Acquisition of Quantifier Scope Interpretation by Chinese-Speaking Learners of English

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1. Introduction

The role of transfer from the first language (L1) has been a central issue in second language (L2) acquisition research (see White, 2003). In particular, researchers have been interested in examining the learnability conditions under which transfer from the L1 can be overcome (Adjémian, 1983; White, 1991). For example, the properties of the L2 may be in a subset relationship with the properties of L1 grammar, in which case the learner has to 'unlearn' the properties that exist in the L1 but do not exist in the L2. In this type of scenario, negative evidence may be necessary to inform the learner that the option available in the L1 needs to be ruled out in the L2 (e.g., Adjémian, 1983; Juffs, 1996; White, 1991). Another possibility is that the properties of the L2 are in a superset relationship with the properties of the L1 grammar, in which case the learner has to acquire a property in the L2 that does not exist in the L1. In this case, if positive evidence is available, this evidence may allow learners to incorporate the 'new' property into their L2 grammar (e.g., Mazurkewich, 1984; Montrul, 2001; Inagaki, 2002).

However, it has been shown that positive evidence may not always be sufficient for the learner to acquire a new property in the L2 (Inagaki, 2002, 2006). For example, Inagaki investigated the acquisition of argument structure by Japanese-speaking learners of English, focusing on a case in which the L1 Japanese is in a subset relationship with the L2 English. He examined the interpretation of sentences containing manner-of-motion verbs such as *run, swim*, and *walk*. In English, these verbs allow prepositional phrases (PPs) such as *under the bridge*, which can be interpreted in two ways. For example, in a sentence such as *John swam under the bridge*, the PP *under the bridge* can be interpreted as locational (John swam back and forth under the bridge) or directional (going under the bridge and coming out on the other side is the goal of the event). In Japanese, only the locational reading is available; the directional reading would need to be encoded with a different structure. Thus, English allows a wider set of options (locational, directional) than Japanese (locational only). Inagaki found that Japanese learners of English were constrained by their L1. Even advanced learners only allowed the locational reading for sentences such as *John swam under the bridge*. Inagaki suggested that learners initially transfer a property from the L1 and are unable to broaden their grammar to include a property that is instantiated only in the L2 if the positive evidence available is not frequent or sufficiently robust.

Similar to Inagaki (2002, 2006), this study aims to test a different case in which the L2 presents a broader range of options than the L1, focusing in particular on the interpretation of quantifier scope. The goal is to examine whether learners can overcome L1 transfer and converge on the target L2 grammar in a different domain. Our study focuses on the interpretation of doubly quantified ambiguous sentences (e.g., *Someone dropped every plate*) by L1 Chinese learners of English. Sentences containing two quantifiers (e.g., *some* and *every*) usually have more than one interpretation (Aoun & Li, 1993; Beghelli, 1997). For example, in English, the sentence in (1) has the following two readings. It can be interpreted as 'there is a distinct person such that this person dropped every single plate.' This is called the **indefinite-wide** scope interpretation. The same sentence can also be interpreted as 'for each single plate, there is a different person who dropped it.' This is called the **universal-wide** scope interpretation.

(1) *Someone dropped every plate.*
    Indefinite-wide scope: There is a distinct person, and this person dropped every single plate.
    Universal-wide scope: For each single plate, there is a distinct person that dropped it.

Crucially, languages differ with respect to how the scope ambiguity is implemented in relation with the syntactic structure. For example, based on the analysis of Aoun & Li (1993), both English active and passive quantified sentences as in (1) and (2) are ambiguous in that they both allow indefinite-wide and universal-wide scope interpretations. However, Chinese contrasts with English with this respect: active sentences in Chinese as in (3) are not ambiguous in that only the indefinite-wide scope interpretation is available; passive sentences in Chinese as in (4), however, are similar to English in that both indefinite-wide and universal-wide scope interpretations are available. Aoun and Li (1993) attribute the differences and similarities between English and Chinese to a phenomenon known as Quantifier Raising, which takes place at the level of Logical Form (LF), a level beyond the surface syntactic representation. We will return to these analyses in the Discussion.

(2) *Every plate was dropped by someone.*

(3) *mou   ge   ren   shuaipo   le   mei   ge   panzi*
    one   CL   person   drop   ASP   every CL   plate
    'Someone dropped every plate.'

