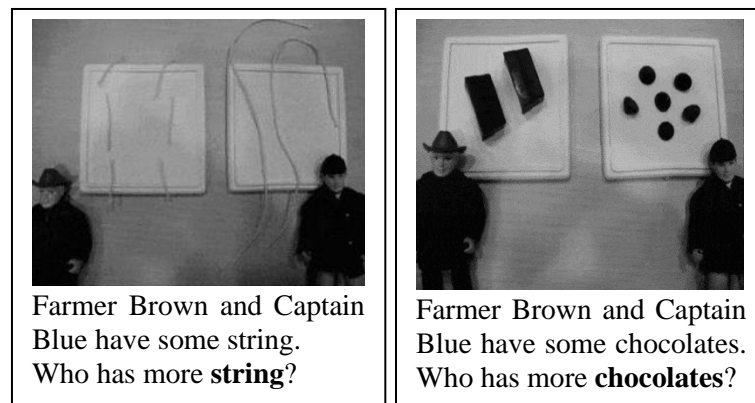
Figure 8 Examples for the mass/count flexible nouns (string, chocolates) (adapted from Inagaki, 2014: p471)

As shown above, the picture on the left shows the mass condition, which is signified by *string* with mass syntax. The judgment was made between six short pieces of string vs. two long pieces of string. If the participants were sensitive to mass syntax, they were expected to quantify by volume and choose two long pieces over six short pieces of string. The picture on the right shows the count condition, which is signified by *chocolates* with count syntax. The comparison is between two large chunks of chocolate vs. six small chunks of chocolate. If participants were sensitive to count syntax, they were expected to quantify by number and choose six small over two large chunks of chocolate.

The results show that the interpretive patterns shown by L2-English participants were more similar to L1-Japanese than L1-English speakers. Specifically, L1-English participants

always quantified the mass-count flexible nouns with count syntax based on number (100%) and tended to with mass syntax based on volume (87.5%), whereas L1-Japanese participants overall quantified the Japanese counterparts based on number and volume fifty-fifty. Although L2-English participants quantified the English flexible nouns with mass syntax based on volume only slightly less often than L1-English participants (71.2%), they quantified them with count syntax based on number only half of the time (52.6%). This means that L2-English participants tended to have difficulty shifting their judgments depending on the mass/count syntax (e.g., *string* vs. *chocolates*).

In general, the findings of Inagaki (2014) show that L1-Japanese L2-English speakers' sensibility to the mass/count syntax associated with English mass-count flexible nouns appears to be at a non-targetlike level expected for L1-English speakers. This suggests that they tend to have difficulty acquiring the mass/count distinction in English.

Following a similar methodology, MacDonald and Carroll (2018) reported the difficulties with English plurals from L1-Korean L2-English speakers. To test how the mass-count morpho-syntactic cues influence L2 learners' interpretation of English nouns, they investigated how Korean ESL speakers interpret mass-count flexible nouns in L2 English. The difference between the experiments in the two studies is that Inagaki (2014) used written stimuli, while MacDonald and Carroll (2018) used oral stimuli. This means that in MacDonald and Carroll (2018), the participants looked at the test pictures and listened to the test sentences. The results showed that Korean ESL speakers were only able to quantify English flexible nouns based on the mass/count syntax accurately half of the time, suggesting that they were insensitive to plural marking in English. MacDonald and Carroll (2018) postulates this might be attributed to L1 transfer, as a strong positive correlation between English flexible nouns and their unmarked counterparts in Korean was identified in their experiments.

To sum up, the findings of the SLA studies reviewed above suggest that L2-English speakers, whose native languages have non-obligatory plural marking (e.g., Chinese, Japanese, Korean), overall tend to face some level of difficulty with the mass/count distinction and plural marking in English, where plural marking is obligatory. The interpretative patterns shown by the L2-English learners were also proposed to be due to L1 transfer, with the potential effect of L2-English proficiency. In the current L2 study, to explain interpretive patterns shown by Chinese EFL/ESL speakers, whose native language is different from English in terms of plural marking, we should also consider to what extent L1 transfer plays a role in the adult L2 acquisition of English bare plurals, in comparison to the role of scalar implicatures, which have been argued to be universally accessible in both L1s and L2s. As discussed in Section 2.2, in

Chinese, the plural marker *-men* is not the only way to yield plural meanings. Chinese bare nouns and some classifier constructions tend to be even more widely used than *men* plurals to express plural meanings. Therefore, the mapping from English to Chinese has multiple possibilities: *-s* to null plural marking and *-s* to *-men*. These two mapping possibilities will be further discussed in Section 2.4.3, together with the potential influence from Chinese mensural classifier constructions that yield plural meanings. The L2 hypotheses based on them will be presented in Chapter 3. Through the current research, we will be able to observe whether Chinese EFL/ESL learners have difficulty interpreting English bare plurals. If so, are the non-targetlike patterns due to L1 transfer? If yes, what is the source of L1 transfer and can transfer be recovered in accordance with proficiency? If not, are the targetlike patterns attributed to the universality of plurality inferences? These questions will be answered by the current L2 study.

The suppliance of *-s*

Now we turn to studies that investigated the suppliance of the plural marker *-s* in L2 English (e.g., Jiang, 2007; Jiang et al., 2011; Song, 2015; Rusk et al., 2020; Choi and Ionin, 2021) and present the common difficulties faced by L2-English learners reported from them. For example, in order to examine the development of linguistic knowledge in adult SLA, Jiang (2007) investigated if Chinese ESL speakers are sensitive to *-s* omission errors in L2 English. This was tested on adult Chinese ESL speakers and native English speakers through a self-paced reading task. In the task, the participants read test sentences word by word presented on a computer monitor at a self-controlled pace, and then were asked to reply yes/no to show if they understood. Their reading times (RTs) were tracked. The test sentences are either grammatical or ungrammatical with a plural error, as shown in (2.57).

(2.57) a. The visitor took several of the rare **coins** in the cabinet.

  b. *The visitor took several of the rare **coin** in the cabinet.

(adapted from Jiang, 2007: p13)

(2.57a) contains the plural *coins* and is grammatically correct, whereas (2.57b) contains the singular *coin* and is ungrammatical. If the participants noticed the grammar error in (2.57b), a delay in sentence processing would be expected. The results show that there was no statistically significant difference in L2 learners' RTs between (2.57a) and (2.57b), whereas a significant difference was identified in native English speakers' results. This suggests that L1-Chinese L2-

English speakers tend not to have a targetlike sensitivity to plural errors (i.e., -*s* omissions) when compared to L1-English speakers.

Similar findings have also been reported from Japanese learners of English (e.g., Jiang et al., 2011) and Korean learners of English (e.g., Song, 2015; Choi & Ionin, 2021). This suggests that plural marking poses potential difficulties for L2 learners whose native languages lack obligatory plural marking, and the effect of L1 transfer also appears to be traceable. Therefore, it is also reasonable to consider whether those L2 learners may face difficulties with plurality interpretations that are also associated with plural marking in English, examine whether or not and (if any) to what extent L1 transfer influences the L2 learners' interpretations of English bare plurals, and identify the source of possible L1 transfer. This will be explored by conducting a TVJT on Chinese EFL/ESL speakers in the current L2 study.

The readings associated with English plurals

As mentioned at the beginning of Section 2.4.2, compared to the mass/count distinction and the suppliance of the plural marker -*s* in English, the readings associated with English plurals seem to have attracted less attention in previous research. Among them, the focus has been mainly concentrated on the generic reading of English plurals (e.g., Slabakova, 2006; Ionin et al., 2013; Morales-Reyes and Arechabaleta-Regulez, 2017). For example, to investigate learnability in the second language acquisition of semantics, Slabakova (2006) tested how L1-Italian L2-English speakers interpret English bare plurals. English bare plurals can be interpreted with either generic or existential readings, whereas Italian bare plurals only denote existential readings and generic readings are realised by definite plurals. The study found that L1-Italian L2-English speakers interpreted the generic reading for English bare plurals at a native-English-like level, and the main difference between L2-English and L1-English groups lay in their computation for existential readings. As another example, Ionin et al. (2013) examined how L1-Spanish L2-English speakers interpret bare plurals and definite plurals in L2 English, to investigate the role of L1 transfer in SLA. Their study found that L2 learners from lower proficiency groups tended to interpret bare plurals with more specific readings and interpret definite plurals with more generic readings than advanced learners and native English speakers. Some level of L1 transfer was also reported from the findings in both studies. Research so far has not directly explored the exclusive/inclusive readings associated with English bare plurals. The current research will fill this research gap for SLA by testing L2 learners from the optional plural marking language Mandarin Chinese. It will also identify if

there is influence from L1 transfer in adult L2 acquisition of plurality and if L1 transfer can be recovered with increasing proficiency.

Summary

To conclude Section 2.4.2, SLA studies on English plurals have mainly focused on examining the mass/count distinction, the suppliance of the plural marker -*s*, and the generic reading associated with bare plurals. By contrast, the investigation of the plurality interpretations for English bare plurals so far, to my knowledge, is absent. Therefore, the current research intends to contribute to this topic with novel data from Chinese EFL/ESL speakers. Through reviewing previous research, it can be seen that English plural marking poses difficulties for L2 learners whose native languages do not have obligatory plural marking (Chinese, Japanese, Korean), and L1 transfer has been attested to in many studies. Therefore, it is natural to consider if Chinese EFL/ESL speakers also encounter difficulties when computing the exclusive/inclusive readings associated with bare plurals in L1 English, and if so, are their interpretive patterns attributed to L1 transfer and what is the source of possible L1 transfer? To test this, it is necessary to know what is already available in Chinese regarding plurality. As presented in Section 2.2, there are several forms to express plurality in Chinese, such as bare nouns, -*men* plurals, and some classifier constructions discussed in the current research. Accordingly, to examine the role of L1 transfer, the current research considers two L1 transfer mapping possibilities (-*s* to -*men* and -*s* to null plural marking) and the potential influence from mensural classifier constructions. The two mapping possibilities are based on the Feature Reassembly Hypothesis, which will be introduced in the next section.

2.5 Motivations for the L2-English study

This section summarises the motivations for the current L2 research which have been discussed in previous sections. Section 2.5.1 concludes the research gaps in SLA found by the literature review and explains the rationale for the current research. Section 2.5.2 further presents the aim of the current L2 study, considering the universality of scalar implicature and the role of L1 transfer in SLA. Section 2.5.3 briefly discussed two relevant L2 approaches to inflectional morphology and explained the current L2 model (the mapping process from the FRH) was adopted to formulate L2 hypotheses regarding L1 transfer through mapping. Before ending this section, I review the Feature Reassembly Hypothesis and relevant L2 studies on it, and extend the discussion to the two mapping options in the current research.

2.5.1 Research gaps and rationale

Through the literature review, several research gaps have been identified. First, the L2 experimental studies surrounding English plurals concentrate mostly on how L2 speakers understand count/mass and their sensitivity to plural marking in their L2. The readings associated with bare plurals have received less attention, and yet, those studies on bare plurals have focused on their generic interpretations. The plurality interpretations (exclusive vs. inclusive readings) of bare plurals have, to my knowledge, not been assessed in an L2. My research will add novel data to the discussion in this area, by testing Chinese EFL/ESL learners in their L2 English.

Second, plural marking is a notable area of difficulty for L2 learners, and there is evidence showing that L2-English learners from classifier language groups (Chinese, Japanese, Korean) tend to encounter difficulty with English plural marking, such as distinguishing the mass/count nouns in English and identifying *-s* use errors. Again, the previous exploration was mainly carried out from the perspective of the mass/count distinction and the suppliance of *-s*, rather than plurality interpretations in the use of plural morphemes. It reminds questionable whether or not L2 learners will also face difficulty when interpreting plurality in English, and if they do, to what extent they will be influenced by their native language. This will be explored in the current research. Through an English TVJT testing the interpretations of English bare plurals, we will trace the interpretive patterns shown by the Chinese EFL/ESL adult learners back to L1-Chinese.

Third, previous L2 research on scalar implicatures has not tested plurality inferences associated with plural morphology, which have been argued to be a type of scalar implicature in recent L1 studies (e.g., Tieu et al., 2014; Renans et al., 2018; Renans et al., 2020). Therefore, the current research extends the investigation on the computation of plurality inferences from L1s to L2s. It compares the Chinese EFL/ESL speakers' performance against that of other scalar implicatures in previous research, advancing our understanding of to what extent the findings on the universality of SIs in L2 can be extended to the use of plural marking in L2 English.

2.5.2 The universality of scalar implicatures and L1 transfer

Through the literature review in previous sections, two major findings can be summarised as follows. On the one hand, scalar implicatures tend to be universally available in both L1s and L2s. This means that assuming plurality inferences associated with the plural marker *-s* are scalar implicatures, L2-English learners will know the targetlike interpretation of

English bare plurals even at the initial state of their interlanguage through the universal principles of pragmatic inferences, bypassing L1 transfer. On the other hand, L2-English learners from non-obligatory plural marking languages tend to have difficulty with English plural marking and L1 transfer tends to be traceable in their performance on English plurals. Given this, the cross-linguistic difference between English and Mandarin Chinese regarding plurality might be where the L1-English and L2-English performance diverges. The aforementioned two aspects (i.e., the universality of scalar implicatures vs. L1 transfer) make different predictions for L2 learners' performance. Therefore, the current research aims to test the universality of scalar implicatures and the role of L1 transfer, exploring whether or not, and how, they will affect Chinese EFL/ESL speakers' interpretations of English bare plurals.

2.5.3 Other possible L2 approaches to plural marking[21]

The current L2 English study investigates the adult L2 acquisition of English bare plurals, so other L2 models concerning inflectional morphology can also potentially be relevant, such as the Bottleneck Hypothesis (Slabakova, 2008) and the problem of form-meaning mapping (DeKeyser, 2005). For example, the Bottleneck Hypothesis (Slabakova, 2008) argues that functional morphology is the bottleneck of acquisition. Following this hypothesis, the L2 learners in question may have difficulty with English bare plurals because English and Chinese use significantly different ways to signal the grammatical plural meaning. This difficulty may also remain even for advanced-proficiency L2 learners. DeKeyser (2005) argues that "the transparency of form-meaning relationships" to a L2 learner determines the difficulty of L2 acquisition, and to what extent a linguistic form is important to the meaning it expresses, influences this transparency and affects what is easy or hard to acquire in an L2 (pp3-4). Based on this, the plural marker -s itself may cause difficulties for L2 English learners, because it shares the same form with third-person -s and genitive -s, despite its differences from the (null) plural marking in Chinese. What the two studies hold in common is that they focus on what is easy and what is hard to acquire in an L2. They point out the difficulty of inflectional morphology and account for why it is more difficult to acquire compared to other linguistic structures. However, they cannot predict any concrete L2 interpretive patterns for the current experimental study. Without these hypotheses, we cannot decide if L1 transfer is manifested in the adult L2 acquisition of plurality, and even if it is, where the effect of L1 transfer is from

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[21] We acknowledge that other L2 models can potentially be relevant to this study (such as Slabakova, 2008; DeKeyser, 2005). However, the mapping process from the FRH was adopted because it can help us predict L2 interpretative patterns. In this section, I briefly explain why the aforementioned approaches cannot practically help the current research.

also remains questionable. On the other hand, by means of the mapping process of the Feature Reassembly Hypothesis (Lardiere, 2008; 2009), we are able to identify the source of possible L1 transfer. As pointed out by Gil and Marsden (2013), the FRH involves two distinct tasks in L2 development: mapping and feature reassembly. Specifically, L2 learners map the target lexical item in L2 input to its equivalents in their L1, and "once this initial mapping is established, 'feature reassembly' can occur, if required" (Gil and Marsden, 2013: pp3-5). The current research concentrates on the initial mapping process, where both meaning and grammatical function are used as cues by L2 learners. Based on the proposed mapping direction in Gil and Marsden (2013), the mapping possibilities for Chinese EFL/ESL learners in this research are:

(i) L2 English plural marker -*s* → L1 Chinese plural marker -*men*
(ii) L2 English plural marker -*s* → L1 Chinese null plural marking

With the mapping options above, we will predict L2 interpretative patterns in the L2 English experiment and explore to what extent L1 transfer is manifested in the adult L2 acquisition of English bare plurals. This will be discussed in detail in the next subsection, with the review of the Feature Reassembly Hypothesis.

2.5.4 Feature Reassembly Hypothesis

The current L2 research examines the universality of scalar implicatures and the potential effect of L1 transfer in the second language acquisition of English bare plurals by Chinese EFL/ESL speakers. Regarding L1 transfer, I adopted the mapping process of the Feature Reassembly Hypothesis (Lardiere, 2008; 2009) as an L2 model to formulate the hypotheses concerning the extent to which L2 learners' plurality interpretations are influenced by the effect of L1 transfer. This mapping process in FRH, simply put, proposes that L2 learners map the target lexical items in the L2 to the existing items in their L1 based on meaning and grammatical functions. In the case of plural marking, the L2 learners are assumed to project an equivalence between -*s* in English and -*men* in Mandarin Chinese. Based on this, we can predict how the knowledge of -*men* affects how the Chinese participants interpret *s* plurals. At the same time, as shown in Section 2.2, bare nouns are also used (even more widely used) to express plural meanings in Chinese. This leads to another one mapping possibility from -*s* in L2 English to null plural marking in Mandarin Chinese, in addition to the -*s* to -*men* which was initially proposed in previous studies (e.g., Lardiere, 2008; 2009). Therefore, in the current L2

study, I will also investigate whether, and if so, how, Chinese bare nouns influence Chinese EFL/ESL learners' interpretations of English *s* plurals. This subsection will first introduce the mapping process of the FRH (Lardiere, 2008; 2009). It then briefly reviews Hwang and Lardiere (2013) who tested the FRH, in order to explain why this mapping process of the FRH is suitable for predicting the influence of L1 transfer on L2 performance in the current research. The hypotheses based on the two mapping possibilities (i.e., *-s* to *-men* and *-s* to null plural marking) and the potential influence of mensural classifier constructions will be presented in detail in Chapter 3, together with the research questions in the current L2 study.

The FRH assumes full L1 transfer and full UG access in adult L2 acquisition, based on the Full Transfer Full Access Hypothesis (FT/FA) (Schwartz and Sprouse, 1994; 1996). The FT/FA argues that the initial state of L2 acquisition is the end state of L1 acquisition. L1 grammar fully transfers ("excluding the phonetic matrices of lexical/morphological items" (Schwartz and Sprouse, 1996: p41)), and when L2 learners fails to assign a representation from their L1 grammar to the L2 input, they will resort to universal grammar, which will cause the restructuring of their interlanguage grammar.

As stated by Lardiere (2009), unlike when acquiring a native language, L2 learners have "an already-fully-assembled set of (L1) grammatical categories" (p175). With the similarities and differences between L1 and L2, the investigation of how a learner's knowledge in their L1 influences the acquisition of an L2 has been widely conducted through different approaches. Among these, the Feature Reassembly Hypothesis (Lardiere, 2008; 2009) considers the role of L1 transfer by the formal features (such as [±plural], [±number]) associated with lexical items. To be specific, it is proposed that L2 acquisition requires learners to map the target lexical items in the L2 input onto the equivalent counterparts that already exist in their L1. They then need to select and assemble the new features associated with the target lexical item in their L2, as well as reassemble the existing configurations of the relevant features in their L1 to the new configurations in their L2 as required. The differences between how features are encoded in the native language and the target language tend to pose difficulties to language learners, especially when the feature assembly of lexical items in their native language is already complex (Lardiere, 2008: p26). Although the feature [±human]/[±animate] does not match in the plural markers *-s* and *-men*, English *s* plurals and Chinese *men* plurals have similar morphological shapes. Both *-s* and *-men* are post nominal and are used to pluralise. Therefore, we apply the mapping process of the FRH to the current research, assuming Chinese learners of English will map *-s* in English to *-men* in Chinese. An example supporting the FRH is the case study reported in Lardiere (2008).

To explore how grammatical features are acquired in an L2, Lardiere (2008) investigated the L2 acquisition of definiteness and number in English by a native Chinese speaker, Patty. She is a native speaker of Mandarin and Hokkien and is also fluent in Cantonese. She had resided in the US for about 10 years when her data was collected for the first time and over 18 years when the third set of data was collected. The data included both spoken English recordings and written English emails. They were used to analyse Patty's (in)definite article production and the plural marker *-s* suppliance/omission. Before reporting the results of this case study, we first consider how definiteness and number are encoded in English and Chinese (Mandarin, Hokkien, Cantonese), with a focus on Mandarin as below.

Lardiere (2008, p8,13,14) generalised that all three Chinese languages (Mandarin, Hokkien, Cantonese) differ from English, and the [+plural] and the [±definite] features in them are realised differently. In English, plurality is marked on definite and indefinite count nouns, the plural marker *-s* is obligatory, and articles are required to indicate (in)definiteness. In Mandarin, on the other hand, plural interpretations can be realised by classifiers. The plural marker *-men,* with a restricted usage, is optional. *Men* plurals denote definite readings and cannot be used in existential constructions. There are also no definite or indefinite articles in Mandarin. In Hokkien, bare nouns can be interpreted as definite. In Cantonese, only *classifier + noun* phrases can be definite (Cheng and Sybesma, 1999; cited in Lardiere, 2008: p8). Consequently, Chinese learners of English will need to delete definiteness from plural marking as it is in Chinese and reassemble the features of definiteness and number in English (Lardiere, 2008: p14).

Through analysing Patty's production of definite/indefinite articles and overt plural marking in English, Lardiere (2008) concluded that Patty had acquired knowledge of [±definite] and [+plural] in English, but the variability in her production data also suggested that she was not entirely at the native-like level. This suggested that *-s* was mapped to the morpheme *-men* and its feature bundle, and this influenced the acquisition of *-s*.

A number of L2 studies investigating other language pairs beyond English-Chinese have also provided empirical evidence to support the mapping process of the FRH (e.g., Hwang and Lardiere, 2013; Cho and Slabakova, 2014; Cho and Slabakova, 2017; Lee and Lardiere, 2019). For example, Hwang and Lardiere (2013) examined the L2 acquisition of plural making in Korean by native English speakers, using this "comparative linguistic feature-based approach" (Hwang and Lardiere, 2013: p58). They treated *-tul* as a counterpart to *-s*. This was tested through L1-English speakers' acquisition of intrinsic and extrinsic plural marking associated with the same plural particle *-tul* in Korean.

According to Hwang and Lardiere (2013), in Korean, intrinsic plural marking is widely used and is similar to English plural marking, whereas extrinsic plural marking is "much less common in the input" (p59). First, consider the example of intrinsic plural marking in Korean, as shown in (2.58).

(2.58) ai(-tul)-i   hakkyo-ey ka-ss-ta.   (Intrinsic)
        child(-PL)-NOM school-to   go-PAST-DECL
        With *-tul*: '(The/some specific) children went to school.'
        Without *-tul*: 'A/the child or (some, non-specific) children went to school.'

                                        (adapted from Hwang and Lardiere, 2013: p59)

In (2.58), although the particle *-tul* is optional, the sentence has two different interpretations with/without it: a specific meaning with *-tul* and a non-specific meaning without *-tul*. When *-tul* appears, the plural refers to multiple children only. We now consider extrinsic plural marking, as shown in (2.59) below.

(2.59) haksayng-tul-i   yelsimhi(-tul) enehak-ul   kongpuha-n-ta.   (Extrinsic)
        student-PL-NOM intently(-EPL) linguistics-ACC study-PRES-DECL
        'The students study linguistics intently.' = 'Every student studies linguistics intently.'
                (adapted from Kim, 1994: p313; cited in Hwang and Lardiere, 2013: p59)

(2.59) has a distributive reading over every individual in its referent. As an extrinsic plural marker, *-tul* can also be associated with non-nominal categories, such as the adverb *yelsimhi* (intently). Hwang and Lardiere (2013) also noted that the equivalent lexical item for the extrinsic *-tul* in English is *each (of the)*.

The main learning tasks for English learners of Korean to acquire the intrinsic and extrinsic plural marking associated with *-tul* include:

  i. learning that plural marking in Korean indicates specificity, which differs from English,
     where plurals are indifferent to specificity
 ii. learning that *-tul* can have a distributive reading, which is similar to *each (of the)* in English
iii. learning that *-tul* as an extrinsic plural marker can be used with non-nominals (e.g., adverbs)
                                        (adapted from Hwang and Lardiere, 2013: p59, p64-66)

Hwang and Lardiere (2013) made developmental predictions for different language proficiency levels. Specifically, L2-Korean learners will initially map the Korean *-tul* to the English *-s* in their native language. At lower proficiency levels, they will overuse *-tul* because plural marking is obligatory in English; they will also fail to interpret the specificity of plurals associated with *-tul*. At advanced proficiency levels, learners will acquire the extrinsic plural marking for *-tul*; this is acquired later than others because it requires employing "a distributive feature from a completely different lexical item in English" (p68), that is, *each (of the)*.

The results from Hwang and Lardiere (2013) appear to support the predictions and show a developmental pattern with increasing proficiency for the acquisition of both intrinsic and extrinsic plural marking. The intrinsic *-tul* was easier to acquire than the extrinsic *-tul*, as the extrinsic *-tul* is equivalent to an entirely different lexical item *each (of the)* and consequently was acquired at a very advanced stage of L2 development. This supported that if there is no direct mapping relation between L1 and L2, such as the extrinsic *-tul* to *each (each of the)* rather than *-s*, the acquisition of the target knowledge tends to appear at a later stage of L2 development.

The findings from Hwang and Lardiere (2013) support the proposal in the FRH, i.e., when acquiring the target items, L2 learners tend to "initially perceive these items in terms of the featural composition of their 'closest' morpholexical equivalents in the L1" (Lardiere, 2009: p213). In their case, *-tul* in L2 Korean tends to be treated as equivalent to *-s* in L1 English. Their findings pointed to the effect of L1 transfer, in that the features and knowledge of *-s* tend to influence how English L2 Korean speakers interpret the target item *-tul*.

Both Korean and Chinese are classifier languages with optional plural marking, and *-tul* (in Korean) and *-men* (in Chinese) have been considered as equivalent counterparts (e.g., Lardiere, 2009; Choi et al., 2018; Gil, 2019; Su, 2019). Looking at the similarities between Korean and Chinese regarding plural marking, which differs from English, it is reasonable to apply the same mapping possibility from *-tul* and *-s* in Hwang and Lardiere (2013) to *-men* and *-s* in the current research, i.e., the mapping from *-s* in L2 English to *-men* and its plurality interpretations in L1 Chinese. To be specific, Korean and Chinese have been reported to share some properties regarding plurality interpretations. First, plural marking in both languages is optional. Second, bare plurals in both languages have been reported to have a "plural" reading, namely, an exclusive reading as discussed in previous sections. Third, Korean bare nouns are number neutral (Liter et al., 2018), which is the same as Chinese bare nouns. This means that bare nouns in both languages have inclusive readings. However, the similarities above are different from that of English, where plural marking is obligatory, bare plurals have both

inclusive and exclusive readings, and bare nouns (or bare singulars) are not allowed. Following the above, one mapping possibility in the current research between L2 English and L1 Chinese regarding plurality interpretations is hypothesised to be from *-s* to *-men*.

In addition to this, I also postulate another possible mapping possibility: from the English plural marker *-s* to null plural marking in Chinese. This is based on the proposal that L2 learners tend to map the target lexical items in the L2 input to what is already available and more or less syntactically and semantically equivalent in their L1 (e.g., Lardiere, 2009; Hwang and Lardiere, 2013).

Now we consider the two mapping possibilities together in detail, together with mensural classifier constructions. In Section 2.1 and Section 2.2, I discussed plurality interpretations in English and Mandarin Chinese based on previous experimental studies and linguistic assumptions. The differences and similarities for the two languages regarding plurality and plural marking are now summarised in Table 1.

	English	Mandarin Chinese
plural marking	Yes (*-s*) obligatory	Yes (*-men*) optional with [+human] nouns prohibited with [-human] nouns
bare nouns (bare singular)	No	Yes – inclusive
bare plurals	Yes – *s* plurals inclusive & exclusive	Yes – *men* plurals exclusive
mensural classifiers	No (but has quantifiers)	Yes – exclusive

Table 1 Comparison of plurality interpretations between English and Mandarin Chinese

As can be seen from Table 1, in English, overt plural marking is obligatory and bare singulars are not allowed. Bare plurals associated with *-s* have been proven to have both inclusive and exclusive readings (e.g., Tieu et al., 2014). Although there are quantifiers in English, they are different from mensural classifiers: quantifiers are associated with plural count nouns or mass nouns to denote the number or amount of their referents, whereas mensural classifiers are associated with bare singulars and refer to a non-inherent multiplicity of objects. In Mandarin Chinese, plurality can be marked by the plural particle *-men*, it is optional with humans and personified entities but is prohibited with non-humans. *Men* plurals yield an exclusive reading, as do mensural classifiers constructions. By contrast, bare nouns have

inclusive readings only. Therefore, in our case, the learning task for Chinese EFL/ESL speakers will be acquiring the inclusive reading for overt plural marking and computing exclusive and inclusive readings as required by *s* plurals in English. If Chinese EFL/ESL speakers map *-s* to *-men*, assuming L1 transfer, we predict that they potentially will, at least at earlier stages of L2 acquisition, interpret *s* plurals under negation with exclusive readings more often than native English speakers. At the same time, they will have no difficulty computing exclusive readings for *s* plurals in positive contexts. These are the same considering the potential influence of Chinese mensural classifier DPs. However, if Chinese EFL/ESL speakers map *-s* to null plural marking, we predict that they will, also at least when they are at lower proficiency levels, interpret *s* plurals in positive contexts with inclusive readings more often than native English speakers, but they will have no difficulty interpreting *s* plurals inclusively in negative contexts. In addition, as proposed in the FRH, the initial full transfer by mapping is followed by feature reassembly through full access to universal grammar. This means that L2 learners will eventually overcome L1 transfer and display targetlike performance. Therefore, different interpretive patterns will be expected at different stages of L2 interlanguage. The current research intends to recruit Chinese EFL/ESL participants from different language proficiency levels. Through analysing their exclusive and inclusive interpretations of English bare plurals in positive and negative contexts, the above hypotheses will be tested.

To conclude, this subsection first briefly reviewed the FRH and its related experimental studies. With the FRH, the hypothesis following the mapping from *-s* in L2 English to *-men* in L1 Chinese was introduced. Based on a similar process, another mapping possibility (i.e., *-s* to null plural marking) has also been postulated. In addition, we also consider the potential influence of Chinese classifier constructions that can express plurality. Through these, we will discuss the role of L1 transfer in the L2 acquisition of plurality, by analysing the results from the English TVJT in the current L2 research. In Chapter 3, the hypotheses raised in this subsection will be presented in specific detail with the L2 research questions.

2.6 Summary

The primary focus of the present study is on exploring plurality and plurality interpretations in both L1 Chinese and L2 English. This chapter has provided a linguistic analysis of plurality interpretations in English and Chinese by reviewing both L1 and L2 studies relevant to scalar implicatures (e.g., plurality inferences), and plurality and plural marking.

Previous L1 research (Tieu et al., 2014; Renans, et al., 2018; Renans et al., 2020) employed the scalar implicature approach to explain the plurality inferences (i.e., exclusive readings) associated with obligatory plural marking. I aim to extend the research into L1 Mandarin Chinese, which has optional plural marking. The investigation is not only limited to the plural marker *-men*, but also includes bare nouns and mensural classifiers which yield plurality in Chinese. The assumptions on plurality interpretations (i.e., exclusive/inclusive readings) associated with bare nouns, *men* plurals, and mensural classifier DPs in Mandarin Chinese have been drawn from the literature review: bare nouns tend to be inclusive in both positive and negative contexts, whereas *men* plurals and mensural classifier DPs tend to have exclusive readings only. This will be tested by the current L1-Chinese study through a Chinese TVJT adapted from Tieu et al. (2014).

I also expand the explorations to L2 research with English as the target language and Chinese as the native language, seeking to observe the universality of scalar implicatures and the role of L1 transfer in L2 acquisition. This will be tested in the current L2-English experiment through an English TVJT. To formulate the L2 hypotheses regarding L1 transfer, the similarities and differences between English and Chinese in terms of plural marking and plurality interpretations have been highlighted. In English, plural marking is obligatory, bare singulars are not allowed, and bare *s* plurals have both inclusive and exclusive readings. In Chinese, plurality can be marked by the plural particle *-men* but it is highly restricted, and there exist other constructions (e.g., bare nouns and mensural classifier DPs) to express plural meanings. While *men* plurals and mensural classifier DPs have exclusive readings, bare nouns have inclusive readings. In light of this comparison between English and Chinese, I introduced the Feature Reassembly Hypothesis and adopted its mapping process to establish hypotheses for the effect of L1 transfer through mapping on L2 performance in the current research. That is, Chinese EFL/ESL speakers have two mapping possibilities: the English plural marker *-s* to null plural marking in Chinese and *-s* to the Chinese plural marker *-men*. The two mapping possibilities and the potential L1 influence of mensural classifier constructions lead to different predictions regarding how Chinese EFL/ESL speakers interpret *s* plurals in positive/negative contexts in the current English TVJT.

The research questions and hypotheses for both L1-Chinese and L2-English studies derived from the discussion and analysis in this chapter will be presented in the next chapter.

Chapter 3 Research Questions and Hypotheses

This chapter outlines the research questions and hypotheses underpinning this thesis, with Section 3.1 for the L1-Chinese study and Section 3.2 for the L2-English study.

3.1 L1-Chinese study

The current L1-Chinese research investigates how native Chinese speakers interpret bare nouns, *men* plurals, and mensural classifier constructions. It helps us understand what plurality interpretations are available in Mandarin Chinese. This will not only contribute to L1 studies on plurality but will also help explain L2 performance in the L2-English research, tracing Chinese EFL/ESL speakers' L2 patterns back to the existing constructions in their L1. Therefore, to find out the potential influence of L1-Chinese knowledge on the interpretation of bare plurals in English by Chinese EFL/ESL speakers, it is necessary to explore how plurality is understood and interpreted in Mandarin Chinese. So, the first research question asks:

Research Question 1 (RQ1): What plurality interpretations (i.e., exclusive/inclusive readings) are available with bare nouns, *men* plurals, and mensural classifier DPs in Mandarin Chinese? To be more specific, how do native Chinese children and adults interpret bare nouns, *men* plurals, and mensural classifier DPs in positive and negative contexts in the Chinese TVJT?

This research question concerns three main factors: age (child vs. adult), category (bare nouns, *men* plurals, mensural classifiers), and context (positive vs. negative). Four hypotheses have been put forward, and the main difference between Hypotheses 1-3 and Hypothesis 4 lies in them being based on different assumptions (theoretical analysis vs. the scalar implicature approach). Hypotheses 1 to 3 are based on the linguistic assumptions on Mandarin Chinese drawn from previous theoretical analysis and are formulated as follows:

Hypothesis 1: Bare nouns have inclusive readings only, and therefore native Chinese adult and child speakers will interpret them inclusively in both positive and negative contexts.
Hypothesis 2: *Men* plurals have exclusive readings only, and therefore native Chinese adult and child speakers will compute more exclusive readings for them than for bare nouns in both positive and negative contexts.

Hypothesis 3: Mensural classifier constructions have exclusive readings only, and therefore native Chinese adult and child speakers will interpret them exclusively in both positive and negative contexts.

Hypotheses 1 to 3 predict Chinese speakers' performance in terms of test item categories (bare noun vs. *men* plural vs. mensural classifier) and the context of test sentences (positive vs. negative), without considering the age group of participants. As discussed in the last chapter, plurality inferences associated with obligatory plural marking have been proposed to be scalar implicatures (e.g., Tieu et al., 2014), with which different interpretation preferences between children and adults are expected. Therefore, an additional hypothesis following the scalar implicature approach to plurality is shown below:

Hypothesis 4: Assuming the plurality inferences associated with the optional plural marker -*men* are also scalar implicatures, we predict that two main interpretive patterns will be identified within the results of Chinese children and adults. First, both adults and children will compute exclusive readings more often in positive than in negative contexts. Second, children overall will interpret exclusive readings with *men* plurals less often than adults. However, this pattern will be distinct from that in bare nouns, where both children and adults will interpret them inclusively.

Hypothesis 4 was formulated based on the assumption that plurality inferences associated with *men* plurals are also scalar implicatures. This hypothesis predicts three main interpretive patterns. First, comparing between the two contexts, we predict that more exclusive readings will be computed in positive than in negative contexts. Second, comparing between two age groups, children in general will interpret fewer exclusive readings with *men* plurals than adults. Third, comparing the interpretation preferences for *men* plurals and bare nouns, both age groups will not display the aforementioned two interpretive patterns with bare nouns, as plurality inferences are reported to be associated with overt plural markers in previous research, and thus the participants will interpret bare nouns without -*men* inclusively in both positive and negative contexts.

The specific predictions for potential experimental responses in the Chinese TVJT by native Chinese child and adult participants will be discussed in Section 4.1.4. Now we move on to the L2 hypotheses.

3.2 L2-English study

The L2-English research investigates the universality of scalar implicatures and the role of L1 transfer, by seeking to observe how Chinese EFL/ESL speakers of different proficiency levels interpret bare plurals in L2 English. Research Question 2 for the current L2 study is shown below:

Research Question 2 (RQ2): How do native Chinese EFL/ESL learners interpret bare plurals in L2 English? When compared with native English speakers, what similar or different patterns do they show? When compared between different proficiency levels, do they show developmental patterns? What (if any) L1 interpretive patterns (from bare nouns, *men* plurals, and mensural classifier constructions) are reflected in their results as manifestations of L1 transfer?

RQ2 concerns the comparison between L2 English learners and native English speakers, the comparison between different L2 proficiency levels, and the comparison between the L1-Chinese results and the L2-English results in the current research. Four hypotheses have been established for this research question and we now consider them one by one.

