**Null and Overt Pronoun Interpretation in L2 Mandarin Resultative Constructions**

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Abstract:

This experimental study examines the acquisition of null and overt pronoun interpretations in Chinese as a second language by native speakers of English. A linguistic phenomenon not present in the native language of the learners is identified: the null element in the embedded subject position of Mandarin resultative constructions can only refer to the main-clause subject, while an overt pronoun in the same position can refer both to the main-clause subject and to another entity in the discourse. Thus the acquisition task includes learning a new functional morpheme, a null element, as well as constraining its interpretation in the resultative construction. We tested 59 L2 learners of Chinese at different proficiency levels and 51 native Mandarin speakers on a truth value judgment task. The learners showed a pattern of interpretation that was statistically indistinguishable from the native speakers’ in all but one context. We argue that our findings point to largely successful acquisition of the requisite proform interpretations, even though the restrictions on the interpretation of null elements cannot be transferred from the native language.

Keywords: pronoun interpretation, adult second language acquisition, null elements, reference, Mandarin as a second language.

**1. Introduction**

The core acquisition task of second language (L2) learners is to acquire the grammatical features of the new language and how they are conveyed through functional morphology. For instance, the meaning of past event is morphologically expressed by the -*ed* morpheme (in the case of regular verbs in English), hence it is possible to map the meaning onto the form. However, not all form–meaning mappings are transparent and possible to acquire based on positive evidence alone. Sometimes, language learners are faced with learning situations where a certain grammatical morpheme can have multiple meanings. Pronouns, for example, can refer to multiple antecedents mentioned in the sentence and in the discourse. The pronoun *she* in (1) can refer to the main clause subject *Jane*, the dative object *Mary,* or someone else known to the speaker and hearer.

(1) Janei explained to Maryj why **she**i/j/k was wrong.

The learning task in those cases becomes considerably more difficult, as learners have to map various contextual situations exemplifying different referents onto a single linguistic form. An even more challenging situation is presented when a null morpheme, or a phonetically empty form, has multiple meanings, and particularly when a null morpheme is not paired with such meanings in the L1 grammar.

Two major positions in generative L2 acquisition research predict different behavior in such difficult learning situations. The Representational Deficit position, including the Failed Functional Features Hypothesis of Hawkins and Chan (1997) and the Interpretability Hypothesis of Tsimpli and Dimitrakopoulou (2007), posits partial access to Universal Grammar, hence it predicts that linguistic contrasts not available through the native grammar are impossible to acquire. The Full Functional Representation position, including the Full Transfer Full Access Hypothesis (Schwarz & Sprouse, 1996) and the Missing Surface Inflection Hypothesis (Prévost & White, 2000), on the other hand, predicts that linguistic contrasts not transferrable from the native grammar are in principle acquirable, if there is evidence for them in the input.

In this article, we investigate the interpretations of null and overt pronouns in Mandarin Chinese resultative constructions by native Mandarin and native English speakers. These null elements and full pronouns appear in the embedded subject position of Mandarin resultative sentences.[[1]](#endnote-1) We build on Zhao’s (2012) investigation of null element reference in complex non-resultative sentences. Null elements in embedded subject position can refer either to the matrix subject or someone else mentioned in the discourse, as the non-resultative example in (2) illustrates. Compared to the null subject in (2), the null subject in the resultative sentence in (3) has a narrower reading: it can only refer to the main clause subject *Zhangsan*. We call this meaning a “coreferential reading.” Thus, there is a reduction of available interpretations for a null morpheme that the learners cannot transfer from their native language in the first place. To be concrete, as English does not allow null pronouns in embedded clauses, learners cannot transfer the use of a null pronoun with its accompanying interpretations.

(2) Zhangsani shuo Øi/j qu guo lundun.

Zhangsan say go PERF London

‘Zhangsan said that he (Zhangsan or someone else) has been to London.

(3) Zhangsani chang de Øi/\*j ku qilai le.

Zhangsan sing DE begin.to.cry LE

‘Zhangsan sang and as a result Zhangsan began to cry.’

Furthermore, we submit that the acquisition of the correct interpretations of the resulative structures as in (3) represents what generative approaches to acquisition term a ‘Poverty of the Stimulus’ (PoS) learning situation (Chomsky, 1978), where knowledge of correct interpretation cannot come from direct form–meaning mapping but has to come from structural acquisition of a system of grammatical representations (Schwartz & Sprouse, 2013). The PoS issue here is that there is no positive evidence in the input which tells the learners that the null element’s disjoint reading is *not* allowed in (3). Furthermore, they cannot rely on statistical learning, or a powerful observation and tracking of the second language input (e.g., Ellis & Wulff, 2020): even if learners are somehow able to pair a certain meaning with a null form (in this case, a coreferential reading), there is still nothing explicit in the input that would lead them to categorically rule out pairing a disjoint reading with this null form.[[2]](#endnote-2)

The acquisition task is further complicated by the fact that a disjoint reading of a null element in non-resultative embedded clauses is possible, as in (2), and there is positive evidence in the input for this reading. As there is no transfer from English possible, the L2 task is therefore the same as the native Chinese speakers had when they learned their native language (L1). At issue is whether this distinction can be learned in an L2, which a Full Functional Representation position would predict.

On the other hand, the overt pronoun *ta* in (4), also a resultative sentence, can purportedly only refer to someone else in the discourse but not *Zhangsan* (Huang J., 1992, Huang Y., 1994, Shibata & Yashima, 2014). Wedesignate this as the “disjoint reading*.*”It appears that the coreferential reading of the overt pronoun *ta* is somehow blocked.[[3]](#endnote-3)

(4) Zhangsani chang de ta\*i/j ku qilai le.

Zhangsan sing DE he begin.to.cry LE

‘Zhangsan sang and as a result he(someone else but not Zhangsan)began to cry.’

In this article, knowledge of null element referential choices as in (3) will be compared to overt pronoun referential meanings as in (4). Since English, the native language of the learners is not a null subject language, the Representational Deficit position would predict that acquiring the subtle choices of the null element in L2 Mandarin will be impossible. That same position also anticipates difficulties in overt pronoun interpretation, due to the blocking in the L2 of one meaning available from the native language. In contrast, the Full Functional Representation position expects that although difficult, the constructions and their interpetations are learnable.

In the next section, we elaborate on the syntactic analyses reported in the literature and describe an experimental study on Chinese-learning children’s interpretations (Shibata & Yashima, 2014). We provide an analysis of the Mandarin resultative construction reflecting the published accounts in the literature, as well as a comparison of Mandarin resultative clauses with English ones. These accounts become the basis of our predictions for learner behavior. We describe Experiment 1, which tested the interpretation of a large group of Mandarin native speakers. To anticipate the results of Experiment 1, our control group of Mandarin native speakers did allow a disjoint reading of *ta* in (4); however, they also allowed a coreferential reading of *ta*, contrary to the claims in the literature. In fact, the coreferential reading turned out to be the preferred reading. In Experiment 2, we used the same task with English-native learners of Mandarin, whose interpretations showed a largely similar pattern as the native speaker interpretations. We discuss our findings from the viewpoint of acquiring the constrained interpretation of a null element not available in the native language and crosslinguistic influence in general.

**2. Native Interpretation of Mandarin Resultatives**

**2.1 Previous syntactic analyses**

One way for Mandarin to express a resultative action is through the V-*de* resultative construction as exemplified in (3) – (4).[[4]](#endnote-4) The resultative meaning stems from the combination of the action verb and the particle *de.* Mandarin V-*de* constructions with unergative verbs have been analyzed as bi-clausal structures (Huang 1988, 1989, 1992; Li 1999, 2005; Tang 1997; Zhang 2001; cf. Huang 2006). It has been generally agreed that the null element in (3) is the subject of the embedded clause. The obligatory coreferential reading of the null element has been attributed to its status as *pro* (Huang 1988, 1989; Li, 1999, 2005) or PRO (Shibata & Yashima, 2014). As such, the embedded null subject in (3) is controlled by the matrix subject as the closest nominal element.

However, Zhao (2008, 2012) argues that null subjects of finite sentences in Mandarin cannot be analyzed as null pronouns. They are products of two deletion processes: either the deletion of the bare reflexive *ziji*, hence the type of null element is Øziji, or a topic deletion, hence ØTopic. Why are the two null element interpretations in (2) and (3) different? Zhao (2012) argues that both Øziji and ØTopic are allowed in the embedded subject position of the complex sentence in (2), leading to coreferential and disjoint readings, respectively. With its phi-features valued by the matrix subject, Øziji is referentially dependent on the matrix subject. *Lisi* in the embedded subject position can be topicalised as in (5) below. ØTopic is derived when the embedded subject, *Lisi* in (5) below, gets topicalised and subsequently deleted under identity with the topic of the preceding sentences in line with the Topic NP Deletion Rule.