(4) *mei   ge   panzi   dou   bei   mou[1]   ge   ren   shuaipo   le.*
    every CL   plate   all   by   some   CL   person   drop   ASP
    'Every plate was dropped by someone'

In sum, the difference between English and Chinese with respect to quantifier scope interpretation is observed in the active sentences, but not in the passive sentences. In English, active sentences have two interpretations whereas Chinese active sentences only have the indefinite-wide scope interpretation available. In passive sentences, the two languages are similar, both allowing the indefinite-wide scope and universal-wide scope interpretations. Given the learning scenario discussed above, Chinese learners of English would need positive evidence to learn the universal-wide scope interpretation for active sentences in English, as this interpretation cannot be transferred from the L1. Following studies such as Inagaki (2002), we investigated whether Chinese learners of English can interpret doubly quantified sentences similarly to English native speakers or whether they are constrained by the properties of the L1. The results of our study support Inagaki's proposal showing transfer effects from L1, with the L2 learners exhibiting difficulty in converging on the target property.

2. Background
2.1. Quantifier scope in second language acquisition

There are very few studies on the L2 acquisition of quantifier scope. Marsden (2009) investigated learners' knowledge of quantifier scope in Japanese as an L2. In Japanese, the typical word order is Subject-Object-Verb (SOV), as is shown in (5); in addition, Japanese also allows scrambled word orders such as Object-Subject-Verb (OSV), as is shown in (6). Although the basic meaning stays the

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[1] Note that, in Chinese, the quantifier *you* 'have/some' typically serves as the existential quantifier (e.g., Tsai, 2003). However, quantifier phrases containing *you* can only occur in subject position (Tsai, 2003); for example, in (i), the sentence is ungrammatical.

(i) **mei   ge   panzi   dou   bei   **you**   ge   ren   shuaipo   le.*
     every CL   Plate   all   by   some   CL   person   drop   ASP
    'Every plate was dropped by someone'

Since this study aims to compare active sentences with passive sentences, such as the one in (i), we selected the quantifier *mou* which can also be translated as 'some' in English and can appear in both active and passive sentences.

same between the two word orders, the difference in word order leads to different scope interpretations. In the typical SOV sentence as in (5), only the indefinite-wide scope interpretation is possible, where *someone* takes scope over *every book.* That is, there is a distinct person and this person reads every book. On the other hand, the OSV sentence is ambiguous. The sentence in (6) allows both the indefinite-wide scope interpretation (similar to (5)) and the universal-wide scope interpretation, in which *every book* takes scope over *someone*. On the universal-wide scope reading, it follows that for each distinct book, there is a distinct person who reads it.

(5) *Dareka-ga   dono hon-mo   yonda.*   (Marsden, 2009, p. 137)
     someone-Nom   every book   read
     'Someone read every book.'

(6) *Dono hon-mo   dareka-ga   yonda.*
     every book   someone-Nom   read
     'Someone read every book. (scrambled)'

Marsden tested native speakers of Korean and English. Korean is similar to Japanese in terms of the interaction between scope interpretation and word order. In Korean, a typical SOV sentence allows only the indefinite-wide scope interpretation, whereas a scrambled OSV sentence allows both interpretations. However, in English, the two interpretations are available in a typical SVO sentence (e.g., *Someone read every book*); in addition, although there is no scrambled word order available, most English sentence types (such as the passive for example) allow both interpretations. Marsden argued that the English-speaking learners of Japanese are confronted with an L2 poverty of stimulus problem in that the word order differences which lead to different scope interpretations in Japanese are subtle and cannot be derived from the L1. The English-speaking learners in her study are in the first learning scenario described in the introduction above, in which they may need negative evidence in order to rule out the interpretation that is available in the L1 but not the L2.

The L1 English and L1 Korean learners of Japanese were divided into intermediate and advanced proficiency levels based on their scores on a cloze test. In the main experiment, both SOV and OSV sentence structures were tested. For each sentence structure, two interpretations, the indefinite-wide scope and universal-wide scope readings, were presented using pictures. The participants were asked to judge whether the sentence is acceptable given the picture by using a four-point scale. In the task, the pictures were presented first, followed by the sentences. The results revealed that the L1 Korean learners of Japanese at both proficiency levels performed similarly to the native speakers, which suggests that the properties of the L1 facilitated acquisition. With respect to the L1 English learners of Japanese, the intermediate proficiency learners showed transfer from the L1, incorrectly accepting SOV sentences in Japanese with the universal-wide scope interpretation. However, the advanced learners were able to correctly reject it. This result suggests that the learners initially transferred the property from their L1, but were still able to converge on the target property in the L2. This is an interesting finding given that negative evidence was presumably not available to the learners. Marsden argues that these results support the Full Transfer/Full Access (Schwartz & Sprouse, 1996) model of L2 acquisition.