First, in L1-English experimental studies (e.g., Tieu et al., 2014), plurality inferences associated with *s* plurals are proposed to be scalar implicatures, and previous studies (e.g., Slabakova, 2010) also argue that linguistic pragmatic inferences (e.g., scalar implicatures) are universal. Therefore, based on the scalar implicature approach to plurality inferences, Hypothesis 5 is shown as the following:

Hypothesis 5: Based on the scalar implicature approach to plurality, we predict that Chinese EFL/ESL learners will show similar performance to native English speakers. This is because the L2 participants are adults and assuming the universality of scalar implicatures, they will compute plurality inferences for bare plurals in English at a similar level to English adult speakers. Due to the same reason, no difference in interpretative patterns will be found among L2 learners across different L2 language proficiency levels. Overall, they will interpret English bare plurals exclusively in positive contexts and inclusively in negative contexts, computing more plurality inferences in positive than in negative contexts.

With Hypothesis 5, we observe the L2 participants' interpretations for *s* plurals and test the universality of plurality inferences in an L2. In Chapter 2, I introduced the Feature Reassembly Hypothesis to make predictions based on the mapping process for the L2 learners in the current research. Two mapping possibilities have been proposed and therefore Hypotheses 6 and 7 were established accordingly.

First, regarding the mapping possibility from the English plural marker *-s* to the Chinese plural marker *-men*, Hypothesis 6 was put forward as follows:

Hypothesis 6: Assuming L1 transfer through the mapping between *-s* and *-men*, Chinese EFL/ESL learners will map *s* plurals in English onto *men* plurals in Chinese. We predict that the participants with lower proficiencies, or at earlier stages of their interlanguage, will transfer the knowledge of *-men* to *-s*. This means that they will interpret *s* plurals exclusively in positive contexts and overinterpret exclusive readings in negative contexts, based on the assumption that *men* plurals have exclusive readings only. However, according to the FRH, L2 learners with higher proficiency levels, or at later stages of their interlanguage, will be able to reassemble features by accessing universal grammar. In the current case, L2 learners will eventually overcome the effect of L1 and interpret *s* plurals at a similar level to the English controls. Therefore, we predict that Chinese EFL/ESL learners with higher proficiencies, or at later stages of their interlanguage, will perform similar to adult native English speakers. They will overall interpret English bare plurals exclusively in positive contexts and inclusively in negative contexts.

As can be seen, the prediction for Chinese EFL/ESL learners with higher proficiency in Hypothesis 6 is the same as what has been predicted in Hypothesis 5. The major difference between the two hypotheses is that Hypothesis 6 predicts a development pattern from lower to higher proficiency, which sets itself apart from the prediction for SIs in Hypothesis 5.

Second, regarding the mapping possibility from the English plural marker *-s* to null plural marking in Chinese, Hypothesis 7 was put forward as follows:

Hypothesis 7: Assuming L1 transfer through the mapping between *-s* and null plural marking, Chinese EFL/ESL learners will map *s* plurals in English onto bare nouns in Chinese. We predict that the participants with lower proficiencies, or at earlier stages of their interlanguage, will be influenced by their knowledge of Chinese bare nouns and have difficulty interpreting the exclusive readings associated with *s* plurals as required. Specifically, they will interpret *s*

plurals exclusively less often than English adults in both positive and negative contexts. This is based on the assumption that bare nouns have inclusive readings only. By contrast, we predict that Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 transfer and interpret *s* plurals at a similar level to adult native English speakers. They will overall interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

As shown above, Hypothesis 7 also predicts a developmental pattern from lower to higher proficiency.

Lastly, we also consider the potential influence from Chinese mensural constructions that express plurality, hence, Hypothesis 8 is established as follows:

Hypothesis 8: Assuming L1 transfer from mensural classifiers, Chinese EFL/ESL learners will be influenced by the plurality interpretations associated with Chinese mensural classifier phrases when interpreting English *s* plurals. We predict that the participants with lower proficiencies, or at earlier stages of their interlanguage, will be more likely to interpret *s* plurals exclusively in both positive and negative contexts, based on the assumption that mensural classifier constructions have exclusive readings only. By contrast, Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 and interpret *s* plurals at a similar level to adult native English speakers. We predict that the learners of higher proficiency will interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

As can been seen, Hypothesis 8 features similar predictions to Hypothesis 6. What differentiates them is that only *-s* and *-men* are equivalent counterparts, and mapping mensural classifier constructions onto *s* plurals tends to be more complex than *-s* and *-men*, given the different morphological shapes and their distributions. Mensural classifiers are prenominal and are in the form "numeral + CL + noun", while *-men* attaches to nouns directly and is a postnominal particle like the plural marker *-s* in English. Therefore, this difference in mapping may lead to different results, at least in lower proficiencies.

In summary, Hypotheses 6 to 8 predict how the knowledge of plurality in L1 Mandarin Chinese influences how L2-English learners interpret English bare plurals at different stages of their interlanguage, addressing the role of L1 transfer. With the hypotheses presented above, we observe and analyse the results of the English TVJT in this L2 study, and explore the source

of L2 patterns demonstrated by the Chinese EFL/ESL learners of different proficiency levels. Thus, the last research question is shown as follows:

Research Question 3 (RQ3): Are the L2 patterns shown by Chinese EFL/ESL learners due to the universality of scalar implicatures or a result of L1 transfer through mapping?

The specific predictions for possible responses by the participants in the English TVJT will be discussed in Section 5.1.4.

To conclude, this chapter raised three research questions and constructed eight hypotheses: RQ1 and Hypothesis 1 to 4 are for the current L1-Chinese study, and RQ2 and RQ3 with Hypothesis 5 to 8 are for the L2-English study. In the next chapter, I will present the L1-Chinese study.

Chapter 4 L1-Chinese study

The L1-Chinese research sets out to explore how plurality is computed and what plurality interpretations are available in Mandarin Chinese. This is done by examining how native Chinese adults and children interpret bare nouns, *-men* plurals, and mensural classifiers phrases in positive and negative contexts, using a Truth-Value Judgement Task adapted from Tieu et al. (2014). This chapter presents the research methods of the L1 study and is organised as follows. Section 4.1 presents the methodology of the L1-Chinese experiment, including task design, rationale, and predictions for possible responses in the TVJT. It also briefly reports the results of the pilot study conducted prior to the main experiment. Section 4.2 presents the experiment procedure and the participant information. Section 4.3 first introduces the statistical modelling process for the L1-Chinese data, then reports both descriptive and inferential results. Section 4.4 summarises the results of the Chinese TVJT and presents the main findings. In this section, I will also revisit the L2 hypotheses regarding L1 transfer through mapping and the potential influence of mensural classifier constructions raised in the previous chapter, and revise them according to the current L1 results if necessary.

4.1 Methodology

This section provides a detailed introduction to the Chinese TVJT. Section 4.1.1 presents the task design and test items. It also discusses what changes have been made compared to the TVJT in Tieu et al. (2014) and the reasons for those changes. Section 4.1.2 explains the rationale for the L1-Chinese experiment. Section 4.1.3 reports the results of the pilot study. Section 4.1.4 spells out the predictions for the participants' potential responses in the TVJT, referring back to the research question and hypotheses for the current L1-Chinese research.

4.1.1 Task design

The Chinese TVJT used a 3x2x2 design: Category (bare nouns vs. *men* plurals vs. mensural classifiers constructions), Context (positive vs. negative), and Condition (singular vs. plural). It should first be noted that *context* here refers to the positive or negative context of test tokens[22] (i.e., positive or negative test sentences), whereas *condition* refers to the singular or

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[22] To clarify, when introducing the Chinese and English TVJTs in this thesis, I use test tokens/sentences to refer to both target tokens/sentences and control tokens/sentences, which are compared to each other.

plural meanings signified by the test stories (i.e., singular or plural test stories). Before going through the three factors, we first consider test items in this task.

There are 36 test items in total, including 18 target and 18 control items. The target items are shown in Table 2.

bare nouns	*men* plurals	mensural classifier phrases
xiongmao (panda)	*xiaotuzi-men* (rabbit-s)	*yi qun xiaoyazi*
zhu (pig)	*xiaoxiong-men* (bear-s)	(one group (of) duck)
ningmeng (lemon)	*xiaoniao-men* (birds)	*yi qun xiaoxiong*
juzi (orange)	*xiaomifeng-men* (bees)	(one group (of) bear)
xigua (watermelon)	*xiaoxiang-men* (elephants)	*yi lan juzi*
caomei (strawberry)	*xiaolu-men* (deer)	(one basket (of) orange)
		yi lan pingguo
		(one basket (of) apple)
		yi xie huojian (some rocket)
		yi xie pingzi (some bottle)

Table 2 Summary of target items in the Chinese TVJT

As shown in Table 2, there are 6 tokens for each category. They are all count nouns[23] and their referents are common entities in everyday life, such as animals (e.g., panda), fruits (e.g., lemon), and other common objects (e.g., bottle). There are three different classifiers being tested: *yi qun* (one group (of)), *yi lan* (one basket (of)), and *yi xie* (some).

The three categories of target items were further constructed into 36 target sentences, which are either positive or negative. They will be presented in detail later when we discuss the test stories. Now we turn to control items, which are singular numeral classifier DPs as shown in Table 3.

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[23] Pelletier, et al. (2021) state that count nouns 'presuppose that there are separate, individual' objects, while mass nouns 'suggest some indeterminate amount of a given sort of matter' (p1). I followed this point of view when selecting the test items, without considering the debate on whether all Chinese nouns are mass or not. However, the test results may in return shed light on this discussion.

yi zhi xiongmao (one CL panda)	*yi zhi xiaotuzi* (one CL rabbit)	*yi zhi xiaoyazi* (one CL duck)
yi zhi zhu (one CL pig)	*yi zhi xiaoxiong* (one CL bear)	*yi zhi xiaoxiong*[24] (one CL bear)
yi ge ningmeng (one CL lemon)	*yi zhi xiaoniao* (one CL bird)	*yi ge juzi* (one CL orange)
yi ge juzi (one CL orange)	*yi zhi xiaomifeng* (one CL bee)	*yi ge pingguo* (one CL apple)
yi ge xigua (one CL watermelon)	*yi zhi xiaoxiang* (one CL elephant)	*yi ge*[25] *huojian* (one CL rocket)
yi ge caomei (one CL strawberry)	*yi zhi xiaolu* (one CL deer)	*yi ge pingzi* (one CL bottle)

Table 3 Summary of control items in the Chinese TVJT

As shown in Table 3, the control items are in the *one CL x* construction, denoting singular meanings. This can help us check whether the participants can understand the test stories and compute the singular meanings from the control sentences. The classifiers used in the control items are *zhi* and *ge*. The sortal classifier *zhi* is commonly used with animals. *Ge* is called a general classifier and "in actual conversations and speech acts there is an overwhelmingly high tendency to use" it (Zhang, 2007: p57; also see Erbaugh, 1986; Sun, 1996; He, 2001; Guo, 2002; cited in Zhang, 2007). Therefore, they should not cause any difficulty in understanding even for the child participants. The control items were further constructed into 18 positive and 18 negative control sentences, which will be presented later in this subsection.

Altogether, the 72 test tokens (36 target sentences and 36 control sentences) were constructed into six test sets. Each participant only needs to finish one test set. The reason for breaking the test material down into six test sets is to shorten the test length. This can prevent

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[24] The tokens *yi zhi xiaoxiong* (one bear) and *yi ge juzi* (one orange) appear twice in this table. However, they are used in different test stories and tokens, so the participants will not listen to repetitive stories and test sentences.
[25] I am aware that *mei* is also a commonly used classifier for *huojian* (rocket). In Chinese, both *mei* and *sou* can be used with *huojian*. As discussed in Section 4.1.3, Chinese children under the age of 5 may not have encountered the classifier *sou*, so it was changed into *ge*. The current TVJT tested the participants' plurality interpretations of the target test tokens, not if the classifiers are the right match for them. The analysis of the results also shows that the participants did not behave differently towards *yi ge huojian*, compared to others. As this phrase only appears as a control token, it does not influence the current conclusions drawn from the test tokens in the L1 Chinese experiment.

the participants from becoming bored and losing concentration. Following the Latin Square design, each test set contains 18 test tokens, including 12 target sentences (4 for each category, either positive or negative) and 6 control sentences (either positive or negative). Among the 6 test sets, each target sentence appears twice and each control sentence appears once. The reason for using fewer control sentences than target sentences in each test set is to avoid the participants from listening to repetitive test stories. It also shortened the task to a more acceptable length[26].

The current Chinese TVJT follows the task design and test process of the TVJT in Tieu et al. (2014). Specifically, the participants were first introduced to a rabbit puppet whose name is *Xiaobai*. The puppet's videos are pre-recorded and were played at different time points during the test. This was controlled by the researcher on a laptop during the test. The participants listened to the pre-recorded short stories and watched their accompanying animations at the same time. After each story, the puppet appeared and was asked *"小白，故事里发生了什么?"* (*Xiaobai, what happened in the story?*) by the experimenter, whose lines are also pre-recorded. The puppet replied to the question with a test token. The participants were asked to judge the puppet's response with a TRUE/FALSE option, based on the acceptability of the test token and the fact in the story. In the following, I will present examples for bare nouns, *men* plurals, and mensural classifier constructions respectively, including test stories (singular vs. plural) with their animations, as well as the positive/negative test tokens (target vs. control) following the test stories.

Bare nouns

We start with bare nouns, as shown in (4.1) and Figure 9.

(4.1) Singular Story[27]: Qianqian went to the zoo. She didn't have enough bamboo, so she only fed this one panda. Experimenter: Xiaobai, what happened in this story?

a. (positive target sentence)

   Qianqian wei le   xiongmao.

   Qianqian feed ASP panda

   *"Qianqian fed panda"

b. (negative target sentence)

   Qianqian meiyou wei xiongmao.

   Qianqian not   feed panda

   *"Qianqian didn't feed panda"
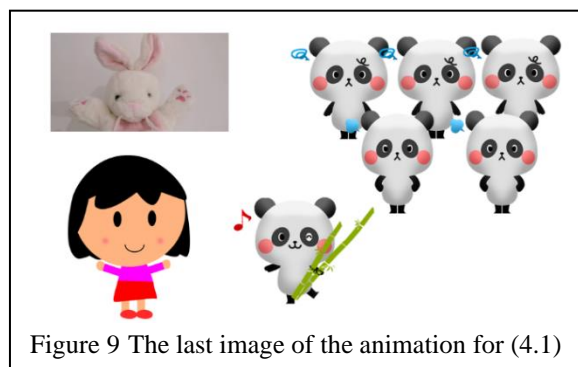
Figure 9 The last image of the animation for (4.1)

The singular story in (4.1) and its animation (Figure 9) show that Qianqian only fed one panda. The puppet's response is either the positive target sentence (4.1a) or the negative (4.1b), both containing the test item *xiongmao* (panda). Using the same story, there are also two control sentences, (4.2a) and (4.2b).

(4.2) Control sentences:

a. (positive) Qianqian wei le   yi   zhi   xiongmao.

   Qianqian feed ASP one S-CL panda

   "Qianqian fed a panda"

b. (negative) Qianqian meiyou wei yi   zhi   xiongmao.

    Qianqian not   feed one S-CL panda

   "Qianqian didn't feed a panda"

Both the positive sentence (4.2a) and the negative (4.2b) contain the singular numeral classifier DP *yi zhi xiongmao* (one panda). Now we turn to the example for plural conditions, as shown in (4.3) and Figure 10.

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[27] The original story and the experimenter's question are in Chinese, here I only present their English translations. The full story is shown in Appendix I. This applies to the other examples in Section 4.1.1.

(4.3) Plural Story: Qianqian saw some pigs. She had three apples, so she fed these three pigs.

Experimenter: Xiaobai, what happened in this story?

a. (positive target sentence)

Qianqian wei le   zhu.

Qianqian feed ASP pig

*"Qianqian fed pig"

b. (negative target sentence)

Qianqian meiyou wei zhu.

Qianqian not   feed pig

*"Qianqian didn't feed pig"
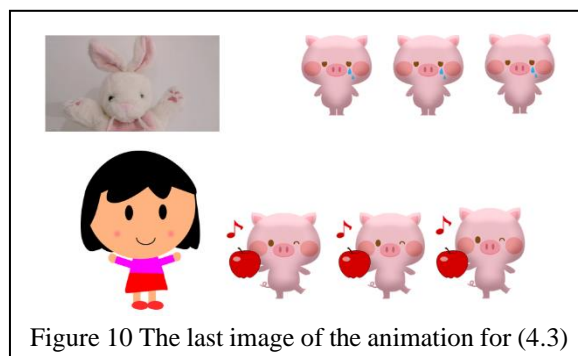
Figure 10 The last image of the animation for (4.3)

The plural story in (4.3) and Figure 10 shows that Qianqian fed more than one pig, which is compared to the singular story in (4.1). (4.3a) and (4.3b) are the target sentences following this plural story and they contain the bare noun *zhu* (pig). There is also one positive and one negative control sentence using this plural story, as shown in (4.4).

(4.4) Control sentences:

a. (positive) Qianqian wei le   yi   zhi   zhu.

Qianqian feed ASP one S-CL zhu

"Qianqian fed a pig"

b. (negative) Qianqian meiyou wei yi   zhi   zhu.

Qianqian not   feed one S-CL zhu

"Qianqian didn't feed a pig"

The control sentences in (4.4) are constructed in the same way as the control sentences in (4.2) that follow a singular test story. They are either positive or negative and contain singular numeral classifier DPs, such as *yi zhi zhu* (one pig) in this case. This applies to all the control sentences in this test, including the ones that follow the test stories for *men* plurals and mensural classifier constructions. The predictions for possible responses to the target sentences, and target answers to the control sentences will be presented in Section 4.1.4.

In total, there are 6 test stories for bare nouns. The stories and their test tokens are summarised in Table 4[28].

	Singular	Plural
Story	Qianqian only fed this one panda.	Qianqian fed three pigs.
positive	a. Qianqian wei le xiongmao. * "Qianqian fed panda" b. Qianqian wei le yi zhi xiongmao. "Qianqian fed a panda"	a. Qianqian wei le zhu. * "Qianqian fed pig" b. Qianqian wei le yi zhi zhu. "Qianqian fed a pig"
negative	a. Qianqian meiyou wei xiongmao. * "Qianqian didn't feed panda" b. Qianqian meiyou wei yi zhi xiongmao. "Qianqian didn't feed a panda"	a. Qianqian meiyou wei zhu. * "Qianqian didn't feed pig" b. Qianqian meiyou wei yi zhi zhu. "Qianqian didn't feed a pig"
Story	Qianqian only picked this one lemon.	Qianqian picked three oranges.
positive	a. Qianqian zhai le ningmeng. * "Qianqian picked lemon' b. Qianqian zhai le yi ge ningmeng. "Qianqian picked a lemon"	a. Qianqian zhai le juzi. * "Qianqian picked orange" b. Qianqian zhai le yi ge juzi. "Qianqian picked an orange"
negative	a. Qianqian meiyou zhai ningmeng. * "Qianqian didn't pick lemon" b. Qianqian meiyou zhai yi ge ningmeng. "Qianqian didn't pick a lemon"	a. Qianqian meiyou zhai juzi. * "Qianqian didn't pick orange" b. Qianqian meiyou zhai yi ge juzi. "Qianqian didn't pick an orange"
Story	Qianqian only took this one watermelon.	Qianqian took three strawberries.
positive	a. Qianqian na le xigua. * "Qianqian took watermelon" b. Qianqian na le yi ge xigua. "Qianqian took a watermelon"	a. Qianqian na le caomei. * "Qianqian took strawberry" b. Qianqian na le yi ge caomei. "Qianqian took a strawberry"
negative	a. Qianqian meiyou na xigua. * "Qianqian didn't take watermelon" b. Qianqian meiyou na yi ge xigua. "Qianqian didn't take a watermelon"	a. Qianqian meiyou na caomei. * "Qianqian didn't take strawberry" b. Qianqian meiyou na yi ge caomei. "Qianqian didn't take a strawberry"

Table 4 Test stories and test tokens for bare nouns

As shown in Table 4, there are 3 singular and 3 plural test stories. Each test story is followed by 1 positive target sentence, 1 negative target sentence, and 2 control sentences (either positive or negative). This design holds the same for *men* plurals and mensural classifier constructions.

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[28] In Table 4, Table 5, and Table 6, the test tokens marked with "a" are target sentences (which are also highlighted) and those marked with "b" are control sentences. The full stories in Chinese with English translations and test sentences will be found in Appendix I.

Men **plurals**

Now we consider *men* plurals. It should be noted that compared to bare nouns, minor changes were made for the test stories for *-men* plurals. In those stories and their animations, Qianqian either executes an action on one out of one object in singular stories, or executes an action on all of the objects in plural stories. For instance, (4.5) and Figure 11 are the examples for the singular condition.

(4.5) Singular Story: There is a rabbit in the classroom. Qianqian is teaching this rabbit English.

Experimenter: Xiaobai, what happened in this story?

a. (positive target sentence)

Qianqian zai jiao xiaotuzi-men xue yingyu.

Qianqian AD teach rabbit-s   learn English

"Qianqian is teaching (the) rabbits English"

b. (negative target sentence)

Qianqian mei zai jiao   xiaotuzi-men xue   yingyu.

Qianqian not AD teach rabbit-s   learn English

"Qianqian is not teaching (the) rabbits English"
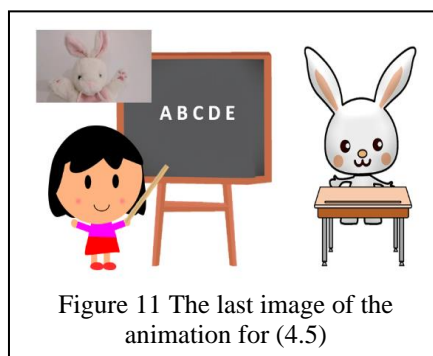
Figure 11 The last image of the animation for (4.5)

The singular story in (4.5) tells the participants that Qianqian is only teaching one rabbit English, and its animation (Figure 11) shows that there is only one rabbit in this entire story, to whom Qianqian is teaching English. Based on the story and the animation, the participants will be asked to make judgments on (4.5a) and (4.5b)[29], which contain the *men* plural *xiaotuzi-men* (rabbit-s). In this way, their judgments will only be made based on their computation of the plural marker *-men* and the singular meaning (one rabbit) signified by the story and its animation. Otherwise, if the animation shows that there is more than one rabbit in the background and Qianqian is not teaching them English, an additional interpretation "there exist xiaotuzi-**men** (rabbit-s) that Qianqian is not teaching English to" will become available to the participants. This interpretation will result in different responses to the test sentences, which is not what is being tested in this task. What we intend to test here is what readings the participants will interpret with the particle *-men*, rather than what interpretations they can come up with for

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[29] I am aware that the test sentences in (4.5) and (4.6) are more complex than the other test tokens, and this complexity could potentially affect the child participants' interpretations. By analysing the child data, the results of these test sentences did not stand out from the others, and *complexity* has no significant effect on the participants' interpretations. However, this issue should absolutely be considered and fully controlled in future relevant research.

the test stories and their animations. Therefore, to avoid potential interpretations as such, in the test stories and their animations for *men* plurals, Qianqian either executes an action on one out of one object in singular studies (e.g., (4.5) and Figure 11) or on all of the objects in plural stories, as shown in (4.6) and Figure 12 below.

(4.6) Plural Story: There are three bears in the classroom. Qianqian is teaching the three bears English. Experimenter: Xiaobai, what happened in the story?

    a.   (positive target sentence)

       Qianqian zai jiao xiaoxiong-men xue yingyu.

       Qianqian AD teach bear-s   learn English

       "Qianqian is teaching (the) bears English"

    b.   (negative target sentence)

       Qianqian mei zai jiao   xiaoxiong-men xue yingyu.

       Qianqian not AD teach bear-s   learn English

       "Qianqian is not teaching (the) bears English"
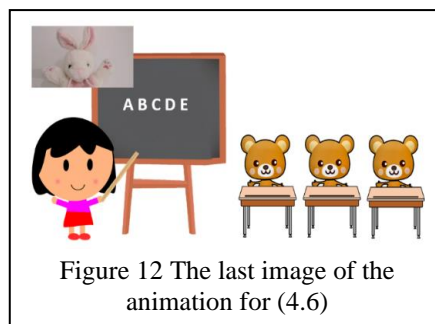
Figure 12 The last image of the animation for (4.6)

The plural story in (4.6) and Figure 12 shows that Qianqian is teaching all three bears English. The reason for this is the same as discussed above. The positive sentence (4.6a) and the negative (4.6b), containing the *men* plural *xiaoxiong-men* (bear-s), are the target sentences following this plural story. In total, there are 3 singular stories and 3 plural stories, as well as 24 test tokens (12 target and 12 control sentences) for *men* plurals, shown in Table 5.

	Singular	Plural
Story	Qianqian is teaching only one rabbit English.	Qianqian is teaching three bears English.
positive	a. Qianqian zai jiao xiaotuzi-men xue yingyu. "Qianqian is teaching (the) rabbits English" b. Qianqian zai jiao yi zhi xiaotuzi xue yingyu. "Qianqian is teaching a rabbit English"	a. Qianqian zai jiao xiaoxiong-men xue yingyu. "Qianqian is teaching (the) bears English" b. Qianqian zai jiao yi zhi xiaoxiong xue yingyu. "Qianqian is teaching a bear English"
negative	a. Qianqian mei zai jiao xiaotuzi-men xue yingyu. "Qianqian isn't teaching (the) rabbits English" b. Qianqian mei zai jiao yi zhi xiaotuzi xue yingyu. "Qianqian isn't teaching a rabbit English"	a. Qianqian mei zai jiao xiaoxiong-men xue yingyu. "Qianqian isn't teaching (the) bears English" b. Qianqian mei zai jiao yi zhi xiaoxiong xue yingyu. "Qianqian isn't teaching a bear English"
Story	There is only this one bird singing on the tree.	There are two bees singing under the tree.
positive	a. Shu shang you xiaoniao-men zai changge. "(The) little birds are singing on the tree" b. Shu shang you yi zhi xiaoniao zai changge.	a. Shu xia you xiaomifeng-men zai changge. "(The) little bees are singing under the tree" b. Shu xia you yi zhi xiaomifeng zai changge.

	"A bird is singing on the tree"	"A bee is singing under the tree"
negative	a. Shu shang meiyou xiaoniao-men zai changge. "No birds are singing on the tree" b. Shu shang meiyou yi zhi xiaoniao zai changge. "There isn't a bird singing on the tree"	a. Shu xia meiyou xiaomifeng-men zai changge. "No bees are singing under the tree" b. Shu xia meiyou yi zhi xiaomifeng zai changge. "There isn't a bee singing under the tree"
Story	Qianqian is jumping on the trampoline with only one elephant.	Qianqian is jumping on the trampoline with three deers.
positive	a. Qianqian zai he xiaoxiang-men zai bengchuang shang tiao. "Qianqian is jumping with (the) elephants on the trampoline" b. Qianqian zai he yi zhi xiaoxiang zai bengchuang shang tiao. "Qianqian is jumping with an elephant on the trampoline"	a. Qianqian zai he xiaolu-men zai bengchuang shang tiao. "Qianqian is jumping with (the) deers on the trampoline" b. Qianqian zai he yi zhi xiaolu zai bengchuang shang tiao. "Qianqian is jumping with a deer on the trampoline"
positive	a. Qianqian mei zai he xiaoxiang-men zai bengchuang shang tiao. "Qianqian is not jumping with (the) elephants on the trampoline" b. Qianqian mei zai he yi zhi xiaoxiang zai bengchuang shang tiao. "Qianqian is not jumping with an elephant on the trampoline"	a. Qianqian mei zai he xiaolu-men zai bengchuang shang tiao. "Qianqian is not jumping with (the) deers on the trampoline" b. Qianqian mei zai he yi zhi xiaolu zai bengchuang shang tiao. "Qianqian is not jumping with a deer on the trampoline"

Table 5 Test stories and test tokens for *men* plurals

Mensural classifiers

We now discuss the last category, mensural classifier constructions. An example for the singular condition is shown in (4.7) and Figure 13.

(4.7) Singular Story: Qianqian bought some oranges. She dropped one orange by mistake.

Experimenter: Xiaobai, what happened in the story?

a. (positive target sentence)

Qianqian diao le   yi   lan   juzi.

Qianqian drop ASP one basket orange

*"Qianqian dropped one basket orange"

b. (negative target sentence)

Qianqian meiyou diao yi   lan   juzi.

Qianqian not   drop one basket orange

*"Qianqian didn't drop one basket orange"
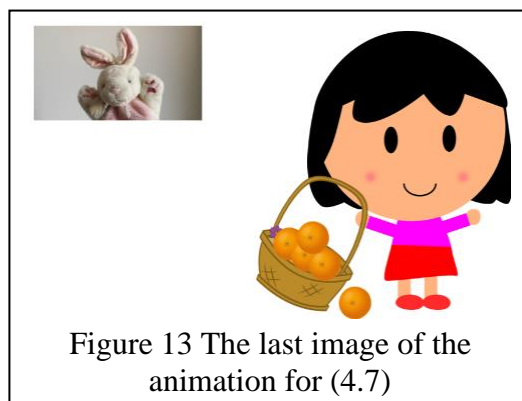
Figure 13 The last image of the animation for (4.7)

The singular story in (4.7) and its animation (Figure 13) show that Qianqian only dropped one orange. The target sentences include the positive sentence (4.7a) and the negative (4.7b), both

containing the target item *yi lan juzi* (one M-CL orange, 'one basket (of) oranges'). Turning to the plural condition, as shown in (4.8) and Figure 14 below.

(4.8) Plural Story: Qianqian bought some apples. She dropped all the apples on the floor.

Experimenter: Xiaobai, what happened in the story?

a. (positive target sentence)

Qianqian diao le   yi   lan   pingguo.

Qianqian drop ASP one basket apple

*"Qianqian dropped one basket apple"

b. (negative target sentence)

Qianqian meiyou diao yi   lan   pingguo.

Qianqian not   drop one basket apple

*"Qianqian didn't drop one basket orange"
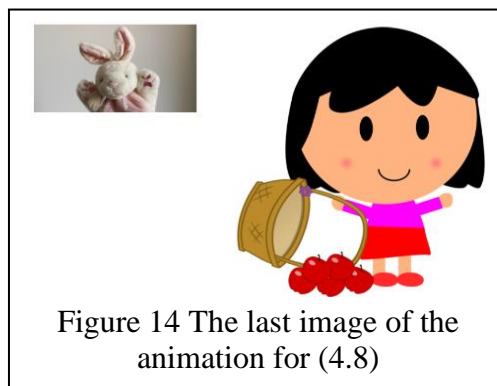
Figure 14 The last image of the animation for (4.8)

The plural story in (4.8) and its animation (Figure 14) show that Qianqian dropped an entire basket of apples on the floor. The participants will be asked to make judgments on the positive target sentence (4.8a) and the negative (4.8b). In sum, the 6 test stories and 24 test tokens for mensural classifiers are shown in Table 6.

	Singular	Plural
Context	Qianqian is dancing with only one duck.	Qianqian is dancing with five bears.
positive	a. Qianqian zai he yi qun xiaoyazi tiaowu. * "Qianqian is dancing with one group duck" b. Qianqian zai he yi zhi xiaoyazi tiaowu. "Qianqian is dancing with a duck"	a. Qianqian zai he yi qun xiaoxiong tiaowu. * "Qianqian is dancing with one group bear" b. Qianqian zai he yi zhi xiaoxiong tiaowu. "Qianqian is dancing with a little bear"
negative	a. Qianqian mei zai he yi qun xiaoyazi tiaowu. * "Qianqian is not dancing with one group duck" b. Qianqian mei zai he yi zhi xiaoyazi tiaowu. "Qianqian is not dancing with a duck"	a. Qianqian mei zai he yi qun xiaoxiong tiaowu. * "Qianqian is not dancing with one group bear" b. Qianqian mei zai he yi zhi xiaoxiong tiaowu. "Qianqian is not dancing with a bear"
Context	Qianqian only dropped one orange.	Qianqian dropped all of the apples.
positive	a. Qianqian diao le yi lan juzi. * "Qianqian dropped a basket orange" b. Qianqian diao le yi ge juzi. "Qianqian dropped an orange"	a. Qianqian diao le yi lan pingguo. * "Qianqian dropped a basket apple" b. Qianqian diao le yi ge pingguo. "Qianqian dropped an apple"
negative	a. Qianqian meiyou diao yi lan juzi. * "Qianqian didn't drop a basket orange" b. Qianqian meiyou diao yi ge juzi. "Qianqian didn't drop an orange"	a. Qianqian meiyou diao yi lan pingguo. * "Qianqian didn't drop a basket apple" b. Qianqian meiyou diao yi ge pingguo. "Qianqian didn't drop an apple"

Context	Qianqian only saw one rocket.	Qianqian put four bottles on the shelf.
positive	a. Qianqian kanjian le yi xie huojian. * "Qianqian saw some rocket" b. Qianqian kanjian le yi ge huojian. "Qianqian saw a rocket"	a. Jiazi shang you yi xie pingzi. * "There are some bottle on the shelf" b. Jiazi shang you yi ge pingzi. "There is a bottle on the shelf"
negative	a. Qianqian meiyou kanjian yi xie huojian. "Qianqian didn't see some rockets" b. Qianqian meiyou kanjian yi ge huojian. "Qianqian didn't see a rocket"	a. Jiazi shang meiyou yi xie pingzi. "There are not some bottles on the shelf" b. Jiazi shang meiyou yi ge pingzi. "There is not a bottle on the shelf"

Table 6 Test stories and test tokens for mensural classifiers

The discussion above has illustrated the test stories and test tokens in the Chinese TVJT. The predictions for the responses to them will be discussed in Section 4.1.4. In addition, the experiment starts with two practice items ((4.9) and (4.10)) to help participants become familiarised with the task process.

(4.9)[30] Story: Qianqian has some flowers and one tomato. She ate the tomato.

Experimenter: Xiaobai, what happened in the story?

Test sentence: Qianqian ate one tomato.

(4.10) Story: Qianqian has some bread and some carrots. She gave this little rabbit two

carrots. Experimenter: Xiaobai, what happened in the story?

Test sentence: Qianqian gave bread to the rabbit.

The test sentences in (4.9) and (4.10) do not relate to what is being tested in the task. If the participants answered incorrectly to both of the examples, I would check the participant's answer sheet. If it further shows that the participant did not understand the task, for instance, if they also did not reply correctly to the control sentences, then their data will be removed from the data set.

In the next subsection, I will discuss the rationale for the L1-Chinese experiment and justify the test design of the Chinese TVJT.

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[30] The full stories and test sentences in Chinese can be found in Appendix I.

4.1.2 Rationale

The L1-Chinese experiment aims to observe how Chinese children and adults understand and compute plurality in their L1. This is tested by the Chinese TVJT, the results of which will show what plurality interpretations are available with bare nouns, -*men* plurals, and mensural classifiers constructions. The findings of the L1 study will also help us trace back the L1-Chinese participants' performance in the L2-English experiment and further identify the potential source for the acquisition patterns that may be displayed by the Chinese EFL/ESL learners. As mentioned earlier, the Chinese TVJT was adapted from the TVJT in Tieu et al. (2014). In their test stories, the main character "executed an action on only one object from a set of objects" (p126); this is treated as a singular condition in the current research. A plural condition has been added to the current Chinese TVJT, where our main character Qianqian executes an action on more than one object (e.g., Examples (4.3), (4.6), (4.8)). In the following, I will explain why the plural condition is needed in the current study.

For bare nouns in Mandarin Chinese, the current TVJT seeks to test whether they are computed with inclusive readings by native Chinese speakers, as proposed in Hypothesis 1. However, the singular test story itself will not directly tell us how participants really perceive the bare nouns being tested. Consider the example presented earlier, repeated in (4.11).

(4.11) Singular Story: Qianqian went to the zoo. She didn't have enough bamboo, so she only
     fed this one panda.
  a. Qianqian wei le   xiongmao.
      Qianqian feed ASP panda
      *"Qianqian fed panda"

The singular story in (4.11) shows that Qianqian only fed one panda. Based on its singular meaning, assigning a TRUE value to the test sentence (4.11a) does not point to an inclusive interpretation only. Instead, (4.11a) is felicitous if the bare noun has a singular reading, and therefore it is ambiguous between an inclusive reading (*one or more than one*) as in (4.12a) and a singular reading *one* as in (4.12b).

(4.12) a. *Qianqian fed one or more than one panda.*   (inclusive)
    b. *Qianqian fed one panda.*   (singular)

In other words, supposing (4.12a) is true to what happened in the story, the judgement was made only based on the fact that Qianqian fed one panda. However, an inclusive reading entails two meanings: *one* and *more than one*, but the *more than one* meaning is excluded in the test story. Therefore, a plural condition (4.13) will allow us to disambiguate if the participants' responses to the singular condition were from the singular or inclusive reading.

(4.13) Plural Story: Qianqian saw some pigs. She had three apples, so she fed these three pigs.

    a.   Qianqian wei le   zhu.

         Qianqian feed ASP pig

         *"Qianqian fed pig"

The story in (4.13) shows that Qianqian fed three pigs. If the participant responded to the test sentence (4.13a) with a TRUE value based on this context alone, again, such an interpretation is ambiguous between an exclusive reading (*more than one*) as in (4.14a) and an inclusive reading (*one or more than one*) as in (4.14b).

  (4.14) a. *Qianqian fed more than one pig.*   (exclusive)

        b. *Qianqian fed one or more than one pig.*   (inclusive)

Therefore, only the participant assigning the TRUE value to both (4.11a) and (4.13a), which follows the singular and plural test story respectively, means that they interpreted bare nouns with inclusive readings. We will come back to other possible responses in Section 4.1.4. Now we turn to the negative target sentences, as shown in (4.15).