(5) ~~Lisi~~, Zhangsan shuo ~~Lisi~~ qu guo Lundun.

Lisi Zhangsan say go PERF London

‘~~Lisi~~, Zhangsan said that he (Lisi) has been to London.’

Assuming this analysis, we check whether the disjoint reading is allowed for the null subject in (3); in other words, if ØTopic is allowed in that position. The derivation of ØTopic takes topicalization and the Topic NP Deletion Rule as preconditions (Huang 1982, 1984, Tsao 1977); however, the embedded subject cannot be topicalized in V-*de* structures (cf. Huang 1992), as shown in (6):[[5]](#endnote-5)

(6) \*Lisi, Zhangsan ku de ~~Lisi~~ hen shangxin.

Lisi Zhangsan cry DE very sad

‘As for Lisi, Zhangsan cried and as a result he was very sad.’ (Adapted from Huang 1989, p.198)

Consequently, the embedded null element is only realized as Øziji and has an obligatory coreferential interpretation.

In contrast to the null element which has to refer to the matrix subject, it has been argued that the overt pronoun *ta* in (4) cannot take the matrix subject as its referent. It has to refer to someone else in the discourse. Huang (1992) argues that the coreferential reading of *ta* in (4) is ruled out by Binding Principle B, under his assumprtions.[[6]](#endnote-6)

**2.2 Shibata and Yashima (2014)**

Unlike Huang (1992), Shibata and Yashima (2014) follow the assumption that *ta* is the subject of the embedded resultative clause in (4). Thus, Binding Principle B is not the reason preventing *ta* from referring to the matrix subject. Shibata and Yashima adopt Chomsky’s (1981) Avoid Pronoun Principle and Reference Set Computation (Reinhart, 2006, 2011) to explain the obligatory disjoint interpretation of *ta* in sentences such as (4).[[7]](#endnote-7)

We briefly review here Shibata and Yashima (2014) experimental design, since their study is the main reference point of our study. Eighteen Mandarin-speaking children (ages 4;7–5;10, M = 5;3) were tested in China. Six participants were excluded because they failed the diagnostic test containing V-*de* sentences with non-resultative interpretations, or because they failed to complete the task. The remaining twelve children participated in an orally administered Truth Value Judgment Task, interpreting test sentences with *ta* ‘he/she’, a null element, and a full NP, enhanced with two pictures per test item. There was a control group of 9 adult participants, who completed a written version of the TVJT enhanced with contextual pictures. The controls behaved as the authors expected: coreferential interpretation of the null element (100%) and a disjoint interpretation of *ta* (89.89%).

The results were highly supportive of the hypothesis that RSC affects children’s interpretations of overt pronouns. Shibata and Yashima’s five-year-old participants chose the coreferential interpretation of the null element 83.33% of the time; they chose the disjoint interpretation 85.42% of the time when a full NP was the subject of the embedded clause. At the same time, the children’s disjoint interpretation of full pronouns dropped to 37.5%. The group findings were reinforced by individual results. Five children provided no disjoint answers, four children’s choices were split at 50%, and only one child produced adult-like answers on the crucial condition. Shibata and Yashima interpreted the high accuracy on the null element and on the full NP condition as an indication that children were able to parse and interpret the test sentences. They attributed the low accuracy on the pronoun condition to the added computational burden of having to compose and compare two legitimate analyses of the test sentence.

**2.3 Experiment 1: L1 Mandarin Speakers**

Despite these published analyses and experimental data, our own and other anecdotal judgements of Mandarin native speakers suggested that the interpretations discussed in the literature and briefly presented above may be incorrect. The first task in a second language acquisition inquiry is to establish the linguistic facts in the target language. We set out to do so with the same initial assumption that an overt pronoun in the embedded clause of Mandarin resultative constructions has an obligatorily disjoint reading. As will be made clear below, this was found not to be the case for our L1 Mandarin controls, who consistently allowed either coreferential or disjoint reading of the overt pronoun. As these native results were in apparent contradiction to those found in Shibata and Yashima (2014), we analyse these results separately, in order to establish a reliable picture of our controls’ native grammar. We used these results as justification for an alternative syntactic analysis of Mandarin resultatives than the one presented above, which formed the basis of our predictions for the L2 acquisition of these structures. The L2 acquisition of resultatives is discussed in section 3.

In order to facilitate a comparison of interpretations, we investigated the reference choices in Mandarin resultative constructions using the same Truth Value Judgement Task (TVJT) created by Shibata and Yashima (2014),[[8]](#endnote-8) as described in detail below.

**2.3.1 Participants**

Fifty-one native Mandarin-speaking controls took part in our experiment. Most participants were monetarily reimbursed for their participation. They were either visiting teachers at UK universities (n = 28) with an average stay of 9.7 months, ranging from 0.5 to 27 months; students at UK universities who had, at the time of testing, been in the UK for less than a month (n = 16); or native speakers living in China at the time of testing (n = 7). Statistical comparisons on all interpretive choices did not reveal any differences between these three native-speaker sub-groups within the group; therefore, we treated them as a single native-speaker group.[[9]](#endnote-9) Table 1 provides more details about the native participants.

<Insert Table 1 around here>

**2.3.2 Task**

We minimally adapted the Truth Value Judgment Task (TVJT) from Shibata and Yashima (2014) for adult speakers. The TVJT consisted of 12 short stories followed by test sentences which were to be judged either True or False in the context of the stories. An example story, provided in Figure 1, involves two characters: Big Elephant, who likes to sing sad songs and Little Monkey, who loves listening to songs. In one version of the story,[[10]](#endnote-10) Big Elephant is so moved by his own sad song that he begins to cry, while Little Monkey is happy because he is listening to music.[[11]](#endnote-11) In a second version,[[12]](#endnote-12) Little Monkey listens to the sad song Big Elephant is singing and begins to cry (see Figure 2). Each story had two versions, one in which the causer (main clause subject) is affected by the action of the subordinate clause resultative (the coreferential context), and one in which the other character in the story is affected (the disjoint context).

<Insert Figure 1 here>

<Insert Figure 2 here>

The contexts were presented on a computer screen with text and pictures. Both Chinese characters and pinyin were given to the participants.[[13]](#endnote-13) Each context was followed by a test sentence that alternated null elements, pronouns and full NPs, which represented the three conditions in the experiment. The full NP condition, as in (9) below, always had a disjoint referent. To iterate, the judgements reflected in the test sentences were our original assumptions, based on Shibata and Yashima (2014).

(7) **Null Element Condition**

Daxiangi  chang-de Øi/∗j kuqilai le.

Big.Elephant sing-DE begin.to.cry LE

‘Big Elephant sang, and as a result he began to cry.’

(8) **Pronoun Condition**

  Daxiangi  chang-de ta\*i/j  kuqilai le.

Big.Elephant sing-DE he begin.to.cry LE

‘Big Elephant sang, and as a result he began to cry.’

(9) **Full NP Condition**

Daxiang chang-de Xiaohouzi kuqilai le.

Big.Elephant sing-DE Little.Monkey begin.to.cry LE

‘Big Elephant sang, and as a result Little Monkey began to cry.’

The 12 stories, each with two versions, were presented with test sentences in three conditions as in (7) – (9) above, resulting in a total of 72 test items. Contexts were counterbalanced so that half of the embedded referential elements (Ø,*ta*, NP) were in a coreferential context, the other half were in a disjoint context. Test items were distributed across six presentation lists so that each participant saw 12 story–test sentence combinations (4 of each of the three conditions, 2 contexts per condition), which were pseudo-randomized by an online survey software.

The general expectations for the TVJT are summarized in Table 2:

<Insert Table 2 here>

**2.3.3 Procedure**

The TVJT was administered online using an online survey software.[[14]](#endnote-14) The participants were asked to read a story on the screen and look at the pictures which illustrated the story. They had to click for the test sentence to appear on the screen, after which they chose whether the test sentence was True or False with regards to the story. Data collection was completed both in person in a laboratory environment (n = 19) and remotely due to Covid-19 restrictions.[[15]](#endnote-15)

**2.3.4 Statistical Modelling**

Data analysis was conducted in *R* (R Core Team, 2019. Version 3.6.1) by means of binomial logistic regression analysis using Generalised Linear mixed effects models with crossed random effects (Baayen, Davidson & Bates, 2008). This was achieved using the *glmer* function of the *lme4* package (Bates, Mächler, Bokler & Walker, 2015), and the package *emmeans* (Lenth, 2018) for Tukey-corrected pairwise comparisons. The results of the TVJT were coded so that the response variable was whether the participant had a coreferential or disjoint interpretation of the embedded element. This was used as the dependent variable in the regression models and coded as 0 for a coreferential interpretation and 1 for a disjoint interpretation. All categorical variables were effects coded and all models included *Participant* and *Item* as random intercepts. We aimed to fit the models using a ‘maximal’ random effects structure with random slopes that reflected the fixed effects structure as far as possible (as recommended by Barr *et al*., 2013). All the relevant fixed effects, and the interactions between them, were included in the initial models. Both the fixed effects and random structure were then reduced using stepwise backwards comparisons in the *lmerTest* package (Kuznetsova, Brockhoff & Christensen, 2016), with final model selection also informed by manual comparisons of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values. These models can be found in Appendix B with coefficient estimates presented as both log odds (logit scale) and odds ratios.