Unlike Marsden (2009) who tested whether leaners can converge on the target grammar without negative evidence, Lee, Yip and Wang (1999) examined whether learners are able to use positive evidence to acquire a property that does not exist in their L1. Lee et al. studied the acquisition of quantifier scope in L2 English by L1 Chinese adult learners. According to Huang (1981), sentences with '*every*' in Chinese are not ambiguous, unlike English. Importantly, Chinese and English follow the same basic word order (SVO) but differ with respect to scope interpretation. The L1 Chinese learners of English who participated in the study were divided into intermediate and advanced groups based on a cloze test. They were asked to complete a judgment task in which they were presented with doubly quantified sentences and given three or four possible written interpretations. The results showed that, similar to native speakers, both groups of learners correctly accepted the universal-wide scope reading for sentences with the object quantified by '*every*'. Thus, Lee et al.'s results do not support Inagaki's proposal in that there was no evidence of L1 transfer at the initial stages of acquisition since both intermediate learners and advanced learners performed similarly to native speakers. That is, even at the early stages of learning, learners were already able to acquire a property not instantiated in the L1.

Overall, the results of Marsden (2009) and Lee et al. (1999) suggest that quantifier scope interpretations are fully acquirable by L2 learners. However, there is an open question with respect to the role of the L1. Marsden's (2009) results provide evidence of full transfer in the initial stages of acquisition, indicating that learners initially use the L1 properties in the L2. In contrast, the results of Lee et al. (1999) do not provide evidence of transfer. Thus, the present study further examines the acquisition of quantifier scope interpretation by Chinese learners of English, adopting Marsden's (2009) methodology, in order to provide further understanding of the role of the L1.

2.2. Hypotheses

Recall that active sentences in English allow both indefinite-wide and universal-wide readings, while they only allow the indefinite-wide reading in Chinese; for passive sentences, both English and Chinese allow indefinite-wide and universal-wide readings. Following the Full Transfer/Full Access model (Schwartz & Sprouse, 1996), which predicts that the L1 forms the initial state of the L2 grammar but convergence on the L2 grammar is potentially possible, we can make the predictions below:

i.   Active Sentences: If there is L1 transfer, low proficiency L1 Chinese learners of English are predicted to correctly accept the indefinite-wide scope interpretation and incorrectly reject the universal-wide scope interpretation in English. In addition, if positive evidence is available and robust enough, high proficiency L1 Chinese learners of English may be able to overcome L1 transfer and correctly accept both the indefinite-wide scope and the universal-wide scope interpretations.

ii.   Passive Sentences: Both low proficiency and high proficiency L1 Chinese learners of English are predicted to correctly accept both the indefinite-wide scope and the universal-wide scope interpretations due to the similarities between Chinese and English.

3. Method
3.1. Participants

The participants were 28[2] native speakers of Mandarin Chinese who were learning English as their L2. Twenty-three of the participants were tested at the National Chiayi University in Taiwan and five of the learners were tested at the University of Kansas. The learners are further divided into advanced and intermediate learner groups based on their scores on the University of Michigan English Listening Comprehension Test, a 45 question test of English grammar. Their scores on the English proficiency test ranged from 23 to 45 (Mean= 35.18). Those who scored 37 to 45 were categorized as advanced learners (N=12) whereas those who scored 23 to 36 were categorized as intermediate learners (N=16). In addition, 14 native English speakers were recruited to serve as the control group.

3.2. Tasks

Participants were asked to complete an English Picture Matching task and a Chinese Picture Matching task. The English Picture matching task was adopted from Marsden (2004, 2009) with some modifications. Figure 1 provides a sample of a trial targeting the indefinite-wide scope interpretation (however, active and passive sentences were tested in separate trials) and Figure 2 provides a sample of a trial targeting the universal-wide scope interpretation (again, active and passive sentences were tested in separate trials).
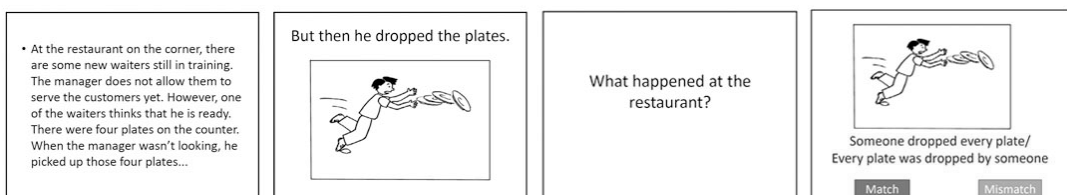