(4.15) Singular Story: Qianqian used a ladder to climb up the tree. She only picked this one lemon.

    a.   Qianqian meiyou zhai ningmeng.

        Qianqian not   pick lemon

      *"Qianqian didn't pick lemon"

The singular story in (4.15) shows that Qianqian only picked one lemon. Assigning a FALSE value to (4.15a) based on the singular meaning of the story indicates two possible interpretations: a singular interpretation (*not one*) as in (4.16a) and an inclusive interpretation (*not one or more*, i.e., none) as in (4.16b).

(4.16) a. *Qianqian didn't one lemon, (she picked two or more).*   (singular)

    b. *Qianqian didn't pick one or more lemons.*   (inclusive)

      = *Qianqian didn't pick any lemon.*

Therefore, a comparison with a plural condition will help disambiguate between the two interpretations of the bare nouns. Consider (4.17) below with a plural story:

(4.17) Plural Story: Qianqian used a ladder to climb up the tree. She only picked three oranges.

    a.   Qianqian meiyou zhai juzi.

       Qianqian not   pick orange

   * "Qianqian didn't pick orange"

The plural story in (4.17) shows Qianqian picking three oranges. Assigning a FALSE value to (4.17a) suggests an exclusive interpretation (*not more than one*) as in (4.18a) and an inclusive interpretation (*none*) as in (4.18b).

(4.18) a. *Qianqian didn't pick more than one orange.*   (exclusive)

    b. *Qianqian didn't pick one or more oranges.*   (inclusive)

      = *Qianqian didn't pick any orange.*

Given the above, only when the participant assigns the FALSE value to both (4.15a) and (4.17a), which follow the singular and plural test story respectively, does it then mean that the bare nouns are interpreted with an inclusive reading ((not) *one or more than one*).

Therefore, the plural condition is needed to figure out what the participants really mean with their responses. With the same rationale, the plural condition was also added to test *men* plurals and mensural classifier constructions. The specific predictions for possible responses will be discussed in Section 4.1.4.

Moreover, for the plural stories, cardinal numerals greater than one (i.e., 2, 3, ...) were employed to imply the *more than one* meaning, instead of using "more than one" straightforwardly in the sentences. For example, *san zhi zhu* (three pigs) in (4.13) and *san ge juzi* (three oranges) in (4.17). This is to keep the test stories clear to the participants and to be neutral at the same time. It ensures that the participants compute the *more than one* meaning from the numeral DPs by themselves, instead of being told directly.

It should be noted that all test items selected in the task only include count nouns, such as fruits and animals. This is because the responses from the L1-Chinese experiment are going to be compared with that of the L2-English experiment, where the test items are also count nouns. Mass nouns in English are not as commonly used with an -*s* to deliver a plural reading as count nouns are. Therefore, to keep it consistent throughout the two experiments, mass nouns in Chinese are not considered in the current research.

This section has justified the task design of the Chinese TVJT. The next subsection will report the pilot study.

4.1.3 Pilot study

The pilot test was carried out on 7 native Chinese speakers to identify if there was any confusion with the test stories and test tokens in the Chinese TVJT. It took place from 16th to 20th April 2020 through one-to-one online meetings. Six adults and one child (4 years 9 months old) were recruited. Each adult participant completed one of the six test sets and the child participant completed two test sets.

After completing the task, the participants were interviewed by me and asked for their opinions and feedback on the task. The adult participants stated that they could understand the task instructions and follow the test process easily, and the test stories and test tokens were clear to them.

The child participant could also understand the test stories and tokens and was able to follow the task instructions. During the test, the child participant raised a question when it came to the control sentence (4.19).

(4.19) Qianqian kanjian le   yi **sou** huojian.

    Qianqian see   AD one CL rocket

    'Qianqian saw a rocket'

(4.19) contains the classifier *sou*, which is normally combined with boats, ships, and rockets. The child participant wondered what *sou* means. It is clear that the child had not yet encountered the classifier *sou*. To avoid confusing the child participants, in the main experiment *sou* was changed to *ge*, which is more widely used and more available in speech than *sou*.

The pilot test also shows that it takes around 12 to 20 minutes for the participant to complete the task. In sum, both adults and children aged 4 years 9 months had no problem understanding the task, apart from the aforementioned case about *sou*. After said adaptation, the main experiment was conducted. In the next subsection, the predictions will be laid out.

4.1.4 Prediction

This section presents the predictions in the Chinese TVJT. In the following, I will discuss the three categories of target items one by one. It should be noted that abbreviations will be used to refer to the four combinations for each test story (Condition: singular or plural) with the target test sentence (Context: positive and negative). They are:

(i) positive target with singular story (PS)
(ii) positive target with plural story (PP)
(iii) negative target with singular story (NS)
(iv) negative target with plural story (NP)

To help interpret the experiment results, I also provide interpretation maps explaining what readings the TRUE/FALSE values present (Figure 15 and 16). The interpretation map for positive contexts has two starting points, PS and PP. Under each is a singular or a plural test story with its test token, followed by True and False responses with their combined possible readings. The readings are connected with each other and eventually lead to three readings without ambiguity. The interpretation map for negative contexts has the same design. We start with the interpretation map for bare nouns, shown in Figure 15.
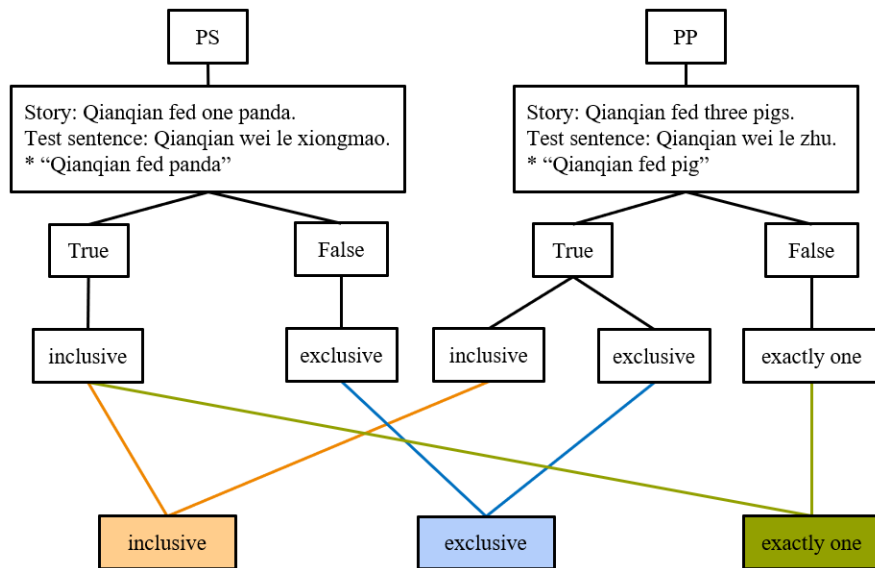
Figure 15 The interpretation map for bare nouns in positive contexts

As shown in Figure 15, in positive contexts, if the participants interpret bare nouns with inclusive readings, they will assign the TRUE value to test sentences under PS and PP. If they interpret bare nouns with exclusive readings, they will assign the FALSE value to the test sentence under PS but the TRUE value to the test sentence under PP. If they interpret bare nouns with an *exactly one* reading, they will assign the TRUE value to the test sentence under PS but the False value to the test sentence under PP. The other response (i.e., assigning the FALSE value to test sentences under PS and PP at the same time) is viewed as providing conflicting answers, and therefore is not included in the interpretation map. This holds the same for other interpretation maps in this study. It should also be noted that when analysing and reporting the inferential statistics for the computation of exclusive readings in Section 4.3.3, the *exact one* response and the aforementioned other response are eliminated from the group results. This is because those two responses are not the main responses provided by the participants, and keeping exclusive/inclusive readings only will make it easier for us to compare the results cross-linguistically with previous results (e.g., Tieu et al., 2014). Now we turn to the interpretation map for bare nouns under negation, shown in Figure 16.
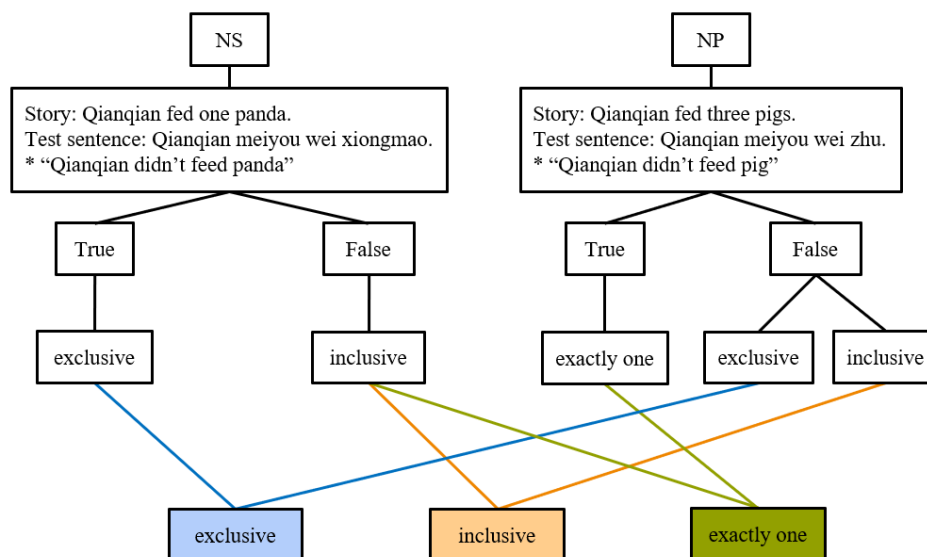
Figure 16 The interpretation map for bare nouns in negative contexts

As can be seen from Figure 16, under negation, if the participants interpret bare nouns with exclusive readings, they will assign the TRUE value to the test sentence under NS but the FALSE value to the test sentence under NP. If they interpret bare nouns with inclusive readings, they will assign the FALSE value to test sentences under NS and NP. If they interpret bare nouns with an *exactly one* reading, they will assign the FALSE value to the test sentence under NS but the TRUE value to the test sentence under NP.

The interpretation maps for *men* plurals and mensural classifiers follow the same structure as for bare nouns, which are summarised as follows. In positive contexts, if the participants interpret *men* plurals or mensural classifier constructions with inclusive readings, they will assign the TRUE value to test sentences under PS and PP. If they interpret them with exclusive readings, they will assign the FALSE value to the test sentence under PS but the TRUE value to the test sentence under PP. If they interpret them with an *exactly one* reading, they will assign the TRUE value to the test sentence under PS but the FALSE value to the test sentence under PP. As for negative contexts, if the participants interpret *men* plurals or mensural classifier DPs with exclusive readings, they will assign the TRUE value to the test sentence under NS but the FALSE value to the test sentence under NP. If they interpret them with inclusive readings, they will assign the FALSE value to test sentences under NS and NP. If they interpret them with an *exactly one* reading, they will assign the FALSE value to the test sentence under NS but the TRUE value to the test sentence under NP.

With the possible interpretations presented above, we will now consider the predictions for the L1 hypotheses established in Chapter 3, starting with Hypothesis 1 for bare nouns.

Hypothesis 1: Bare nouns have inclusive readings only, and therefore native Chinese adult and child speakers will interpret them inclusively in both positive and negative contexts.

If Hypothesis 1 is supported, in positive contexts, we predict that the participants will assign the TRUE value to test sentences combined with bare nouns under PS and PP, as shown in the interpretation map for positive contexts (Figure 15). In negative contexts, we predict that they will assign the FALSE value to test sentences under NS and NP, as shown in the interpretation map for negative contexts (Figure 16).

Hypothesis 2: *Men* plurals have exclusive readings only, and therefore native Chinese adult and child speakers will compute more exclusive readings for them than for bare nouns in both positive and negative contexts.

If Hypothesis 2 is supported, we predict that the participants will be likely to assign the FALSE value to test sentences combined with *men* plurals under PS and the TRUE value to test sentences under PP at the same time (Figure 15). We also predict that they will be likely to assign the TRUE value to test sentences combined with *men* plurals under NS and the FALSE value to test sentences under NP at the same time (Figure 16).

Hypothesis 3: Mensural classifier constructions have exclusive readings only, and therefore native Chinese adult and child speakers will interpret them exclusively in both positive and negative contexts.

If Hypothesis 3 is supported, we predict that in positive contexts, the participants will assign the FALSE value to test sentences combined with mensural classifiers under PS and the TRUE value to test sentences under PP at the same time (Figure 15). In negative contexts, we predict that they will assign the TRUE value to test sentences combined with mensural classifiers under NS and the FALSE value to test sentences under NP at the same time (Figure 16).

The responses that will support the three hypotheses above are summarised in Table 7.

	Context (positive/negative) x Condition (singular/plural)	Responses
Hypothesis 1	PS	TRUE
	PP	TRUE
	NS	FALSE
	NP	FALSE
Hypothesis 2 Hypothesis 3	PS	FALSE
	PP	TRUE
	NS	TRUE
	NP	FALSE

Table 7 Responses supporting Hypothesis 1 to 3

Now we move on to Hypothesis 4, which is based on the scalar implicature approach to plurality and is repeated as follows.

Hypothesis 4: Assuming the plurality inferences associated with the optional plural marker -*men* are also scalar implicatures, we predict that two main interpretive patterns will be identified within the results of Chinese children and adults. First, both adults and children will compute exclusive readings more often in positive than in negative contexts. Second, children overall will interpret exclusive readings with *men* plurals less often than adults. However, this pattern will be distinct from that in bare nouns, where both children and adults will interpret them inclusively.

First, if both adults and children compute exclusive readings more often in positive than in negative contexts, they will assign the FALSE value to PS and the TRUE value to PP more often than assigning the TRUE value to NS and the FALSE value to NP. Second, if children interpret exclusive readings with *men* plurals less often than adults, they will assign the TRUE value to test sentences under PS and PP and the FALSE value to test sentences under NS and NP more often than adults. Third, if both age groups interpret bare nouns inclusively, both age groups will assign the TRUE value to PS and PP and the FALSE value to NS and NP.

As for the control sentences, if participants can distinguish between singular and plural meanings signified by singular/plural stories and control items, they will assign the True value to control sentences under PS (4.20a), but the False value to control sentences under NS (4.20b), PP (4.21a), and NP (4.21b).

(4.20) (Singular Story) Qianqian fed one panda.

    a.   Qianqian wei le yi zhi xiongmao.   (Target answer: TRUE)

        "Qianqian fed a panda"

    b.   Qianqian meiyou wei yi zhi xiongmao   (Target answer: FALSE)

        "Qianqian didn't feed a panda"

(4.21) (Plural Story) Qianqian fed three pigs.

    a.   Qianqian wei le yi zhi zhu.   (Target answer: FALSE)

        "Qianqian fed a pig"

    b.   Qianqian meiyou wei yi zhi zhu.   (Target answer: FALSE)

        "Qianqian didn't feed a pig"

The control sentence (4.20a) is consistent with what happened in the singular story in (4.20), so its target answer is TRUE. (4.20b) conflicts with the fact that Qianqian fed a panda, so its target answer is FALSE. (4.21a) with a singular meaning conflicts with the plural meaning of the test story in (4.21), so its target answer is FALSE. (4.21b) conflicts with the fact that Qianqian fed a pig (to be exact, 3 pigs), so its target answer is also FALSE.

This subsection presented the predictions for possible responses to the target sentences and the target answers for the control sentences in the Chinese TVJT. In the next section, I will introduce the experiment procedure and the participants recruited for this experiment.

4.2 Participants and procedure

In total, 30 native Chinese-speaking children and 66 native Chinese-speaking adults were recruited. To better understand the participants' linguistic backgrounds, a language background survey (in Appendix II) was carried out for both age groups. In sum, all participants considered themselves as Mandarin Chinese speakers. They were from a dynamic Chinese dialect background. The majority of adult participants were or had experience learning English as a foreign language in a class, and some participants were or had experience of learning other languages apart from English. All of them primarily use Mandarin Chinese in their daily life.

4.2.1 Children

Procedure

The L1-Chinese experiment was originally planned to be conducted face-to-face with the participants in China. However, due to the global pandemic caused by Covid-19, I could

not travel to China. Therefore, the experiment was moved online. It was carried out in the form of one-to-one video meetings through the online communication application DingTalk.

30 Chinese child participants were recruited with the help of the teachers from a kindergarten in Dalian, Liaoning Province, China. The information sheet about the experiment and the consent form were handed out to the students' guardians in advance. The guardians were asked to inform the kindergarten teacher if their children would like to participate in the experiment with their approval. Then, the child participant's guardian set up the meeting for the participant on a computer, and they met with the researcher, me, at a pre-agreed time slot. In the test, I shared my screen with the child participant through the application to let them watch and listen to the task material. The whole meeting was held under the observation of the child's guardian. The guardian was informed in advance that they should not help their children answer the questions during the test.

At the beginning of the meeting, the child participant and their guardian were first asked some simple questions by me, including the participant's age and the language(s) they speak. Afterwards, I introduced the task and explained the instructions to the child participant. They were told that they were going to cooperate with *Xiaobai*, the puppet used in the research, to complete a task. First, they watched and listened to some stories with Xiaobai. Following each story, Xiaobai was asked what happened in the story. After hearing Xiaobai's answer, I asked if they thought Xiaobai's answer was correct, as shown in (4.22).

(4.22) ni   juede Xiaobai shuode dui   haishi budui?
     you think Xiaobai said   correct or   incorrect
     'Do you think what Xiaobai said is correct or incorrect?'

In (4.22), the phrase *dui haishi budui* (correct or incorrect) was used, instead of another commonly used phrase asking for confirmation *dui ma* (*correct* with *ma* as a particle for questions), which means 'is it correct'. This is to stay neutral and avoid the child's judgment being influenced by my question.

The participants then replied with *dui* (correct) or *budui* (incorrect), representing the TRUE or FALSE value respectively. Their answers were also recorded on answer sheets by myself, in case the child did not fully follow the instructions to write down their answers or forgot to do so. Each meeting lasted 30 to 40 minutes.

Participant information

The 30 child participants were all Mandarin Chinese speakers between the ages of 4 and 6.5 (M = 5;01; SD = 0.83), who were born in Dalian, Liaoning Province, China. They were taught in Mandarin Chinese at school. First, 23 out of 30 children regularly took one to two English classes per week at language training schools. The classes normally lasted 25 to 40 minutes. Up to the meeting dates, 14 of them had learnt English for 1 to 6 months, 4 for 6 to 12 months, 3 for 12 to 18 months, and the other 2 for 18 to 24 months. During a typical day, 7 of their parents reported that their children only or predominantly used Mandarin; 11 reported that their children used Mandarin 75% of the time and used English and/or the local dialect around 25% of the time; 4 reported that their children used Mandarin and the local dialect roughly equally; 1 reported that their child used Mandarin and English roughly equally. Second, 6 out of 30 children did not learn English or other languages. During a typical day, 4 of the parents reported that their children only used Mandarin, and 2 reported that their children used Mandarin and the local dialect roughly equally. Third, 1 out of 30 children regularly took two English classes and one French class per week at language training schools. This child had learned English for one year and 4 months and French for 5 months. Their parent reported that this child used Mandarin 75% and English 25% of the time in a typical day. In sum, although 75% of the child participants took English classes regularly, the majority of them predominantly used Mandarin Chinese in their daily life.

4.2.2 Adults

Procedure

The adult participants in the L1-Chinese experiment were recruited in two rounds. In total, 66 participants completed the TVJT. Among them, 13 participants used test set one, 9 participants used test set two, 16 participants used test set three, 10 participants used test set four, 7 participants used test set five, and 11 participants used test set six. As introduced previously, there are six test sets for the Chinese TVJT. If the number of participants for each test set is equal, the responses received for each test item of each category will also be equal. However, as the number of participants for each test set is different as shown above[31], this results in an imbalanced number of responses to each test item.

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[31] This is due to using the online experiment platform in the second recruitment phase. The platform assigns test sets 1 to 6 to participants automatically with a pre-set ratio. However, when a participant dropped out, the loop (1 to 6) kept going without re-using the same dropped test set with another participant. Therefore, when removing all the participants who did not complete the entire task, the number of participants for each test set became imbalanced.

The first recruitment was conducted through posting the recruiting advertisement on Chinese social media. 21 participants were recruited from China and completed the experiment through online one-to-one meetings in November and December 2020. The experiment procedure is similar to that for children, except that the adult participants wrote down their answers on paper by themselves and sent me photos of their answers after the test was done.

The second recruitment was conducted through the volunteer email list of the University of Sheffield and through sharing the experiment link on social media. The experiment was created and conducted using the Gorilla Experiment Builder (www.gorilla.sc) (Anwyl-Irvine et al., 2019). Between 16th February 2021 and 2nd August 2021, 45 participants[32] completed the task through the experiment link, and their data was included in this research. The participants were mainly university students based in China or temporarily living in the UK for education.

After the participant clicked on the experiment link, they first saw the information page that introduces this experiment, as well as the consent form page. After they consented to participate, they then needed to fill in a language background survey before starting the Chinese TVJT. The instructions for the task were first shown on the webpage, informing the participants that they would watch a series of short, animated videos; after each video, they would be given an English sentence and be asked to choose whether it is True/False based on the video's content by clicking the *zhengque* (True) or *cuowu* (False) button on the webpage. The task was self-paced.

Participant information

The 66 participants were from 19 provinces, autonomous regions, and municipalities in China, aged from 19 to 36 years old. Their native language is Chinese and none of them stated that they could use another language or other languages at the native level. 41 out of 66 participants had experience learning English at school and/or outside school; 12 had experience learning more than one foreign language, including English, German, Japanese, French, Korean, and Malay; the other 13 did not have foreign language learning experience. In a typical day, 7 out of 66 participants used Mandarin only; 29 participants used Mandarin 75% of the time, and the foreign language(s) and their local dialects 25% of the time; 20 participants used Mandarin half of the time, and the foreign language(s) and their local dialects the other half; 8

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[32] More than 150 participants started the task but dropped out in the process. In the end, there were only 45 participants left.

participants used Mandarin and their local dialects equally; 2 participants used English 75% of the time, and Mandarin and/or their local dialects 25% of the time. In sum, although the adult participants were recruited from both China and the UK, the majority of them primarily used Mandarin Chinese in their daily life.

4.2.3 Ethical considerations

The experiments in this thesis have obtained ethics approval from the ethics committee of the University of Sheffield in 2020. Participation in this research is entirely voluntary. The responses from the experiments were coded in a way that participants will not be identifiable, and the data was analysed and reported as a group result or an anonymous individual result.

Before experimenting, for the interview group, the information sheets and the consent forms (see Appendix III) were sent to the child participants' guardians and the adult participants. For the child participants, the experiment was conducted after both the children and their guardians had agreed to participate. During the experiment, the children's guardians were sat next to the children and observed the entire experiment. For the adult participants, the experiment was also conducted after they had agreed to participate.

For the participants who took part in the experiment through the online platform Gorilla, the information page and the consent page were at the beginning of the task. They read them and consented to participate first before proceeding to the main task.

4.3 Data analysis and results

This section reports the results of the Chinese TVJT in the current research. It first displays the dependent and independent variables in the current data analysis, which will help us understand what information the analysis tells us. It then presents the descriptive results, including both child group and adult group results. This will provide us with a general picture of the results. Next, I will introduce the mixed-effects models used in the current L1-Chinese research and report the inferential statistics. Inferential analysis of the task results can help us find out what factors have an effect on the participants' interpretations of plurality in Mandarin Chinese. This section then ends with a brief report of the individual results, which supports what we found with the group results.

4.3.1 Variables

The dependent variable in the current analysis is the exclusive reading interpreted by the participants, the main independent variables which may have an effect on the dependent variable include *category*, *context*, *condition*, and *age group*. Table 8 presents the dependent variable and all the independent variables in the analysis, with their factor levels.

Variables	Number of levels	Levels
subject	96	CC1, CA1, ...
response	2	t (TRUE), f (FALSE)
exclusive reading	2	1 (exclusive), 0 (non-exclusive)
category	4	bare nouns, *men* plurals, mensural classifiers, *yi xie*
context	2	positive, negative
condition	2	singular, plural
age group	2	child, adult
age	integer	NA for adults; children: 4, 5, ...
item	18	*xiongmao* (panda), *tuzi-men* (rabbits), ...
Target	2	1 (target sentence), 0 (control sentence)
test method	2	interview, Gorilla
test set	6	set1, set2, set3, set4, set5, set6

Table 8 Summary of the variables in the L1 Chinese data analysis

As shown in Table 8, there were 96 participants in total, child participants were coded as *CC1* to *CC30*, while adult participants were coded as *CA1* to *CA66*. *Response* and *exclusive reading* are dependent variables. The participants' responses were first recorded as *t* or *f*, which stands for the TRUE or FALSE value assigned by them to the test items in the TVJT. This does not mean the participant has provided a correct or incorrect answer to the test tokens. As discussed in Section 4.1, exclusive interpretations were calculated based on the TRUE/FALSE values, with the exclusive readings coded as 1 and non-exclusive readings coded as 0.

The independent variable *category* has four levels: bare nouns, *men* plurals, mensural classifiers, and *yi xie* (some). *Yi xie* was originally treated as one kind of mensural classifier following previous literature. However, an interesting point appears later on in the research,

that is, whether native Chinese speakers will treat *yi xie* the same as the scalar expression *you xie*, considering the two have the same literal meaning *some*. As discussed in Chapters 2 and 3, viewing *yi xie* as a mensural classifier or as a scalar expression will lead to different predictions for participants' interpretations. Therefore, when analysing the data, I separated *yi xie* from the other two mensural classifiers (*yi qun* (one group) and *yi lan* (one basket)). In this way, we will be able to identify whether the participants respond differently to them. The statistical results indeed show that the participants interpreted *yi xie* differently from the other two mensural classifier constructions. This will be discussed in detail in the following sections.

Turning back to the independent variables in the current research. *Context* has two levels (positive or negative), as the test sentences are either positive or negative. *Condition* also has two levels (singular or plural), as the test stories in the TVJT either denote singular or plural meanings. *Age group* has two levels, child and adult. *Age* is an integer variable, where the child participant's age is stored, the value for adults is NA because their age was not considered in the current research. *Item* has 18 levels, which stand for the 18 test items in this task. *Target* indicates whether a test token is a target test sentence (coded as 1) or a control sentence (coded as 0). *Test method* was also treated as an independent variable in the current analysis, with online interviews and the experimental platform Gorilla as its two levels. After finishing cleaning and coding the data, I first tested whether the test methods had influenced how the participants responded to the test items. The statistical results show that there was no effect of the test method on the participants' responses (*p>.05*). Therefore, I analysed and will report the L1 data collected through the two ways together. It is the same with *test set*, which comprises six levels for the six test sets. There was no statistically significant difference between the participants' responses to the test tokens from different test sets (*p>.05*), so I also analysed and will report the results together.

4.3.2 Descriptive statistics

This subsection first reports the group results for target test sentences: starting with bare nouns, followed by *men* plurals, then mensural classifier constructions and *yi xie* (some). It then presents the results for control sentences in this task.

Bare nouns

In the following, I will report the child group results first, then the adult group results. Before ending this subsection, I will also compare the child and adult results. 120 responses to the bare noun target test sentences were collected from the 30 child participants. Table 9 shows

the frequency of TRUE/FALSE responses under the four combinations of Context with Condition (i.e., PS, PP, NS, NP).

Bare noun target sentences (%)			
Context x Condition	TRUE	FALSE	Total
PS	93.33 (n=28)	6.67 (n=2)	100.00 (n=30)
PP	93.33 (n=28)	6.67 (n=2)	100.00 (n=30)
NS	10.00 (n=3)	90.00 (n=27)	100.00 (n=30)
NP	10.00 (n=3)	90.00 (n=27)	100.00 (n=30)

Table 9 Frequency of responses to bare nouns by child participants
(PS stands for positive singular, PP for positive plural,
NS for negative singular, NP for negative plural)

As shown in Table 10, the child participants predominantly assigned the TRUE value to the positive target sentences under PS and PP. By contrast, they predominantly assigned the FALSE value to the negative target sentences under NS and NP. This means that the child participants tend to interpret bare nouns inclusively in both positive and negative contexts. Turning to the adult group results, 264 responses were received from the 66 participants. The frequency of their TRUE/FALSE responses is shown in Table 10.

Bare noun target sentences (%)			
Context x Condition	TRUE	FALSE	Total
PS	93.94 (n=62)	6.06 (n=4)	100.00 (n=66)
PP	93.94 (n=62)	6.06 (n=4)	100.00 (n=66)
NS	1.52 (n=1)	98.48 (n=65)	100.00 (n=66)
NP	3.03 (n=2)	96.97 (n=64)	100.00 (n=66)

Table 1 Frequency of responses to bare nouns by adult participants
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)

Table 10 shows that the adult participants predominantly assigned the TRUE value to the positive target sentences under PS and PP, but the FALSE value to the negative target sentences under NS and NP. This means that they also tend to interpret bare nouns with inclusive readings in both positive and negative contexts.

It can be noticed that the responses assigned to bare nouns by child and adult participants are almost indistinguishable. They tend to assign TRUE values to target sentences in positive contexts and FALSE values in negative contexts. This means that they tend to interpret bare nouns inclusively in both positive and negative contexts. The comparison between the computation of exclusive readings by children and adults will be presented in Section 4.3.3 with inferential statistics. Next, I present the descriptive results for *men* plurals.

men plurals

120 responses to *men* plural target sentences were collected from the child participants. The frequency of their TRUE/FALSE responses is shown in Table 11.

men plural target sentences (%)			
Context x Condition	TRUE	FALSE	Total
PS	66.67 (n=20)	33.33 (n=10)	100.00 (n=30)
PP	86.67 (n=26)	13.33 (n=4)	100.00 (n=30)
NS	6.67 (n=2)	93.33 (n=28)	100.00 (n=30)
NP	6.67 (n=2)	93.33 (n=28)	100.00 (n=30)

Table 2 Frequency of responses to *men* plurals by child participants
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)

As shown in Table 11, two-thirds of the child participants assigned the TRUE value to the positive target sentences under PS. This is slightly lower than the frequency of TRUE values for the positive target sentences under PP (26 out of 30). These together mean that children mainly interpreted *men* plurals inclusively in positive contexts. For the negative test sentences under NS and NP, the participants predominantly assigned the FALSE value to them, meaning bare nouns under negation tend to be interpreted with inclusive readings. Altogether, the group results show while the child participants mainly interpreted *men* plurals inclusively in both positive and negative contexts, exclusive interpretations tend to appear more often in positive contexts than in negative contexts.

Now we turn to the 264 responses from the adult participants, shown in Table 12.

men plural target sentences (%)			
Context x Condition	TRUE	FALSE	Total
PS	21.21 (n=14)	78.79 (n=52)	100.00 (n=66)
PP	92.42 (n=61)	7.58 (n=5)	100.00 (n=66)
NS	27.27 (n=18)	72.73 (n=48)	100.00 (n=66)
NP	4.55 (n=3)	95.45 (n=63)	100.00 (n=66)

Table 3 Frequency of responses to *men* plurals by adult participants
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)

Table 12 shows that under PS, the adult participants mainly (78.79%) assigned the FALSE value to the positive target sentences, whereas under PP, they assigned the TRUE value to the positive targets with a higher percentage (92.42%). The FALSE value under PS and the TRUE under PP indicate an exclusive reading. This suggests that Chinese adults tend to interpret *men* plurals exclusively in positive contexts. As for the negative context, the participants mainly

assigned the FALSE value to the target sentences under both NS (72.73%) and NP (95.45%), with a higher percentage for NP. This means that under negation, although adult participants mainly interpreted *men* plurals inclusively, almost one-third of the participants interpreted them exclusively.

Comparing child and adult responses, it can be seen from that the main difference lies in PS. Children mainly assigned the TRUE value to the target sentences under PS, whereas adults mainly assigned the FALSE value to them. The difference in the responses under NS between the two age groups is also more observable than the other two combinations (PP and NP), that is, adults replied with more FALSE values than children did. Altogether, the above suggests that adults tend to interpret *men* plurals with exclusive readings more often than children in both positive and negative contexts.

In sum, the current descriptive results show that child participants in the Chinese TVJT tend to interpret *men* plurals inclusively in both positive and negative contexts, whereas adults overall tend to interpret *men* plurals exclusively in positive contexts but inclusively under negation. We will come back to the discussion in more detail in Section 4.3.3. Next, I present the descriptive results for mensural classifiers and *yi xie*.

Mensural classifiers and *yi xie*

120 responses were collected from the child participants for two mensural classifiers and *yi xie* (some), with 80 and 40 responses for each category respectively. The frequency of TRUE/FALSE values for them is shown in Table 13.

Mensural classifier and *yi xie* target test sentences				
Context	Category	TRUE	FALSE	Total
PS	mensural classifier	n=1	n=19	n=20
	yi xie	n=4	n=6	n=10
PP	mensural classifier	n=17	n=3	n=20
	yi xie	n=10	n=0	n=10
NS	mensural classifier	n=5	n=15	n=20
	yi xie	n=1	n=9	n=10
NP	mensural classifier	n=0	n=20	n=20
	yi xie	n=0	n=10	n=10

Table 4 Frequency of responses to mensural classifiers and *yi xie* by child participants (PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)

Table 13 shows that the child participants predominantly assigned the FALSE value to mensural classifier targets under PS, whereas their TRUE/FALSE responses to *yi xie* are almost

fifty-fifty. Under PP, they predominantly assign the TRUE value to both mensural classifier and *yi xie* target sentences. This means that in positive contexts, child participants tend to interpret mensural classifier constructions exclusively, compared to which they computed exclusive readings less often for *yi xie*. Turning to negative contexts, for both mensural classifiers and *yi xie*, most of the child participants assigned the FALSE value to them under NS, and all of them assigned the FALSE value to them under NP. This means that the child participants tend to interpret mensural classifiers and *yi xie* inclusively under negation, although they interpreted exclusive readings slightly more often with mensural classifiers than with *yi xie*.

As discussed earlier, we originally treated *yi lan* (one basket (of)), *yi qun* (one group (of)), and *yi xie* (some) as mensural classifiers when designing the Chinese TVJT, following previous linguistic assumptions. However, the question of whether *yi xie* should be viewed as scalar implicature expression arose in the process of this study. Therefore, I analysed the results for both categories separately. Our current child group results indeed show some level of difference among the interpretations for mensural classifiers and *yi xie*. But without further investigation, no conclusions should be drawn from the current results for now.

Now we turn to adult results for mensural classifier targets and *yi xie* targets, shown in Table 14.

Mensural classifier and *yi xie* target test sentences (%)				
Context	Category	TRUE	FALSE	Total
PS	mensural classifier	4.00 (n=2)	96.00 (n=48)	100.00 (n=50)
	yi xie	0.00 (n=0)	100.00 (n=16)	100.00 (n=16)
PP	mensural classifier	95.00 (n=38)	5.00 (n=2)	100.00 (n=40)
	yi xie	96.15 (n=25)	3.85 (n=1)	100.00 (n=26)
NS	mensural classifier	80.00 (n=32)	20.00 (n=8)	100.00 (n=40)
	yi xie	38.46 (n=10)	61.54 (n=16)	100.00 (n=26)
NP	mensural classifier	6.00 (n=3)	94.00 (n=47)	100.00 (n=50)
	yi xie	0.00 (n=0)	100.00 (n=16)	100.00 (n=16)

Table 14 Frequency of responses to mensural classifiers and *yi xie* by adult participants
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)

As shown in Table 14, the adult participants predominantly assigned the FALSE value to mensural classifiers and *yi xie* under PS and assigned the TRUE value to both categories under PP. This means that they interpreted mensural classifiers and *yi xie* exclusively in positive contexts. Under NS, 80% of the participants assigned the TRUE value to mensural classifiers, whereas more than 60% of them assigned the FALSE value to *yi xie*. Under NP, they

predominantly assigned the FALSE value to both categories. This means that in negative contexts, the participants interpreted exclusive readings more often with mensural than with *yi xie*. In sum, the adult results revealed different interpretation patterns for mensural classifiers and *yi xie* in negative contexts but not in positive contexts.

Comparing child and adult responses to mensural classifier constructions, the main difference between the two age groups' responses lies in NS. While almost 80% of the child participants assigned the FALSE value to target sentences under NS, 80% of the adult participants assigned the TRUE value to them. This suggests that adult participants tend to interpret mensural classifiers exclusively under negation, whereas child participants tend to interpret them inclusively.

Comparing child and adult responses to *yi xie*, the differences can be identified in PS and NS. Under PS, child participants assigned the TRUE value to *yi xie* 40% of the time, whereas adult participants only provided FALSE values to them. This suggests that in positive contexts, children tend to compute fewer exclusive readings with *yi xie* than adults. Under NS, children assigned more FALSE values to *yi xie* than adults. This suggests that in negative contexts, adults tend to compute exclusive readings with *yi xie* more often than children. However, considering the limited number of responses to *yi xie* collected from the participants, the current descriptive results may not be representative, requiring future research.

From the above discussion, we have seen a complicated picture for mensural classifiers and *yi xie*. Regarding child results, although they tend to interpret both mensural classifiers and *yi xie* exclusively in positive contexts and inclusively in negative contexts, they tend to compute exclusive readings less often with *yi xie* than with mensural classifiers in positive contexts. Regarding adult results, they tend to interpret mensural classifiers exclusively in both positive and negative contexts, whereas they tend to interpret *yi xie* exclusively in positive contexts but inclusively under negation.

The computation of exclusive readings for mensural classifiers and *yi xie* by the two age groups will be analysed in Section 4.3.3 with inferential statistics. In the following, I will report the results for control sentences.

Control sentences

The child results for control test sentences are summarised in Table 15.