**2.3.5 Results**

*Descriptive Statistics*

We firstly analysed the native speakers’ mean proportion of disjoint vs. coreferential interpretations in each condition, see Figure 3.

<Insert Figure 3 here>

This demonstrated that the native speakers overwhelmingly interpreted the null elementas having a coreferential reading (93.6%). They also interpreted the full NP as having a predominantly disjoint reading (94.6%). Proportions for the overt pronoun were more balanced between coreferential and disjoint interpretations, with a slight preference for a coreferential reading (56.4%).

However, this analysis did not reveal whether, for a given condition, both coreferential and disjoint interpretations could be assigned to a similar extent by *individual* native speakers. For *ta* especially, it may instead have been that just under half of the native speakers gave a categorical disjoint interpretation and just over half of individuals gave a strictly coreferential interpretation. To observe variability between native speakers within the three conditions, we calculated each individual’s mean disjoint readings and plotted the corresponding densities, presented in Figure 4.

<Insert Figure 4 here>

The figure illustrates the vast majority of native speakers were categorical in their interpretation of the null element as coreferential and full NP as disjoint. However, their interpretation of the overt pronoun *ta* is far more variable. A substantial number of native speakers allowed both coreferential and disjoint interpretations to the same extent (11/51) suggesting both readings are equally acceptable to them. A further 13/51 were categorical in their interpretation of *ta* as coreferential and 6/51 as strictly disjoint. Of the remaining native speakers, 10/51 had a slight preference for a coreferential interpretation and 11/51 had a slight preference for a disjoint interpretation.

*Inferential statistics: mixed effects models*

We conducted further statistical analyses in the form of mixed-effects models in order to explore further discrepancies between ours and Shibata and Yashima’s native speaker results. Shibata and Yashima (2014:331) reported no significant difference between the native speaker interpretations on the overt pronoun and *NP* condition of their study (in both cases speakers have a very strong preference for disjoint interpretations). To compare the interpretations of the three conditions with our native speakers, we fitted a model with the categorical variables *Condition* (*null element*, *NP*, and *ta* as the reference level), *Context* (whether the contextual story was coreferential or disjoint as described in 2.4), and the interactions between them, as fixed effects. The preliminary model also included by-participant random slopes for the interaction between *Condition* and *Context*. However, the predictor *Context* was not found to be significant and thus removed, and the random structure reduced due to convergence issues (See Appendix B, Table 1 for final model). This indicated that native speakers’ interpretations on each condition were similar irrespective of whether the contextual story was coreferential or disjoint.

The final model revealed a significant main effect of *Condition* (χ2 = 90.44, df = 2, *p* < .001), with coefficients indicating the native speakers of the present research were significantly more likely to interpret the full *NP* as disjoint compared to the overt pronoun *ta* (*β* = 5.27, SE = 1.38, *z* = 3.81, *p* < .001). As such, unlike in Shibata and Yashima, our native speakers assigned a significantly higher proportion of coreferential interpretations to the overt pronoun than they did to the *NP*. While these results confirm that the present native speakers do not interpret *ta* as strictly disjoint, it also appears that they do not have a categorical coreferential interpretation. Indeed, subsequent comparisons between the *null element* and *ta* reveal that the native speakers provide significantly higher coreferential interpretations for the *null element* (*β* = –3.41, SE = 0.79, *z* = –4.30, *p* < .001).

**2.3 Discussion of Experiment 1**

Despite the claims made in the literature and the two syntactic analyses presented in 2.1, we observe that *ta* as in (4) and (8) can take either a coreferential reading or a disjoint reading. This is supported by our findings from 51 native speakers of Mandarin discussed above.

Prompted by Huang (1992), we argue that V*-de* constructions with overt embedded subjects like (8) and (9) have two types of interpretations, and therefore can be analysed in two different sentence structures. Huang (1992: 123) notes that *ta* ‘he’ in a sentence like (4) “may or may not be interpreted as patient.” He further claims that the sentence “may simply be a description of the extent of the event of *Zhangsan*’ssinging” or “it may be a description of what *Zhangsan* did to him” (Huang, 1992: 123). Nonetheless, Huang did not fully consider the syntactic implications of the former possibility. Following Li, A. (p.c.), we argue that the V-*de* resultative constructions warrants further investigation.

The embedded clause’s meaning can therefore be either that of an extent expression or of a result expression. When the sentence in (4) is interpreted as a resultative action and *ta* takes a patient role, the sentence is syntactically represented as in (10) below. *Ta* cannot refer to *Zhangsan* in the matrix subject position because this would violate Binding Principle B. ResultC stands for result clause.

(10) [CP Zhangsani [vP chang-de [VP ta\*i/j [V'  ~~chang-de~~ [ResultC Øziji ku qilai le]]]]].

Zhangsan sing-DE he begin.to.cry LE

‘Zhangsan sang and as a result he began to cry.’

When the embedded clause in (4) is interpreted as an extent expression, *ta* is not an affected argument ofZhangsan’s singing. Rather, it is simply the agent of the action of starting to cry. Thus, the sentence has the structure proposed in (11) and *ta* can refer to either the matrix subject *Zhangsan* or someone in the discourse. ExtentC stands for extent clause.

(11) [CP Zhangsan [VP chang-de [ExtentC ta ku qilai le]]].

Zhangsan sing-DE he begin.to.cry LE

‘Zhangsan sang to the extent that he began to cry.’

Our native speaker participant interpretations challenge the linguistic analysis assumed by Shibata and Yashima (2014). With a pool of native speakers much larger than theirs (51 versus 9), we established that *ta* can indeed have a coreferential interpretation in addition to the disjoint one. All 9 of their native speakers were tested in China; 7 of our native participants were living in China. However, while their 9 speakers interpret *ta* as disjoint 88.89% of the time, our participants do so only 32% of the time (see Appendix A for further detailed results). This discrepancy cannot be just be due to where the participants were living at the time of testing. We argue that our larger pool of participants was able to better reflect the large variability of these interpretations among Chinese native speakers.

Our findings, although they suggest that the Avoid Pronoun Principle may not be the best explanation of pronominal reference in Chinese V-*de* constructions, do not invalidate the RSC explanation of pronoun difficulties in language acquisition. For example, Reinhart (2006, 2011), following Grodzinsky & Reinhart (1993), identifies computational complexity as an account of L1 children’s relatively poor performance on pronouns in English, as opposed to their superior performance on reflexive interpretation (Chien & Wexler, 1990). The RSC has also been proposed to explain interesting pronoun interpretion effects among adult L2 learners of English with French and Spanish as native languages (Slabakova, White & Brambatti Guzzo, 2017).

To summarize this section, testing Mandarin native speakers interpreting resultative clauses, we uncovered that they allowed two interpretations of the overt embedded subject pronoun, a coreferential one and a disjoint one, contrary to the analyses in the literature (Huang, 1992) and the findings of previous experimental studies (Shibata & Yashima, 2014). Therefore, we used this baseline of interpretations in our Experiment 2 with second language learners of Mandarin.

**3. L2 acquisition of Mandarin resultatives**

**3.1 Two L2 acquisition accounts**

The two theoretical positions we discuss in this article have been explored with various linguistic parameters and properties. Here we briefly mention studies that have used Mandarin as an L1 or L2. For instance, Hawkins and and Chan (1997), arguing for the the Failed Functional Features Hypothesis, sought to demonstrate that feature representations among post-puberty learners are restricted to those features that are present in their native grammars. They explored the *wh*-feature required to produce and interpret English relative clauses. Across a number of phenomena, the authors showed that Chinese native speakers performed significantly worse than French speakers; the latter enjoyed an advantage because they could transfer the feature from their native language. However, Hawkins and Chan also documented that Chinese speakers improved their performance at higher proficiency levels. They argued that, since the learners had only partial access to the UG-provided feature inventory (and thus a representational deficit), the successful learners were building an L1-based grammar that gave a semblance of nativelike representations.

The Representational Deficit position is further elaborated in the Interpretability Hypothesis (Tsimpli & Dimitrakopoulou, 2007; Hawkins & Hattori, 2006). The proponents argue that new *uninterpretable* features cannot be transferred from the native grammar, while new *interpretable* freatures, those that have an effect on sentence interpretation, fare better in L2 acquisition. Thus the Interpretability Hypothesis, supported with L2 English data, offers a principled feature-based distinction in explaining why some grammatical properties may be excessively difficult for L2 learners.