Figure 1. Sample target trial targeting the indefinite-wide scope interpretation

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2   There were originally 33 learners, but 5 of them were eliminated from the analysis because they failed to judge the fillers with at least 80% accuracy.
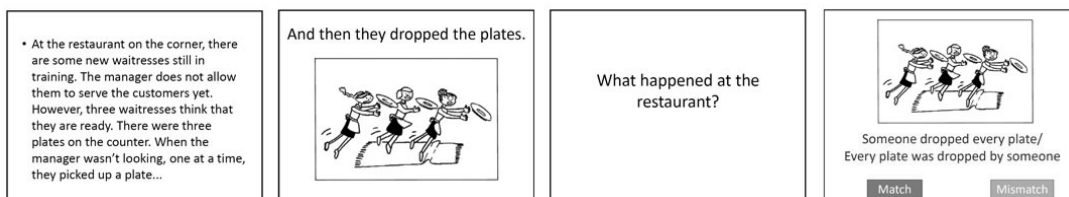
Figure 2. Sample target trial targeting the universal-wide scope interpretation

We used a subset of the pictures from Marsden's stimuli[3] but in our task, rather than simply presenting a picture with a target sentence, we also included a written story context before the target sentence and target picture, as is shown in Figures 1 and 2 above. In our task, participants were asked to read a short story and then were shown the target picture at the end of the story. They were then asked what happened in the story. Finally, the target picture appeared again along with the target sentence. Then, the participants need to judge whether the sentence match the picture and the story by selecting either 'Match' or 'Mismatch'. The English Picture Matching Task used a 2 (Sentence structure - active vs. passive) x 2 (Scope – indefinite-wide vs. universal-wide) design, which resulted in four conditions, as is summarized in Table 1. The target items included sentences with *every* in both active and passive voice (*someone dropped every plate* versus *every plate was dropped by someone*)[4]. For each condition, there were ten items.

Table 1. Summary of target items

	Sentence Structure	Readings	# of items
Target	active	indefinite-wide	10
		universal-wide	10
	passive	indefinite-wide	10
		universal-wide	10

In addition to the target items, we included 40 fillers that were designed to be rejected (Mismatch) as all test items were designed to be accepted (Match) by native speakers of English. There were two types of fillers. In the first type of filler, there is a one-to-one mapping in terms of the objects and agents, (similar to the indefinite-wide scope stories: three girls each wash a different window) but the test sentence targeted an object that was not present in the picture (e.g., test sentence: *The three girls*

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[3] We are very grateful to Heather Marsden for her kindness in sharing her materials with us.

[4] An anonymous reviewer pointed out that the comparison of doubly quantified sentences with respect to voice is not on equal footing. Between the two possible readings for the sentences involving the indefinite/existential *some* and the universal *every* as the ones we used in the current study, the indefinite-wide scope reading entails the universal-wide scope reading, i.e., when it is true that a distinct person dropped every plate (the indefinite-wide reading), it must also be true that for each plate, someone dropped it (the universal wide reading), but not vice versa. In the indefinite-wide scenario as in Figure 1, the indefinite-wide reading is true, and it follows, by entailment, that the universal-wide reading is also true; in the universal-wide scenario as in Figure 2, the universal-wide reading is true, but the indefinite-wide reading is false. Hence, while the universal-wide reading is true in both of the scenarios, the indefinite-wide reading is true in the indefinite-wide scenario but not in the universal-wide scenario. Based on this observation, the reviewer pointed out that, assuming that the surface scope reading is more easily accessible, the passive sentences used in the current study are more readily accepted, because the surface scope reading of the passive sentences is the universal-wide reading, which becomes true in both of the scenarios, contrary to the active sentences, whose surface reading is the indefinite-wide reading that is verified in one scenario but falsified in the other. Considering such a logical asymmetry between the active and passive sentences used in our study, the current study focuses on the acquisition of English doubly quantified sentences in active voice. We would like to address that a future study should include two additional types of sentences, namely, '*everyone dropped some plate*' (active sentences whose surface scope reading is the universal-wide reading) and '*some plate was dropped by everyone*' (passive sentences whose surface scope reading is the indefinite-wide reading), as well as the sentences used in the current study (active sentences whose surface scope reading is the indefinite-wide reading, and passive sentences whose surface scope reading is the universal-wide reading), in order to have the reverse order of the entailment relationship in both active and passive sentences and all four possible combinations of scope interaction with voice.

washed every dish). The second filler type included pictures that have 'extra objects' (e.g., a girl pushed just one of three boys in the picture). The sentence structure was identical to the target test sentences (e.g., *Someone pushed over every boy*). In this way, participants cannot develop a strategy in which they can simply accept sentences that start with *som*e or *someone*. This task was presented using the experiment software *Paradigm* by Perception Research Systems (Tagliaferri, 2005). We presented the items in four blocks with ten targets and ten fillers in each block. Only one sentence from each of the four test conditions (active/indefinite-wide, active/universal-wide, passive/indefinite-wide, passive/universal-wide) appeared in the same block. We randomized both the presentation of the four blocks and the presentation of the sentences within each block.