Control sentences (response rates, %)			
Context x Condition	TRUE	FALSE	Total
PS	**100.00 (n=45)**	0.00 (n=0)	100.00 (n=45)
PP	11.11 (n=5)	**88.89 (n=40)**	100.00 (n=45)
NS	8.89 (n=4)	**91.11 (n=41)**	100.00 (n=45)
NP	13.33 (n=6)	**86.67 (n=39)**	100.00 (n=45)

Table 15 Frequency of responses to control sentences by child participants
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)
(Target answers are in bold)

As shown in Table 15, the child participants predominantly responded to the control sentences correctly, that is, assigning the TRUE value to controls under PS (100%), and assigning the False value to controls under PP, NS, and NP (around 90%).

The adult results for the control test sentences are summarised in Table 16.

Control sentences (response rates, %)			
Context x Condition	TRUE	FALSE	Total
PS	**89.81 (n=97)**	10.19 (n=11)	100.00 (n=108)
PP	10.00 (n=9)	**90.00 (n=81)**	100.00 (n=90)
NS	2.22 (n=2)	**97.78 (n=88)**	100.00 (n=90)
NP	25.92 (n=28)	**74.07 (n=80)**	100.00 (n=108)

Table 16 Frequency of responses to control sentences by adult participants
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)
(Target answers are in bold)

As shown in Table 16, the adult participants also predominantly responded to the control sentences correctly by assigning the TRUE value to controls under PS (90%) and the False value to controls under PP (90%), NS (98%), and NP (75%)[33].

In general, the child and adult participants responded with the target answers to the control sentences. This means that they did not have difficulty understanding the singular and plural meanings signified by the test stories and control sentences.

---

[33] It can be noticed that for NP, 25% of the responses are TRUE. That is where the participants were asked to make judgments on "Qianqian didn't feed a pig" when Qianqian fed three pigs. We suspect that participants who assigned the TRUE value to this sentence interpreted it with an enriched singular meaning "Qianqian didn't feed exactly one pig (because she fed three)". The computation of the readings associated with singular constructions such as *one CL x* is not the focus of the current research, so we leave this investigation for the future. This result does not affect the validity of the current results or conclusions because they are control tokens, which were used to show if the participants have understood the test stories and test tokens. It also does not affect the validity of the research design, and instead, it shows what the result for the interpretation of singular sortal classifiers could be like and calls for future in-depth analysis. Future research could include more singular sortal classifier constructions and test them on both child and adult speakers, to identify whether this enriched singular meaning is available for both children and adults.

This subsection has reported the descriptive statistics of the L1-Chinese child and adult data. In the next subsection, I will present the inferential statistics by calculating the exclusive readings interpreted by the participants for bare nouns, *men* plurals, mensural classifiers, and *yixie* (some).

4.3.3 Generalised linear mixed-effects models and inferential statistics

This section presents the inferential analyses for the L1 Chinese data collected from the TVJT[34]. Due to the repeated measurements of participants in the TVJT, mixed-effects analysis was performed using R and the *glmer* function from the package lme4 (Bates et al., 2015). The generalised linear mixed-effects (GLM) models can remove individual variation (from different participants/test items) of repeated measurements, so they produce more realistic results. The models in this study investigate the relationship between the exclusive readings interpreted by the participants and other independent variables. In the following, we first have a general look at the L1 data (Model 1). Second, I present the comparisons within bare nouns and *men* plurals respectively (i.e., positive vs. negative and child vs. adult). Then, I compare bare nouns and *men* plurals. Lastly, I will compare the results in positive and negative contexts, as well as by child and adult groups, within mensural classifiers and *yi xie*, respectively.

Model 1 aims to test whether *age group* (child vs. adult), *context* (positive vs. negative), and *category* (bare nouns vs. *men* plurals vs. mensural classifiers vs. some (i.e., *yi xie*)) have an effect on how participants compute exclusive readings. In the model, *age group*, *context*, and *category* are fixed effects. *Subject* is a random effect, which means one intercept for each participant. This removes participant individual variation. The GLM regression analysis reveals a main effect of age group ($p<.001$), context ($p<.001$), and category ($p<.001$) on the interpretation of exclusive readings, as shown in Table 17.

	Estimate	Std.Error	z value	Pr(>|z|)
(Intercept)	-3.5363	0.4202	-8.416	< 2e-16 ***
ageGroupadult	1.5540	0.2932	5.300	1.16e-07 ***
contextnegative	-2.2100	0.2681	-8.243	< 2e-16 ***
categorymen Plural	3.1559	0.3906	8.080	6.50e-16 ***
categorymensural classifier	5.3627	0.4701	11.408	< 2e-16 ***
categorysome	3.9519	0.4743	8.332	< 2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05

Table 17 Results of Model 1 for the L1 data[35]

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[34] The data being analysed is from responses to PS and NS. This is because, as explained in Section 4.1.2, the main purpose of adding plural conditions (i.e., plural test stories) in this task is to help us decide what readings the participants intended to mean with their responses to PS and NS.

[35] In the table, *ageGroupadult* means the reference or baseline for the factor *age group* is the child group; *contextnegative* means the reference or baseline for the factor *context* is the *positive* context; *categorymen plural*,

To show the results more clearly, the rates of exclusive interpretations computed across age groups, contexts, and categories are provided in Figure 17.
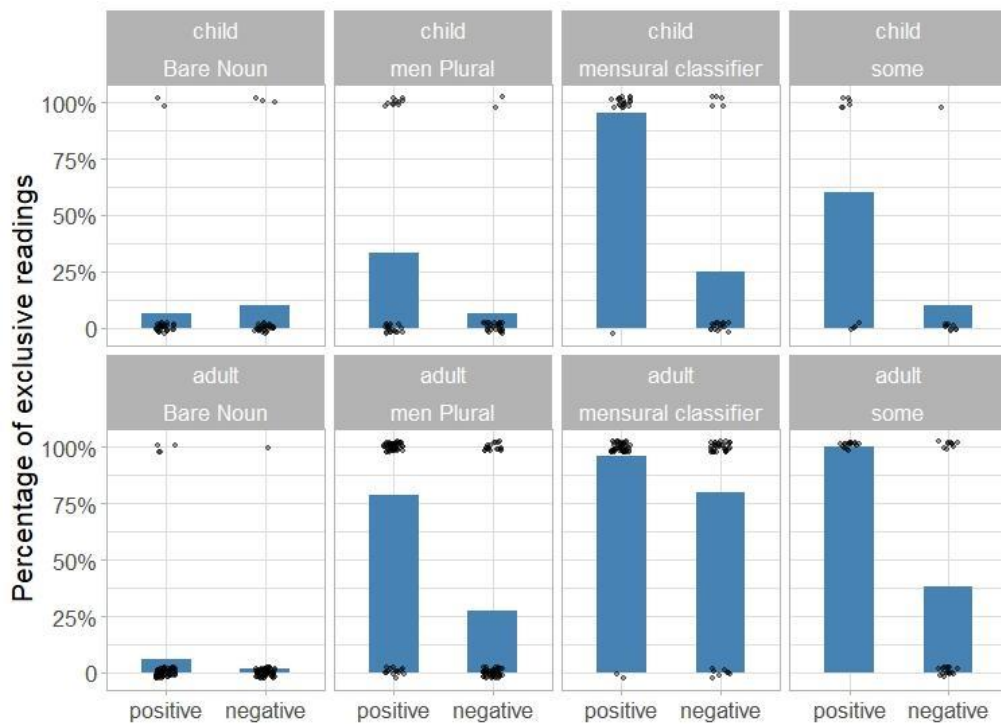
Figure 17 Percentage of exclusive readings by two age groups (positive vs. negative)

In Figure 17, the graphs on the top are the child results and the graphs at the bottom are the adult results. As can be seen, participants showed different interpretation patterns in different contexts for different categories. We now have a closer look at each category, starting with bare nouns.

Bare nouns

A GLM model fitted to the bare noun data shows no effect of *context* (*p>.1*) and *age group* (*p>.1*) on exclusive interpretations from the child and adult participants. There is also no interaction between *context* and *age group* (*p>.1*). The comparison between positive and negative contexts within each age group, as well as the comparison between child and adult groups, are shown in Figure 18.

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categorymensural classifier, and *categorysome* mean that the responses to *men* plurals, mensural classifiers, and *some* were compared to the responses to the reference group *bare nouns*.

110
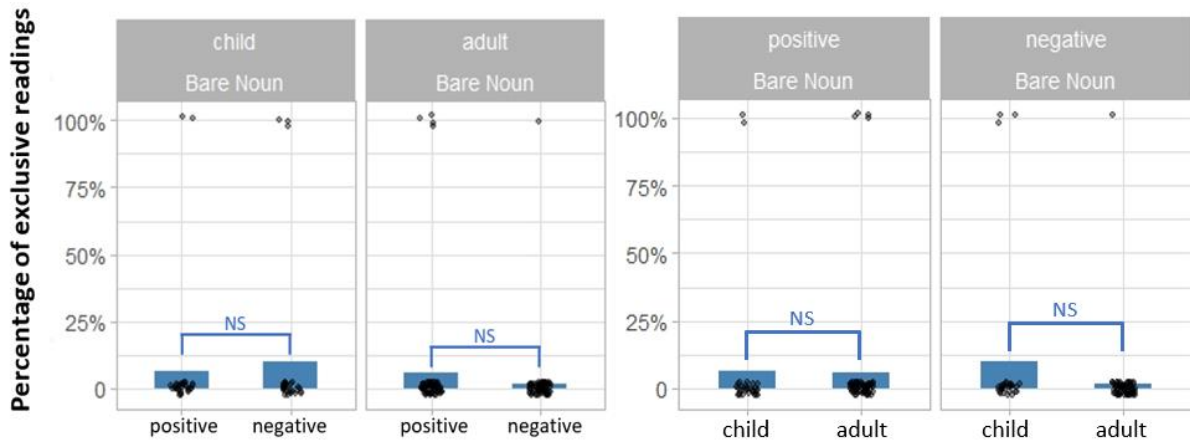
Figure 18 Percentage of exclusive readings for bare nouns by children and adults

As shown in Figure 18, the two graphs on the left show the comparison between positive and negative contexts, whereas the two graphs on the right show the comparison between child and adult groups. There is no significant difference between children's and adults' exclusive interpretations across contexts. Both child and adult participants tend to interpret bare nouns inclusively in both positive and negative contexts. Next, we turn to *men* plurals.

men plurals

A GLM model fitted to the *men* plural data shows main effects of *context* ($p=0.0181$) and *age group* ($p<.001$) on exclusive interpretations and no interaction between *context* and *age group* ($p>.1$). Next, I will first present the comparison between positive and negative contexts within each age group, as shown in Figure 19.
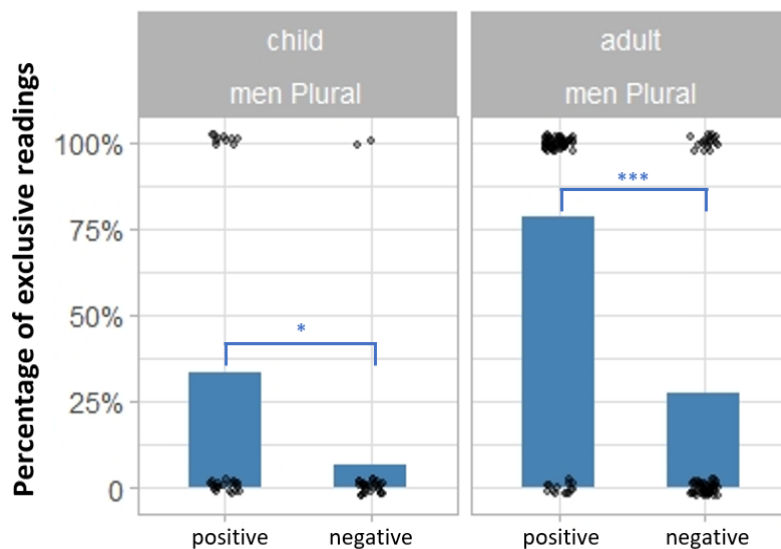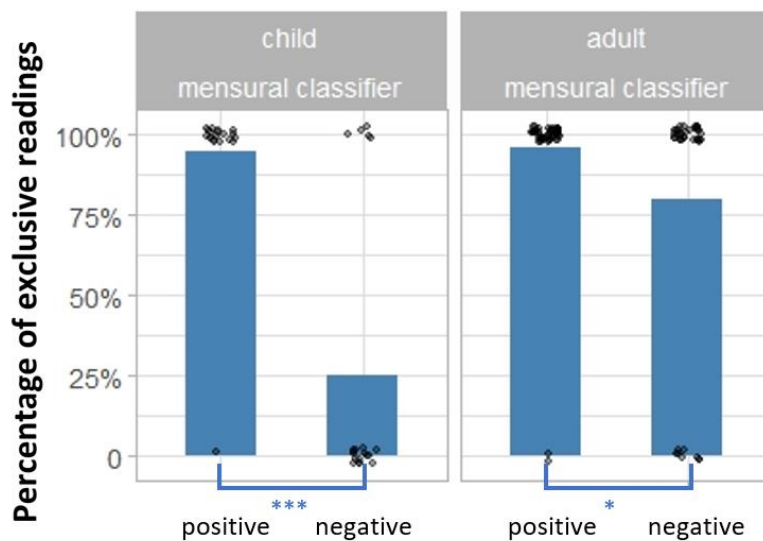

Figure 19 Percentage of exclusive readings for *men* plurals (positive vs. negative)

As shown in Figure 19, the exclusive readings computed by children in positive and negative contexts are marginally different (*p<.05*). This means that although children generally interpreted *men* plurals inclusively, they tend to interpret them exclusively more often in positive than in negative contexts. On the other hand, the exclusive readings computed by adult participants in positive and negative contexts are significantly different (*p<.001*). This means that they tend to interpret *men* plurals exclusively in positive contexts but inclusively in negative contexts. But as shown in the graphs, there was a fair number of inclusive readings computed by adults in positive contexts and exclusive readings computed in negative contexts, around 25% for each.

Now we turn to the comparison between child and adult results in positive and negative contexts, shown in Figure 20.
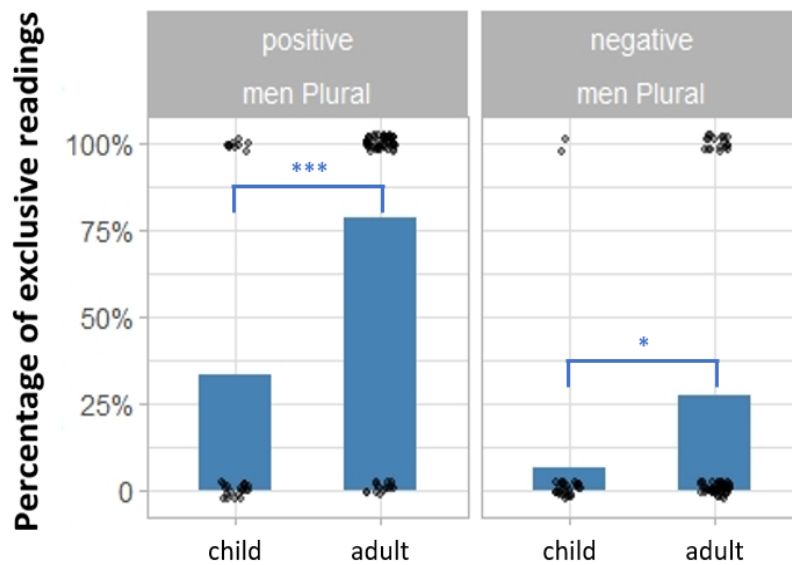
Figure 20 Percentage of exclusive readings for *men* plurals (child vs. adult)

As shown in Figure 20, in positive contexts, the percentage of exclusive readings computed by the child participants is significantly different from that of the adult participants (*p<.001*). This means that children interpreted exclusive readings with *men* plurals in positive contexts significantly less often than adults. Under negation, the percentages of exclusive readings computed by the child and adult participants are only marginally different (*p<.05*). This means that even though both children and adults tend to interpret *men* plurals inclusively under negation, adults still computed more exclusive readings than children. Next, we compare bare nouns and *men* plurals.

bare nouns vs. *men* plurals

The results for bare nouns and *men* plurals are compared and analysed because this will inform us on what interpretations are available with/without plural marking in L1 Chinese. A GLM model fitted to the bare nouns and *men* plural data reveals an effect of *category* (*p<.05*) on children's and adults' exclusive interpretations. It also reveals an interaction between *category* and *age group* (*p<.001*). We now have a closer look at the comparison within each age group, shown in Figure 21.
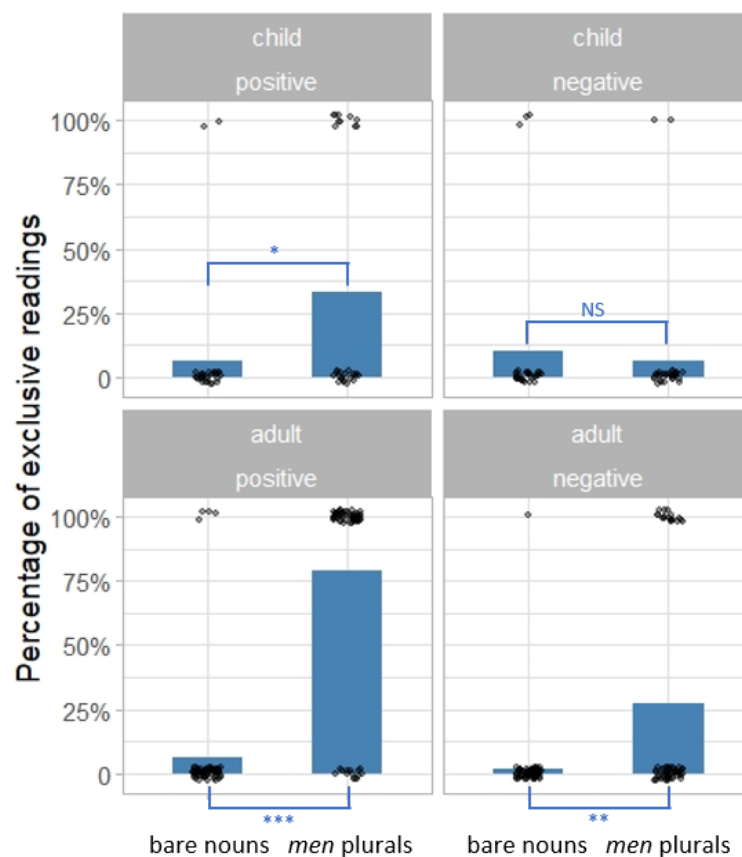
Figure 21 child and adult results (bare nouns vs. *men* plurals)

Figure 21 shows both child (top) and adult results (bottom) for bare nouns and *men* plurals, with positive contexts on the left and negative contexts on the right. For the child participants, their exclusive interpretations for bare nouns are marginally different from that of *men* plurals (*p<.05*) in positive contexts, whereas no significant difference is found in negative contexts (*p>.1*). In terms of the adult results, significant differences between their exclusive interpretations for bare nouns and *men* plurals are found in positive contexts (*p<.001*) and in negative contexts (*p<.01*). The results suggest that children tend to interpret more exclusive readings with *men* plurals than with bare nouns in positive contexts, although they overall

interpreted both bare nouns and *men* plurals inclusively in both positive and negative contexts. As for adults, they interpreted more exclusive readings with *men* plurals than with bare nouns in both positive and negative contexts. They also interpreted *men* plurals with exclusive readings more often in positive than in negative contexts.

We now move on to mensural classifier constructions.

mensural classifiers

A GLM model fitted to the mensural classifier data shows the main effect of *context* (*p<.001*) but no significant effect of *age group* (*p>.1*) on exclusive interpretations, with no interaction between *context* and *age group* (*p>.1*). Next, the first comparison was made between positive and negative contexts within each age group, shown in Figure 22.

Figure 22 Percentage of exclusive readings for mensural classifiers (positive vs. negative)

Figure 22 shows that the difference between exclusive interpretations by children in positive and negative contexts is statistically significant (*p<.001*). This suggests that children tend to interpret mensural classifiers exclusively in positive contexts and inclusively in negative contexts, although they interpreted them with exclusive readings under negation 25% of the time. Regarding the adult results, the difference in exclusive interpretations between positive and negative contexts is only marginally significant (*p<.05*). This means that although they tend to interpret more exclusive readings in positive than in negative contexts, they overall interpreted mensural classifiers exclusively in both positive and negative contexts.

Second, the comparison was made between child and adult results in positive and negative contexts, shown in Figure 23.
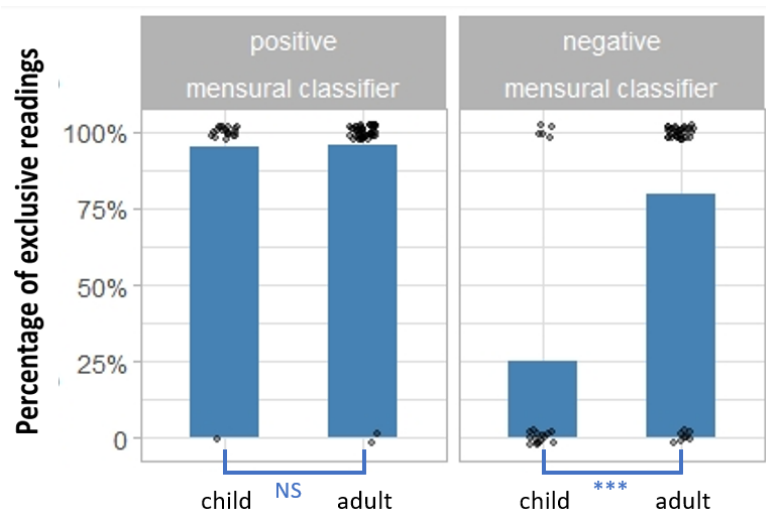
Figure 23 Percentage of exclusive readings for mensural classifiers (child vs. adult)

Figure 23 shows that in positive contexts, there is no significant difference between children's and adults' exclusive interpretations (*p>.1*). Both age groups tend to interpret mensural classifiers exclusively in positive contexts. However, under negation, the child result is significantly different from the adult result (*p<.001*). This suggests that children tend to interpret mensural classifiers inclusively under negation, whereas adults tend to interpret them exclusively. Next, we turn to *yi xie*.

yi xie

A GLM model fitted to the mensural classifier data shows main effects of *context* (*p<.001*) and *age group* (*p<.05*) on exclusive interpretations. The comparison between positive and negative contexts within each age group (left) and the comparison between the two age groups (right) are presented in Figure 24.
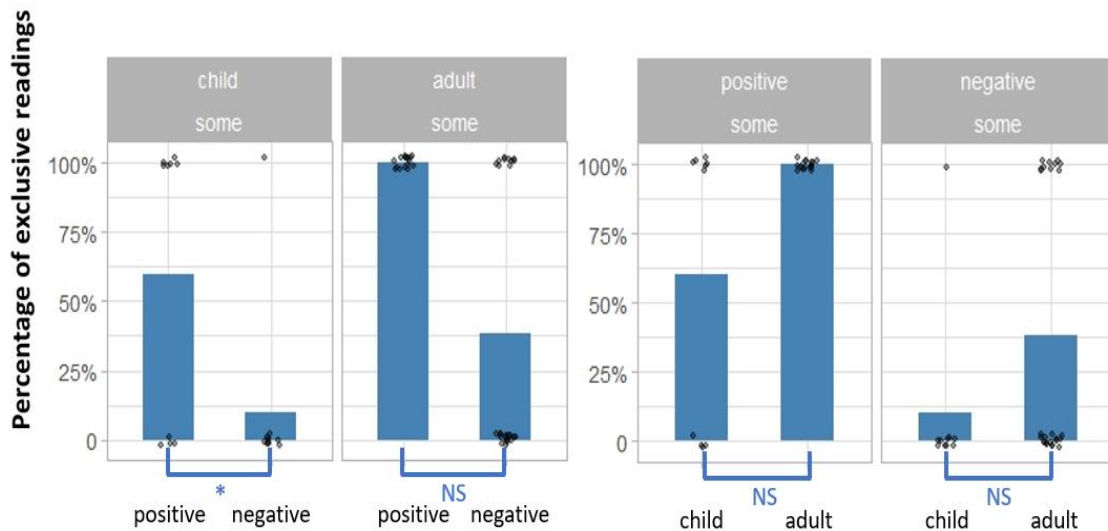
Figure 24 Percentage of exclusive readings for *yi xie*

As shown in Figure 24, the statistical analyses for each comparison only revealed a marginal difference between children's exclusive interpretations in positive and negative contexts (*p=0.0352*), whereas no statistically significant difference was found among other comparisons (*p>.1*). This is due to the small and imbalanced sample size for *yi xie*. This suggests that even though the descriptive results for *yi xie* showed some level of difference across contexts and age groups, no conclusion can be drawn from the current inferential statistics.

4.3.4 Individual results

What we found with the group results discussed above also has received support from the individual results. In this subsection, I briefly report child and adult individual results for each category, starting with bare nouns.

Bare nouns

Table 18 on the following page shows different readings for bare nouns interpreted by the child participants across contexts and conditions. The exclusive/inclusive/exactly one readings were calculated based on the interpretation maps presented in Section 4.1.4. The results are sorted by the youngest age of the children to the oldest.

subject	inclusive	exclusive	exactly one	age
CC1	4	0	0	4
CC2	3	0	1	4
CC3	4	0	0	4
CC4	4	0	0	4
CC5	4	0	0	4
CC6	4	0	0	4
CC7	4	0	0	4
CC8	4	0	0	4.5
CC9	4	0	0	4.5
CC10	2	0	2	4.5
CC11	2	0	2	4.5
CC12	4	0	0	4.5
CC13	4	0	0	5
CC14	4	0	0	5
CC15	2	2	0	5
CC16	4	0	0	5
CC17	4	0	0	5
CC18	4	0	0	5.5
CC19	4	0	0	5.5
CC20	4	0	0	6
CC21	2	0	2	6
CC22	2	1	1	6
CC23	2	2	0	6
CC24	2	2	0	6
CC25	4	0	0	6
CC26	4	0	0	6
CC27	4	0	0	6
CC28	4	0	0	6
CC29	4	0	0	6
CC30	2	2	0	6.5

Table 18 Child individual results for bare nouns in the Chinese TVJT
(**highlighted**: inclusive and exclusive/*exactly one* readings for bare nouns)

Table 18 shows that the majority of the child participants interpreted bare nouns inclusively across contexts and conditions, whereas only 9 out of 30 (as highlighted) did not consistently interpret bare nouns with inclusive readings in this task. Other available readings for them are the exclusive reading and the *exactly one* reading. But as shown above, among the interpretations by the 9 participants, at least half of them are inclusive ones. This suggests that the child individual results are consistent with the group results.

Turning to the adult individual results, the majority of the adult participants interpreted bare nouns inclusively across contexts and conditions. Only 8 out of 66 did not do so consistently, and their results are shown in Table 19.

subject	inclusive	exclusive	exactly one
CA1	2	2	0
CA2	2	1	1
CA4	2	1	1
CA5	2	1	1
CA7	2	0	2
CA3	2	0	2
CA6	2	1	1
CA8	3	0	1

Table 19 Individual adult results for bare nouns from the 8 participants
(**highlighted**: inclusive and exclusive/*exactly one* readings in positive contexts)

As shown in Table 19, 5 participants interpreted non-inclusive readings in positive contexts (as highlighted), whereas 3 participants interpreted non-inclusive readings in negative contexts (CA3, CA6, CA8). Both exclusive and *exactly one* readings are available to them, but at least half of their responses are still inclusive ones. Therefore, the adult individual results do not conflict with the findings of the adult group results.

men plurals

Now we consider the child individual results for *men* plurals, shown in Table 20.

subject	inclusive	exclusive	exactly one	age
CC1	4	0	0	4
CC2	0	2	2	4
CC3	2	2	0	4
CC4	2	2	0	4
CC5	4	0	0	4
CC6	2	0	2	4
CC7	2	0	2	4
CC8	4	0	0	4.5
CC9	4	0	0	4.5
CC10	2	2	0	4.5
CC11	4	0	0	4.5
CC12	4	0	0	4.5
CC13	4	0	0	5
CC14	4	0	0	5
CC15	4	0	0	5
CC16	4	0	0	5
CC17	4	0	0	5
CC18	2	2	0	5.5
CC19	4	0	0	5.5

CC20	2	2	0	6
CC21	4	0	0	6
CC22	2	0	2	6
CC23	0	2	2	6
CC24	4	0	0	6
CC25	2	2	0	6
CC26	2	2	0	6
CC27	2	2	0	6
CC28	4	0	0	6
CC29	4	0	0	6
CC30	2	2	0	6.5

Table 20 Child individual results for *men* plurals in the Chinese TVJT
(**not highlighted**: inclusively in both positive and negative contexts;
green: exclusively in positive but inclusively in negative contexts; **grey**: others)

In Table 20, more than half of the child participants (16 out of 30) interpreted *men* plurals inclusively in both positive and negative contexts. As highlighted by the green colour, around 25% of the participants (8 out of 30) interpreted *men* plurals exclusively in positive contexts and inclusively under negation. Looking in more detail at the results from the remaining 6 participants, three of them (CC6, 7, 22) interpreted *men* plurals with an *exactly one* reading in the positive context and inclusively under negation. One (CC3) interpreted *men* plurals inclusively in the positive contexts but exclusively under negation, one (CC23) interpreted them exclusively in the positive contexts but with *exactly one* readings under negation, and the other one (CC2) seemed to split between exclusive and *exactly one* readings in both positive and negative contexts. What we have seen so far is that the child participants predominantly interpreted *men* plurals inclusively under negation. However, they showed a mixed picture in the positive contexts: more than half of the participants interpreted them inclusively, while one-third of the participants interpreted them exclusively. The exclusive interpretation of *men* plurals in positive contexts appears more often starting at the age of 5.5 (7 out of 13, around 54%) than at the age 5 and below (2 out of 17, around 12%). The child individual results also do not conflict with the group results.

Regarding the adult individual results, we first consider the comparison between positive and negative contexts. Figure 25 shows the participant percentage for different readings interpreted in positive and negative contexts.
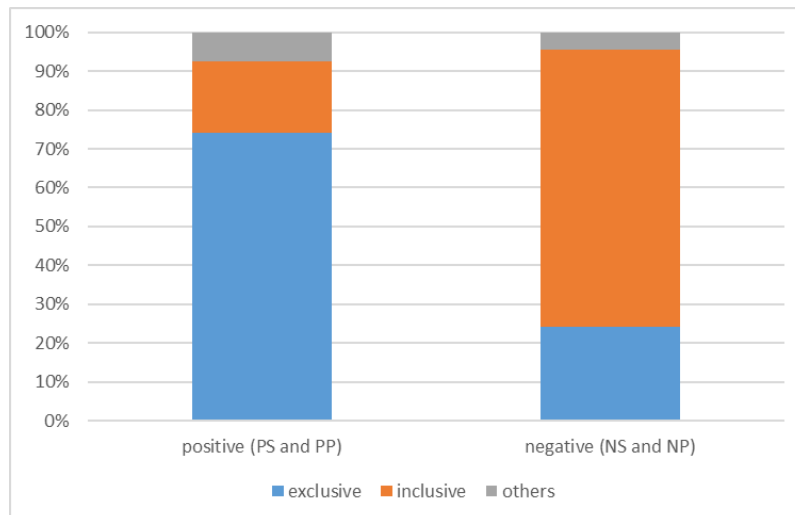
Figure 25 Participant percentage for different readings in positive and negative contexts

As shown in Figure 25, in positive contexts, the majority of adult participants (49 out of 66, more than 70%) interpreted *men* plurals exclusively under both PS and PP, whereas only around 20% of the participants (12 out of 66, around 20%) interpreted *men* plurals inclusively. In negative contexts, the majority of adult participants interpreted *men* plurals inclusively under both NS and NP (47 out of 66, more than 70%), whereas around 25% of the participants (16 out of 66) interpreted them exclusively.

In previous experiment studies, part of the evidence to support the scalar implicature approach to plurality inferences is that plurality inferences (i.e., exclusive readings) tend to appear in positive contexts but disappear in negative contexts. Therefore, we need to have a deeper look into the individual results and observe the participants' responses to positive and negative contexts at the same time. I name interpreting *men* plurals exclusively in positive contexts and inclusively in negative contexts as the *scalar implicature* response option, as this pattern is in line with the scalar implicature approach to plurality. If the participants interpreted *men* plurals exclusively in both positive and negative contexts, I name this response option as *exclusive*. If they interpreted them inclusively in both positive and negative contexts, I name it as *inclusive*. The participant count for the response options above is shown in Figure 26.
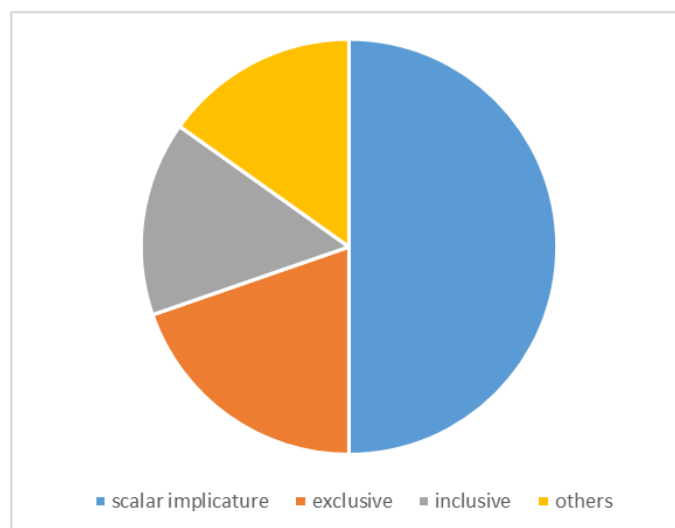
Figure 26 Participant percentage for the interpretations of *men* plurals
in positive and negative contexts

As shown in Figure 26, half of the participants (33 out of 66) interpreted *men* plurals exclusively in positive contexts and inclusively under negation. Around 20% of the participants (13 out of 66) interpreted *men* plurals exclusively in both positive and negative contexts. 10 (out of 66, around 15%) participants interpreted *men* plurals inclusively in both positive and negative contexts. Among the remaining 10 participants, two interpreted *men* plurals inclusively in positive contexts and exclusively under negation, two interpreted *men* plurals with an *exactly one* reading in positive contexts and inclusively under negation, and the rest of them showed different interpretations across PS, PP, NS, and NP.

It is obvious that the individual adult results showed a more complex picture than their group results, but in general, it does not conflict with the trend we see with the group results, that is, Chinese adults tend to interpret *men* plurals with an exclusive reading more often in positive contexts than in negative contexts. Next, we consider the individual results for mensural classifiers and *yi xie*.

mensural classifiers and *yi xie*

As stated previously, *yi xie* was treated as a mensural classifier when designing the TVJT. This caused some participants to reply to both *yi xie* and the other mensural classifiers (*yi qun* (one group) and *yi lan* (one basket)) and some to reply to mensural classifiers only.

10 (out of 30) child participants responded to mensural classifier target sentences only. Across singular and plural conditions, 6 of them interpreted mensural classifier constructions exclusively in positive contexts but inclusively in negative contexts. 3 participants interpreted

them exclusively in both positive and negative contexts. 1 participant interpreted them inclusively in both positive and negative contexts. This does not conflict with the group result that child participants tended to interpret mensural classifiers exclusively in positive contexts and inclusively in negative contexts. On the other hand, 20 (out of 30) child participants responded to both mensural classifier and *yi xie* target sentences. Across singular and plural conditions, 13 of them interpreted the target sentences exclusively in positive contexts and inclusively in negative contexts. However, compared with the group results, it is not obvious whether fewer exclusive readings were computed with *yi xie* than with mensural classifiers in positive contexts.

We now consider the adult individual results. For positive contexts, the majority of the participants in total only provided exclusive readings to mensural classifiers and *yi xie*. For negative contexts, 24 (out of 66) participants responded to mensural classifiers only. Among them, 20 (out of 24) interpreted them exclusively. On the other hand, 42 (out of 66) participants responded to both mensural classifier and *yi xie* targets under negation. Across conditions, 21 of them interpreted both categories inclusively, whereas the other 21 interpreted both categories exclusively. The individual results together show that adults tended to interpret mensural classifiers exclusively in both positive and negative contexts. Under negation, adult participants tended to compute exclusive readings more often with mensural classifiers than with *yi xie*. This also does not conflict with the group results.

4.4 Findings and discussion

The previous section reported both descriptive and inferential statistics of the Chinese TVJT. The results can be summarised as follows. Regarding bare nouns, both child and adult participants tended to interpret them with inclusive readings in both positive and negative contexts. For *men* plurals, children overall tended to interpret them inclusively in both positive and negative contexts, while adults tended to interpret them exclusively in positive contexts but inclusively in negative contexts. Comparing the two age groups, adults overall computed more exclusive readings than children in both positive and negative contexts. Comparing positive and negative contexts, both child and adult participants tended to compute exclusive readings more often in positive contexts than in negative contexts. In terms of the comparison between bare nouns and *men* plurals, children overall tended to interpret bare nouns and *men* plurals inclusively in both positive and negative contexts. They computed exclusive readings more often for *men* plurals in positive contexts than in negative contexts; they also computed

exclusive readings more often for *men* plurals in positive contexts than for bare nouns in both positive and negative contexts. Adults overall interpreted significantly more exclusive readings with *men* plurals than with bare nouns in both positive and negative contexts.

For mensural classifiers, both children and adults tended to interpret them exclusively in positive contexts. In negative contexts, children tended to interpret them inclusively, whereas adults tended to interpret them exclusively. As for *yi xie*, *context* (positive vs. negative) and *age group* (child vs. adult) tended to have an effect on how participants compute exclusive readings. However, further data is required to draw more solid conclusions.

In the following, I will discuss and interpret the results in terms of the research questions and hypotheses raised in the current L1 study. Research Question 1 asks what plurality interpretations (i.e., inclusive/exclusive readings) are available with bare nouns, *men* plurals, and mensural classifiers in Chinese. Firstly, I discuss the results from bare nouns and *men* plurals and interpret the findings regarding the presence/absence of plural marking. I also compare the interpretive patterns displayed by children and adults regarding plurality inferences associated with optional plural marking. Secondly, I will discuss the findings on mensural classifiers and *yi xie* (some). Before ending this section, I will also point out the implication of the current L1-Chinese results for the L2-English study in this thesis, and revise the L2 hypotheses regarding L1 transfer based on the current L1 results.