Other scholars working with Mandarin have come to the opposite conclusion with respect to learnability. In particular, the acquisition of the null element and the overt pronoun interpretations in L2 Chinese has enjoyed significant research attention. Yuan (1993) investigated whether English native speakers allowed null arguments (subjects and objects) in their L2 Chinese interlanguage. He used an acceptability judgment task and tested participants at different proficiency levels. The study established that his learners accepted both null subjects and null objects from a very low level of proficiency. Zhao (2012) expanded on this research program by investigating the interpretation of the null element and the overt pronoun *ta* in finite embedded clauses such as the example below, among others:

(12) Xiao Zhangi shou Øi/j/tai/j xihuan \_Lao Wang.

Xiao Zhang say Ø / he like Lao Wang

‘Xiao Zhang says that \*Ø/he likes Lao Wang.’

Zhao used a picture judgment task and a written interpretation task to test interpretation of the embedded subject. The results of both tasks were in consort. High intermediate and advanced learners as well as native speakers had statistically similar evaluations of *ta* in coreferential and disjoint contexts, as well as of the null element combined with a coreferential picture. When the null element was paired with a disjoint picture, the native speakers as well as the advanced learners allowed the reading (although with lower scores), but the high intermediate learners did not (Zhao also tested null object interpretation, which we will not discuss here.) In summary, Yuan’s results show that null elements are present in L1 English speakers’ L2 Mandarin interlanguage from low levels of proficiency, while Zhao revealed that advanced learners could interpret null elements in a native-like manner. These two are among the many studies (White, 2003; Slabakova, 2016) which support a Full Functional Representation position. We come back to these two theoretical positions in the discussion sections.

**3.2 Linguistic analyses of English resultative constructions**

English is the native language of the L2 Mandarin learners in this experiment, and therefore English resultative constructions as in (13) through (16) may be assumed to be the initial hypothesis of our L2 Mandarin learners. They describe an action and its result.

(13) John painted the walls blue.

(14) John shouted himself hoarse.

(15) Johni shouted him\*i/j out of the room.

(16) Johni sang until hei/j /\*Ø was in tears.

Let us delve into the linguistic contrast in more detail now. Resultative structures as in (13) predicate the result of the action onto the object. It follows that verbs in English resultative structures are usually transitive. When the verb is unergative (e.g., *shout*), a dummy object reflexive such as *himself* is inserted as in (14). In (15), the unergative verb takes a small clause as a complement, containing the subject of the small clause, an affected participant (*him*), and the endpoint of the event (the PP *out of the room*) (Hoekstra, 1988). Principle B postulates that the subject of a non-finite small clause cannot refer to the main subject. Embedded clauses introduced by *such … that*…, *so … that*…and *until* can also be used to describe an action and its result or extent, as shown in (16). English does not allow null subjects in finite clauses, as it is neither a language with rich inflectional morphology nor a topic-prominent language (Chomsky, 1981, 1982; Holmberg, 2005; Huang, 1989; Rizzi, 1986; Roberts, 2010; Taraldsen, 1978; among others). The pronoun *he* in the embeddedclause in (16) can refer to either the main subject *John* or someone else in the discourse (Chomsky, 1981; Manzini, 1983).

**3.4 What needs to be acquired?**

What do English-speaking learners of Mandarin have to acquire in order to have a targetlike L2 grammar for this construction? From the analyses presented in the previous two sections, it is clear that English has at least two constructions equivalent in meaning to the MandarinV-*de* construction: the small clause resultative as in (15) and the finite embedded clause as in (16). Even if the resultative analysis in the two languages exhibits some parallels, the anaphorically-dependent elements in the embedded clauses have very different interpretations. To reiterate, while the Mandarin and English pronominal subjects in (4) and (16) *can* refer back to the matrix subject, the Mandarin null element in (3) *has to*.

This is an interpretive contrast that stems from the grammatical distinction in subject realization, Mandarin allowing null elements, unlike English. However, this is not all. A native English learner of Mandarin, together with the possibility of null elements, has to acquire the additional interpretive restriction of such null elements in the resultative V-*de* construction. In this article, we have tentatively proposed that this interpretive restriction is due to the TP (in contrast to CP) status of the embedded clause, hence the lack of ØTopic in resultative clauses. We argue that this acquisition is possible; however, it involves distinguishing the two null elements in Mandarin and evaluating whether one or both types are allowed in a sentence position. Provided they have acquired the ambiguity of the null element in non-resultatives (and Zhao, 2012 shows that advanced learners have), learners may wrongly extend this ambiguity to the null element interpretation in resultatives. Hence, difficulties might be expected with the null element interpretation in our experimental test items.

In contrast to the null element, the Mandarin overt pronominal subject can have a coreferential or a disjoint reading, as revealed by Experiment 1 above. The closest English equivalent to the resultative in (4) may be the finite clause in (16). Adult L2 learners of Mandarin may transfer this broad linguistic knowledge from their native language. The non-finite resultative as in (15) with its restricted interpretation is not expected to influence those learners who treat the Mandarin resultative construction as finite.

We also need to consider the interpretability of the features involved in the acquisition task, in order to probe the Interpretability Hypothesis. As argued earlier, the obligatory coreferential interpretation of the null element is due to the availability of Ø*ziji* but not Ø*Topic* in the embedded subject position. The features involved in the derivation of Ø*ziji* are phi-features and a categorial [N] feature of *ziji*; those are interpretable as they are related to the lexicosemantic constitution of the reflexive (Spyropoulos, 2005). However, uninterpretable Case is also involved in that Agree relationship. The probe and goal need to share the same Case for the goal to contain a subset of features of the probe.[[16]](#endnote-16) In terms of the unavailability of the null topic, our tentative proposal is that the embedded subject cannot be topicalised as the matrix verb (or the combination of the V-*de*) subcategorises for a TP rather than CP. This property could indeed be related to the semantic meaning of the verb (including the unergative nature of the V-*de*), hence its nature is interpretable.

To summarize the learning task, learning difficulties may be expected with the coreferential-only interpretation of the null element, while the coreferential or disjoint interpretation of the overt pronoun *ta* is not expected to create difficulty. Furthermore, the correct interpretation of the null element relies on both interpretable and uninterpretable features.

**3.5 Experiment 2**

The interpretation of anaphorically dependent subjects in the Mandarin resultative construction has not been investigated in second language acquisition so far. In this experimental study, we were interested in whether learners of Mandarin pattern with Mandarin native speakers in their interpretation of referential elements in the embedded clause of the resultaive V-*de* construction. Our expectations about learner behavior were based on the native speaker interpretations obtained in Experiment 1. We also took native language influence into account. Table 3 summarizes the new predictions.

<Insert Table 3>

**3.5.1 Research questions and hypotheses**

In the introduction, we framed the learnability of this set of interpretations in terms of Representational Deficit (e.g., Hawkins & Chan, 1997) versus Full Functional Representation (Schwartz & Sprouse, 1996; Prévost & White, 2000 a.o.) in second language acquisition. In section 3.4, we discussed the learning task as possibly affected by native language transfer. Our research questions reflect these theoretical positions.

*Research Question 1.* Can L2 learners acquire the constrained interpretation of the null element in Mandarin resultative constructions?

*Hypothesis 1.* Learners could experience difficulty with the null element interpretation, for three reasons. Firstly, null pronouns are not available in English finite embedded clauses. Secondly, not all null elements in Mandarin sentences have a restricted, obligatorily coreferential reading as the embedded null subject in the resultative V-*de* construction.Thus, learners have to treat this construction differently from other structures containing embedded null elements. For this reason, as we suggested in Section 1, the acquisition of the correct null element interpretation is a PoS learning situation. In addition, both interpretable and uninterpretable features are involved in the correct feature checking. Faulty representation leading to indiscriminate interpretation (for example, accepting everything prompted by a yes bias) would support the Representational Deficit position, including the Interpretability Hypothesis. Successful acquisition defined as discriminating between meanings in different contexts, on the other hand, supports Full Functional Representation.

*Research Question 2*. Are there proficiency effects in the learner interpretations? Furthermore, does proficiency have the same effect across the three conditions?

*Hypothesis 2*. Based on copious L2A research (White, 1985; Schwartz & Sprouse, 1996 a.o.), we expect that there will be a proficiency effect in the data; that is, less proficient learners will demonstrate more noisy interpretations, while more advanced learners will come closer to the target interpretation.

**3.5.2 Participants and Procedures**

In addition to the native speakers described previously, in this section we report the results of 59 learners of Mandarin with English as their native language. Nine Mandarin learners were excluded due to scoring 50% or less on an 8-item diagnostic Grammaticality Judgment Task, which checked whether they knew the V-*de* construction with a non-resultative interpretation. The remaining analyses were performed with 50 learners. The proficiency of the L2 learners ranged between 2 and 38 on a 40-item proficiency (cloze) test, with a mean of 21.32 (SD = 9.12). The test assesses both grammatical and lexical knowledge and is intended for use with intermediate to very advanced learners. The learners were not divided into levels based on proficiency; instead, proficiency was treated as a continuous variable. Table 1 in section 2.3.1 provides more details about the participants.