In addition to the English Picture Matching task, L2 learners were asked to complete a Chinese Picture Matching task. The results of this task were interpreted to demonstrate their scope representation based on their L1 knowledge, and were used as the baseline to which the results of the English Picture Matching task was compared to examine the possibility of transfer from L1 Chinese and to verify the judgments of the syntactic analyses of Chinese. This task included 12 target test items (a subset of the pictures from the English Picture Matching task) for a total of three items for each of the four test conditions. In the Chinese task, participants were presented with a target picture and a target sentence in Chinese without the addition of the written story contexts[5]. Participants were asked to judge whether the picture was compatible with the test sentence by choosing either 'Match' or 'Mismatch'.

3.3. Procedure

Participants were tested individually using computers for the English Picture Matching task. Participants were given a 5-minute rest between blocks. Following the English Picture Matching task, participants were asked to complete the English proficiency test and the Chinese Picture Matching task, which were both given as paper-and-pencil tests. The whole experiment lasted about one hour.

4. Results
4.1. Chinese Picture Matching task

The Chinese Picture Matching task was used to examine how Chinese learners of English interpret scope in their native language. Recall that according to Aoun & Li (1993), Chinese active and passive sentences take different scope interpretations; Chinese active sentences allow only the indefinite-wide scope interpretation whereas passive sentences allow both indefinite-wide scope and universal-wide scope interpretations. However, the results from the Chinese judgment task only partially support the proposal above. As can be seen in Figure 3, the results for the active sentences is in line with Aoun & Li's proposal with mean acceptance of the indefinite-wide scope reading at 100.00% and the mean acceptance of the universal-wide scope reading at 0.00%. However, contrary to this proposal, the participants also have a strong preference for the indefinite-wide scope reading (98.81%) as compared to the universal-wide scope reading (26.19%) for the passive sentences. The acceptance between the two scope readings for the passive sentences is significantly different ($t(27)=10.917$, $p<.001$).
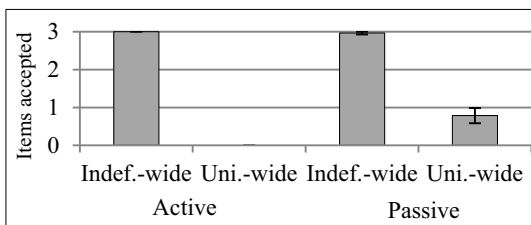
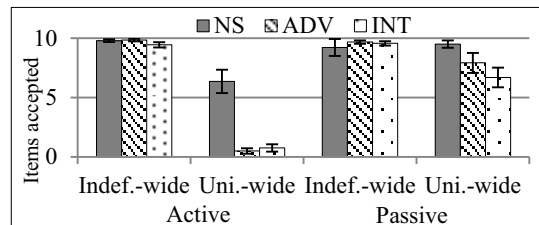Figure 3. Mean acceptance of Chinese active and passive sentences with two scope interpretations

Figure 4. Mean acceptance of English active and passive sentences with two scope interpretations

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[5] Since the Chinese Picture Matching task was administered right after the English Picture Matching task within one single experimental session, we did not include the story contexts for the Chinese task in order to shorten the overall length of the session.

The acceptance of the universal-wide scope interpretation for the passive sentences varied across individuals. Three out of 28 participants consistently accepted the passive sentence with the universal-wide scope interpretation. Nine out of 28 participants accepted either one or two of the three items. Although the acceptance of the universal-wide scope interpretation is low for the passive sentences, it is nevertheless clear that Chinese speakers treat active and passive sentences differently.

4.2. English Picture Matching Task

A summary of the results for the English Picture Matching task is presented in Figure 4 above. According to Aoun and Li (1999), in English, both active and passive sentences allow both indefinite-wide and universal-wide scope interpretations. However, as shown in Figure 4, English native speakers have a preference towards the indefinite-wide scope reading for actives sentences while they allow both readings for the passive sentences. With respect to the learners, for the active sentences, as predicted, the acceptance of the indefinite-wide scope reading is above 90%. However, the acceptance of universal-wide scope reading is below 10% for both the intermediate and advanced learners. For the passive sentences, the acceptance of the indefinite-wide scope reading is also above 90%, similar to native speakers, but learners' acceptance of the universal-wide scope reading is not as strong as native speakers and there seems to be a gradual increase in acceptance from the intermediate to the advanced learners. In order to examine these differences in the results, a mixed 3x2x2 Repeated Measures ANOVA was conducted with the between subjects factor of Group (advanced L2 vs. intermediate L2 vs. English native) and the within subject factors of Structure (active vs. passive) and Scope (indefinite-wide vs. universal-wide).