4.4.1 Presence/absence of plural marking in Chinese

In this section, I evaluate Hypotheses 1, 2, and 4, which concern the presence/absence of plural marking in Mandarin Chinese. Hypothesis 1 was formulated for bare nouns in Chapter 3 and is repeated as follows:

Hypothesis 1: Bare nouns have inclusive readings, and therefore native Chinese adult and child speakers will interpret them inclusively in both positive and negative contexts.

The current results show that both Chinese children and adults generally interpreted bare nouns inclusively in positive and negative contexts (Figure 18). There was no significant difference in the participants' performance across contexts or age groups. Therefore, Hypothesis 1 is supported and the current finding suggests that bare nouns in Mandarin Chinese have inclusive readings only. This adds empirical support to the previous view that bare nouns are number neutral (e.g., Krifka, 1995; Rullmann and You, 2006).

Regarding *men* plurals, Hypothesis 2 concerns the exclusive interpretation associated with *men* plurals and its comparison to bare nouns. On the other hand, Hypothesis 4 was formulated based on the scalar implicature approach to plurality inferences.

Hypothesis 2: *Men* plurals have exclusive readings only, and therefore native Chinese adult and child speakers will compute more exclusive readings for them than for bare nouns in both positive and negative contexts.

Hypothesis 2 is only partially supported by the current results, based on two sets of results. First, while exclusive readings do surface with *men* plurals in both positive and negative contexts, inclusive readings are dominant in negative contexts, evidenced in both child and adult results. It is also clear that Chinese children and adults displayed different preferences for exclusive and inclusive readings. We will come back to this when discussing Hypothesis 4. Second, comparing *men* plurals to bare nouns, in positive contexts, Chinese adults and children indeed computed exclusive readings with *men* plurals more often than with bare nouns (Figure 21). However, in negative contexts, while adults computed more exclusive readings with *men* plurals than with bare nouns, children predominantly interpreted both categories inclusively with no statistically significant difference (Figure 21). Implications from Hypothesis 2 will be discussed later. Now we first turn to Hypothesis 4.

Hypothesis 4: Assuming the plurality inferences associated with the optional plural marker -*men* are also scalar implicatures, we predict that two main interpretive patterns will be identified within the results of Chinese children and adults. First, both adults and children will compute exclusive readings more often in positive than in negative contexts. Second, children overall will interpret exclusive readings with *men* plurals less often than adults. However, this pattern will be distinct from that in bare nouns, where both children and adults will interpret them inclusively.

Predictions are borne out from the results, supporting Hypothesis 4. First, as shown in Figure 23 in Section 4.3.3, although Chinese children overall interpreted *men* plurals inclusively in both positive and negative contexts, within the exclusive readings they showed, they appeared more in positive than in negative contexts. As for Chinese adults, they overall interpreted *men* plurals exclusively in positive contexts and inclusively in negative contexts (Figure 19). Second, comparing the results from the two age groups (Figure 20), in positive contexts, adults

computed significantly more exclusive readings than children did. On the other hand, in negative contexts, although both age groups overall interpreted *men* plurals inclusively, adults computed exclusive readings more often than children. The results align with English children and adults in Tieu et al. (2014). Third, compared to the different preferences for exclusive/inclusive readings for *men* plurals by the two age groups, there was no statistically significant difference between children's and adults' interpretations of bare nouns. Both children and adults tend to interpret bare nouns inclusively in both positive and negative contexts. Therefore, Hypothesis 4 is fully supported by the current results. This also suggests that exclusive readings are associated with the plural marker *-men*, and therefore no exclusive reading will be computed for bare nouns without *-men*.

The discussion above leads to the proposal that plurality inferences (i.e., exclusive readings) associated with the optional plural marker *-men* are also scalar implicatures. Before going into further detail, we first briefly revisit the discussion on plurality inferences in languages with obligatory plural marking, with English as an example. Tieu et al. (2014) argued that plurality inferences associated with obligatory plural marking are scalar implicatures based on two major results. First, both English children and adults interpreted *s* plurals with exclusive readings more often in positive contexts than in negative contexts. Second, children overall computed fewer exclusive readings than adults did. The two results are consistent with what has been found with scalar terms such as *some*, supporting the scalar implicature approach to plurality inferences. We now turn to Chinese and discuss why plurality inferences associated with optional plural marking are also proposed to be scalar implicatures. In addition to looking for parallel results of the aforementioned child and adult results shown in Tieu et al. (2014), the comparison between the interpretations of bare nouns and *men* plurals should also be considered. This is attributed to the fact that the plural marker *-men* is not necessarily needed to yield plural meanings. In the following, I will report the three major results supporting the scalar implicature approach to plurality inferences in Chinese.

First, regarding the comparison between positive and negative contexts, previous studies have reported that scalar implicatures appear in positive contexts but tend to disappear in negative contexts (e.g., Papafragou and Musolino, 2003; Barner et al., 2011). This is what we found with Chinese adults and children in the current L1 study, in that they computed more exclusive readings for *men* plurals in positive than in negative contexts. This means that the exclusive readings associated with *men* plurals, as plurality inferences, conform to the nature of scalar implicatures.

Second, regarding the comparison between children and adults, previous studies have reported that children tend to compute plurality inferences and other scalar implicatures less often than adults (e.g., Tieu et al., 2014; Renans, et al., 2018; Renans, et al., 2020; Noveck, 2001; Papafragou and Musolino, 2003; Katsos and Bishop, 2011; Zhao et al., 2021). This is also supported by our study – Chinese children provided far fewer exclusive readings for *men* plurals than adults in both positive and negative contexts. This is the same as children's insensitivity to plurality inferences associated with obligatory plural marking and other scalar implicatures associated with scalar terms (e.g., some) reported in previous experimental studies.

Third, as discussed above, plurality inferences, as a type of scalar implicature, will lead to different interpretive patterns between children and adults. Comparing the interpretations of bare nouns and *men* plurals, it is clear that Chinese children and adults displayed different performances for these two categories. While there is no significant difference in adults' and children's interpretations of bare nouns, different preferences for exclusive/inclusive readings were found with *men* plurals. In other words, the presence and absence of *-men* gives rise to different plurality interpretations, and plurality inferences were only computed with *men* plurals, not bare nouns. This suggests that the plural marker *-men* is what generates plurality inferences. The current study also proposes that inclusive readings are the base meaning for both bare nouns and men plurals, as this is the meaning shown by children at the age when scalar implicatures are not computed at the adult-like level, and thus are independent of scalar implicatures.

Therefore, based on the findings discussed above regarding the nature of scalar implicatures, children's insensitivity to plurality inferences, and different interpretive patterns with/without *-men*, this L1-Chinese study proposes that plurality inferences associated with *men* plurals are also scalar implicatures. This is in support of the implicature approach to plurality inferences in experimental research conducted in obligatory plural marking languages (Tieu et al., 2014; Renans et al., 2018; Renans et al., 2020). Crosslinguistically, this indicates that plurality inferences can be derived from overt plural marking even in languages with non-obligatory plural marking.

In addition, the current study has reported that both exclusive and inclusive readings are available with *men* plurals. This conflicts with previous linguistic assumptions that *-men* is associated with the *more than one* reading only (Li, 1999; Kim and Melchin, 2018; Li, 2020). Such a finding also points to the conclusion that *men* plurals are similar to *s* plurals in terms of plurality interpretations, even though *-men* is optional in Chinese and *-s* is compulsory for bare plurals in English.

4.4.2 Mensural classifiers and *yi xie*

In this L1 study, *yi xie* was originally viewed similarly to the other two mensural classifiers, *yi qun* (one group) and *yi lan* (one basket). Accordingly, Hypothesis 3 was established following the speculation that *yi xie* was a type of mensural classifier. However, as reported in the previous section, *yi xie* tends to be different from the other mensural classifiers. Therefore, I will first evaluate Hypothesis 3 within the data on the mensural classifiers *yi qun* and *yi lan* (i.e., mensural classifiers). Then, I will interpret what has been found with *yi xie* and compare the results to that of mensural classifiers and other scalar terms. Hypothesis 3 is repeated as follows.

Hypothesis 3: Mensural classifier constructions have exclusive readings only, and therefore native Chinese adult and child speakers will interpret them exclusively in both positive and negative contexts.

The current results only partially support Hypothesis 3. First, mensural classifiers indeed have exclusive readings in positive contexts, evidenced by both adult and child results. However, children overall interpreted mensural classifier expressions inclusively in negative contexts, which was unexpected. For adults, there is also a marginal difference between their exclusive interpretations in positive and negative contexts. That is, adults computed fewer exclusive readings in negative contexts than in positive contexts, although they overall interpreted them exclusively in both positive and negative contexts. This means that inclusive readings did surface, though minimally, with mensural classifier expressions for adults, and they are the dominant interpretation in negative contexts for child participants. Therefore, we conclude that Hypothesis 3 is partially supported.

Turning to *yi xie*, it should be noted first that the current findings were mainly drawn from the descriptive results, as the regression analysis did not generalise informative findings due to the small and imbalanced sample size for *yi xie*. The overall results on *yi xie* suggest that both age groups tended to compute more exclusive readings in positive than in negative contexts, and adults tend to compute more exclusive readings than children. For children, the descriptive results show that both exclusive and inclusive readings are available with *yi xie* in positive contexts, and children tended to compute them almost fifty-fifty. By contrast, inclusive interpretations are dominant in negative contexts. This difference in exclusive interpretations between positive and negative contexts is also revealed by the inferential result. As for adults, the descriptive results show that they tend to interpret *yi xie* in positive contexts with exclusive

127

readings only, whereas they predominantly interpreted them inclusively in negative contexts. This suggests that *yi xie* tends to be different from the other mensural classifier constructions tested in the current study. Instead, it appears to be similar to what has been found with *men* plurals. Specifically, in positive contexts, adults computed more exclusive readings with *yi xie* and *men* plurals than children. By contrast, there is no significant difference between adult and child performances for mensural classifiers, and both age groups interpreted mensural classifiers exclusively to a similar extent in positive contexts. In negative contexts, adults mainly interpreted mensural classifiers exclusively. This is also different from their interpretations for *yi xie* and *men* plurals under negation. Therefore, the current research calls for *yi xie* to be treated differently from other mensural classifiers.

4.4.3 Implications for L2-English study

The current L1-Chinese study aimed to find out what plurality interpretations (exclusive vs. inclusive readings) are available in Chinese. Based on the findings from this L1 study, we can investigate whether the results of the main three tested L1 categories are reflected in the L2 results as manifestations of L1 transfer. In Chapter 3, L2 hypotheses regarding L1 transfer through lexical mapping (Hypothesis 6 and 7) and Hypothesis 8 were originally established based on the L1 hypotheses. Since not all of the L1 hypotheses are supported as evaluated in the previous subsection, I will now revisit and revise the L2 hypotheses according to the current L1-Chinese adult results.

Hypothesis 6 was previously established based on the assumption that *men* plurals have exclusive readings only. However, the current results have shown that although exclusive readings are the majority in positive contexts and do surface in negative contexts, Chinese adults mainly provided inclusive interpretations in negative contexts (around 75%). This supports the scalar implicature approach to plurality inferences. Therefore, Hypothesis 6 is now revised as follows:

Hypothesis 6: Assuming L1 transfer through the mapping between *-s* and *-men*, Chinese EFL/ESL learners will map *s* plurals in English onto *men* plurals in Chinese. We predict that the participants, with lower proficiency levels or at earlier stages of their interlanguage, will transfer the knowledge of *-men* to *-s*, and interpret *s* plurals following the same interpretative patterns for *men* plurals shown in the L1-Chinese data. However, according to the FRH, L2 learners with higher proficiency levels, or at later stages of their interlanguage, will be able to reassemble features by accessing universal grammar. In the current case, L2 learners will eventually overcome the effect

of L1 and interpret *s* plurals at a similar level to the English controls. **Since the current L1 data has shown that plurality inferences associated with *men* plurals and *s* plurals are the same and they are scalar implicatures, we predict that L2 learners will all perform similar to adult native English speakers, showing no developmental pattern. They will overall interpret English bare plurals exclusively in positive contexts and inclusively in negative contexts**.

We now turn to the revised Hypothesis 7, shown as follows:

Hypothesis 7: Assuming L1 transfer through the mapping between -*s* and null plural marking, Chinese EFL/ESL learners will map *s* plurals in English onto bare nouns in Chinese. We predict that the participants, with lower proficiency levels, or at earlier stages of their interlanguage, will be influenced by their knowledge of Chinese bare nouns and have difficulty interpreting the exclusive readings associated with *s* plurals as required. Specifically, they will interpret *s* plurals exclusively less often than English adults in both positive and negative contexts. This is because bare nouns in Chinese are combined with inclusive readings only, as shown in the current L1 data. By contrast, we predict that Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 transfer and interpret *s* plurals at a similar level to adult native English speakers. They will overall interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

As can be seen, the revised Hypothesis 7 also predicts the same interpretive patterns as the original. This is because the current results show that bare nouns have almost only inclusive readings in both positive and negative contexts, which is consistent with the linguistic assumption that the original Hypothesis 7 was based on.

Turning to Hypothesis 8, which was previously established based on the linguistic assumption that mensural classifiers have exclusive readings only. The current results show that although adults interpreted more exclusive readings in positive than in negative contexts, exclusive readings are predominant in both contexts. Therefore, the revised Hypothesis 8 predicts the same interpretive patterns as the original one, shown as follows:

We predict that the participants with lower proficiencies, or at earlier stages of their interlanguage. By contrast, Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 and interpret *s* plurals at a

similar level to adult native English speakers. We predict that the learners of higher proficiency will interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

Hypothesis 8: Assuming L1 transfer from mensural classifiers, Chinese EFL/ESL learners will be influenced by the plurality interpretations associated with Chinese mensural classifier phrases when interpreting English *s* plurals. We predict that the participants with lower proficiency levels, or at earlier stages of their interlanguage, will interpret *s* plurals exclusively in both positive and negative contexts, following the interpretative patterns of mensural classifier phrases shown in the L1 Chinese data. By contrast, Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 and be more native-English-like. We predict that the learners of higher proficiency will then interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

The current L1 results reported in this subsection will be further discussed with the aforementioned L2 hypotheses in Chapter 5.

To sum up, this chapter first presents the research methods in the L1-Chinese experiment. It then reports the descriptive and inferential statistics of the Chinese TVJT. The findings of the current L1 study will also be discussed in Chapter 6. The next chapter will present how the L2-English experiment was carried out and report its results, following the same structure as this chapter.

Chapter 5 L2-English study

The current study aims to explore the universality of scalar implicatures and the potential effect of L1 transfer in the second language acquisition of plurality. The L2-English experiment was designed to observe how Chinese adult EFL/ESL learners interpret English bare plurals in positive and negative contexts. This chapter introduces the methodology and research methods of the L2 study, and reports its findings. Section 5.1 presents the details of the L2-English experiment, including task design, rationale, pilot study results, and predictions for participants' responses in the TVJT. Section 5.2 provides the information about the participants and introduces the experiment procedure. Section 5.3 reports both the descriptive and inferential statistics of the TVJT. Section 5.4 interprets the results of the TVJT and discusses the findings of the current study.

5.1 Methodology

This section is organised as follows. Section 5.1.1 introduces the task design and test items of the TVJT in this L2 study. Section 5.1.2 compares the current TVJT with the one in Tieu et al. (2014). It explains how the task was adapted from Tieu et al. (2014) to make it suitable for the current research. Section 5.1.3 briefly reports the pilot study. Section 5.1.4 outlines the predictions for the participant's potential responses in the TVJT, revisiting the aforementioned research questions and hypotheses.

5.1.1 Task design

The English TVJT has a similar task structure as the Chinese TVJT presented in Chapter 4. It adopted a 2x2 design: context (positive vs. negative) and condition (singular vs. plural). The test sentences are either positive or negative, following either singular or plural test stories. In total, there are 12 test stories (6 singular and 6 plural) and 48 test tokens (24 target sentences and 24 control sentences), shown in Table 21[36]. It should be noted that the current task only includes inanimate objects, as it is a replication of the research in Tieu et al. (2014). This was done in order to compare our results with theirs. Future research should look to test both animate and inanimate objects, in order to distinguish between the effect of the semantic features [±human]/[±animate] and the plurality of *men* plurals.

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[36] Target test sentences are marked with *a* and are highlighted, whereas control test sentences are marked with *b*. The full stories and test sentences are shown in Appendix I.

	Singular	Plural
Story	Emily only fed one panda.	Emily fed three pigs.
positive	a. Emily fed pandas. b. Emily fed a panda.	a. Emily fed pigs. b. Emily fed a pig.
negative	a. Emily didn't feed pandas. b. Emily didn't feed a panda.	a. Emily didn't feed pigs. b. Emily didn't feed a pig.
Story	Emily only picked one lemon.	Emily picked three oranges.
positive	a. Emily picked lemons. b. Emily picked a lemon.	a. Emily picked oranges. b. Emily picked an orange
negative	a. Emily didn't pick lemons. b. Emily didn't pick a lemon.	a. Emily didn't pick oranges. b. Emily didn't pick an orange.
Story	Emily only took one watermelon.	Emily took three strawberries.
positive	a. Emily took watermelons. b. Emily took a watermelon.	a. Emily took strawberries. b. Emily took a strawberry.
negative	a. Emily didn't take watermelons. b. Emily didn't take a watermelon.	a. Emily didn't take strawberries. b. Emily didn't take a strawberry.
Story	Emily only painted one star.	Emily painted four hearts.
positive	a. Emily painted stars. b. Emily painted a star.	a. Emily painted hearts. b. Emily painted a heart.
negative	a. Emily didn't paint stars. b. Emily didn't paint a star.	a. Emily didn't paint hearts. b. Emily didn't paint a heart.
Story	Emily only dropped one orange.	Emily dropped five apples.
positive	a. Emily dropped oranges. b. Emily dropped an orange.	a. Emily dropped apples. b. Emily dropped an apple.
negative	a. Emily didn't drop oranges. b. Emily didn't drop an orange.	a. Emily didn't drop apples. b. Emily didn't drop an apple.
Story	Emily only drew one flower.	Emily drew three trees.
positive	a. Emily drew flowers. b. Emily drew a flower.	a. Emily drew trees. b. Emily drew a tree.
negative	a. Emily didn't draw flowers. b. Emily didn't draw a flower.	a. Emily didn't draw trees. b. Emily didn't draw a tree.

Table 21 Summary of test sentences in the L2-English experiment

The test tokens and test stories in Table 21 were divided into two test sets. Each participant only needs to finish one test set. Each test set contains 24 test stories, followed by 24 test tokens, including 12 target sentences (6 positive and 6 negative) and 12 control sentences (6 positive and 6 negative). The sequence of the test stories in each test set was pre-randomised.

The L2 English experiment adapted the test procedure of the TVJT in Tieu et al. (2014) into an online, self-paced scenario, using the experiment platform Gorilla. Participants needed to open the experiment link to get access to the task. After they started the task, they were first introduced to a rabbit puppet named *Tony*. Then they listened to test stories and watch their accompanying animations. After each story, the puppet appeared and was asked **"Tony, what happened in this story?"** by the experimenter. The puppet replied to the question with a test token. The participants were then asked to judge the puppet's response with a TRUE/FALSE value by clicking the TRUE/FALSE button on the webpage. The stories, animations, Tony's replies, and the experimenter's lines were all pre-recorded and uploaded to the platform. They were played either automatically at a pre-set time point, or after being clicked by the participants. Participants needed to click on each video to let it play. After they made their judgment on the acceptability of each test token, they also needed to click *Next* to go to the next page to watch the next test story.

In the following, I present examples for test stories (singular vs. plural) with their animations and test tokens (positive vs. negative) following the stories. We first consider singular stories, as shown in (5.1).

(5.1) Singular Story: Emily didn't have enough paint, so she only painted this one star.

Experimenter: Tony, what happened in this story?

    a. (positive target sentence)

        Emily painted stars.

    b. (negative target sentence)

        Emily didn't paint stars.
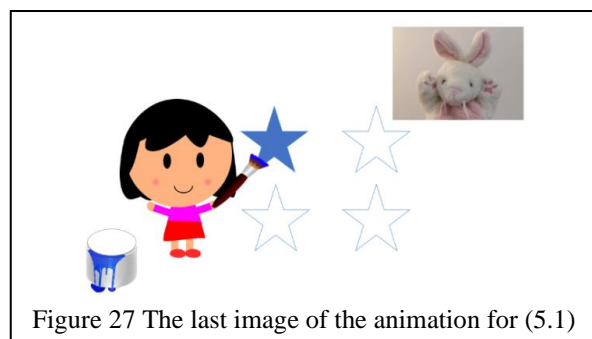
Figure 27 The last image of the animation for (5.1)

The singular story in (5.1) and its animation (Figure 27) show that Emily painted only one star. The puppet's response is either the positive target sentence (5.1a) or the negative (5.1b), both

containing the bare plural *stars*. Using the same story, there are also two control sentences, as in (5.2a) and (5.2b).

(5.2) Control sentences:

    a. (positive) Emily painted a star.

    b. (negative) Emily didn't paint a star.

Both the positive sentence (5.2a) and the negative (5.2b) contain the singular DP *a star*. Now we turn to the example for plural conditions, shown in (5.3) and Figure 28.

(5.3) Plural Story: Emily had enough paint, so she painted four stars.

    Experimenter: Tony, what happened in this story?

    a. (positive target sentence)
        Emily painted hearts.

    b. (negative target sentence)
        Emily didn't paint hearts.
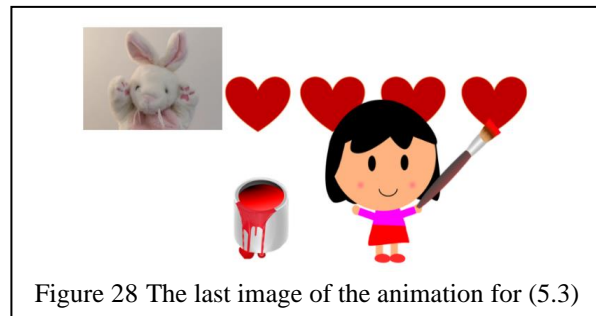
Figure 28 The last image of the animation for (5.3)

The plural story in (5.3) and its animation (Figure 28) show that Emily painted four hearts. (5.3a) and (5.3b) are the target sentences following this plural story and they contain the bare plural *hearts*. The control sentences using the same plural story are shown in (5.4).

(5.4) Control sentences:

    a. (positive) Emily painted a heart.

    b. (negative) Emily didn't paint a heart.

The predictions for possible responses to target sentences and the expected answers for control sentences will be presented in Section 5.1.4. Apart from the above, there are also two warm-up practice examples at the beginning of each test set ((5.5) and (5.6)).

(5.5) Story: Emily has some flowers and one tomato. She ate the tomato.

　　　Experimenter: Xiaobai, what happened in the story?

　　　Test sentence: Emily ate one tomato.

(5.6) Story: Emily has some bread and some carrots. She gave this little rabbit two carrots.

　　　Experimenter: Xiaobai, what happened in the story?

　　　Test sentence: Emily gave bread to the rabbit.

This is to let participants become familiar with the task procedure. In the next subsection, I explain the rationale for the L2-English experiment.

5.1.2 Rationale

　　　The L2-English experiment in the current study seeks to observe what readings Chinese EFL/ESL learners compute with English bare plurals associated with the suffix -*s*. By comparing their responses to the current L1 results on the three constructions that yield plural meanings in Chinese, we examine each mapping possibility from English to Chinese, looking to identify if the effect of L1 transfer is reflected in the second language acquisition of plurality. The L2 group's responses will also be compared with native English speakers from the control group, looking to identify different or similar interpretive patterns across the two language groups in order to examine the universality of scalar implicatures.

　　　The current English TVJT was adapted from the TVJT in Tieu et al. (2014), which tested native English speakers (adults and children). The main difference between the two TVJTs is that the current one includes plural stories to disambiguate the participant's interpretations, as discussed in the previous chapter. If the exclusive interpretations associated with English bare plurals are scalar implicatures as proposed in Tieu et al. (2014), we expect our Chinese EFL/ESL learners' interpretive patterns to be consistent with what has been found for native English adults in their study.

5.1.3 Pilot study

　　　The pilot study for the L2-English experiment was carried out first on L1-English speakers to identify potential problems in the test design. It took place from 2nd to 6th April 2020 and six participants were recruited. The participants were monolingual adult English speakers.

The participants were asked to provide feedback on the test material and procedure after they completed the task. In general, they believed that the task was easy to understand and that test stories and sentences were clear without confusion. One participant mentioned that in one test story, the verb *took* was used, whereas in the test sentences following the story *get/got* was used, as shown in (5.7).

(5.7) Story: Emily really likes strawberries, so she **took** three strawberries from the table.
Experimenter: Tony, what happened in the story?
a. Emily **got** strawberries.
b. Emily didn't **get** strawberries.

The participant believed that in (5.7), changing from *took* to *got/get* would potentially cause people to think what was being tested here is the choice of vocabulary. This would then make them make their judgments based on the verbs, not on the singular/plural meanings signified by the test stories and test tokens. Therefore, an adaptation was made to the test sentences, using *took/take*, the same as in the test story, to avoid confusion. Another participant commented that in some stories, the sound effect for the main character's action was too loud and covered some of the stories, so changes were also implemented for the relevant situations by deleting those sound effects.

The pilot test was also carried out on L1-Chinese L2-English learners. It took place from the 9th to 15th April 2020 and six participants were recruited. In general, the participants believed that the stories and test tokens were understandable and it was easy for them to follow the instructions. One participant mentioned that the pronunciation of 'a' in the recordings was /eɪ/, instead of /ə/. This made them feel confused as it sounded less familiar to them. However, this kind of pronunciation in sentences is commonly accepted in English and this also did not change the meaning of the test stories. Thus, no alterations were made to these sentences.

5.1.4 Predictions

Interpretation maps were also created for *s* plurals to help interpret the results of the L2-English experiment. We first consider positive contexts, shown in Figure 29.
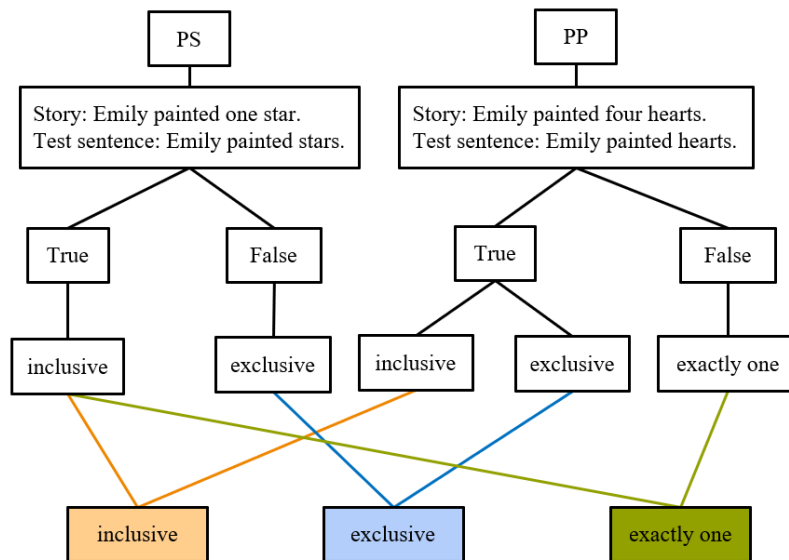
Figure 29 Interpretation map for English bare plurals in positive contexts
(PS: positive test sentences following singular stories
PP: positive test sentences following plural stories)

As shown in Figure 29, under PS, participants will respond to the positive test sentence which follows the singular story with either the True or False option. The True response leads to an inclusive reading, whereas the False option leads to an exclusive reading. Under PP, participants will also respond with True or False to the positive test sentence following a plural story. The True option is ambiguous between an inclusive and an exclusive reading, whereas the False option represents the *exactly one* reading. Combining the possible True/False responses under PS and PP together, we can disambiguate the readings represented by the TRUE/FALSE values. When participants assign the TRUE value to the target sentences under PS and PP at the same time, it means that they interpret English bare plurals inclusively. If they assign the FALSE value to the target sentences under PS but the TRUE value to the sentence under PP, it means that they interpreted English bare plurals exclusively. If they assign the TRUE value to the sentence under PS but the FALSE value to the one under PP, it means they interpreted them with the *exactly one* reading. Assigning the FALSE value to test sentences under PS and PP at the same time is viewed as providing inconsistent or conflicting responses and is not shown on the map. It is calculated as part of the *others* option when presenting individual results as in Section 5.3.4, and it (and the *exactly one* response) is eliminated from the group results when presenting the percentage of exclusive responses in Section 5.3.3. This is the same with the next interpretation map.

Turning to negative contexts, the interpretation map is shown in Figure 30.
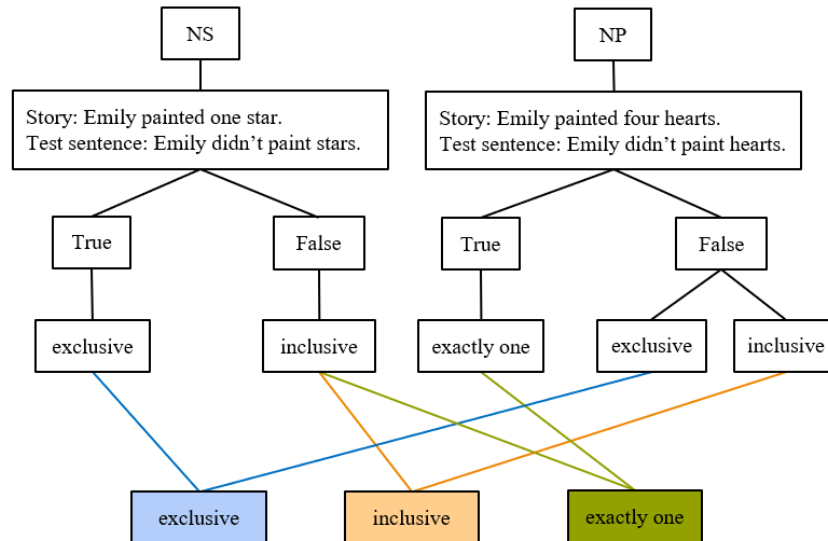
Figure 30 Interpretation map for bare plurals in negative contexts
(NS: negative test sentences following singular stories
NP: negative test sentences following plural stories)

As shown in Figure 30, under negation, if the participants assign the TRUE value to the target sentence under NS but the FALSE to the one under NP at the same time, it means they interpreted English bare plurals exclusively. If they assign the FALSE value to the target sentences under NS and NP, it means they interpreted them inclusively. If they assign the FALSE value to the sentence under NS and the TRUE value to the one under NP, it means they interpreted them with the *exactly one* meaning. Conflicting responses include assigning the TRUE value to the test sentences under NS and NP at the same time.

Now we discuss the hypotheses for this L2 English study, using the possible interpretations presented above. It should be noted that, as revised in Section 4.4.3 after receiving the L1-Chinese results, Hypothesis 5 and Hypothesis 6 predict the same performances for L2 learners, but they are based on different linguistic assumptions. We start with Hypothesis 5, which was formulated under the scalar approach to plurality and is repeated as below.

Hypothesis 5: Based on the scalar implicature approach to plurality, we predict that Chinese EFL/ESL learners will show similar performance to native English speakers. This is because the L2 participants are adults and assuming the universality of scalar implicatures, they will compute plurality inferences for bare plurals in English at a similar level to English adult speakers. Due to the same reason, no difference in interpretative patterns will be found among L2 learners across different L2 language proficiency levels. Overall, they will interpret English

bare plurals exclusively in positive contexts and inclusively in negative contexts, computing more plurality inferences in positive than in negative contexts.

If Hypothesis 5 is supported, L2 participants will interpret *s* plurals with exclusive readings more often in positive than in negative contexts. Specifically, in positive contexts, they will assign the FALSE value to the target sentences following singular stories (PS) and the TRUE value to the ones following plural stories (PP). Under negation, they will mainly assign the FALSE value to the target sentences, no matter whether the sentences follow singular or plural stories (NS and NP). This is based on the nature of scalar implicatures, in which they appear in positive contexts but tend to disappear in negative contexts. The aforementioned interpretative pattern should also be consistent across different language proficiency levels, as adults are able to access universal pragmatic inferences. It should be noted that the scalar approach can also account for the exclusive reading being computed as a local inference under negation. Therefore, exclusive readings might surface as a result of *s* plurals being computed locally under negation, although they are not the main reading predicted for negative contexts. In this case, participants will assign the TRUE value to the target sentences under NS and the FALSE value to the ones under NP.

Turning to Hypotheses 6, this was formulated concerning L1 transfer through the mapping from *-s* to *-men* and is repeated as below.

Hypothesis 6: Assuming L1 transfer through the mapping between *-s* and *-men*, Chinese EFL/ESL learners will map *s* plurals in English onto *men* plurals in Chinese. We predict that the participants, with lower proficiency levels or at earlier stages of their interlanguage, will transfer the knowledge of *-men* to *-s*, and interpret *s* plurals following the same interpretative patterns for *men* plurals shown in the L1-Chinese data. However, according to the FRH, L2 learners with higher proficiency levels, or at later stages of their interlanguage, will be able to reassemble features by accessing universal grammar. In the current case, L2 learners will eventually overcome the effect of L1 and interpret *s* plurals at a similar level to the English controls. **Since the current L1 data has shown that plurality inferences associated with *men* plurals and *s* plurals are the same and they are scalar implicatures, we predict that L2 learners will all perform similar to adult native English speakers, showing no developmental pattern. They will overall interpret English bare plurals exclusively in positive contexts and inclusively in negative contexts**.

If Hypothesis 6 is supported, our predictions are as follows. In positive contexts, Chinese EFL/ESL learners from all proficiency levels overall will respond with the FALSE value under PS and the TRUE value under PP. In negative contexts, they will respond with the FALSE value under NS and NP. However, L2 learners of different proficiency groups will show the same interpretive pattern as native English speakers due to different reasons. For Chinese EFL/ESL learners of lower proficiencies, it is because they map *s* plurals to *men* plurals and interpret *s* plurals in the same way as *men* plurals, being influenced by the effect of L1 transfer. As *men* plurals are shown to be the same as *s* plurals by the current data, their interpretative preferences for *s* plurals and *men* plurals are also the same. This leads to *s* plurals being computed by them in the same way as native English speakers. As for Chinese EFL/ESL learners of higher proficiencies, it is because they have already overcome L1 transfer and are able to interpret *s* plurals at the target-like level to native English adults.

The two hypotheses discussed above are based on the scalar implicature approach to plurality and L1 transfer through the mapping between *-s* and *-men*, respectively. They predicted the same performances for L2 learners but based on different reasons. They will be evaluated in Section 5.4.

Now we turn to the mapping possibility from the English plural marker *-s* to null plural marking in Chinese, as in Hypothesis 7.

Hypothesis 7: Assuming L1 transfer through the mapping between *-s* and null plural marking, Chinese EFL/ESL learners will map *s* plurals in English onto bare nouns in Chinese. We predict that the participants, with lower proficiency levels, or at earlier stages of their interlanguage, will be influenced by their knowledge of Chinese bare nouns and have difficulty interpreting the exclusive readings associated with *s* plurals as required. Specifically, they will interpret *s* plurals exclusively less often than English adults in both positive and negative contexts. This is because bare nouns in Chinese are combined with inclusive readings only, as shown in the current L1 data. By contrast, we predict that Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 transfer and interpret *s* plurals at a similar level to adult native English speakers. They will overall interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

If Hypothesis 7 is supported, the predictions are as follows. Chinese EFL/ESL learners with lower proficiency levels will assign TRUE values in positive contexts (PS and PP) and FALSE values in negative contexts (NS and NP) more often than native English speakers. This is

because the current L1-Chinese data has shown that bare nouns have inclusive readings in both positive and negative contexts, which will result in *s* plurals being interpreted with less exclusive readings by L2-English learners of lower proficiencies because of L1 transfer. As for Chinese EFL/ESL learners with higher proficiency levels, they will show a similar interpretive pattern to native English speakers, as predicted earlier.

Turning to Hypothesis 8, which is established considering the potential influence from Chinese mensural classifiers to the interpretations of English bare plurals.

Hypothesis 8: Assuming L1 transfer from mensural classifiers, Chinese EFL/ESL learners will be influenced by the plurality interpretations associated with Chinese mensural classifier phrases when interpreting English *s* plurals. We predict that the participants with lower proficiency levels, or at earlier stages of their interlanguage, will interpret *s* plurals exclusively in both positive and negative contexts, following the interpretative patterns of mensural classifier phrases shown in the L1 Chinese data. By contrast, Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 and be more native-English-like. We predict that the learners of higher proficiency will then interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

If Hypothesis 8 is supported, we predict that Chinese EFL/ESL learners of different proficiencies will show different interpretive preferences for *s* plurals. For L2 learners of lower proficiency levels, in positive contexts, they will assign the FALSE value to test sentences under PS but the TRUE value to test sentences under PP. In negative contexts, they will assign the TRUE value to NS but the FALSE value to NP. This is because mensural classifier phrases tend to be computed with exclusive readings by Chinese adults in both positive and negative contexts as shown by the current L1 data. This will result in *s* plurals being overinterpreted with exclusive readings in negative contexts by L2 learners of lower proficiency groups, as they will be influenced by the interpretations of mensural classifier constructions in Chinese. As for L2 learners of higher proficiencies, they will show a similar interpretive pattern to native English speakers in both positive and negative contexts, by assigning FALSE values under PS and TRUE values under PP, and assigning FALSE values under both NS and NP.