The L2 learners completed the same TVJT as the native speakers of Mandarin, as described in sections 2.3.2 and 2.3.3. After the participants finished the TVJT, they completed the diagnostic Grammaticality Judgment Task, the proficiency cloze task and a background questionnaire.[[17]](#endnote-17) The majority of the data was collected in person (37 L2 learners).[[18]](#endnote-18)

**3.5.3 Statistical Modelling**

The statistical methods employed were the same as those described in 2.3.4.

**3.5.4 Results**

*Descriptive statistics*

To answer our research questions, we analysed the interpretations of the three embedded elements within the L2 learner group and then performed direct comparisons with the native speaker data. Our first stage of analyses focused on comparing learners’ interpretations between conditions. Their mean values are plotted in Figure 5.

<Insert Figure 5 here>

Figure 5 demonstrates that L2 learners overwhelmingly interpreted the *null element* as having a coreferential reading (81%), and treated the full *NP* as having a predominantly disjoint reading (83%). These results align with those reported for the native speakers in 2.3.5. The learners’ interpretations were more variable for the overt pronoun, as compared to the other conditions, but there was a clear preference for *ta* having a coreferential interpretation (71.5%). This skew towards a coreferential interpretation was stronger than that of the native speakers reported earlier (56.4%).

Next, we analysed the variability between L2 learners individually for each of the three conditions by calculating each participant’s mean disjoint readings and plotting the corresponding densities, see Figure 6.

<Insert Figure 6 here>

The majority of learners provided a coreferential interpretation to the null element and a disjoint interpretation for the full NP condition. *Ta* was more variable, as expected, but with more learners providing a categorical coreferential interpretation (16/50) than a strictly disjoint interpretation (2/50). The number of learners who provided equal disjoint and coreferential responses for *ta* stood at 11/50, and of the remaining learners, most had a preference towards a coreferential reading (18/50), with only 3/50 learners having a preference towards a disjoint reading. Although these results are similar to those for the native speakers, it appears that for the *ta* pronoun, a higher percentage of learners had a strictly coreferential interpretation (32% among learners vs. 25% among the native speakers), as well as a coreferential preference (36% among learners vs. 19.6% among the native speakers).

*Inferential statistics: Mixed-effects models (L2 learners)*

Subsequently, we fitted a series of statistical models to the learner data in isolation in order to compare their interpretations between each condition and to determine whether any of the individual variability observed in Figure 6 can be attributed to L2 proficiency.

The initial model included the categorical variables *Condition* (*NP*, *null element* and *ta* as the reference level), *Proficiency* as a centred continuous variable, *Context* (whether the contextual story was coreferential or disjoint as described in 2.3.2), and the interactions between them as fixed effects. We included a by-item random slope for *Proficiency,* and by-participant random slopes for the interaction for *Condition* and *Context*. *Context* was not found to improve model fit, however; it was therefore removed as a fixed effect and random slope. The final model can be found in Table 2 in Appendix B, with the coefficient estimates presented as both log odds (logit scale) and odds ratios.

A Likelihood Ratio Test revealed a significant main effect for the interaction between *Proficiency* and *Condition* (χ2 = 26.08, df = 2, *p* < .001). The fitted interaction was visualised in Figure 7, and to further investigate how the effect of proficiency varied across conditions, we used the *emtrends* function in the *emmeans* package (Lenth, 2018) to estimate the slopes of the covariate trend for each condition.

<Insert Figure 7 here>

Results indicate that as proficiency increases, the proportion of disjoint interpretations significantly decreases for the *null element* (*β* = –0.10, SE = 0.03, *z* = –2.97, *p* < .01) and significantly increases for the *NP* (*β* = 2.05, SE = 0.05, *z* = 4.05, *p* < .001). For the overt pronoun, however, no effect of proficiency was found (*β* = –0.03, SE = 0.03, *z* = –1.08, *p* = .28)*.*

Controlling for this proficiency effect, pairwise comparisons between conditions were then performed (Lenth, 2018). These suggested that *NP* received a significantly higher proportion of disjoint interpretations than *ta* (*β* = 4.09, SE = 0.64, *z* = 6.40, *p* < .001)*,* mirroring the results for the native speakers reported earlier. However, there was a tendency for learners to more frequently assign a coreferential interpretation to *ta* than native speakers, as demonstrated by a lack of significant difference from the *null element* (*β* = 0.84, SE = 0.41, *z* = 2.07, *p* = 0.10). This is in contrast to the native speaker results reported earlier, where *ta* was interpreted as coreferential significantly less often than the *null element.*

*Inferential statistics: Mixed-effects models (L2 learner & native speaker comparisons)*

Having explored the within group results for both the native speakers (2.3.5) and the learners (3.5.4), direct comparisons were next made between the two groups. We began with a model containing the categorical variables *Condition* (*NP*, *null element* and *ta* as the reference level), *Context* (whether the contextual story was coreferential or disjoint as described in 2.3.2), *Group* (Native speakers vs. L2 Learners), and the interactions between them, as fixed effects. A by-item random slope for *Group* was included, along with by-participant random slopes for the interaction between *Condition* and *Context*. The final model can be found in Table 3 in Appendix B, with the coefficient estimates presented as both log odds (logit scale) and odds ratios.

Results reveal a 3-way interaction between *Condition, Group,* and *Context* (χ2 = 8.15, df = 2, *p* < .05), which is visualised in Figure 8 by plotting the predicted probability of each interpretation for both groups and in both contexts.

<Insert Figure 8 here>

This figure demonstrates that within the coreferential context (first row), there is no significant difference between the proportion of disjoint vs. coreferential interpretations between L2 learners and native speakers for the *null element* (89.7% coreferential vs. 96.6%, respectively), *NP* (97.1% disjoint vs. 100.0%, respectively) or *ta* (80.5% coreferential vs. 63.6%, respectively). Very similar proportions between the L2 learners and native speakers can also be observed within the disjoint context (second row) for both *NP* (93.0% disjoint vs. 97.2%, respectively) and *ta* (76.4% vs. 55.1%, respectively). However, for the *null element* in the disjoint context, the native speakers exhibit a more categorical coreferential interpretation (99.0%) compared to the learners (82.9%), as confirmed by pairwise comparisons using *emmeans* (Lenth, 2018) (*β* = –3.03, SE = 0.83, *z* = –3.63, *p* = .01). This demonstrates that for the null element in the disjoint context, the native speakers gave a significantly higher proportion of coreferential interpretations compared to the learners. Pairwise comparisons (Lenth, 2018) confirmed no other significant differences between the L2 learner and native speaker interpretations.

**3.6 Discussion of Experiment 2**

The results of learner responses in Experiment 2 were analyzed both within the group as well as in comparison to the native speaker interpretations from Experiment 1. We comment on the within-group learner results in this section, and leave the between-group comparison for the general discussion.

The within-group results, pointing to a categorical distinction between interpretations on the three anaphoric elements, suggest that acquisition of these elements is on the right track, and completed for the majority of learners. To reiterate, L2 learners overwhelmingly interpreted the null element as having a coreferential reading, while distinguishing it from that of the full NP with a disjoint reading. In addition, there was a signficant effect of proficiency for the learners on the null element and NP, but not for *ta*. The latter suggests that the two non-ambiguous referential elements follow an ascending line of development, with low proficiency learners starting out with indiscriminate interpretations (Figure 7) but improving quickly.

At the same time, there was no significant difference between *ta* and the null element in the learner model, after controlling for proficiency. This suggests that the learners’ interpretations are skewed towards a coreferential interpretation for *ta.* While learners’ interpretationof the ambiguous overt pronoun is certainly more variable, the preference for a coreferential interpretation follows a universal processing pressure, as we discuss in the next section.

**4. General Discussion**

In this experimental study, we examined the referential choices for the null element, overt pronoun and NP in the embedded clause of the resultative V-*de* construction of Mandarin native speakers and learners of Mandarin as a second language. We tested a group of 59 English-native learners of Mandarin (n = 50 after exclusion based on the results of a diagnostic test) on a TVJT adapted minimally from Shibata and Yashima (2014).

**4.1 Is the null element interpretation a challenge in L2 acquisition?**

Our first research question asked whether learners could acquire the null element interpretation in embedded resultative clauses. To reiterate, we hypothesized that learners could have difficulty acquiring the correct null elment interpretation on two grounds: Firstly, null pronouns are not available in English finite clauses, so there is nothing for them to transfer. Even if the learners were to transfer the interpretations of an overt pronoun from the closest equivalent English structure to the null element in Mandarin resultatives, as in (16), they would transfer interpretations not possible for the null element in the Mandarin structure.