Table 2. 3x2x2 Mixed ANOVA

Source	df	F	p
Group	2	15.088	.000
Scope	1	231.106	.000
Structure	1	101.862	.000
Scope * Group	2	23.832	.000
Structure * Group	2	6.974	.003
Scope * Structure	1	77.258	.000
Scope * Structure * Group	2	2.801	.073

As can be seen in Table 2, every main effect and interaction is either significant ($p <.05$) or marginal ($.1 > p >.05$). To examine the significant main effect of group, post-hoc comparisons using Bonferroni corrections were conducted. Results showed that there was not a significant difference between the intermediate and advanced learners ($p > .05$). However, both learner groups performed significantly different from the native speakers. In what follows, we will analyze the results of native speakers and learners separately.

For the native speakers, a 2x2 Repeated Measures ANOVA with the within-subject factors of Structure (active vs. passive) and Scope (indefinite-wide vs. universal-wide) was conducted. The results revealed a significant interaction between Scope and Structure ($F(1,13) = 6.882, p < .05$). More specifically, the acceptance of the indefinite-wide and universal-wide scope readings is significantly different for the active sentences while there is no difference between the two readings for the passive sentences (Active: $t(13)=-.363 , p < .05$; Passive: $t(13)=3.492 , p > .05$). In short, the acceptance of the universal-wide scope reading is higher for the passive sentences than for the active sentences. Furthermore, as we take a look at the individual data, native speakers' acceptance of the active sentences with the universal-wide scope reading varies. Table 3 summarizes the number of items that participants accepted for the English active sentence with the universal-wide scope interpretation. If we set 70% as an arbitrary cut-off point, seven out of 14 native speakers accepted the universal-wide scope reading with the active sentences while seven participants generally rejected it.

Table 3. Distribution of English natives based on the acceptance of English active sentence with the universal-wide scope reading

# of items accepted	0	1	2	3	4	5	6	7	8	9	10
English Natives (N)	1	1	0	2	1	1	1	0	1	1	5

With respect to the L2 learners, a 2 x2 x 2 mixed Repeated Measures ANOVA was conducted with the between subject factor Group (intermediate vs. advanced) and the within subject factors of Structure (active vs. passive) and Scope (indefinite-wide scope vs. universal-wide scope). There was a significant interaction between Structure and Scope ($F(1, 28) = 101.451$, $p < .001$). A post-hoc paired t-test was conducted to test for differences between acceptance of the indefinite-wide scope and universal-wide scope readings for both active and passive sentences. As there was no main effect of Group, results for the two proficiency levels were collapsed. Learners' acceptance of the indefinite-wide and universal-wide scope readings differed for both active and passive sentences (Active: $t(27)=36.757$, $p < .001$; Passive: $t(27)=3.955$, $p < .001$). However, descriptively, as is shown in Table 4, advanced learners accepted more passive sentences with the universal-wide reading than the intermediate learners.

Table 4. Mean acceptance of English active and passive sentences with two scope readings

	Active		Passive	
	Indefinite-wide	Universal-wide	Indefinite-wide	Universal-wide
Intermediate	94.38%	7.50%	95.63%	66.88%
Advanced	98.33%	5.00%	96.67%	79.17%

In summary, the general patterns observed for both learners and native speakers is similar in that both groups treat active and passive sentences differently in terms of scope interpretation. However, there are also several differences. For active sentences, all three groups show a significant difference in the acceptance of the indefinite-wide and universal-wide scope readings. However, the learners exclusively accepted the indefinite-wide scope reading, strongly rejecting the universal-wide scope reading, while the native speakers showed a strong preference for the indefinite-wide scope over the universal-wide scope reading. For the passive sentences, native speakers showed no difference between the two scope interpretations, accepting both readings. Although learners also accepted both the indefinite-wide scope and universal-wide scope readings, the degree of acceptance between the two readings differs, with learners showing a preference for the indefinite-wide scope reading.