The L2 hypotheses in the current study have been presented as above. They will be evaluated with L2 results in Section 5.4. As for the control sentences, if participants can distinguish between singular and plural meanings signified by singular/plural stories and control items, they would assign the TRUE value to control sentences under PS (5.8a), but the FALSE value to control sentences under NS (5.8b), PP (5.9a), and NP (5.9b).

(5.8) (Singular Story) Emily fed one panda.

    a.   Qianqian fed a panda   (Target answer: TRUE)

    b.   Qianqian didn't feed a panda   (Target answer: FALSE)

(5.9) (Plural Story) Emily fed three pigs.

    a.   Qianqian fed a pig   (Target answer: FALSE)

    a.   Qianqian didn't feed a pig   (Target answer: FALSE)

The control sentence (5.8a) is in line with what happened in the singular story (5.8), so its target answer is TRUE. (5.8b) conflicts with the fact that Emily fed a panda, so its target answer is FALSE. (5.9a) has a singular meaning and it conflicts with the plural meaning of the test story (5.9), so its target answer is FALSE. (5.9b) conflicts with the fact that Qianqian fed 3 pigs, so its target answer is also FALSE.

In the next subsection, I will present the experiment procedure and the participant information.

5.2 Participants and procedure

Procedure

The L2-English experiment was created and hosted by the online experiment platform Gorilla. When participants clicked on the experiment link, they first saw the information page, followed by the consent form, shown in Appendix III. After they consented to participate, and before starting the TVJT, they first needed to finish a short language background survey (Appendix II). Chinese participants also needed to finish a quick proficiency test (Appendix IV). In total, data was collected from 65 Chinese EFL/ESL adults and 50 native English adults.

The data was originally planned to be collected from Chinese students from a university in China in a face-to-face scenario. However, the data collection process was affected by Covid-19 and Chinese adult EFL/ESL participants were recruited in three rounds from January 2021 to November 2021. The first recruitment stage was conducted through sharing the online

experiment link with the volunteer email list of the University of Sheffield. The second was carried out through sharing the experiment link in student chat groups on Chinese social media. For the third, students were recruited from Nanjing Tech University in China with the help of multiple teachers working there, and they also completed the test through the online experiment link. Altogether, 34 participants completed test set one, and 31 participants completed test set two.

As for native English speakers, they were treated as the control group in this L2 English study. They were recruited by posting recruiting advertisements on English social media and sharing the experiment link with the volunteer email list of the University of Sheffield. From February 2021 to September 2021, 50 L1-English adults completed the TVJT and their data was included in the data set for analysis. The experiment procedure was the same as for the L2-English group, except they did not need to complete the proficiency test. Half of the participants completed test set one and the other half finished test set two.

The experiment in this L2 study obtained ethics approval from the ethics committee of the University of Sheffield in 2020. Participation in this research was entirely voluntary. The responses from the experiments were coded in a way so that the participants will not be identifiable, and the data was analysed and reported as either a group result or an anonymous individual result.

Participant information

The proficiency test for the Chinese EFL/ESL participants is a cloze test adopted from Slabakova (2000). As noted by Slabakova (2000), the cloze test has received support for its validity as "an integrative test of overall proficiency in English as a second language" (Hinofotis, 1980; Irvine et al., 1974; Jonz, 1990; cited in Slabakova, 2000: p754), and it is "significantly correlated with standardized ESL tests in predicting the learner's level of proficiency" (Hanania and Shikhani, 1986; cited in Slabakova, 2000: p754). One reason for choosing this cloze test is also to shorten the experiment length. There were forty blank spaces in the test passage and the participants were required to fill in one and only one word which best fit each blank space. The marking procedure follows Slabakova (2000). If the participant filled the blank space with 'the exact match of the word in the original text', then one point was given. If they did not supply any word for the blank space or the word provided was 'meaningful but not the exact match of the original word', then no point was given (p754). The maximum score for the cloze test was 40. The results from the participants are shown as follows.

Maximum score	Minimum score	Median	Mean
25	0	13	13.83077

Table 22 Results of the cloze test (n=65)

Based on their scores, the participants were divided into three proficiency groups: low intermediate (n=21), high intermediate (n=24), and advanced (n=20), as shown in Table 23.

Proficiency group	Mean	Median	SD	Score range
low intermediate (n=21)	8.52381	10	3.022339	0–11
high intermediate (n=24)	13.875	13	1.423391	12–16
advanced (n=20)	19.35	19	2.351064	17–25

Table 23 Results of three proficiency groups

It should be noted that the name of proficiency groups does not reflect the participants' true proficiency as in standardised proficiency tests. The names of the proficiency groups (low intermediate, high intermediate, advanced) are arbitrary and only indicate the gradient difference in proficiency. The responses from participants of the three proficiency groups will be analysed and compared to identify if there is a developmental pattern present among them.

The 65 L2 adult participants were from 24 provinces, autonomous regions, and municipalities in China, aged from 20 to 34 years old. Their native language is Chinese and none of them stated that they could use another language or other languages equally well on a day-to-day basis. 24 out of 65 had never been to the UK or any other English-speaking countries for travel, study, or work purposes; 22 were living in China but had experience of staying in an English-speaking country for studying/working purposes for 1 to 3 years; the other 19 were studying in the UK when the experiment was conducted. In a typical day, for the 46 out of 65 participants who were living in China, 13 of them predominantly used Mandarin/their dialects, 22 used Mandarin/their dialects 75% of the time and English 25% of the time, and 11 used Mandarin/their dialects 50% of the time and English for the other half of the time. As for the 19 participants who were studying in the UK, 5 used English 75% of the time and Mandarin/their dialects 25% of the time, 7 used English and Mandarin/their dialects roughly equally, 7 used English 25% of the time and Mandarin/their dialects 75% of the time. In sum, almost two thirds of the Chinese EFL/ESL participants primarily used Chinese, whereas the other one third either mainly used English or used English and Chinese equally in their daily life.

5.3 Data analysis and results

This section reports the results of the English TVJT in the current study, including both descriptive and inferential statistics. It is organised as follows. Section 5.3.1 displays the dependent and independent variables in this study. Section 5.3.2 presents the descriptive results, including group results for both L2 and L1 groups. Section 5.3.3 reports the inferential statistics from the mixed-effects models used in the current L2-English research. Section 5.3.4 reports the individual results for the two language groups.

5.3.1 Variables

The dependent and independent variables are summarised in Table 24.

Variables	Number of levels	Levels
subject	115	C1, E1, ...
response	2	t (TRUE), f (FALSE)
exclusive reading	2	1 (exclusive), 0 (non-exclusive)
context	2	positive, negative
condition	2	singular, plural
language group	2	L2-English, L1-English
proficiency level	4	low-intermediate, high-intermediate, advanced, native
item	22	pigs, pandas, …
target	2	1 (target sentence), 0 (control sentence)
test set	2	set1, set2

Table 24 Summary of the variables in the L2 English data analysis

As shown in Table 24, there were 115 participants in total. Chinese EFL/ESL participants were coded as *C1* to *C65*, while native English participants were coded as *E1* to *E50*. *Response* and *exclusive reading* are dependent variables. The participants' responses were first recorded as *t* or *f*, which stands for the TRUE or FALSE value. Exclusive readings were calculated based on TRUE/FALSE values following the interpretation maps (Figure 33 and Figure 34), with the exclusive readings coded as 1 and non-exclusive readings coded as 0. Both *context* and *condition* have two levels, the same as in the Chinese TVJT. *Language group* has two levels, L2-English (i.e., Chinese EFL/ESL speakers) and L1-English (the control group). *Proficiency*

level has 4 levels, low-intermediate, high-intermediate, and advanced based on the cloze test scores of the L2 speakers, as well as native for native English speakers. *Item* has 22 levels and includes target and control test items. Target test sentences are coded as 1 and controls are coded as 0, they are the two levels of *target*. *Test set* has two levels, set1 and set2. Statistical analysis shows that there is no effect of *test set* on the participants' interpretations of exclusive readings in the English TVJT (*p>.1*). Therefore, I will analyse and report the data collected from the two test sets together in the next subsection.

5.3.2 Descriptive statistics

This subsection reports group descriptive results for each language group, starting with L2-English speakers.

L2-English speakers

We first consider the group results from all three proficiency groups. 780 responses to target sentences in the English TVJT were collected from the L1-Chinese L2-English speakers. Table 25 shows the frequency of TRUE/FALSE values assigned to the target sentences under PS, PP, NS, and NP, with 195 responses for each combination.

Target sentences (%)			
Context x Condition	TRUE	FALSE	Total
PS	17.95 (n=35)	82.05 (n=160)	100.00 (n=195)
PP	93.33 (n=182)	6.67 (n=13)	100.00 (n=195)
NS	11.28 (n=22)	88.72 (n=173)	100.00 (n=195)
NP	5.64 (n=11)	94.36 (n=184)	100.00 (n=195)

Table 25 Frequency of responses to target sentences by L2-English speakers
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)

As shown in Table 26, more than 80% of the participants assigned the FALSE to target sentences under PS, and more than 90% of the participants assigned the TRUE value to the ones under PP. This suggests that Chinese EFL/ESL speakers mainly interpreted *s* plurals exclusively in positive contexts. Under negation, the participants predominantly assigned FALSE values to target sentences under NS and NP, meaning they overall interpreted *s* plurals inclusively in negative contexts. The relationship between exclusive interpretations and contexts (positive vs. negative), language groups (L2-English vs. L1-English), and proficiency

levels within the L2-English group (low-intermediate vs. high-intermediate vs. advanced) will be further analysed with mixed-effects analysis in the next subsection.

We now move on to the results of control items. 778 responses were collected from the L2-English speakers and the results are shown in Table 26.

Control sentences (response rates, %)			
Context x Condition	TRUE	FALSE	Total
PS	79.65 (n=180)	20.35 (n=46)	100.00 (n=226)
PP	14.87 (n=29)	85.13 (n=166)	100.00 (n=195)
NS	7.32 (n=12)	92.68 (n=152)	100.00 (n=164)
NP	16.41 (n=32)	83.59 (n=163)	100.00 (n=195)

Table 26 Frequency of responses to control sentences by L2-English speakers
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)

As shown in Table 26, the accuracy for control sentences under PS and NP is around 80%, for PP about 85%, and the accuracy for NS is the highest at more than 90%. This suggests that the Chinese EFL/ESL participants did not have difficulty understanding the task and were able to distinguish singular and plural meanings signified by test stories and test tokens.

Next, we consider the descriptive results from the control group.

L1-English speakers

The L1-English speakers are the control group in this L2 study. 600 responses were collected from them for the target sentences in this task. The frequency of their TRUE and FALSE responses is shown in Table 27.

Target sentences (%)			
Context x Condition	TRUE	FALSE	Total
PS	13.33 (n=20)	86.67 (n=130)	100.00 (n=150)
PP	97.33 (n=146)	2.67 (n=4)	100.00 (n=150)
NS	31.33 (n=47)	68.67 (n=103)	100.00 (n=150)
NP	2 (n=3)	98 (n=147)	100.00 (n=150)

Table 27 Frequency of responses to target sentences by L1-English speakers
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)

Table 28 shows that native English participants mainly assigned the FALSE value to target sentences under PS (86.67%), and they predominantly provided the TRUE value to the sentences under PP (97.33%). This suggests that they tended to interpret *s* plurals with

exclusive readings in positive contexts. In negative contexts, one-third of the responses for *s* plurals under NS is the TRUE value (68.67%). By contrast, the responses for *s* plurals under NP are almost entirely the FALSE value (98%). This suggests that although the participants generally tended to interpret *s* plurals with inclusive readings under negation, they also computed a considerable number of exclusive readings. The relationship between exclusive interpretations and contexts (positive vs. negative) as well as language groups (L1-English vs. L2-English) will be analysed in the next subsection.

As for the control sentences, 600 responses were collected from the L1-English speakers, shown in Table 28.

Control sentences (response rates, %)			
Context x Condition	TRUE	FALSE	Total
PS	**99.33 (n=149)**	0.67 (n=1)	100.00 (n=150)
PP	24.67 (n=37)	**75.33 (n=113)**	100.00 (n=150)
NS	2.67 (n=4)	**97.33 (n=146)**	100.00 (n=150)
NP	22 (n=33)	**78 (n=117)**	100.00 (n=150)

Table 28 Frequency of responses to control sentences by L1-English speakers
(PS: positive singular, PP: positive plural, NS: negative singular, NP: negative plural)
(Target answers are in bold)

As shown in Table 28, the accuracy for control sentences under PS and NS is almost 100%. Although the percentages of target answers for PP and NP are lower, they are still higher than 75%[37]. This means that the participants had no difficulty computing the singular and plural meanings signified by test stories and test tokens.

This subsection has reported the descriptive results of the English TVJT from both L2-English and L1-English language groups. The next subsection will present the GLM models used in this L2 study and report the inferential results.

5.3.3 Generalised linear mixed-effects models and inferential statistics

This section presents the inferential analysis for the data collected from the English TVJT. Mixed-effects analysis was performed using R and the *glmer* function from the package

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[37] It is clear that both L2-English speakers and native English speakers presented lower percentages of target answers for the control sentences under PP and NP. The current research cannot explain why this happens and it is not the focus of the current research. Future research could look to investigate the computation of singularity in positive and negative contexts by L1 and L2 speakers. Crosslinguistic comparison can also be considered because, in previous L1 Chinese data, we also identified that Chinese adults tended to show an alternative interpretation (i.e., an enriched singular meaning) for singular sortal classifier constructions in the form of *one CL x*.

lme4 (Bates et al., 2015). In the following, we first consider the effect of *context* and *language group* on the participants' computation of exclusive readings for English bare plurals in general (Model 1). Next, I compare the results within contexts (positive vs. negative) and language groups (L2-English vs. L1-English). Lastly, we take proficiency groups into consideration. It should be noted that following Tieu et al. (2014), I only report the results in terms of exclusive readings only, instead of both inclusive and exclusive readings, to help ease the understanding of the comparison across contexts and language groups.

In Model 1, *language group*, *context*, and the interaction between *language group* and *context* are treated as fixed effects, and *subject* and *item* are treated as random effects. The results are shown in Table 29.

	Estimate	Std.Error	z value	Pr(>|z|)
(Intercept)	1.6457	0.3804	4.327	1.51e-05 ***
contextnegative	-4.4982	0.5071	-8.871	< 2e-16 ***
languageL1-English	0.4856	0.4642	1.046	0.2956
contextnegative:languageL1-English	1.1462	0.5223	2.195	0.0282 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 29 Results of Model 1 in the L2 study[38]

As shown in the table, the GLM regression analysis reveals the main effect of *context* on the participants' exclusive interpretations (*p<.001*) and there is an interaction between *context* and *language group* (*p<.05*). However, the current model did not reveal an effect of *language group* on the computation of exclusive readings. This means that while participants have significantly different interpretations for *s* plurals in positive and negative contexts, their interpretations are not significantly different based on language groups but do vary when both *context* and *language group* are combined. In other words, both L2-English and L1-English speakers tend to interpret exclusive readings more often in positive than in negative contexts.

Taking a closer look at the results, we compare the exclusive readings computed in positive and negative contexts within each language group, as shown in Figure 31.

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[38] In the table, *contextnegative* means the reference or baseline for the factor *context* is the *positive* context; *languageL1-English* means the reference or baseline for the factor *language group* is the *L2-English* group; *contextnegative:languageL1-English* means the interaction between *context* and *language group*.
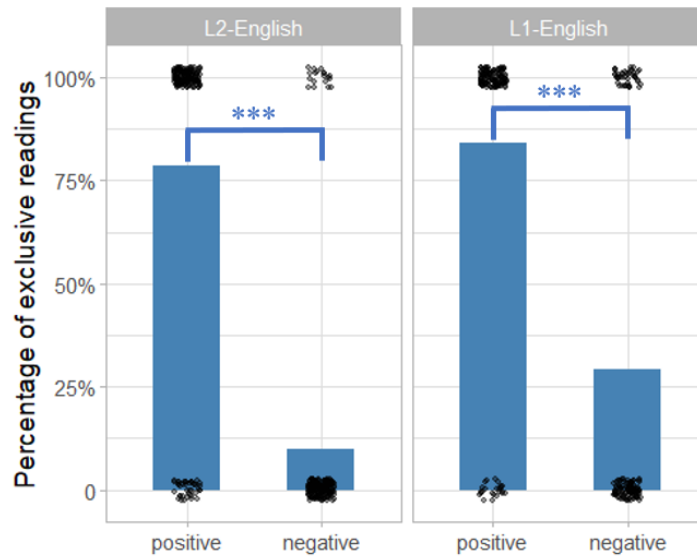
Figure 31 Percentage of exclusive interpretations by the two language groups
(positive vs. negative)

In Figure 31, the graph on the left is the L2 results and the graph on the right is the L1 results. GLM analysis shows the main effect of *context* on exclusive interpretations within the L2-English group (*p<.001*) and within the L1-English group (*p<.001*). Both Chinese EFL/ESL and native English speakers tend to interpret *s* plurals with exclusive readings significantly more often in positive contexts than in negative contexts.

Next, we compare the exclusive interpretations by L2-English and L1-English participants within each context, as shown in Figure 32.
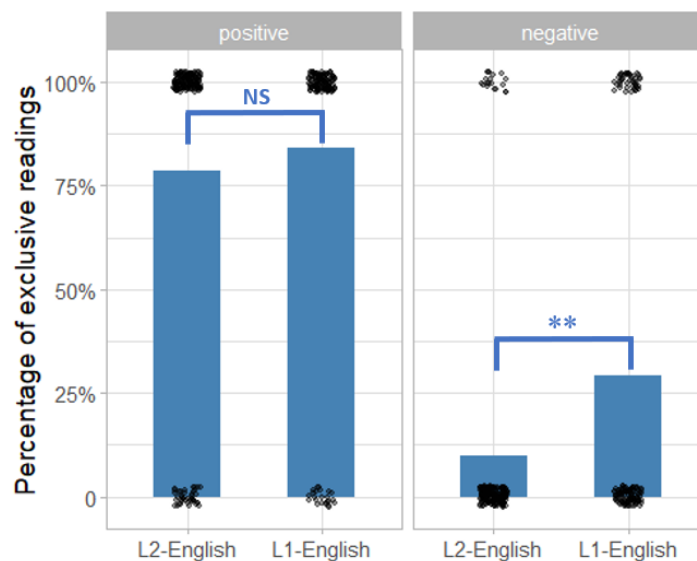
Figure 32 Percentage of exclusive interpretations in positive and negative contexts
(L2-English vs. L1-English)

As shown in Figure 32, in positive contexts (on the left graph), there is no significant difference between the performances of L2-English and L1-English speakers (*p>.1*). This suggests that both Chinese EFL/ESL and native English speakers tend to interpret *s* plurals similarly and exclusively in positive contexts. In negative contexts (on the right graph), there is a significant difference between the performances of the two language groups (*p<.01*). This means that although both language groups overall interpreted *s* plurals inclusively under negation, Chinese EFL/ESL speakers tend to compute fewer exclusive readings than native English speakers.

To sum up the above, both Chinese EFL/ESL learners and native English speakers tend to interpret *s* plurals with exclusive readings significantly more often in positive contexts than in negative contexts. In the positive context, Chinese EFL/ESL learners tend to interpret *s* plurals exclusively at the same level as native English speakers. By contrast, in negative contexts, they tend to interpret *s* plurals with exclusive readings less often than native English speakers, although both language groups tend to interpret *s* plurals inclusively under negation.

We now consider the proficiency level of L2-English speakers. First, the comparison is made within the positive context, shown in Figure 33.
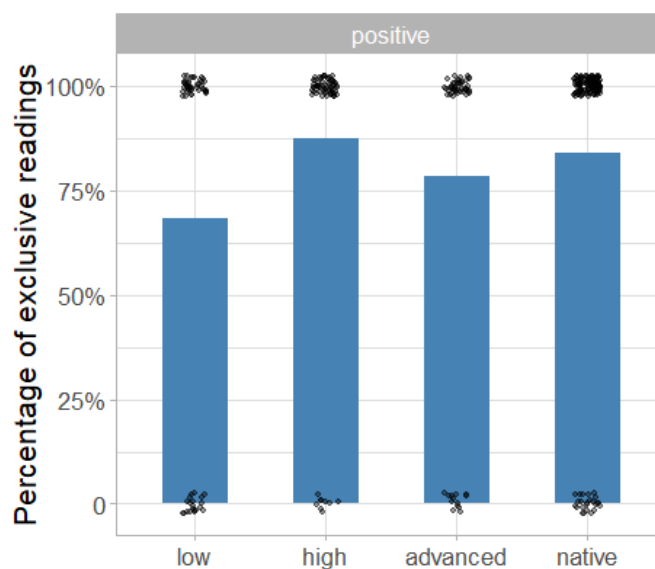
Figure 33 Percentage of exclusive interpretations in positive contexts
(low intermediate vs. high intermediate vs. advanced vs. native)

As can be seen from Figure 33, the percentage of exclusive readings computed by all participant groups ranges from around 70% to almost 90%. The GLM analysis shows that there is no effect of *proficiency level* on the participants' exclusive interpretations in positive contexts (*p>.05*). Chinese EFL/ESL learners of low-intermediate, high-intermediate, and advanced groups tend

to interpret *s* plurals exclusively in a similar way to native English speakers in positive contexts. Next, the comparison within the negative context is presented in Figure 34.
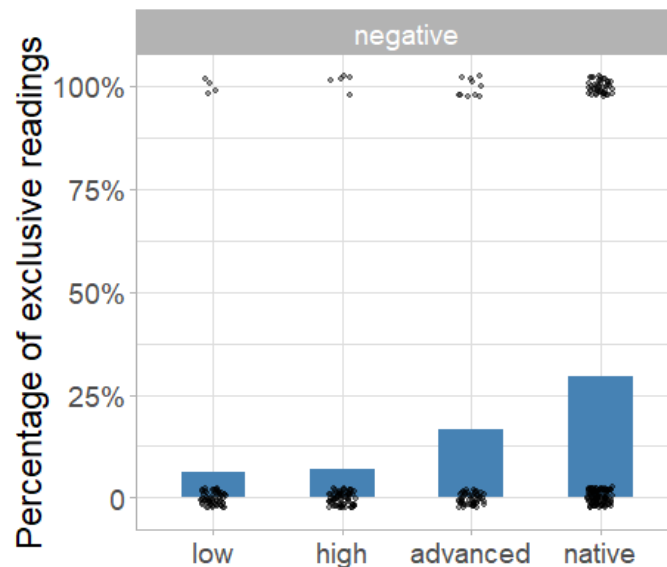
Figure 34 Percentage of exclusive interpretations in negative contexts
(low intermediate vs. high intermediate vs. advanced vs. native English)

Figure 34 shows a linear trend with increasing proficiency among the participants' interpretations for *s* plurals under negation. The results revealed by the GLM analyses are as follows. First, there is a marginal difference between the exclusive interpretations interpreted by the low-intermediate/high-intermediate and native groups (*p<.05*). Second, there is no statistically significant difference between the low-intermediate and the high-intermediate group (*p>.1*). Third, there is no statistically significant difference between the advanced and the native English group (*p>.1*).

The results above suggest that in negative contexts, although both L2-English and L1-English speakers generally interpreted *s* plurals inclusively, L2 participants from low-intermediate and high-intermediate groups tended to interpret exclusive readings significantly less often than native English speakers. By contrast, the interpretations for *s* plurals under negation by the advanced L2 learners tended to be target-like, similar to the L1-English speakers.

Overall, the inferential results show that both L2-English learners and L1-English speakers tend to interpret English bare plurals exclusively in positive contexts and inclusively in negative contexts. Regarding the different language proficiency levels of the L2 learners, the performance of advanced learners is statistically indistinguishable from that of native speakers in both positive and negative contexts. As for learners of lower levels (low- and high-

intermediate groups), although their performance is in line with the overall interpretation trend (i.e., exclusively in positive and inclusively in negative contexts), they are more target-like in positive contexts than in negative contexts, where they tend to compute fewer exclusive readings than native English speakers. We will come back to the results when evaluating Hypothesis 5 to 8 and discussing the findings in Section 5.4.

Based on the observed data above, the predicted probabilities of exclusive interpretations for L2-English and L1-English speakers in positive and negative contexts are shown in Figure 35.
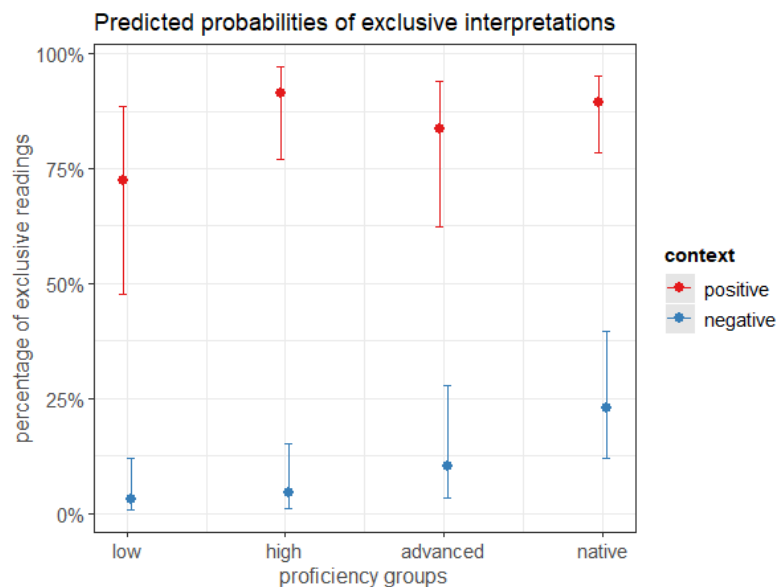
Figure 35 Predicted probabilities of exclusive interpretations for each proficiency group

In Figure 35, the red and blue dots are the predicted average percentage of exclusive interpretations by Chinese EFL/ESL speakers of low-intermediate, high-intermediate, and advanced proficiency levels, as well as native English speakers. The red and blue lines are the range of probabilities within each proficiency group (i.e., confidence intervals). As can be seen, both L2-English learners and L1-English speakers tended to interpret more exclusive readings in positive contexts than in negative contexts. It is noticeable that in positive contexts, there are overlaps among the probability ranges from each proficiency group, whereas in negative contexts, there tends to be no overlap between the ranges of probabilities for the low-intermediate group and the native English group. This indicates that the difference between L2-English learners of lower proficiencies and native English speakers tends to be more distinguishable in negative contexts than in positive contexts.

5.3.4 Individual results

The group results presented in the preceding subsection also received support from individual results. This subsection will briefly report the individual results, starting with L2-English speakers.

L2-English speakers

Combining PS and PP (i.e., positive contexts) and NS and NP (i.e., negative contexts), respectively, I calculated the participant count for exclusive/inclusive readings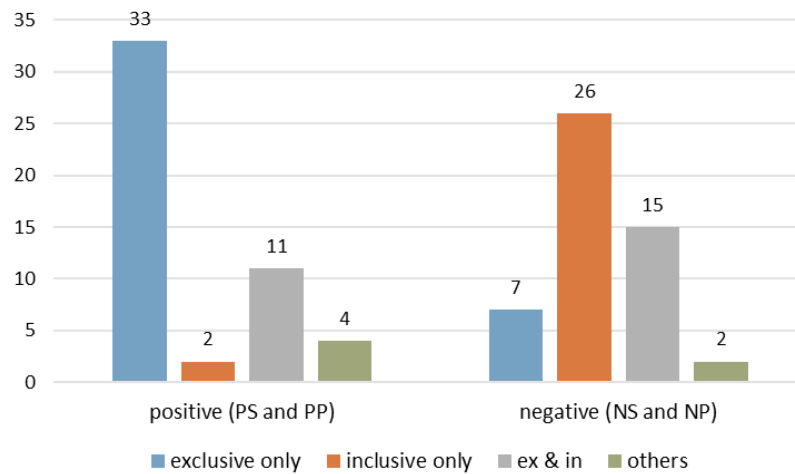 computed in positive and negative contexts, shown in Figure 36. It should be noted that in the figure, 'exclusive only' means that participants only replied with exclusive readings, while 'inclusive only' means that participants only replied with inclusive readings; 'ex & in' means that participants interpreted *s* plurals with both exclusive and inclusive readings for different test tokens, and "others" includes the *exactly one* responses as shown on the interpretation maps and conflicting responses as mentioned in Section 5.1.4. This also applies to Figure 37.
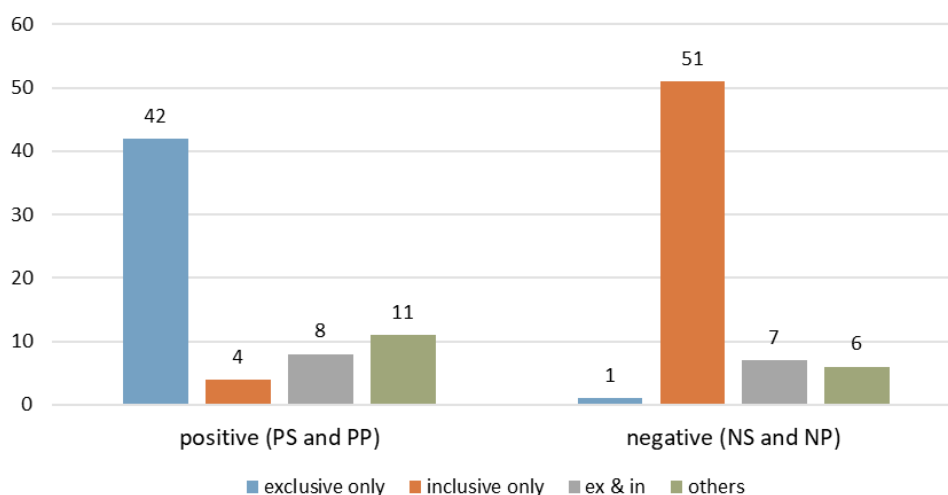
Figure 36 Participant counts for exclusive/inclusive readings
computed by L2-English speakers (positive vs. negative)

As Figure 36 shows, in positive contexts (including both PS and PP), 42 out of 65 participants (64.62%) interpreted *s* plurals exclusively only, 8 participants interpreted *s* plurals with both exclusive and inclusive readings, and 4 participants interpreted *s* plurals inclusively only. This suggests that the majority of the participants have provided consistent responses and overall interpreted *s* plurals exclusively in positive contexts. Turning to negative contexts, 51 out of 65 participants (69.23%) interpreted *s* plurals inclusively only, 7 participants interpreted *s* plurals with both exclusive and inclusive readings, and 1 participant interpreted *s* plurals

154

exclusively only. This also suggests that participants predominantly provided consistent responses and they overall interpreted *s* plurals inclusively in negative contexts. The individual results are consistent with the group results of L2-English speakers.

L1-English speakers

The same analysis reported above was also conducted on L1-English participants. The participant count for exclusive/inclusive readings computed in positive and negative contexts is shown in Figure 37.

Figure 37 Participant counts for exclusive/inclusive readings computed
by L1-English speakers (positive vs. negative)

As shown in Figure 37, under both PS and PP (i.e., positive contexts), 66% (33 out of 50) of the participants interpreted *s* plurals with exclusive readings only, whereas more than 20% (11 out of 50) of the participants provided both exclusive and inclusive interpretations. This means that participants overall tended to interpret *s* plurals exclusively in positive contexts. Regarding NS and NP (i.e., negative contexts), more than half (26 out of 50) of the participants interpreted *s* plurals with inclusive readings only, whereas exclusive readings were made by the other half of the participants (22 out of 50), among which, 7 participants interpreted *s* plurals under negation only with exclusive readings. This means that while participants mainly tended to interpret *s* plurals inclusively, there was still a number of participants who interpreted *s* plurals exclusively under negation. It is also noticeable that only a few participants were classified into the *others* group in positive (4 out of 50) and negative contexts (2 out of 50). The individual results of L1-English speakers suggest that the majority of participants have provided consistent responses in the TVJT and they are consistent with the group results.

5.4 Findings and discussion

The previous subsection has reported both the descriptive and inferential statistics of the English TVJT. In the following, I will evaluate each hypothesis put forward in the current L2 study and develop what we have found regarding the L2-English and L1-English participants' interpretations for *s* plurals from the current experiment. Two research questions were formulated for the current L2 study. Research Question 2 asks how Chinese EFL/ESL learners interpret *s* plurals in positive and negative contexts, addressing the comparison between L2-English and L1-English speakers. Four hypotheses were formulated in this regard. First, Hypothesis 5 is put forward under the assumption that scalar implicatures are universal, and is reproduced below.

Hypothesis 5: Based on the scalar implicature approach to plurality, we predict that Chinese EFL/ESL learners will show similar performance to native English speakers. This is because the L2 participants are adults and assuming the universality of scalar implicatures, they will compute plurality inferences for bare plurals in English at a similar level to English adult speakers. Due to the same reason, no difference in interpretative patterns will be found among L2 learners across different L2 language proficiency levels. Overall, they will interpret English bare plurals exclusively in positive contexts and inclusively in negative contexts, computing more plurality inferences in positive than in negative contexts.

Predictions were borne out from the results, supporting Hypothesis 5. First, the GLM model revealed a main effect of context (positive vs. negative) but no effect of language group (L2-English vs. L1-English) on the participants' exclusive interpretations of *s* plurals. This means that differences were identified by comparing the exclusive readings computed in positive and negative contexts across language groups, but not between L2-English and L1-English speakers across contexts. Second, both L2-English and L1-English speakers computed exclusive readings significantly more often in positive than in negative contexts. In general, they tended to interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts. This pattern has been identified in every L2 English language proficiency group tested in this experiment. The results are in line with what has been found for plurality inferences in the current and previous L1 studies and L2 studies testing other scalar terms. This suggests that plurality inferences, as a type of scalar implicature, are universally available to L2 speakers. As adult speakers, they are sensitive to pragmatic inferences and are able to compute them as

required by the contexts. However, it should be noted that this conclusion is still tentative because the results above could equally be due to L1 transfer as predicted in Hypothesis 6. In the following, I will evaluate Hypothesis 6 and explain why this hypothesis is not supported by the current research. Hypothesis 6 is reproduced below.

Hypothesis 6: Assuming L1 transfer through the mapping between -*s* and -*men*, Chinese EFL/ESL learners will map *s* plurals in English onto *men* plurals in Chinese. We predict that the participants, with lower proficiency levels or at earlier stages of their interlanguage, will transfer the knowledge of -*men* to -*s*, and interpret *s* plurals following the same interpretative patterns for *men* plurals shown in the L1-Chinese data. However, according to the FRH, L2 learners with higher proficiency levels, or at later stages of their interlanguage, will be able to reassemble features by accessing universal grammar. In the current case, L2 learners will eventually overcome the effect of L1 and interpret *s* plurals at a similar level to the English controls. **Since the current L1 data has shown that plurality inferences associated with *men* plurals and *s* plurals are the same and they are scalar implicatures, we predict that L2 learners will all perform similar to adult native English speakers, showing no developmental pattern. They will overall interpret English bare plurals exclusively in positive contexts and inclusively in negative contexts**.

These predictions are not borne out from the results, thus not supporting Hypothesis 6. Hypothesis 6 predicts that no matter what stages the L1-Chinese L2-English speakers are at in their interlanguage, they will show similar performance to native Chinese speakers for *men* plurals and native English speakers for *s* plurals. This is because the plurality inferences associated with *men* plurals and *s* plurals tend to be the same, as shown by the current L1 research. However, what has been identified in the current results is that L2-English speakers computed fewer exclusive readings in negative contexts than L1-English speakers and L1-Chinese speakers, although the three groups showed similar performances in positive contexts. This is shown in Figure 38 below.

157
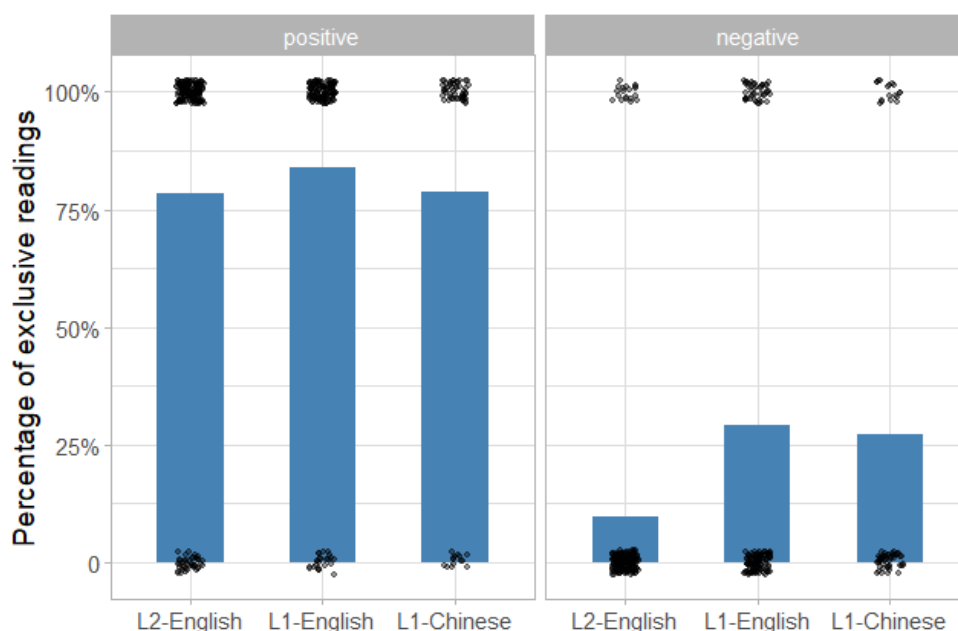
Figure 38 Exclusive interpretations for *s* plurals and *men* plurals
in positive and negative contexts (L2-English vs. L1-English vs. L1-Chinese)

The GLM analysis for the data presented in Figure 38 shows that in positive contexts, there is no significant difference between the L2-English and L1-English groups (*p>.1*), between the L2-English and L1-Chinese groups (*p>.1*), or between the L1-English and L1-Chinese groups (*p>.1*). By contrast, in negative contexts, there is a significant difference between the L2-English and L1-English groups (*p<.01*), a marginal difference between the L2-English and L1-Chinese groups (*p<.05*), but no statistical difference between the L1-English and L1-Chinese groups (*p>.1*). If language transfer from *men* plurals to *s* plurals occurs, the L1 influence will be reflected in the L2 results across contexts. However, this is not what the current results and analysis above show. Therefore, as evidenced by the inconsistency between the L2 results in positive and negative contexts, the current results do not reveal L1 transfer patterns via the mapping between *-men* and *-s*. Although the plural particle *-men* has been treated as an equivalent morpheme to the plural marker *-s* in English, given the limited distribution of *-men*, L2 learners tend not to map *-s* to *-men*, which is not productive in their L1. There are other constructions (e.g., bare nouns and mensural classifier phrases) to express plural meanings in Chinese, and they could equally be candidates for L1 transfer. I will discuss them in detail in the following. In sum, Hypothesis 6 is not supported by the current results, and I argue that the L2 interpretive patterns shown in this L2 study are not attributed to the influence of *men* plurals in Chinese.