Secondly, null elements in non-resultative structures might, by analogy, influence the null element interpretation in resultatives structures. This is because the L2 Mandarin grammar allows a wider range of interpretations for the null element in embedded non-resultative clauses, as in example (2) above. As argued in Section 2.1, only Øziji is allowed in the embedded subject position of the V-*de* construction; the disjoint reading is ruled out due to the unavailability of ØTopic in this position. According to our analysis, learners have to analyze the embedded clause with a null element as a TP, not a CP, in order to disallow subject topicalization. Even if the exact analysis we proposed is not correct, some linguistic account along these lines must be in place to explain the categorical native interpretation of the null element in V-*de* resultative clauses (see Experiment 1).

Of course, from our data alone we cannot assume that our learners are aware of the wider interpretive choices of the null element with non-resultatives. In this respect, we rely on the findings of Zhao’s (2012) study, which showed that ØTopic in non-resultatives was fully acquired at advanced proficiency levels, while just less than half of the high intermediate learners had successfully acquired it. Thus, it could be the case that only our more proficient learners needed to restrict their acquired interpretations or resist overgeneralising the interpretations from non-resultatives. Nevertheless, the fact remains that the variety of interpretations for Mandarin embedded null elements might influence all learners because all meanings are attested in the input they are exposed to.

Despite the hypothesized potential sources of difficulty with the acquisition of null elements, results show that overall the learner group correctly interpreted the null element as coreferential 81% of the time, compared to the native speakers’ 93.6%. Considering the two contexts, coreferential vs. disjoint, we found the probability that the learners as a group selected the null element with a coreferential reading to be 89.7% in coreferential contexts. Learners’ proportions are not distinct from the native speaker ones, confirming that their acquisition in this context has been successful at a group level. To visualize this result, the first two columns in the top row of Figure 8 are illuminating.

However, the results become more mixed when we consider the disjoint context results: our learners as a group did experience some difficulty with null element interpretations, in that they allowed 17.1% disjoint interpretations for the null element in disjoint contexts (see Figure 8). In fact, this interpretation of the null element in the disjoint context is the only interpretation in which the learners as a group differed significantly from native speakers.

Before we consider this finding further, let’s consider another comparison which is informative for these results. The full NP condition as in (9) was intended to examine which readings learners chose in a sentence with a clear disjoint interpretation, containing two R-expressions in a context with two referents. Learners could make these referential choices once they knew the Mandarin words. We found a significant difference between the learners and natives on the null element in disjoint contexts but not between the learners and natives on the NP in coreferential contexts. This finding suggests two things. Firstly, it shows that it was easier to reject the wrong interpretation of the NP, compared to the wrong interpretation of the null element. Secondly, it further demonstrates that the non-native like performance on the null element in the disjoint context is not due to any general ‘yes-bias’ in the learner responses, as learners rejected the incorrect interpretation of the NP in coreferential context to a statistically similar degree to the controls.

How can we explain this non-native-like acquisition in the disjoint context? One possibility is that, based on Zhao (2012), we might expect the advanced learners in our study to have overextended the interpretation of the null element in disjoint contexts with non-resultative structures (where ØTopic is possible) to our disjoint contexts with resultative structures (where ØTopic is not possible), thereby resulting in significantly more disjoint interpretations of the null element in disjoint contexts than the natives.

To look at this further, we can consider the proficiency effects in Figure 7. Recall that we only have proficiency data for the L2 learners, and that when proficiency was controlled for in the learner-only model, there was no significant effect of context. Thus the proficiency effects presented here are for the conditions as a whole. Figure 7 shows that at the lowest levels of proficiency, our participants were around chance with the null element interpretation, suggesting that correct interpretation is difficult for these learners. Indeed, it is possible that lower proficiency L2 learners might initally treat the embedded null subject as a null pronoun, rather than a null reflexive (Øziji). The number of incorrect disjoint interpretations does significantly decrease with proficiency (as illustrated by Figure 7 and confirmed by the *emtrends* results reported in 3.4). However, Figure 7 also illustrates that it is only the most proficient learners who (near) categorically reject disjoint readings (compare with the NP interpretations, for which the proportions of correct (disjoint) responses reach ceiling earlier). Therefore, it is conceivable that our more advanced learners are overextending the possible interpretations of disjoint contexts with non-resultatives, though the most advanced learners seem to overcome this.

For acquisition to be considered successful, L2 learners’ performance does not have to be statistically indistinguishable from that of native speakers. It is sufficient to show that learners’ grammars categorically distinguish between grammatical elements (functional morphemes, acceptable and unacceptable sentences, interpretations) (White, 2003; Slabakova, 2016). Thefore, we argue here that, although the learners as a group do experience some difficulty with the null element interpretation in disjoint contexts compared to coreferential contexts, the results presented suggest a picture of generally successful acquisition at the group level. Such behavior is in keeping with the findings of Zhao (2008, 2012), who found that English-speaking learners can acquire Ø*ziji* in Mandarin at higher proficiency levels. In addition, these choices are in line with the child Mandarin speakers in Shibata and Yashima’s (2014) study, who chose the coreferential interpretation 83.3% of the time.

**4.2 Full Functional Representation and Poverty of the Stimulus**

Having considered the null element results in light of the (im)possibility of transfer and potential influence from non-resultative L2 structures, we now consider the findings in light of the two theoretical proposals hypothesized to affect the ease of the acquisition task: Representational Deficit vs Full Functional Representation accounts and the PoS argument.

We framed our research questions within the theoretical debate on the kind of formal features that are more easily acquirable in second language acquisition, and those that present insurmountable difficulty so that learners have to resort to rote learning and native language imitation in their L2 performance. In this respect, the most recent proposal for L2 acquisition challenges is the Interpretability Hypothesis (Tsimpli & Dimitrakopoulou 2007, Hawkins & Hattori, 2006, see section 3.1). The hypothesis makes a distinction between interpretable and uninterpretable features, and purports that the latter cannot be successfully acquired in an L2 if learners do not transfer knowledge of these features from the L1. The Full Functional Representation Hypothesis (Schwartz & Sprouse 1996, Slabakova, 2016; White 2003), on the other hand, argues that all formal features remain accessible and are acquirable based on UG and the L2 input. Both hypotheses allow for proficiency effects.

We argued in section 3.4 that both interpretable and uninterpretable features were involved in checking the features of the null element in Mandarin. Crucially for evaluating the predictions of the Interpretability Hypothesis, an uninterpretable Case feature is involved in the Agree relationship between the Øziji and the main clause subject (see also footnote 19). We contended that an incomplete featural representation would lead to, for instance, accepting all interpretations prompted by a yes bias, or to indiscriminate choices. Such findings would indeed support the Interpretability Hypothesis. Successful acquisition, as defined in 4.1, would support

As argued in 4.1 above, our results point towards largely successful acquisition of the null element at a group level, with the most advanced learners being successful in both contexts. In order to exhibit the correct interpretation, the learners had to reset both interpretable and uninterpretable features. We therefore argue that this set of findings supports the Full Functional Representation position for post-puberty second language acquisition.

In addition, we purport that our experimental results also address the PoS argument in L2 acquisition. We suggested the acquisition of the correct interpretation of the null element is a PoS learning situation in that there is no positive evidence in the input to tell the learner that a disjoint interpretation is not possible, and that it is unlikely this could be learned based on input quanitification and reference tracking alone. Furthermore, learners cannot be aided by L1 transfer and the influence of non-resultative constructions arguably complicates the acquisition task further (see section 1 for more detail). Nethertheless, overall our learners managed to, in the absence of explicit evidence in the input, constrain the interpretation of a null element – which that they could not transfer from their native grammar – in a new syntactic environment, thus overcoming a PoS.

**4.3 Proficiency effects**

Turning to research question 2 now, our learners’ proficiency in Mandarin ranged along a wide continuum, with some true beginners as well as very advanced learners (see section 3.5.2). Proficiency effects were addressed with the statistical model using the learner data only. It was not surprising to see a significant interaction between proficiency and condition. As proficiency increased, learners made fewer disjoint choices with the null element (as discussed in 4.1) and more disjoint choices with the full NP. Figure 7 visualises these statistical findings. However, interpretational choices with the *ta* pronoun did not show any development across proficiency levels. As there were no significant group level differences between learners and natives in either context for *ta*, and in the absence of any proficiency effect, we can conclude that correct interpretation of *ta* had been acquired right from the lower proficiency levels. This result could be attributed to native language influence (Schwartz & Sprouse 1996; White, 1985), which helped the lowest proficiency learners with accurate *ta* interpretations. In addition, it is also possible that the free range of *ta* interpretations was also a factor in this successful acquisition, as there was no restricted reading to acquire. Despite this free reading, however, the learners were clearly not purely guessing, as their proportion of interpretations was different in disjoint and coreferential contexts, while within native speaker range.