5. Discussions and Conclusions

The present study examined whether learners at the early stages of language development are constrained by the properties of the L1 and whether more advanced learners can acquire a property that is instantiated in the L2 but not the L1. Specifically, based on the predictions of Full Transfer/Full Access, we examined whether intermediate proficiency Chinese-speaking learners of English would incorrectly reject the universal-wide scope interpretation with active sentences due to L1 transfer and whether more advanced learners would show target-like acceptance of the universal-wide reading due to the positive evidence that is presumably available in the input. Moreover, we also compared the acceptance pattern of indefinite-wide and universal-wide scope interpretations in English actives and passives. We expected both intermediate proficiency and more advanced learners would correctly accept both the indefinite-wide and universal-wide scope interpretations in English passive sentences due to the proposed similarities between English and Chinese. For the active sentences, we found that both intermediate and advanced learners incorrectly rejected the universal-wide scope interpretation. For the passive sentences, we found that both groups of learners correctly accepted the indefinite-wide scope reading, but the acceptance of the universal-wide scope interpretation was not as robust. The results of this study may lend support to Inagaki's proposal. Learners exhibited similar acceptance of the universal-wide scope interpretation with active sentences in both English and Chinese which might provide evidence of L1 transfer, suggesting that even if positive evidence is available to learners, it may not be robust enough to force the learners to revise their interlanguage grammar. However, it is

also important to point out that even English native speakers show a clear preference for the indefinite-wide scope reading for active sentences, which further suggests that there may be little positive evidence available to facilitate the acquisition of this interpretation. For the passive sentences, learners correctly accepted the indefinite-wide reading, as they did in the L1 Chinese, but there is variability in the acceptance of the universal-wide reading. It is unclear whether the variability is tied to their level of proficiency in English (there is a numerical difference in the acceptance of the universal-wide scope reading for intermediate and advanced learners) or is tied to their acceptance of the universal-wide scope reading with passives in Chinese, where variability was also observed[6]. In what follows, we turn to a discussion of these open questions for both the active and passive sentences.

5.1. English native speakers: Processing Scope Economy and preference?

The results from English native speakers for the active sentences were unexpected according to the syntactic analyses summarized earlier. The English natives did not show high acceptance of the universal-wide scope interpretation with active sentences. However, the results are not surprising in comparison to previous experimental studies (Kurtzman & MacDonald, 1993; Marsden, 2004, 2009; Musolino & Lidz, 2003). The results are consistent with a psycholinguistic study of English native speakers by Kurtzman & MacDonald (1993), who investigated active and passive sentences in English with respect to scope preference. Their results showed a preference for the indefinite-wide scope reading with active sentences but no obvious scope preference with passive sentences, in line with the results of the present study. Anderson (2004) proposed a possible account of the indefinite-wide scope reading for actives, which is referred to as the principle of *Processing Scope Economy,* shown in (7).

> (7) *Processing Scope Economy* (p.138): The human sentence processing mechanism prefers to compute a scope configuration with the simplest syntactic representation (or derivation). Computing a more complex configuration is possible but incurs a processing cost.

The proposal in (7) states that the parser prefers the interpretation that arises due to the simplest syntactic representation. We will consider the derivations of the two readings associated with doubly quantified active sentences. According to Aoun and Li's (1993) analysis of Quantifier Raising at Logical Form, in active sentences as in (8), in order to represent the indefinite-wide scope interpretation, the object Noun Phrase only needs to move from the complement of the Verb to the Specifier of the Verb Phrase. As shown in Figure 5, the subject *someone* c-commands the object *every plate.* Thus the subject takes scope over the object at both LF and in the surface syntax. Thus, we can also refer to the indefinite-wide scope reading as the surface scope reading. However, in order to represent the universal-wide scope interpretation, the object Noun Phrase must undergo long movement in which it has to move from the object NP position to a position that is higher than the subject NP as is shown in Figure 6. The object now c-commands the subject at LF. Thus, the object takes scope over the subject and it leads to the universal-wide scope interpretation. Note that in Figure 6, the object takes scope over the subject at LF (*every plate*, *someone*) but this is the reverse of the order of the quantifiers in the surface syntax (*someone*, *every plate*); this is thus referred to as inverse scope.

> (8) Someone dropped every plate.
>   Interpretation 1: (indefinite-wide scope/surface scope)
>   There is a distinct person, and this person dropped every single plate. (Figure 5)
>   Interpretation 2: (universal-wide scope/inverse scope)
>   For each single plate, there is a distinct person that dropped it. (Figure 6)

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[6] As an anonymous reviewer pointed out, another possible factor here is the entailment relationship between the indefinite-wide scope reading and universal-wide scope reading discussed in footnote 4. That is, if the surface scope reading is more accessible, participants will easily accept the universal-wide scope reading (the surface scope reading) and by entailment accept the indefinite-wide scope reading.
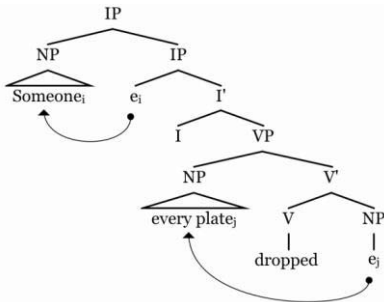
Figure 5. Tree structure of an English active sentence with the indefinite-wide scope interpretation
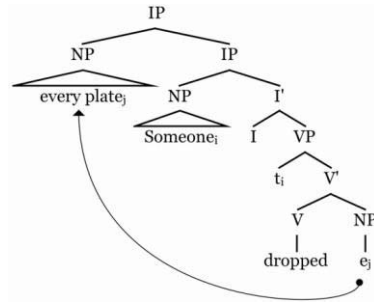