Now we turn to Hypothesis 7, regarding the mapping from *s* plurals to bare nouns.

Hypothesis 7: Assuming L1 transfer through the mapping between -*s* and null plural marking, Chinese EFL/ESL learners will map *s* plurals in English onto bare nouns in Chinese. We predict that the participants, with lower proficiency levels, or at earlier stages of their interlanguage, will be influenced by their knowledge of Chinese bare nouns and have difficulty interpreting the exclusive readings associated with *s* plurals as required. Specifically, they will interpret *s* plurals exclusively less often than English adults in both positive and negative contexts. This is because bare nouns in Chinese are combined with inclusive readings only, as shown in the current L1 data. By contrast, we predict that Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 transfer and interpret *s* plurals at a similar level to adult native English speakers. They will overall interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

These predictions are not borne out by the current results, not supporting Hypothesis 7. As opposed to the hypothesis, L2-English participants, regardless of their English proficiency level, did not compute significantly more inclusive readings than native English speakers in positive contexts (Figure 38). In negative contexts, the L2 participants indeed overall interpreted fewer exclusive readings than native English speakers. As reported in Section 4.3.3, a statistically significant difference is identified between L2 learners of low- and high-intermediate groups and L1-English speakers (*p<.05*), but not between the advanced L2 learners and L1-English speakers (*p>.1*).

We also compare the L2 results to the interpretations of bare nouns in negative contexts by L1-Chinese speakers, as shown in Figure 39.
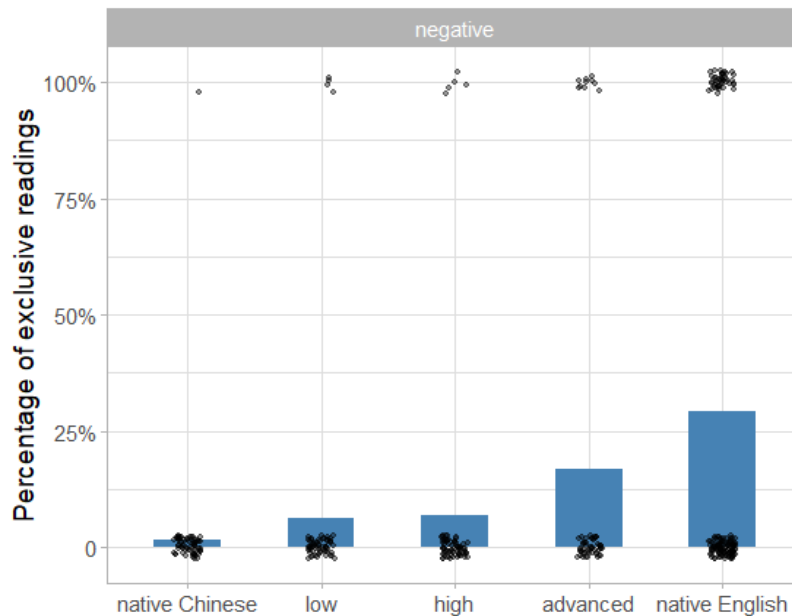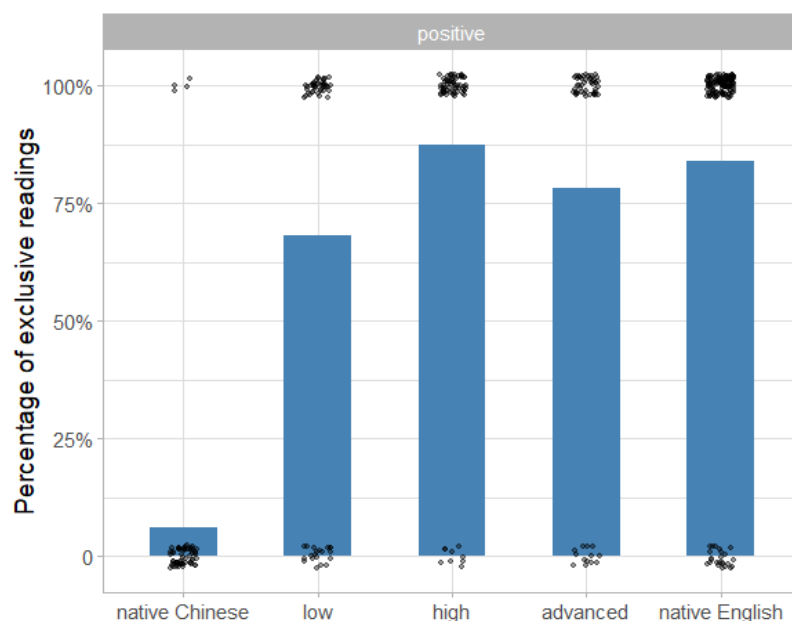
Figure 39 Exclusive interpretations for *s* plurals and bare nouns in negative contexts
(L1-Chinese vs. low-intermediate vs. high-intermediate vs. advanced vs. L1-English)

The statistical analysis shows that there is no significant difference between the native Chinese group and the low- and high-intermediate L2-English groups ($p>.1$). However, if L1 transfer of bare nouns happens, it should be reflected in the results of L2 participants in both contexts, and therefore this developmental pattern shown in Figure 39 should also be presented in positive contexts. This is clearly not what we have identified in the current results, shown in Figure 40 below.

Figure 40 Exclusive interpretations for *s* plurals and bare nouns in positive contexts
(L1-Chinese vs. low-intermediate vs. high-intermediate vs. advanced vs. L1-English)

Therefore, even though it seems that L2 participants tend to be influenced by their L1 knowledge of bare nouns in negative contexts, we argue that the L2 performance overall found in the current data is not attributed to L1 transfer via the mapping from the English plural marker -*s* to null plural marking in Chinese, evidenced by the aforementioned inconsistency between the positive and negative contexts.

We now turn to Hypothesis 8, which is established assuming the potential influence from Chinese mensural classifiers.

Hypothesis 8: Assuming L1 transfer from mensural classifiers, Chinese EFL/ESL learners will be influenced by the plurality interpretations associated with Chinese mensural classifier phrases when interpreting English *s* plurals. We predict that the participants with lower proficiency levels, or at earlier stages of their interlanguage, will interpret *s* plurals exclusively in both positive and negative contexts, following the interpretative patterns of mensural classifier phrases shown in the L1 Chinese data. By contrast, Chinese EFL/ESL speakers with higher proficiency levels, or at later stages of their interlanguage, will overcome the effect of L1 and be more native-English-like. We predict that the learners of higher proficiency will then interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts.

These predictions are not supported by the results and therefore Hypothesis 8 is not supported. As reported in the last chapter, the current L1-Chinese study indicates that native Chinese adults tended to interpret mensural classifier phrases exclusively in both positive and negative contexts. This means that if L1-Chinese L2-English speakers map *s* plurals to mensural classifier constructions, the participants from lower proficiency groups will follow the interpretive preference for mensural classifier phrases in Chinese and interpret *s* plurals exclusively in both positive and negative contexts. Moreover, as advanced learners will be able to overcome the effect of L1 transfer and be target-like similar to native English speakers, distinct interpretive patterns will also be expected among different proficiency groups. Specifically, learners of lower proficiencies will also interpret *s* plurals under negation with more exclusive readings than the advanced and the control groups. However, the aforementioned two interpretative patterns were not identified in the current results. We first consider the positive context, shown in Figure 41.
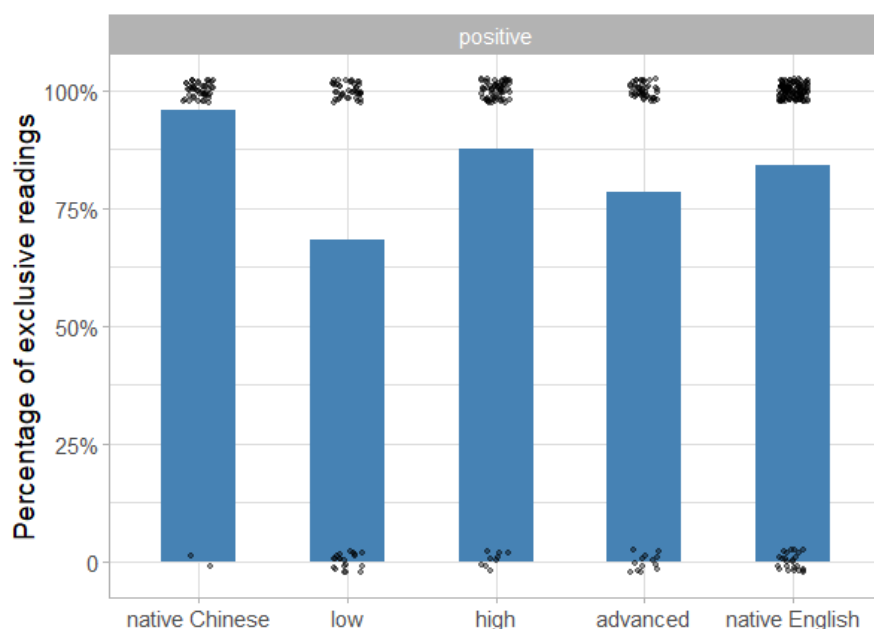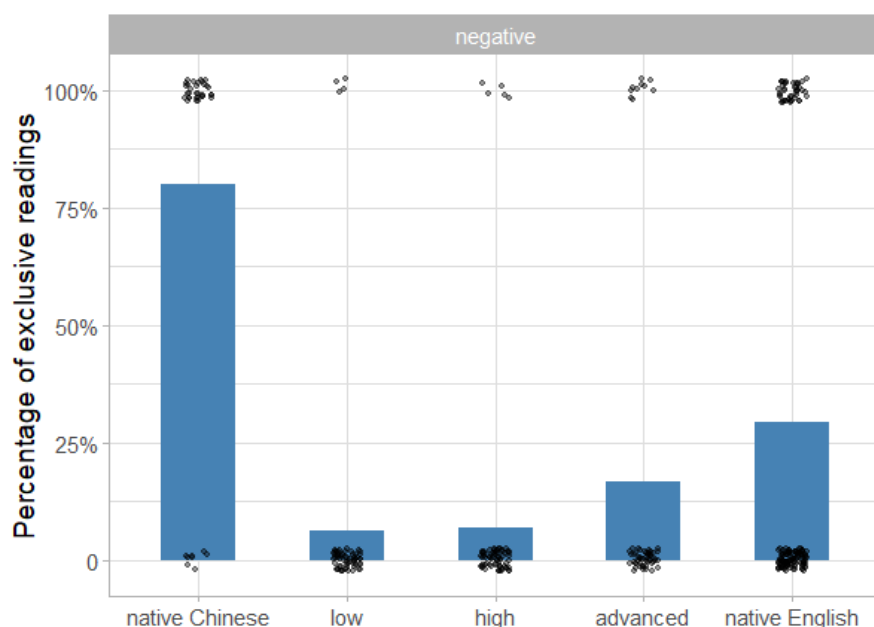
Figure 41 Exclusive interpretations for *s* plurals and mensural classifier phrases
in positive contexts
(L1-Chinese vs. low-intermediate vs. high-intermediate vs. advanced vs. L1-English)

As shown in Figure 41, although the L2-English participants from the low-intermediate group overall interpreted *s* plurals exclusively in positive contexts, there is a marginal difference between their exclusive interpretations for *s* plurals and the L1-Chinese participants' exclusive interpretations for mensural classifier phrases (*p<.05*). By contrast, there is no significant statistical difference between the high-intermediate group and the L1-Chinese group (*p>.1*) or the advanced group and the L1-Chinese group (*p>.05*). Following Hypothesis 7, L2 learners of lower proficiencies, rather than advanced learners, will be affected by L1 transfer and will display a similar performance to L1-Chinese speakers. This is clearly not the case as shown above. Therefore, the current result for positive contexts does not reveal the effect of L1 transfer from mensural classifier constructions.

We now turn to negative contexts, as shown in Figure 42.

Figure 42 Exclusive interpretations for *s* plurals and mensural classifier phrases
in negative contexts
(L1-Chinese vs. low-intermediate vs. high-intermediate vs. advanced vs. L1-English)

As shown in Figure 42, the results in negative contexts displayed by L2 participants of lower proficiency groups contradict the performance predicted in Hypothesis 8. They overall interpreted *s* plurals inclusively and they did not compute more exclusive readings than the advanced group. This could also be interpreted as evidence that the L2 participants were not influenced by the L1 transfer of mensural classifiers. Therefore, I argue that the L2 performance presented in the current study is not due to L1 transfer from Chinese mensural classifier constructions.

Taken together, Hypothesis 6 to 7 regarding L1 transfer via two mapping options and Hypothesis 8 based on the L1 influence from Chinese mensural classifier constructions are all rejected by the current results, whereas only Hypothesis 5 regarding the universality of scalar implicatures is supported. The mapping possibilities tested in the current L2 study cannot account for the variability of the performances shown by the Chinese EFL/ESL participants. In Mandarin Chinese, bare nouns and *men* plurals are similar to *s* plurals and they can all be used to yield plural meanings. I propose that the complexity of the mapping possibilities tends to hinder Chinese EFL/ESL speakers from seeking and identifying the morpholexical equivalents for the plural marker -*s* in their L1-Chinese. Instead, as mature speakers, they tend to use their pragmatic knowledge to understand plurality and compute the exclusive readings associated with -*s* in their English.

We now turn to the last research question, as presented below.

Research Questions 3: Are the L2 patterns shown by Chinese EFL/ESL learners due to the effect of L1 transfer or the universality of scalar implicatures?

In response to this, the current study proposes that the interpretive patterns shown by our Chinese EFL/ESL participants are attributed to the universality of scalar implicatures. Plurality inferences, as scalar implicatures, are universal across languages, and adult language speakers are able to access them without difficulty. This also provided evidence for the scalar implicature approach to plurality inferences from L2 English data.

To sum up, the current L2 study provided independent evidence for the second language acquisition of scalar implicatures by examining the interpretations of *s* plurals by Chinese EFL/ESL speakers. The L2-English participants computed more exclusive readings in positive contexts than in negative contexts, and overall tended to interpret *s* plurals exclusively in positive contexts and inclusively in negative contexts. Such a pattern is consistent with that of native English speakers in the current study and Tieu et al. (2014). This supported the scalar implicature approach to plurality inferences proposed in previous L1 studies (e.g., Tieu et al, 2014; Renans et al., 2018; Renans et al., 2020), by drawing empirical evidence from an L2. This finding is also in line with what was signified by the L1-Chinese study in this thesis. Together, they point to the conclusion that linguistic pragmatic principles tend to be universal in L2s (e.g., Slabakova, 2010; Snape and Hosoi, 2018). The current study did not reveal the effect of L1 transfer via mapping on L2 performance. L2-English learners tend to have no difficulty computing plurality inferences for *s* plurals due to the universality of scalar implicatures.

Furthermore, as indicated in previous research (e.g., Tieu et al., 2014), in negative contexts, the scalar implicature approach to plurality inferences can explain both inclusive readings computed at the sentence level and exclusive readings computed locally under the scope of negation. This has been further supported by the results of *s* plurals from the advanced L2-English learners and native English speakers in the current L2 study. That is, inclusive interpretations of bare plurals in negative contexts are not the participants' only choice; there are a number of exclusive interpretations (around 25%), which are computed as local inferences.

Lastly, to explain the linear trend from lower to higher proficiency in negative contexts observed in the current study, I offer two tentative speculations. First, the current L2 results, in general, are attributed to the universality of scalar implicatures, but L1 transfer is also traceable. Chinese EFL/ESL speakers of low English proficiency tend to be influenced by their understanding and knowledge of Chinese bare nouns when interpreting *s* plurals in both

positive and negative contexts. For the L2 learners in the current study, those from the low- and high-intermediate groups are already able to eliminate the influence of L1 transfer and compute exclusive readings similarly to native English speakers in positive contexts, but they are still influenced by the inclusive readings associated with bare nouns in negative contexts. As for the advanced L2 learners, they are able to compute exclusive readings similarly to native English speakers in both positive and negative contexts, without being influenced by their L1 language. If this speculation is on the right track, for L2 learners whose language proficiency is even lower than the current low-intermediate group, we predict that they will be influenced by their L1 knowledge of bare nouns in both positive and negative contexts. That is, they will compute more inclusive readings than participants of higher proficiencies in both positive and negative contexts. This also suggests that the participants of the low-intermediate group in the current study are not at the very initial stage of their interlanguage. With the given proficiency groups in this L2-English experiment, this speculation cannot be tested using the current dataset. However, what the current findings can inform us of is that if the L1 influence from bare nouns exists, it is not sustained, as the more advanced L2 learners showed native-like performance similar to the L1-English speakers. The lack of L2 learners who are at the very beginning stage in this research does not affect the current argument, but calls for future research.

Second, the linear trend from lower to higher proficiency in negative contexts is due to the potentially different computation mechanisms for global and local inferences. As indicated by the interpretations of bare plurals under negation in both current L1 and L2 studies, inclusive readings appear to be more available than local inferences (i.e., exclusive readings) for speakers. Therefore, as using an L2 is already difficult, participants of lower proficiencies are likely to compute bare plurals at the sentence level, as this is less effort-demanding than computing local inferences under the scope of negation. However, this speculation also cannot be supported by the findings of the current study. We leave this for future research.

To conclude, this chapter first presented the methodology and research methods of the current L2 study. It then reported the descriptive and inferential statistics of the TVJT in the L2-English experiment. It drew together the research questions and the task results and evaluated the hypotheses following those research questions. The following chapter will conclude this thesis.

Chapter 6 Conclusion

The current research explores the second language acquisition of plurality by Chinese EFL/ESL speakers. It consists of two studies as reported in Chapter 4 and Chapter 5. The L1-Chinese study explores what plurality interpretations are available in Mandarin Chinese. It was carried out by testing three Chinese constructions that can yield plural meanings on both L1-Chinese adults and children. The L2-English study examines the universality of scalar implicatures and the effect of L1 transfer by observing how Chinese EFL/ESL interpret English bare plurals in positive and negative contexts. We traced the L2-English learners' performance back to the findings identified in the L1 study, by evaluating each hypothesis established for the research questions. The current chapter concludes this thesis. It first summarises the major findings from both current L1-Chinese and L2-English studies in Section 6.1. Section 6.2 discusses the contributions of the current research, while Section 6.3 reflectively reviews its limitations. Section 6.4 provides the implications for future research.

6.1 Summary of major findings

The current findings support the scalar implicature approach to plurality; that is, the exclusive readings (i.e., plurality inferences) associated with overt plural marking are scalar implicatures. It further proposes that those plurality inferences are universal across languages, no matter whether the plural marker is obligatory or not, and no matter if they are computed in an L1 or L2. This is evidenced by two major findings from both current L1 and L2 studies. First, regarding the results of *men* plurals in the L1-Chinese experiment, the performances displayed by native Chinese adults and children are in line with what has been identified for *s* plurals by native English adults and children in Tieu et al. (2014). This suggests that *men* plurals are the same as *s* plurals, even though the plural particle *-men* in Mandarin Chinese is not always required to yield a plural meaning. Second, regarding the results of *s* plurals in the L2-English experiment, the L1-Chinese L2-English adult learners have shown a target-like sensitivity to plurality inferences as L1-English speakers in this study and in Tieu et al. (2014). This further supported the universality of scalar implicatures cross-linguistically. In the following, I summarise the other findings from each study of the current research.

6.1.1 L1-Chinese study

Concerning the L1 study, four major findings are drawn from the current data. First, the current results suggest that plurality inferences associated with Chinese bare plurals arise from

the particle -*men*. This is evidenced by the different interpretations that occur with the presence of -*men* (*men* plurals) and the absence of -*men* (bare nouns). This finding can also explain the non-appearance of exclusive readings for bare nouns, which is shown in both child and adult results. It further provided additional evidence for the statement in previous research that bare nouns are number neutral (e.g., Rullmann and You, 2006).

Second, based on the current child results for *men* plurals, I propose that, unlike the observations reported in the literature, inclusive readings are the base meaning for *men* plurals. This is because inclusive readings are the meanings computed by children at the age (4 to 6) when they are not as sensitive to scalar implicatures as adults. Furthermore, inclusive readings surface with *men* plurals in both positive and negative contexts as observed for adults and children in the current experiment, meaning the overt plural marking on *men* plurals does not necessarily exclude a singular reference. I argue this is evidence opposed to previous linguistic analysis for -*men* which assumes *men* plurals have exclusive readings only.

Third, different interpretative patterns shown by adults and children have been observed for mensural classifier constructions and *men* plurals in the current experiment. First, regarding the adult results, although they overall interpreted both categories exclusively in positive contexts, different performances were observed for negative contexts: while they preferred inclusive readings for *men* plurals, they tended to prefer exclusive readings (i.e., local inferences under negation) for mensural classifiers. Second, the major difference between the adult and child results lies in positive contexts for *men* plurals but in negative contexts for mensural classifiers. Children are insensitive to the plurality inferences associated with *men* plurals, which is shown by how they computed significantly fewer exclusive readings than adults in positive contexts. However, for mensural classifiers, children have no difficulty computing the exclusive readings in positive contexts and the distinction between child and adult results appears when mensural classifiers are embedded under negation: while adults interpreted them exclusively, children interpreted them inclusively. The current research cannot yet account for this, as this requires first explaining the derivation of the plurality inferences associated with *men* plurals (which was touched on in Section 6.4.2) and defining what the inferences associated with the mensural classifier constructions are. This is beyond the scope of the current research. Future research could look to explain why adults switched to prefer local inferences for mensural classifiers under negation, and why children are able to interpret mensural classifiers in positive contexts at a similar level to adults, but prefer inclusive readings in negative contexts, which is significantly different to adults. It will shed light on

whether the inferences associated with mensural classifiers and the plurality inferences associated with bare plurals (e.g., *men* plurals and *s* plurals) are the same or different.

In addition, the interpretative patterns identified with *yi xie* (some) appear to be different from mensural classifiers but similar to *men* plurals. Although with the current data we cannot draw solid inferential decisions on *yi xie*, we can still, to say the least, propose that *yi xie* should be treated differently from other mensural classifiers, such as *yi qun* (one group) and *yi lan* (one basket) that have been tested in this L1 study.

6.1.2 L2-English study

Turning to the L2 study, three major findings are summarised as follows. First, no consistent evidence of L1 transfer via two mapping possibilities (the English plural marker *-s* to the plural marker *-men* and to null marking in Chinese) is reflected in the current data. No consistent evidence of the influence from mensural classifier constructions was found. The L2 performance is proposed to be due to the nature and universality of scalar implicatures; that is, scalar implicatures tend to appear in positive contexts and disappear in negative contexts, and they are universally available for adult speakers across L1s and L2s. Second, we speculate that the complexity of what is available in Chinese might be a hindrance for Chinese EFL/ESL speakers in mapping *-s* in L2 English to its equivalent counterparts in L1 Chinese (i.e., *-men* and null plural marking). Bare nouns, *men* plurals, and mensural classifier phrases can all be used to deliver plural meanings in Mandarin Chinese, and the current research also revealed variations in their interpretations. As such, Chinese EFL/ESL learners may not know what they should map *-s* to, so they turn to universal pragmatic inferences instead. However, this is only speculation, which was not directly tested in the current research.

Third, as indicated in previous research (Tieu et al., 2014; Renans et al., 2018; Renans et al., 2020), while the scalar implicature approach predicts that the plurality inferences (i.e., exclusive readings) associated with bare plurals tend to appear in positive and disappear in negative contexts, it can still account for the exclusive readings computed under negation as local inferences. The availability of the local inference under negation has been further supported by the current L2 study, shown in the results from participants of both L2-English and L1-English groups. In addition, we also found that L2 learners at lower proficiency levels computed significantly fewer local inferences than both the more advanced L2 learners and native English learners. Therefore, a question arises as to why this interpretive pattern surfaces.

Although the current study cannot answer this question yet, this finding informs us of a future research direction. I will come back to this discussion in Section 6.4.

6.2 Contributions of the current research

By expanding the research into SLA and an L1 with non-obligatory plural marking (i.e., Chinese), the current research provided new experimental evidence for the scalar implicature approach to plurality which was originally proposed in obligatory plural marking languages (e.g., Tieu et al., 2014; Renans et al., 2018; Renans, et al., 2020). This has enhanced our understanding of plurality cross-linguistically. First, plurality inferences associated with overt plural marking tend to be the same in languages with or without obligatory plural marking. Adult L2 learners, whose L1 has optional plural marking, are sensitive to plurality inferences associated with bare plurals in an obligatory plural marking language. This sensitivity tends to be at the same level as that of L1 speakers from both types of languages. This sheds light on the universality of plurality inferences from the domain of SLA and L1-Chinese study. Second, plurality inferences may also be associated with plural meaning triggering constructions other than bare plurals, such as mensural classifier constructions in Chinese. However, the process or mechanism to compute them tends to be different from that for bare plurals, as evidenced by the different preferences for the local inferences displayed by Chinese adults and children in the current L1 experiment. This suggests that to better understand plurality, research should also be extended to other constructions more than bare plurals and with more diverse language backgrounds.

In the following, I discuss other contributions from the current research to L1 Chinese and SLA studies respectively. First, the current research has contributed to our knowledge of scalar implicatures in L1 Chinese studies. It proposes that plurality inferences are also scalar implicatures by providing a new set of data from *men* plurals, as the current results are largely consistent with previous studies which test scalar terms such as *youde* or *youxie* (some; e.g., Wu and Tan, 2009; Su and Su, 2015; Zhao et al., 2021). By comparing the results of *yi xie* to other categories tested in the L1 study, the current research also points out that *yi xie*, whose literal meaning is also *some*, might need to be analysed as a scalar term. Second, the current research has provided novel empirical evidence for some previous statements. For instance, the results of the current L1 study support the statement that bare nouns are number neutral but oppose the postulation that *men* plurals have a *more than one* reading only. In addition, the current research has also provided experimental data on the possible plurality interpretations

associated with menstrual classifier constructions in Chinese. This had not been examined before. The results also suggest that a more in-depth case-by-case analysis on mensural classifiers is necessary, as evidenced by the distinctions between the interpretations for *yi qun* and *yi lan* vs. *yi xie.*

We now turn to the contributions of the current research to SLA studies. In this thesis, I tested the interpretations of English bare plurals by Chinese EFL/ESL speakers. Despite the investigation on plurality inferences having attracted gradual attention in recent years, it had not been explored in an L2. As discussed in Section 2.4.1, much research found that L2 learners tend to have no difficulty with scalar implicature computation and that SIs are universally available to them (e.g., Slabakova, 2010; Snape and Hosoi, 2018). However, conflicting results have also been reported for other types of implicatures, such as the contrastive reading associated with *that*, with which, Cho (2021) argues, "crosslinguistic influence plays out selectively in L2 scalar implicatures" (p24). This means that the differences between L1 and L2 can potentially pose problems for L2 implicature computation. The current research has provided evidence from plurality inferences, and the findings lead to the proposal that the computation of scalar implicatures in an L2 tends not to be affected by L1 transfer. This also suggests that plurality inferences tend not to be the part that will cause difficulties for L2 speakers regarding scalar implicature computation at the semantics-pragmatics interface.

6.3 Limitations of the current research

There are also a few methodological limitations of the current experiment, which need to be addressed in future research. First, in the L1-Chinese experiment, the singular test stories and animations for *men* plurals and mensural classifiers show that our main character Qianqian executed her action on one and only one object. For example, there is only one rabbit in this story and Qianqian is teaching it English. As explained in Chapter 4, this is to avoid the possible interpretation that there are rabbits that Qianqian is not teaching English to in the same story, which could occur if there was more than one rabbit shown in the picture. By contrast, the singular test stories and animations for bare nouns and *s* plurals show that the main character executed her action on one of the other objects. The contrast between the two task designs is also the same with the plural condition. For example, the plural test stories and animations for *men* plurals and mensural classifiers show that the main character executed her action on all of the objects in the story, whereas the ones for bare nouns and *men* plurals show that the main character executed her action on some (more than one but not all) of the objects in the story.

Although the statistical analysis revealed no significant effect of this difference on the test results, it should be controlled more carefully. Future research can look to test both situations and observe whether there are additional explanatory variables that can influence how participants interpret the aforementioned constructions, in addition to context (positive vs. negative), and age (child vs. adult), which have already been explored in the current and previous studies.

Second, *yi xie* (some) was originally treated and tested as a type of mensural classifier. This means that fewer responses were collected for DPs associated with *yi xie*, compared to other categories. This led to the results not being inferential, and therefore more data is needed.

Third, the test items in the current L2-English study include animals (e.g., panda) and other non-human objects (e.g., orange), whereas, in the L1-Chinese study, the test items for *men* plurals are all personified animals. This means that the current L2-English experiment did not consider what potential influence the participants' knowledge of the property *animacy* or semantic features [±human] and [±animate] in Chinese may have on their computation of plurality in English. Adding bare plurals that have personified referents will help us break down the effect of L1 transfer from universal semantics and the plurality of *men* plurals.

Fourth, both L1-Chinese and L2-English experiments in the current research were planned to be conducted in offline face-to-face scenarios. However, this was interrupted by the Covid-19 pandemic and the research had to be transferred onto an online experiment platform. Due to the increased difficulty of recruiting participants online during the pandemic, the sample size for each language group in both studies was smaller than planned. The experiments also had to be shorter to better recruit participants, meaning fewer test tokens were included in each test set than planned. This further led to only limited conclusions being able to be drawn from *yi xie*.

6.4 Implications for future research

In previous sections, connections were made between the current findings and the existing theories that are relevant to plural marking and the computation of plurality. In this section, I point out the implications of this thesis for future second and first language acquisition research.

6.4.1 SLA of plurality inferences

In the following, I discuss three major implications for future research regarding second language acquisition of plurality inferences. First, more L2 data is needed. Although the current results rejected all hypotheses regarding L1 effects on L2 performance and did not reveal a consistent effect of proficiency across contexts, we found a linear trend with increasing proficiencies shown in negative contexts. The source that causes this pattern is still open to discussion. Two possible explanations were raised in Chapter 5, either considering L1 transfer through the mapping from *-s* to null plural marking or the comparison between computing them at the local vs. sentence level. Some previous studies that focus on the SLA of scalar implicatures associated with *some* (e.g., Slabakova, 2010; Snape and Hosoi, 2018) also suggest that the computation of scalar implicatures may depend on processing resources, with which L2 learners are able to "calculate a meaning, compare it to a situation, and then discard this meaning in favor of another" (Slabakova, 2010: p2468). They argue this could explain the discrepancy among native adults and L2 adult learners (and potentially native children). It can be seen from the current results that L2 participants showed similar performance in negative contexts to that of native English children in Tieu et al. (2014), which appeared to be different from that of native English adults in the current research and Tieu et al. (2014). In future investigations, it might be possible to analyse the L2 performance of plurality inferences by considering the availability of processing resources, including checking the possible alternatives of the target item and inspecting L2 learners' calculation process for them. In addition, even though the effect of proficiency is not statistically supported by the current results, there is research evidence showing that L2 learners with lower English proficiency levels appear to be less sensitive to scalar implicatures than those of higher proficiency levels (e.g., Khorsheed et al., 2021). As the current L2 data was collected mainly from postgraduate students studying in the UK and undergraduate/postgraduate students in China, and a sizable number of them were studying linguistics-related subjects, future research will require more data from L2 learners who are at the earlier stages of their interlanguage.

Second, future research can be undertaken to investigate L2 learners with different L1 backgrounds. The current research investigated how L2 learners from an optional plural marking language interpret bare plurals in an obligatory plural marking language; it would be interesting to test the opposite acquisition process. For example, how L1-English speakers compute the exclusive/inclusive readings associated with *men* plurals. This will enlighten us further on the optionality of *-men* in Chinese. Second, plurality inferences are not only

associated with count nouns (multiplicity inferences in the current case) but they are also associated with mass nouns as abundance inferences in languages such as Greek and Turkish. Thus, it would also be interesting to see how L1-Chinese speakers interpret both types of inferences for Greek count and mass bare plurals. Those investigations above may further reveal the nature of plurality inferences in relation to obligatory/non-obligatory plural marking.

Lastly, it is also worth investigating how plurality and plural marking are taught in L2-English classes and thinking about how that might influence the computation of plurality by L2-English learners. For instance, future research could conduct content analysis by examining the instructions, exercises, and activities in textbooks for teaching English plurals, and further conduct consumption analysis by observing and measuring what L2 learners gain from them. This will help us better understand what may influence plurality interpretations by L2 learners.

6.4.2 FLA of scalar implicatures

In the following, I discuss four major implications for future research regarding the first language acquisition of plurality inferences and other scalar implicatures. First, previous studies in languages with obligatory plural marking explored the way how plurality inferences are derived. For example, Tieu et al. (2014) stated that plural inferences arise from "the negation of the enriched singular" (i.e., not exactly one = more than one) (p123). The findings of the current L1-Chinese study also pose an interesting question on the derivation process of plurality inferences associated with *men* plurals in Chinese. Based on Spector (2007) and van Tiel et al. (2014), we speculate that the exclusive-inclusive alternation of *men* plurals may be realised via the scale of expressions, [*one..CL..N > bare nouns > -men plurals*], shown in Figure 43.
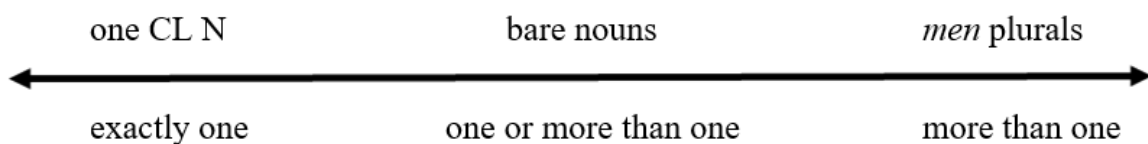

Figure 43 Scale of expressions for plurality interpretations

As shown in Figure 43, unlike English, where the comparison is made directly between plurals and singulars to derive plural inferences, bare nouns appear in the middle of the scale. They have inclusive readings and can be used to express either a plural or a singular meaning. For *men* plurals, when compared to bare nouns, they have an enriched *more than one* reading

because of the particle *men*. For singular classifier DPs, when compared to bare nouns, they have an enriched *exactly one* meaning because of the singular sortal classifier structure (i.e., *one CL*). *Men* plurals and singular classifier DPs do not directly compare to each other. A further study would elucidate the precise mechanism behind the derivation of plural inferences using this kind of scale in Chinese and its implications for cross-linguistic variation.

Second, by testing Chinese adults and children aged 4-6, the results of the current L1-Chinese study show that children of this age group are not fully able to compute scalar implicatures like adults. This finding is in line with what has been found in Zhao et al. (2021), which tested Chinese children aged 4-8 on the scalar term *you xie* (some). It is worth investigating the source of the consistent difference between child and adult performances on different types of scalar implicatures. For example, some studies considered children's ability to access alternatives (e.g., Barner, et al., 2011; Tieu et al., 2014). As for plurality inferences, children will need to learn that the singular and plural are competitors and learn to "exhaustify the alternatives" to compute plurality inferences (Tieu et al., 2014: p133). However, as discussed in the previous part, the derivation of plurality inferences may be different between English and Chinese. Therefore, future research should also take this into account when analysing the source of the different plurality interpretations shown by adults and children.

Third, the current research put forward that *yi xie* should be treated differently from mensural classifiers. One possible approach is to test them as scalar implicature expressions, as the current results of the L1 study have shown that *yi xie* tends to be similar to *men* plurals. This suggests that the readings associated with *yi xie* may appear to be scalar implicatures, as with *men* plurals. Further research could conduct empirical research to directly compare *yi xie* with scalar terms in Chinese such as *you xie* (some) and *you de* (some).

Lastly, the test items for bare nouns and mensural classifiers in the current L1-Chinese study are combined with "count nouns". In other words, the referents of the test items are all individual entities that can be separated from other individuals and can be counted directly by themselves, such as pandas and apples. But in addition to them, there are also substance-mass nouns in Chinese (e.g., *shui* (water) and *sha* (sand)). For example, the sentences in (6.1) are combined with the bare mass noun *shui* (water).

(6.1) a. Zhuozi shang you shui.

       table   on   have water

       'There is water on the table'

     → *There is a little or more than a little water on the table.*   (inclusive)

b. Zhuozi shang mei you   shui.

   table   on   not have water

   'There is no water on the table'

→ T*here is not a little or more than a little water on the table.*   (inclusive)

Both the positive sentence (6.1a) and the negative (6.1b) tend to have inclusive interpretations.

      We now turn to mensural classifiers. As mentioned in Section 2.2.3, mensural classifiers contain collective classifiers (e.g., *dui*, (pile); *qun*, (group)) and container classifiers (e.g., *wan* (bowl); *lan*, (basket)). In the current L1-Chinese study, we have tested mensural classifier constructions that combined *qun* and *lan* with count nouns. In the following, I present examples of mensural classifier constructions associated with substance-mass nouns, as shown in (6.2).