Why did our control group of native speakers behave so differently from the control group in Shibata and Yashima (2014)? We do not know for certain, and we attribute the difference to the low number of native speakers in the latter study (9 in their study vs. 51 in ours). This contrast underscores the necessity of using a sizeable control group in additional language acquisition experimental studies, particularly if the property has not been investigated widely before. Our learners’ results on the overt pronoun *ta* reference could have been interpreted quite differently if we had not ascertained that *ta* has both a coreferential and a disjoint reading in Mandarin.

**4.4 Coreferential reading preference with the overt pronoun**

Having addressed our research questions, we turn finally to one further finding that remains to be addressed. Within the overt pronoun reading choices, learners exhibit a clear preference for the pronoun having a coreferential interpretation. Although still not statistically different to the natives’ choices, learners chose that reading 71.5% of the time, compared to 56.4% for natives (with 34/50 learners having either a coreferential preference or categorical coreferential interpretation, compared to 23/51 for natives). Let us look at the learner choices in more detail.

We argued in Section 2.3 that the V-*de*constructions with overt subjects can be further analysed as either a construction indicating the extent of an action or one signifying the result of an action. In the former, *ta*is the embedded subject, allowing both coreferential reading and disjoint reading. In the latter, *ta*is the external object of the verb-result complex predicate and only allows the disjoint reading. Native language influence would ensure that learners should accept *ta* in Mandarin with both a coreferential and a disjoint reading as in (16). The fact that learners not only allow but also prefer the coreferential reading seems to indicate that the result reading (and therefore possibility of a disjoint interpretation) of the embedded clause may be more difficult to access. The results might also imply that the majority of the learners do not treat the resultative sentence with a small clause in (15) as an equivalent to the Chinese V-*de* construction.

Why do the L2 learners show an even stronger preference for the coreferential reading, compared to the native speakers then? Several non-mutually exclusive explanations for the attested preference are possible here, in addition to the construction complexity. It is well-known that the matrix subject is the easiest antecedent for embedded subjects to access in processing.[[19]](#endnote-19) For one, it is syntactically the most prominent argument (Crawley, Stevenson & Kleinman, 1990; Grober*,* Beardsley & Caramazza*,* 1978). The subject is also often semantically the most prominent argument, if it is Agent (Ferreira, 1994; Kaiser, 2011). Furthermore, first-mentioned arguments, regardless of their syntactic function, enjoy a privileged cognitive status in the interlocutors’ mental discourse representation (Gernsbacher, 1989). Under the increased cognitive pressures of L2 processing, it seems like such universal prominence effects exhibit a geater influence than in native language processing; however, for our learners this still does not result in statistically non-native-like interpretations at the group level.

**5. Conclusions**

In this experimental study, we identified a linguistic phenomenon not present in the native language of the learners; namely, the obligatory coreferential interpretation of the null element in the embedded subject position of Mandarin resultative constructions. The important learning task was to restrict the interpretation of Mandarin null elements, which range over coreferential and disjoint readings. While L2 learners can observe in the input that the null element can have a co-referential reading, there is nothing in the input that tells them that a disjoint reading is not allowed. This learning situation gets even more complicated as non-resultative constructions (which are probably more frequent) do allow a disjoint reading. Thus learners, particularly advanced ones, may have to resist overextending this interpretation to non-resultatives. In a referential-choice TVJT, our L2 participants demonstrated largely successful acquisition of the coreferential interpretation, even though they also exhibited some influence from the freer interpretation of null elements in other constructions. These findings suggest that referential restrictions of null proforms are indeed possible to acquire in a second language, even if the native language is not a null-subject language.

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Table 1: Participant Background Information

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | N | Female | Mean Age | Age Range | Proficiency |
| L2 learners | 50 | 21 | 27.8 | 20–64 | 2–38/40 |
| Native speakers | 51 | 32 | 27.4 | 22–41 | n.a. |

Note: Nine learners were eliminated from the study because they did not pass the V-*de* knowledge task.

Table 2. Initial expectations for the Truth Value Judgement Task based on the syntax and L1 acquisition literature

|  |  |  |
| --- | --- | --- |
| Condition | Coreferential Context | Disjoint Context |
| Ø | T | F |
| *ta* | F | T |
| NP | F | T |

Note: T = True, F = False

Table 3. Amended expectations for the Truth Value Judgement Task after Experiment 1 results

|  |  |  |
| --- | --- | --- |
| Condition | Coreferential Context | Disjoint Context |
| Ø | T | F |
| *ta* | **T** | T |
| NP | F | T |

Note: T = True, F = False

Graphical user interface, text, application, chat or text message

Description automatically generated

Figure 1. An example of Context 1 with a test item

**Graphical user interface, text, application, chat or text message

Description automatically generated**

Figure 2. An example of Context 2 with a test item

**

Figure 3: Native speaker interpretations by condition (null element, full NP and pronoun *ta*) in Experiment 1



Figure 4: Native speaker variability by condition (null element, full NP and pronoun *ta*) in Experiment 1



Figure 5: Learner interpretations by condition (null element, full NP and pronoun *ta*) in Experiment 2.



Figure 6: Learner choice variability by condition (null element, full NP and pronoun *ta*) in Experiment 2



Figure 7: Interaction between Proficiency and Condition for learners in Experiment 2.



Figure 8: Fitted interaction between Condition, Group and Context in Experiments 1 and 2. Error bars represent 95% confidence interval

**Appendix A:**

Table 1: Mean proportion of disjoint interpretations per condition per native speaker subgroup

|  |  |  |
| --- | --- | --- |
| Subgroup | Condition | Mean proportion of disjoint interpretations |
| China | NP | 1.00 |
| UK Student | NP | 0.95 |
| UK Teacher | NP | 0.93 |
| China | Null Element | 0.00 |
| UK Student | Null Element | 0.09 |
| UK Teacher | Null Element | 0.06 |
| China | Ta | 0.32 |
| UK Student | Ta | 0.44 |
| UK Teacher | Ta | 0.46 |

**Appendix B: Model formulas and output tables**

Note that formulas are written using *R* notation, where asterisks represent main effects and interactions between variables, while ‘+’ represents a main effect only. Random effects are written in brackets, for example, “(1|item)”. Significant *p*-values are marked with an asterisk in the tables. The condition *ta* was set as the reference condition for both models.

**Mandarin Native Speaker model:**

Final Model:

Interpretation ~ Condition + (1+Condition|Participant) +(1 |Item)

Table 1: L2 Mandarin Native Speakers. Model estimates, standard errors, *z*- and *p*- values for the fixed effects.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Fixed Effects | Log odds (logit) | Odds ratio | Std. Error | *z* value | *p* value |
| (Intercept) | 0.16 | 1.78 | 0.44 | 0.37 | 0.07 |
| ConditionNP | 5.27 | 194.71 | 1.38 | 3.81 | < .001\* |
| Condition–∅ | -3.41 | 0.03 | 0.79 | -4.30 | < .001\* |

Number of obs: 612, groups: Item, 72; Participant, 51. Confidence Level used: 0.95.

**L2 Mandarin Learner model (Proficiency):**

Final model:

Interpretation ~ Condition\*Proficiency + (1+ Condition | Participant) + (1+Proficiency | Item).

Table 2: L2 Mandarin Learners Only (proficiency). Model estimates, standard errors, *z*- and *p*- values for the fixed effects.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Fixed Effects | Log odds (logit) | Odds ratio | Std. Error | *z* value | *p* value |
| (Intercept) | -0.13 | 0.88 | 0.20 | -0.65 | 0.52 |
| Proficiency | 0.02 | 1.02 | 0.02 | 1.12 | 0.26 |
| Condition–NP | 4.09 | 59.74 | 0.64 | 6.40 | < .001\* |
| Condition–∅ | -0.84 | 0.43 | 0.41 | -2.07 | < .05\* |
| Proficiency:ConditionNP | 0.24 | 1.27 | 0.06 | 3.78 | < .001\* |
| Proficiency:Condition–∅ | -0.07 | 0.93 | 0.04 | -1.73 | 0.08 |

Number of obs: 600, groups: Item, 72; Participant, 50. Confidence Level used: 0.95.

**L2 Mandarin Learners and Native Speaker model:**

Final model:

Interpretation~ Condition\*Group\*Context+ (1+Condition\*Context| Participant) + (1+Group | Item).

Table 3: L2 Mandarin Learners and Native Speakers. Model estimates, standard errors, *z*- and *p*- values for the fixed effects.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Fixed Effects | Log odds (logit) | Odds ratio | Std. Error | *z* value | *p* value |
| (Intercept) | 0.28 | 1.33 | 0.32 | 0.89 | 0.37 |
| ConditionNP | 5.45 | 233.69 | 0.95 | 5.77 | < .001\* |
| Condition–∅ | -2.09 | 0.12 | 0.45 | -4.63 | < .001\* |
| GroupL2 Learners | -0.65 | 0.52 | 0.38 | -1.71 | 0.09 |
| ContextDisjoint | -1.05 | 0.35 | 0.63 | -1.66 | 0.09 |
| ConditionNP:GroupL2 Learners | -2.23 | 0.11 | 1.26 | -1.78 | 0.08 |
| Condition–∅:GroupL2 Learners | 3.03 | 20.68 | 0.71 | 4.29 | < .001\* |
| ConditionNP:ContextDisjoint | -3.42 | 0.03 | 1.74 | -1.96 | < .05\* |
| Condition–∅:ContextDisjoint | -0.63 | 0.53 | 0.84 | -0.76 | 0.45 |
| GroupL2 Learners:ContextDisjoint | 2.04 | 7.67 | 0.79 | 2.60 | < .01\* |
| ConditionNP:GroupL2 Learners:ContextDisjoint | 4.51 | 90.49 | 2.01 | 2.24 | < .05\* |
| Condition–∅:GroupL2 Learners:ContextDisjoint | 1.95 | 7.03 | 1.20 | 1.63 | 0.10 |

Number of obs: 1212, groups: Participant, 101; Item, 72. Confidence Level used: 0.95.

NOTES

1. The subjecthood of overt noun phrases and full pronouns is debatable, as will be discussed later. [↑](#endnote-ref-1)
2. It has been suggested that some apparent PoS structures might be learnable for children on the basis of ‘indirect negative evidence’ (Chomsky, 1981), where the absence of a particular form–meaning mapping may constitute evidence that this mapping is not possible in the grammar. However, absence of evidence is not necessarily evidence of absence, and the empirical support for this type of learning is mixed (see Lasnik & Lidz, 2016 for a discussion of statistical (Bayesian) learning on the basis of indirect negative evidence). [↑](#endnote-ref-2)
3. Although, as the reader will see later in this article, our experimental results show otherwise. [↑](#endnote-ref-3)
4. The other construction with a similar meaning is the resultative verb complex V–V construction, which is not investigated in this study. On the other hand, the combination of V and *de* can also lead to a descriptive V-*de* construction.

   (i) Ta pao de hen kuai.

   He run DE very fast

   ‘He runs very fast.’ [↑](#endnote-ref-4)
5. Why can *Lisi* be topicalised in (5) but not in (6)? We tentatively propose that the verb *shuo* ‘say’in (5) subcategorizes for a CP clause whereas the unergative verb *ku* ‘cry’ in (6)subcategorizes for a TP clause. In this, we follow Rizzi and Shlonsky (2007) who propose the Subject Criterion, i.e., syntactic elements that have been moved to the subject position are frozen there. In line with this, we assume that any element that moves into Spec,TP position cannot be further extracted. Zhao (2012) proposes that Chinese C does not usually transmit its *phi*-features to T. Thus, the subject of a Chinese sentence moves from its base-generated position Spec, vP to Spec, CP in one fell swoop and can be topicalised in most cases. This is the case with sentence (4). By contrast, *Lisi* in (5) moves from Spec,vP to Spec,TP. It gets frozen there and cannot be topicalised. Consequently, ØTopic is not allowed in the embedded subject position of the V-*de* construction in (3). The embedded null subject is only realized as Øziji and has an obligatory coreferential interpretation. [↑](#endnote-ref-5)
6. Huang maintains that despite its nature as an unergative verb, the action verb *chang* ‘to sing’ in sentences with overt embedded subjects brings about a result and that two participants are involved in the verb-plus-result combination. Furthermore, Huang claims that, unlike (3), sentences as in (4) involve a transitive complex predicate composed of the matrix verb and the resultative predicate. This transitive complex predicate can be represented as a VP shell structure. The pronoun *ta* in (4) can be considered as the object of the verb-plus-result combination and appear as Specifier of the lower VP (i.e., the external object of V’) as in (i) below, which controls a *pro* in the subject position of the resultative clause (RC). This analysis is supported by the fact that *ta* can be passivized as in (ii).

   (i) [IP Zhangsan [VP chang-dei [VP ta [V' ti [RC pro ku qilai le]]]]].

   Zhangsan sing-DE he begin.to.cry LE

   ‘Zhangsan sang and as a result he began to cry.’ (Adapted from Huang 1992: 119)

   (ii) Ta bei Zhangsan chang de ku qilai le.

   he BEI Zhangsan sing DE begin.to.cry LE

   ‘Lisi was made to cry as a result of Zhangsan’s singing.’

   As shown in (i), the matrix clause is the governing category of *ta*, and thus Binding Principle B rules out the coreferential reading of *ta*. [↑](#endnote-ref-6)
7. The Avoid Pronoun Principle postulates that the null element should be preferred over an overt pronoun when the same reading is possible with either a null element or an overt pronoun in the same position of the sentence. As the null element must take the coreferential reading in Mandarin resultative constructions, *ta* should be disprefered for the coreferential reading and assume the disjoint reading. The meaning computation where two competing derivations are constructed and evaluated in order to choose one of them as the appropriate one is known as a Reference Set Computation (RSC, Grodzinsky & Reinhart, 1993; Reinhart, 2006, 2011). [↑](#endnote-ref-7)
8. We are extremely grateful to the authors for generously sharing their experimental materials with us. [↑](#endnote-ref-8)
9. Descriptive statistics suggested the proportion of disjoint interpretations (vs. coreferential interpretations) for each of the three conditions (NP, Null Element and Ta) was similar across all three of these native speaker subgroups (see Table 1 in Appendix A and 2.3.2 for the experimental conditions). Modelling the proportion of disjoint interpretations vs. coreferential interpretations under a binary logistic regression mixed effects model also confirmed that there was no significant Native Subgroup\*Condition interaction (χ2  = 8.51, df = 4, *p* = .07), nor was there a main effect of Native Subgroup (χ2  = 1.26, df = 2, *p* = .53). Further post-hoc comparisons (Length, 2018) for the interaction revealed no significant differences between subgroups for each condition. [↑](#endnote-ref-9)
10. Translation of Context 1: Big Elephant sings a song for Little Monkey to listen to. He sings a very sad song. The more Little Monkey listens, the happier he feels inside, but the more Big Elephant sings, the sadder he feels. In the end, he starts to cry. [↑](#endnote-ref-10)
11. We inserted smiley faces to make it clear who is happy and who is crying in the pictures, where appropriate for the story. [↑](#endnote-ref-11)
12. Translation of Context 2: Big Elephant sings a song for Little Monkey to listen to. He sings a very sad song. The more Big Elephant sings, the more excited he feels; however the more Little Monkey listens, the sadder he feels. In the end, he starts to cry.

    [↑](#endnote-ref-12)
13. Both Chinese characters and pinyin were given to the non-native participants to increase comprehension of the context and the test sentence. The native speakers saw the exact same versions of the test, even though they didn’t need the pinyin, to make sure that all participants’ performance could be compared. [↑](#endnote-ref-13)
14. We used iSurvey, software proprietory to the University of Southampton. [↑](#endnote-ref-14)
15. Modelling the proportion of disjoint interpretations vs. coreferential interpretations under a binary logistic regression mixed effects model confirmed that there was no significant interaction between Method (coded Online vs. Offline) and Condition (χ2 = 3.45, df = 2, *p* = .18), nor was there a main effect of Method (χ2 = -0.27, df = 1, *p* = .99). Further post-hoc comparisons (Length, 2018) for the interaction revealed no significant differences between the two methods for each condition. As such, the native speakers were treated as one group, irrespective of whether they were tested offline or online. [↑](#endnote-ref-15)
16. For example, Case is the reason why Øziji is not allowed in embedded object position. As argued in Zhao (2012), *ziji* in the embedded object position has accusative case, whereas its probe, the embedded subject, has nominative case. The feature set of *ziji* is not a subset of that of the embedded subject, making it impossible for *ziji* to delete. An example illustrating this analysis is below in (i)

    Zhangsani shuo Lisi xihuan e\*i/j.

    Zhangsan say Lisi like

    'Zhangsan says that Lisi likes \*e.’ [↑](#endnote-ref-16)
17. The background questionnaire asked participants about their age, native language, years of studying Chinese and whether they had studied abroad. [↑](#endnote-ref-17)
18. Modelling the proportion of disjoint interpretations vs. coreferential interpretations under a binary logistic regression mixed effects model confirmed that there was no significant interaction between Method (coded Online vs. Offline) and Condition (χ2 = 3.78, df = 2, *p* = .15), nor was there a main effect of Method (χ2 = 0.44, df = 1, *p* = .51). Further post-hoc comparisons (Length, 2018) for the interaction revealed no significant differences between the two methods for each condition. As such, the learners were treated as one group, irrespective of whether they were tested offline or online. [↑](#endnote-ref-18)
19. We are thankful to Terje Lohndal, Anne Dahl, Dave Kush and Andrew Weir for discussion. [↑](#endnote-ref-19)