(6.2) a. yi   wan   shui

     one M-CL water

     'one bowl of water'

    → *more than one drop of water / more than a little water*   (exclusive)

  b. yi   di   shui

     one S-CL water

     'one drop of water'   (singular)

In (6.2a), the mensural classifier DP *yi wan shui* (one CL-bowl (of) water) can be interpreted with an exclusive reading. This is compared to the sortal classifier DP (6.2b) *yi di shui* (one CL-drop (of) water), yielding a singular meaning. Another example is shown in (6.3).

(6.3) a. yi dui   sha

     one M-CL sand

     'one pile of sand'

    → *more than one grain of sand / more than a little sand*   (exclusive)

  b. yi   li   sha

     one S-CL sand

     'one grain of sand'   (singular)

In (6.3a), the mensural classifier DP *yi dui sha* (one CL-pile (of) sand) can be interpreted with an exclusive reading, whereas the sortal classifier DP *yi li sha* (one CL-grain (of) sand) denotes a singular meaning.

From examples (6.2) and (6.3), we can see that singular mensural classifier DPs containing mass nouns tend to have exclusive readings compared to singular sortal classifier DPs. Future research can look to analyse them in both positive and negative sentences. In addition, empirical research has been conducted on abundance inferences associated with bare mass plurals such as in Greek (Renans et al., 2018). Parallel experiments can also be carried out with the mensural classifier DPs associated with mass nouns in Chinese as presented above.

To sum up the discussion above, future research can consider investigating the interpretations of the constructions associated with "mass nouns" in Chinese and compare them with what we found in the current L1 data. This will further shed light on the exploration of plurality and our understanding of the mass/count distinction.

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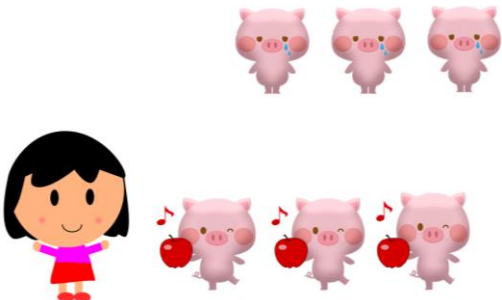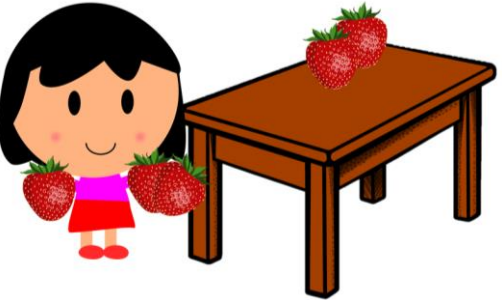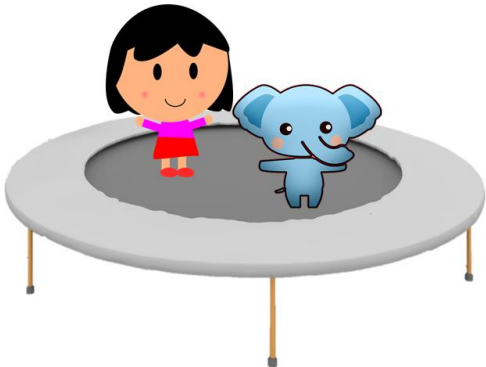
Appendix I

1. L1-Chinese TVJT[39]

Bare nouns

Singular Stories	Test Tokens
  芊芊去动物园看熊猫，可是她带的竹子不够多，所以只能喂这一只熊猫。 [Qianqian went to the zoo, but she didn't have enough bamboo, so she can only feed one panda.]	a. 芊芊喂了熊猫。 Qianqian wei le xiongmao. * "Qianqian fed panda" b. 芊芊没有喂熊猫。 Qianqian meiyou wei xiongmao. * "Qianqian didn't feed panda" c. 芊芊喂了一只熊猫。 Qianqian wei le yi zhi xiongmao. "Qianqian fed a panda" d. 芊芊没有喂一只熊猫。 Qianqian meiyou wei yi zhi xiongmao. "Qianqian didn't feed a panda"
  芊芊用梯子爬上树，只摘了这一个柠檬。[Qianqian climbed up the tree, and only picked one lemon.]	a. 芊芊摘了柠檬。 Qianqian zhai le ningmeng. * "Qianqian picked lemon' b. 芊芊没有摘柠檬。 Qianqian meiyou zhai ningmeng. * "Qianqian didn't pick lemon" c. 芊芊摘了一个柠檬。 Qianqian zhai le yi ge ningmeng. "Qianqian picked a lemon" d. 芊芊没有摘一个柠檬。 Qianqian meiyou zhai yi ge ningmeng. "Qianqian didn't pick a lemon"
  西瓜太沉了，芊芊只从桌子上拿了这一个西瓜。[Watermelons are so heavy, so Qianqian only took one watermelon.]	a. 芊芊拿了西瓜。 Qianqian na le xigua. * "Qianqian took watermelon" b. 芊芊没有拿西瓜。 Qianqian meiyou na xigua. * "Qianqian didn't take watermelon" c. 芊芊拿了一个西瓜。 Qianqian na le yi ge xigua. "Qianqian took a watermelon" 芊芊没有拿一个西瓜。 d. Qianqian meiyou na yi ge xigua. "Qianqian didn't take a watermelon"

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[39] The highlighted test tokens are target test sentences, where positive ones are marked with 'a' and negative ones are marked with 'b'. Control sentences are marked with 'c' (positive) and 'd' (negative). This applies to both L1-Chiense and L2-English tasks presented in Appendix I.

Plural stories	Test tokens
  芊芊看见一群猪，她有三个苹果，所以她喂了三只猪。[Qianqian saw a group of pigs. She had three apples, so she fed three pigs.]	a. 芊芊喂了猪。 Qianqian wei le zhu. * "Qianqian fed pig" b. 芊芊没有喂猪。 Qianqian meiyou wei zhu. * "Qianqian didn't feed pig" c. 芊芊喂了一只猪。 Qianqian wei le yi zhi zhu. "Qianqian fed a pig" d. 芊芊没有喂一只猪。 Qianqian meiyou wei yi zhi zhu. "Qianqian didn't feed a pig"
  芊芊用梯子爬上树，摘了三个橘子。[Qianqian climbed up the tree, and picked three oranges.]	a. 芊芊摘了橘子。 Qianqian zhai le juzi. * "Qianqian picked orange" b. 芊芊没有摘桔子。 Qianqian meiyou zhai juzi. * "Qianqian didn't pick orange" c. 芊芊摘了一个橘子。 Qianqian zhai le yi ge juzi. "Qianqian picked an orange" d. 芊芊没有摘一个橘子。 Qianqian meiyou zhai yi ge juzi. "Qianqian didn't pick an orange"
  芊芊非常喜欢吃草莓，所以她从桌子上拿了三个草莓。[Qianqian likes strawberries, so she took three strawberries from the table.]	a. 芊芊拿了草莓。 Qianqian na le caomei. * "Qianqian took strawberry" b. 芊芊没有拿草莓。 Qianqian meiyou na caomei. * "Qianqian didn't take strawberry" c. 芊芊拿了一个草莓。 Qianqian na le yi ge caomei. "Qianqian took a strawberry" d. 芊芊没有拿一个草莓。 Qianqian meiyou na yi ge caomei. "Qianqian didn't take a strawberry"

***Men* plurals**

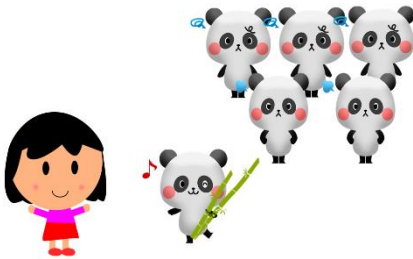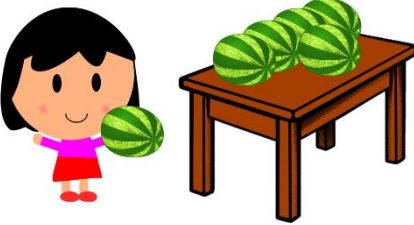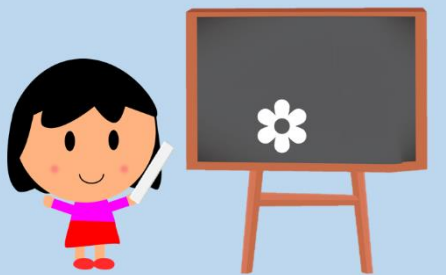| **Singular stories**	**Test tokens**
  教室里有一只小兔子，芊芊正在教它学英语。[There is a rabbit in the classroom, Qianqian is teaching this rabbit English.]	a. 芊芊在教小兔子们学英语。 Qianqian zai jiao xiaotuzi-men xue yingyu. "Qianqian is teaching (the) rabbits English" b. 芊芊没在教小兔子们学英语。 Qianqian mei zai jiao xiaotuzi-men xue yingyu. "Qianqian isn't teaching (the) rabbits English" c. 芊芊在教一只小兔子学英语。 Qianqian zai jiao yi zhi xiaotuzi xue yingyu. "Qianqian is teaching a rabbit English" d. 芊芊没在教一只小兔子学英语。 Qianqian mei zai jiao yi zhi xiaotuzi xue yingyu. "Qianqian isn't teaching a rabbit English"
  公园里，芊芊看到一只小鸟在树上唱歌。 [In the park, Qianqian saw one bird singing on the tree.]	a. 树上有小鸟们在唱歌。 Shu shang you xiaoniao-men zai changge. "(The) birds are singing on the tree" b. 树上没有小鸟们在唱歌。 Shu shang meiyou xiaoniao-men zai changge. "There are no birds singing on the tree" c. 树上有一只小鸟在唱歌。 Shu shang you yi zhi xiaoniao zai changge. "A bird is singing on the tree" d. 树上没有一只小鸟在唱歌。 Shu shang meiyou yi zhi xiaoniao zai changge. "There isn't a bird singing on the tree"
  芊芊今天去了游乐场，她现在正在和一只小象在蹦床上跳。[Qianqian comes to the playground today, now she is jumping with one elephant on the trampoline.]	a. 芊芊在和小象们在蹦床上跳。 Qianqian zai he xiaoxiang-men zai bengchuang shang tiao. "Qianqian is jumping with (the) elephants on the trampoline" b. 芊芊没在和小象们在蹦床上跳。 Qianqian mei zai he xiaoxiang-men zai bengchuang shang tiao. "Qianqian is not jumping with (the) elephants on the trampoline" c. 芊芊在和一只小象在蹦床上跳。 Qianqian zai he yi zhi xiaoxiang zai bengchuang shang tiao. "Qianqian is jumping with an elephant on the trampoline" d. 芊芊没在和一只小象在蹦床上跳。 Qianqian mei zai he yi zhi xiaoxiang zai bengchuang shang tiao. "Qianqian is not jumping with an elephant on the trampoline"

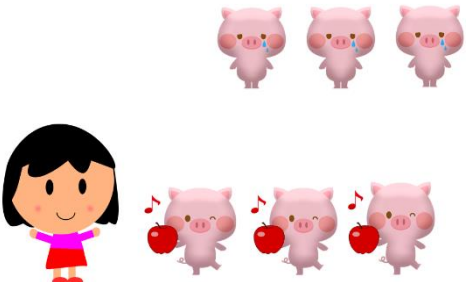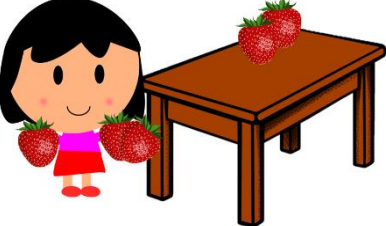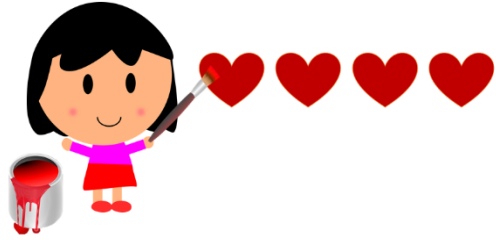| Plural stories	Test tokens
  教室里有三只小熊，芊芊正在教它们学英语。[There are three bears in the classroom. Qianqian is teaching them English.]	a. 芊芊在教小熊们学英语。 Qianqian zai jiao xiaoxiong-men xue yingyu. "Qianqian is teaching (the) bears English" b. 芊芊没在教小熊们学英语。 Qianqian mei zai jiao xiaoxiong-men xue yingyu. "Qianqian isn't teaching (the) bears English" c. 芊芊在教一只小熊学英语。 Qianqian zai jiao yi zhi xiaoxiong xue yingyu. "Qianqian is teaching a bear English" d. 芊芊没在教一只小熊学英语。 Qianqian mei zai jiao yi zhi xiaoxiong xue yingyu. "Qianqian isn't teaching a bear English"
  芊芊看见树下有两只小蜜蜂，它们正在唱歌。[Qianqian saw two bees under the tree. They are singing.]	a. 树下有小蜜蜂们在唱歌。 Shu xia you xiaomifeng-men zai changge. "(The) little bees are singing under the tree" b. 树下没有小蜜蜂们在唱歌。 Shu xia meiyou xiaomifeng-men zai changge. "There are no bees singing under the tree" c. 树下有一只小蜜蜂在唱歌。 Shu xia you yi zhi xiaomifeng zai changge. "There is a bee is singing under the tree" d. 树下没有一只小蜜蜂在唱歌。 Shu xia meiyou yi zhi xiaomifeng zai changge. "There isn't a bee singing under the tree"
  芊芊遇见了三只小鹿，她现在正在和它们一起在蹦床上跳。[Qianqian met three deers, now she is jumping with them on the trampoline.]	a. 芊芊在和小鹿们在蹦床上跳。 Qianqian zai he xiaolu-men zai bengchuang shang tiao. "Qianqian is jumping with (the) deers on the trampoline" b. 芊芊没在和小鹿们在蹦床上跳。 Qianqian mei zai he xiaolu-men zai bengchuang shang tiao. "Qianqian is not jumping with (the) deers on the trampoline" c. 芊芊在和一只小鹿在蹦床上跳。 Qianqian zai he yi zhi xiaolu zai bengchuang shang tiao. "Qianqian is jumping with a deer on the trampoline" d. 芊芊没在和一只小鹿在蹦床上跳。 Qianqian mei zai he yi zhi xiaolu zai bengchuang shang tiao. "Qianqian is not jumping with a deer on the trampoline"

Mensural classifiers

Singular stories	Test tokens
  芊芊去小鸭子家做客，她现在正在和这只小鸭子跳舞。[Qianqian is visiting the duck, now she is dancing with this duck.]	a. 芊芊在和一群小鸭子跳舞。 Qianqian zai he yi qun xiaoyazi tiaowu. * "Qianqian is dancing with one group duck" b. 芊芊没在和一群小鸭子跳舞。 Qianqian mei zai he yi qun xiaoyazi tiaowu. *"Qianqian is not dancing with one group duck" c. 芊芊在和一只小鸭子跳舞。 Qianqian zai he yi zhi xiaoyazi tiaowu. "Qianqian is dancing with a duck" d. 芊芊没在和一只小鸭子跳舞。 Qianqian mei zai he yi zhi xiaoyazi tiaowu. "Qianqian is not dancing with a duck"
  芊芊在回家的路上买了许多橘子，可是她一不小心，掉了一个橘子。[Qianqian bought a lot of oranges on her way home, but she dropped one by mistake.]	a. 芊芊掉了一篮橘子。 Qianqian diao le yi lan juzi. * "Qianqian dropped a basket orange" b. 芊芊没有掉一蓝橘子。 Qianqian meiyou diao yi lan juzi. * "Qianqian didn't drop a basket orange" c. 芊芊掉了一个橘子。 Qianqian diao le yi ge juzi. "Qianqian dropped an orange" d. 芊芊没有掉一个橘子。 Qianqian meiyou diao yi ge juzi. "Qianqian didn't drop an orange"
  芊芊是一名宇航员，在太空中，她看见一个火箭。[Qianqian is an astronaut. In space, she saw one rocket.]	a. 芊芊看见一些火箭。 Qianqian kanjian le yi xie huojian. * "Qianqian saw some rocket" b. 芊芊没有看见一些火箭。 Qianqian meiyou kanjian yi xie huojian. "Qianqian didn't see some rockets" c.芊芊看见一个火箭。 Qianqian kanjian le yi ge huojian. "Qianqian saw a rocket" d. 芊芊没看见一个火箭。 Qianqian meiyou kanjian yi ge huojian. "Qianqian didn't see a rocket"

187

Plural stories	Test tokens
 芊芊遇见了五只小熊，现在她正在和它们一起跳舞。[Qianqian met five bears. Now she is dancing with them.]	a. 芊芊在和一群小熊跳舞。 Qianqian zai he yi qun xiaoxiong tiaowu. * "Qianqian is dancing with one group bear" b. 芊芊没在和一群小熊跳舞。 Qianqian mei zai he yi qun xiaoxiong tiaowu. * "Qianqian is not dancing with one group bear" c. 芊芊在和一只小熊跳舞。 Qianqian zai he yi zhi xiaoxiong tiaowu. "Qianqian is dancing with a little bear" d. 芊芊没在和一只小熊跳舞。 Qianqian mei zai he yi zhi xiaoxiong tiaowu. "Qianqian is not dancing with a bear"
 芊芊买了许多苹果。可是她一不小心，把所有的苹果都掉在了地上。[Qianqian bought a lot of apples, but she dropped all the apples by mistake.]	a. 芊芊掉了一篮苹果。 Qianqian diao le yi lan pingguo. * "Qianqian dropped a basket apple" b. 芊芊没有掉一篮苹果。 Qianqian meiyou diao yi lan pingguo. * "Qianqian didn't drop a basket apple" c. 芊芊掉了一个苹果。 Qianqian diao le yi ge pingguo. "Qianqian dropped an apple" d. 芊芊没有掉一个苹果。 Qianqian meiyou diao yi ge pingguo. "Qianqian didn't drop an apple"
 芊芊有四个瓶子，她把它们都放在了架子上，现在架子上有四个瓶子。 [Qianqian has four bottles and she put them all on the shelf. Now there are four bottles on the shelf.]	a. 架子上有一些瓶子。 Jiazi shang you yi xie pingzi. * "There are some bottle on the shelf" b. 架子上没有一些瓶子。 Jiazi shang meiyou yi xie pingzi. "There are not some bottles on the shelf" c. 架子上有一个瓶子。 Jiazi shang you yi ge pingzi. "There is a bottle on the shelf" d. 架子上没有一个瓶子。 Jiazi shang meiyou yi ge pingzi. "There is not a bottle on the shelf"

2. L2-English TVJT

Singular stories		Test tokens
	Emily went to the zoo, but she didn't have enough bamboo, so she only fed one panda.	a. Emily fed pandas. b. Emily didn't feed pandas. c. Emily fed a panda. d. Emily didn't feed a panda.
	Emily climbed up the tree and picked one lemon.	a. Emily picked lemons. b. Emily didn't pick lemons. c. Emily picked a lemon. d. Emily didn't pick a lemon.
	The watermelons are very heavy, so Emily only took one watermelon from the table.	a. Emily took watermelons. b. Emily didn't take watermelons. c. Emily took a watermelon. d. Emily didn't take a watermelon.
	Emily doesn't have enough blue paint, so she only painted one star.	a. Emily painted stars. b. Emily didn't paint stars. c. Emily painted a star. d. Emily didn't paint a star.
	Emily bought some oranges on her way home, but she dropped one by accident.	a. Emily dropped oranges. b. Emily didn't drop oranges. c. Emily dropped an orange. d. Emily didn't drop an orange.
	Emily likes to draw. She drew one flower.	a. Emily drew flowers. b. Emily didn't draw flowers. c. Emily drew a flower. d. Emily didn't draw a flower.

Plural stories	Test tokens
Emily had some apples, so she fed three pigs.	a. Emily fed pigs. b. Emily didn't feed pigs. c. Emily fed a pig. d. Emily didn't feed a pig.
Emily climbed up the tree and picked three oranges.	a. Emily picked oranges. b. Emily didn't pick oranges. c. Emily picked an orange d. Emily didn't pick an orange.
Emily really likes strawberries, so she took three strawberries from the table.	a. Emily took strawberries. b. Emily didn't take strawberries. c. Emily took a strawberry. d. Emily didn't take a strawberry.
Emily had enough red paint, so she painted four hearts.	a. Emily painted hearts. b. Emily didn't paint hearts. c. Emily painted a heart. d. Emily didn't paint a heart.
Emily was carrying a basket of apples. But she is very clumsy and dropped them all.	a. Emily dropped apples. b. Emily didn't drop apples. c. Emily dropped an apple. d. Emily didn't drop an apple.
Emily likes to draw. She drew three trees.	a. Emily drew trees. b. Emily didn't draw trees. c. Emily drew a tree. d. Emily didn't draw a tree.

Appendix II

1. Language background survey for L1-Chinese children

语言背景问卷(儿童)

请您依照问题标出与**您的孩子**实际情况相符的选项，并按要求将答案补充完整。

1. 年龄：_____

2. 出生地（省、市）：_____

3. 除了汉语外，您的孩子目前是否还在学习外语？如果是，请说明哪（几）种语言。

4. 如果您的孩子正在学习外语，请具体说明其学习情况。

总学习时长（比如，一个月，半年等）：
每周上课时长：
每周自主学习时长：

5. 在正常情况下，您孩子每天使用每种语言所占的比例大约是（请列出并标出数字）：

普通话： ☐ 小于 25% ☐ 25% ☐ 50% ☐ 75% ☐ 100%

_____： ☐ 小于 25% ☐ 25% ☐ 50% ☐ 75% ☐ 100%

_____： ☐ 小于 25% ☐ 25% ☐ 50% ☐ 75% ☐ 100%

_____： ☐ 小于 25% ☐ 25% ☐ 50% ☐ 75% ☐ 100%

6. 关于您孩子的语言背景和语言学习情况，您有其他想告知我们的吗？

2. Language background survey for L1-Chinese adults

语言背景问卷

请您依照问题标出与您实际情况相符的选项，并按要求将您的答案补充完整。

1. 您的年龄：_____

2. 您的出生地:

   ☐ 中国

   ☐ 其他:_____

3. 您的母语：

   ☐ 中文

   ☐ 其他:_____

4. 除了上述语言外，您还使用哪门语言并且达到母语水平？_____

5. 如果中文是您的母语，请问您来自哪个省／自治区／直辖市／特别行政区?

   ☐ _____

6. 您所使用的方言是：

   ☐ _____

   ☐ 我不使用方言

7. 在正常情况下，您每天使用每种语言或方言所占的比例是（请列出并标出数字）：

普通话：☐ 小于25%   ☐ 25%   ☐ 50%   ☐ 75%   ☐ 100%

_____：☐ 小于25%   ☐ 25%   ☐ 50%   ☐ 75%   ☐ 100%

_____：☐ 小于25%   ☐ 25%   ☐ 50%   ☐ 75%   ☐ 100%

_____：☐ 小于25%   ☐ 25%   ☐ 50%   ☐ 75%   ☐ 100%

8. 关于您的语言背景，您有其他重要的或想告知我们的吗？

3. Language background survey for L2-English adults

Language Background Survey

Please tick the box, and write down your answer on the line if required.

1. Your Age (in years): _____

2. Your Country of Origin:

☐ China

☐ Other: _____

3. Your Native Language (the language you have been exposed to from birth):

☐ Chinese

☐ Other: _____

4. Apart from the language you mentioned above, are you able to use another language/ other languages **equally well on a day-to-day basis**?

☐ Yes, and it is / they are _____

☐ No

5. If you are a native Chinese speaker, which province/ area are you from?

☐ _____

6. What dialects of Chinese do you use? (If you use more than one dialect, please write all of them down.)

☐ _____

☐ I don't speak any dialect.

(A dialect, also known as '方言', refers to a variety of a language that is spoken in one area with grammar, words, and pronunciation that may be different from other forms of the same language. For example, Yue/ Cantonese, Shanghainese, and Shandong-hua.)

7. Have you been to any other English-speaking countries (e.g., America, Canada, Australia, New Zealand), how long have you stayed there, and for what purposes (e.g. study, traveling, etc)?

☐ No, I haven't been to any other English-speaking countries.

☐ Yes, I stayed in _____ (the place) for _____(years/ months), for the purpose of study/traveling/others, _____(please specify).

If you have more than one visit, please write down here following the format above:

8. In a typical day, which languages/ dialects of Chinese do you use at what percent?

Mandarin Chinese (普通话): ☐less than 25%   ☐25%   ☐50%   ☐75%   ☐100%

English :   ☐less than 25%   ☐25%   ☐50%   ☐75%   ☐100%

Your dialect: ☐less than 25%   ☐25%   ☐50%   ☐75%   ☐100%

_____: ☐less than 25%   ☐25%   ☐50%   ☐75%   ☐100%

_____: ☐less than 25%   ☐25%   ☐50%   ☐75%   ☐100%

9. Is there anything else that you feel is interesting or important about your language background that you'd like me to know?

4. Language background survey for L1-English adults

Language Background Survey

Please tick the box, and write down your answer on the line if required.

1. Your Age (in years): _____

2. Your Country of Origin:

☐ UK

☐ Other: _____

3. Your Native Language (the language you have been exposed to from birth):

☐ English

☐ Other: _____

4. Apart from the language you mentioned above, are you able to use another language/ other languages **equally well on a day-to-day basis**?

☐ Yes, and it is / they are _____

☐ No

Appendix III

1. Chinese information sheet

实验信息告知书

感谢您对本研究的关注。本实验信息告知书讲向您介绍此次实验的主题、目的、步骤，以及其他相关信息，请您仔细阅读后做出是否参与此次实验的决定。如果您有关于本研究的任何问题，请您随时询问研究员。

1．研究课题:
中文作为母语的第一语言习得研究

2．　实验目的:
此次实验将探寻以中文作为母语的成年人和儿童，如何学习和使用普通话。此次实验的结果将被用于研究员完成其应用语言学博士论文，以及相关论文的撰写与发表。

3．　为什么我被邀请参与此次实验?
因为您作为中文使用者符合该项研究的入组条件。

4．　我必须要参加此次实验吗?
您可以决定是否参与此次实验。如果您自愿参与此次实验，研究员将向您提供知情同意书并请您在知情同意书上签字。在实验过程中，您可以随时选择退出此项实验。在实验后三个工作日以内，您仍可告知研究员退出此项实验。此期限过后，您在实验中所提供的数据将会被匿名收录于数据库中，届时您将无法退出此项实验。

5．　在同意参加此次实验后，我需要做什么?
如果您是成年人，在正式实验之前，您将会填写一份语言背景调查表，此项调查将花费您 3 至 5 分钟。在正式实验中，您将观看一些动画，在观看后，您将根据动画中的故事判断您听到的句子是否正确。正式实验将耗时约 45 分钟。

如果实验参与者是儿童，您将代替被监护人完成一份语言背景调查表，此项调查将花费您 3 至 5 分钟。您的被监护人将在其幼儿园老师的帮助下完成此项实验。在正式实验中，您的被监护人将观看一些动画，在观看后，您的被监护人将根据动画中的故事判断其听到的句子是否正确。正式实验将耗时约 45 分钟。

6.　　在实验后，我所提供的数据将被如何处理和使用?

您所提供的答案将以编码的形式进行处理，并将与其他答案一起组成实验组用于研究，所以您的数据不会做为个体被单独识别出。所有的问卷将会被妥善保管，并将在研究员完成其博士毕业论文以及相关论文发表后被销毁。

7.　　谁是此项研究的数据控制员?

谢菲尔德大学（*The University of Sheffield*）。

8.　　参加此次实验有何风险?

此次实验对您没有任何风险。您在实验中所提供的数据不会用于此项研究之外的任何目的。您的姓名以及其他个人信息将会被严格保密，并且不会在任何报告或发表中被识别。您在实验中所提供的数据不会做为您成绩的衡量和个人学业的参考。

9.　　参加此次实验有何收益?

您的参与会为一语习得研究提供宝贵的数据，这能帮助其他语言学习者们更好的掌握和使用中文甚至其他语言。另外， 在完成此次实验后，您将收到来自研究员的小礼物。

10.　　对于实验数据的使用和处理，此项研究的法律依据是什么?

参考 Article 6(1)(e)：'processing is necessary for the performance of a task carried out in the public interest'。更多信息请参见:
https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

11.　　谁对此项研究进行了伦理审核?

经谢菲尔德大学英语学院（*School of English*）的审核，此项研究通过了谢菲尔德大学实验伦理审核程序（*The University of Sheffield's Ethics Review Procedure*）。

12.　　如果实验中发生了预期外的状况，我可以向谁求助?

如果实验中出现任何问题，您可以随时向研究员寻求帮助；如果您对处理结果不满意，您可以联系谢菲尔德大学英语学院。如果您认为您的权益受到了严重侵犯，您可以直接联系研究员的导师，或者谢菲尔德大学英语学院的院长。具体信息请参见:
https://www.sheffield.ac.uk/govern/data-protection/privacy/general

联系方式
项目负责人: 刘艺　　　　　邮箱: yliu183@sheffield.ac.uk
导师: Dr. Kook-Hee Gil　　　邮箱: k.gil@sheffield.ac.uk
地址: School of English, Jessop West, 1 Upper Hanover Street, Sheffield, S3 7RA, UK

感谢您对此项研究的关注与支持 ：）

2. Chinese consent form (children)

知情同意书

请在对应回答下打勾	是	否
关于参与本实验		
作为此项实验参与者的监护人，我已经阅读并向被监护人解释实验信息告知书中的相关内容，我同意被监护人自愿参与本次实验。		
我已被告知我可以就本次实验提出问题，我已知晓并向被监护人解释其可以在实验进行中或实验后三个工作日以内向研究员告知退出此项研究，我以及被监护人不需要提供理由，我以及被监护人不用承担任何后果。		
关于个人信息		
我已知晓实验参与者个人信息不会被用于此项研究之外的任何目的。我知晓并且同意被监护人在实验中所提供的数据将会用于研究报告书写以及论文发表等。我知晓并且同意本监护人在此项研究中的数据将被储存于保密文件以作研究使用。		

监护人签名　日期

研究员签名　日期

联系方式:
项目负责人: 刘艺　　　　邮箱: yliu183@sheffield.ac.uk
导师: Dr. Kook-Hee Gil　邮箱: k.gil@sheffield.ac.uk

地址: School of English, Jessop West, 1 Upper Hanover Street, Sheffield, S3 7RA, UK

3. Chinese consent form (adults)

知情同意书

请在对应回答下打勾	是	否
关于参与本实验		
我已经阅读实验信息告知书，并自愿参与本次实验。		
我已被告知我可以就本次实验提出问题，我已知晓我可以在实验进行中或实验后三个工作日以内向研究员告知退出此项研究，我不需要提供理由，我不用承担任何后果。		
关于个人信息		
我已知晓我的个人信息不会被用于此项研究之外的任何目的。我知晓并且同意我在实验中所提供的数据将会用于研究报告书写以及论文发表等。我知晓并且同意我在此项研究中的数据将被储存于保密文件以作研究使用。		

参与者签名　日期

研究员签名　日期

联系方式

项目负责人: 刘艺　　　邮箱: yliu183@sheffield.ac.uk

导师: Dr. Kook-Hee Gil　邮箱: k.gil@sheffield.ac.uk

地址: School of English, Jessop West, 1 Upper Hanover Street, Sheffield, S3 7RA, UK

4. English information sheet

Participant Information Sheet

1. Research Project Title:
Second Language Acquisition of English by native Chinese Speakers who learn English as a Foreign or Second Language

2. Invitation paragraph
You are being invited to take part in a research project. Before you decide whether or not to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

3. What is the project's purpose?
The test that we ask you to complete is part of the main experiment of my thesis for a PhD in English Language and Linguistics. It investigates how native Chinese learners who learn English as a foreign/second language acquire English knowledge. The study will be carried out from ___ to ____.

4. Why have I been chosen?
You have been chosen because you are either a native Chinese speaker who is learning English as a foreign/ second language or you are a native speaker of English.

5. Do I have to take part?
It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time during the test. You do not have to give a reason. If you wish to withdraw from the research after the test is done, please contact the lead researcher within 3 working days. After this date, your responses cannot be removed from the study, because it would have been anonymised and included within a large dataset.

6. What will happen to me if I take part? What do I have to do?
If you decide to participate in the test, the test paper will be distributed by hand to you. You will need to listen to a series of short stories with animation. Then you will be asked to rate the test sentences on the test paper according to the stores. The test should take you no longer than 45 mins.

7. What are the possible disadvantages and risks of taking part?
There are no potential risks for physical or psychological harm or distress to you for taking part in the test.

8. What are the possible benefits of taking part?

Whilst there are no immediate benefits for the participants participating in the project, it is hoped that this research will help in understanding how Chinese speakers learn English.

9. Will my taking part in this project be kept confidential?

All the information that we collect about you during the research will be kept strictly confidential and will only be accessible to the lead researcher. You will not be able to be identified in any reports or publications.

10. What is the legal basis for processing my personal data?

According to data protection legislation, we are required to inform you that the legal basis we are applying in order to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). Further information can be found in the University's Privacy Notice https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

11. What will happen to the data collected, and the results of the research project?

Your answers will be analysed and reported as a group result alongside the responses of other participants. The responses will be coded in a way that you will not be identifiable in any reports or publications. The response sheets collected by e-mail will be anonymously stored in an encrypted folder and an encrypted USB drive. The response sheets collected by paper copy will be anonymously stored securely by the researcher through the relevant security processes. The collected responses will be incorporated into my PhD thesis and may be used in further research and possibly publication. The responses sheets will be destroyed after the entire research for my PhD and further research is done.

12. Who is the Data Controller?

The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.

13. Who has ethically reviewed the project?

This project has been ethically approved via the University of Sheffield's Ethics Review Procedure, as administered by School of English.

14. What if something goes wrong and I wish to complain about the research?

For normal complaints the lead researcher will act as the first point of call for redress, and if their resolutions are unsatisfactory the complaint will be escalated to a member of the department of the School of English. For serious complaints, please contact the supervisor of the research, or the head of department of the School of English directly. if your complaint is related to the handling of your personal data, please refer to the University's Privacy Notice: https://www.sheffield.ac.uk/govern/data-protection/privacy/general and follow the complaints procedure outlined there.

15. Contact for further information:
Lead Researcher: Yi Liu   E-mail: yliu183@sheffield.ac.uk
Supervisor: Kook-Hee Gil   E-mail: k.gil@sheffield.ac.uk
Address: School of English, Jessop West, 1 Upper Hanover Street, Sheffield, S3 7RA, UK

You will be given a copy of the information sheet and a signed consent form to keep.
Thank you for taking part in the project.

5. English consent form

Consent Form

Please tick the appropriate boxes	Yes	No
Taking Part in the Project		
I have read and understood the project information sheet dated ___/___/ ___ or the project has been fully explained to me. (If you will answer No to this question please do not proceed with this consent form until you are fully aware of what your participation in the project will mean.)		
I have been given the opportunity to ask questions about the project.		
I agree to take part in the project. I understand that taking part in the project will include completing a task and a language background survey.		
I understand that my taking part is voluntary and that I can withdraw from the experiment at any time; I do not have to give any reasons for why I no longer want to take part and there will be no adverse consequences if I choose to withdraw. I understand if I want to withdraw from the research after the test is done, I need to contact the lead researcher within 3 working days.		
How my information will be used during and after the project		
I understand my personal details will not be revealed to people outside the project.		
I understand and agree that my words may be quoted in publications, reports, web pages, and other research outputs. I understand that I will not be named in these outputs unless I specifically request this.		
I understand and agree that other authorised researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.		
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.		
I give permission for my responses and explanations to the test paper that I provide to be deposited in Google Drive, an encrypted folder, and a securely locked physical folder, so it can be used for future research and learning.		
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.		

Name of Participant   Signature   Date

Name of Researcher   Signature   Date

Project contact details for further information:
Lead Researcher: Yi Liu   E-mail: yliu183@sheffield.ac.uk
Supervisor: Kook-Hee Gil   E-mail: k.gil@sheffield.ac.uk

Address: School of English, Jessop West, 1 Upper Hanover Street, Sheffield, S3 7RA, UK

Appendix IV Cloze test for Chinese EFL/ESL participants

Please fill in the blanks in the following passage. Each blank must have one and only one word.

Joe came home from work on Friday. It was payday, but he wasn't _too_ excited about it. He knew that _when_ he sat down and paid his _bills_ and set aside money for groceries, _some_ for the car and a small _amount_ in his savings account, there wasn't _too_ much left over for a good _time_.

He thought about going out for _dinner_ at his favourite restaurant, but he _just_ wasn't in the mood. He wandered _about_ his apartment and ate a sandwich. _For_ a while, he couldn't stop himself _from_ worrying about the money situation. Finally, _he_ got into his car and started _driving_. He didn't have a destination in _mind_, but he knew that he wanted _to_ be far away from the city _where_ he lived.

He drove onto a quiet country _road_. The country sights made him feel _good_. His mind wandered as he drove _along_ small farms and he began to _imagine_ living on his own piece of _land_ and becoming self-sufficient. It had always _been_ a dream of his, but he _had_ never done anything to make it _a_ reality. Even as he was thinking, _his_ logical side was scoffing at his _wild_ imaginings. He debated the advantages and _disadvantages_ of living in the country and _growing_ his own food. He imagined his _farmhouse_ equipped with a solar energy panel _on_ the roof to heat the house _in_ winter and power a water heater. _He_ envisioned fields of vegetables for canning _and_ preserving to last through the winter. _If_ the crops had a good yield, _then_ he could sell the surplus and _buy_ some farming equipment with the extra _cash_.

Suddenly, Joe stopped thinking and laughed _out_ loud, "I'm really going to go _ahead_ with all this?"

(Extracted from Slabakova, 2000)