Figure 6. Tree structure of an English active sentence with the universal-wide scope interpretation

Anderson (2004) suggests that inverse scope has a more complex syntactic representation or derivation at LF compared to surface scope. Under this processing view, surface scope is easier to process and thus, surface scope readings, such as the indefinite-wide reading in the present study, may be preferred. The inverse scope interpretation, the universal-wide reading in the case of the present study, is still possible but is more costly in processing. This account is compatible with the findings of the English natives in the present study for the active sentences.

5.2. L2 Learners of English

With respect to the learners, the results of the Chinese Picture Matching task only partially support Aoun & Li's (1993) proposal. On the Chinese judgment task, in line with Aoun & Li, Chinese speakers exclusively accepted the indefinite-wide scope reading for the active sentences but contrary to the proposal, they did not consistently accept both the indefinite-wide and universal-wide scope readings for the passive sentences. For the passives, the Chinese natives showed high acceptance of the indefinite-wide scope interpretation, but their acceptance of the universal-wide scope interpretation was lower and differed across individuals. There are at least two possible explanations for why Chinese natives showed unexpected judgments for the Chinese passives. As suggested by an anonymous reviewer, one possibility is that the Chinese task did not include the story context, unlike the English task. However, the two tasks included the same pictures and the Chinese task always followed the English task so it is unlikely that these methodological differences are solely responsible for the differences in judgments for the two languages. We can address this further in a future study by testing the Chinese sentences with the full experimental paradigm used for the English task. Another possibility is due to the linguistic properties of the test sentences targeting the Chinese passive. The passive test sentences, such as (4) above, include the quantifier *dou* (while the active sentences do not). The presence of *dou* is required in sentences that include the quantifier phrase as *mei ge*, which is included in all of the passive sentences (Tsai, 2003). Lin (1998), Yang (2000) and others (e.g., Huang (1996) have proposed that *dou* in Chinese is a universal quantifier. In other words, in a sentence such as (4), there are potentially three quantifiers which can interact with each other in deriving an interpretation. Furthermore, Yang (2000) suggests that *dou* may serve as a scope operator which determines the scope interpretation over other quantifiers such as *mei*. Given these proposals, the interpretation of a doubly-quantified passive sentence in Chinese such as (4) may not be so straightforward and this may account for some of the variability observed in the native judgments.

With respect to the English Picture Matching task, in spite of the ongoing debate on scope processing among English native speakers, we can still evaluate the L2 learners' performance. For the active sentences, intermediate learners accepted only the indefinite-wide scope interpretation. But the same pattern was observed in the advanced learners as well, which suggests that even if positive evidence is available (which needs to be examined further, given the judgments of the English native speakers), it does not help the learners to overcome L1 transfer. As a result, even the advanced learners in this study maintain a preference for the indefinite-wide scope reading which is the pattern shown in their L1 judgment. These results are different from the findings in Lee et al. (1999) where convergence

was shown to be possible for advanced learners[7]. There are at least two possibilities for our results. We will address the results for the active sentences first. One possibility is that the learners are showing an adherence to the principle of *Processing Scope Economy,* similar to the native speakers. According to Anderson (2004), the indefinite-wide scope interpretation is easier to derive while the universal-wide scope interpretation is possible but more costly in terms of processing resources. This principle may explain the preference for the indefinite-wide scope reading in both groups. A second possibility is that the learners are constrained by the properties of the L1. As was shown previously, the acceptance of indefinite-wide scope in Chinese active sentence is 100% while the acceptance of universal-wide scope is 0%. The learners may reject the universal-wide reading in English because it is not allowed in Chinese. It is possible that the positive evidence available to the learners may not be clear and frequent enough to force learners to revise their grammar. As we pointed out, this possibility is likely given the results of the English native speakers. Further research is needed in order to fully evaluate these two possibilities. It is necessary to test an additional group of learners whose L1 is similar to English in order to see whether this learner group would also demonstrate a preference for the indefinite-wide scope reading with active sentences. If this pattern is observed, the processing account would be supported. In contrast, if the group whose L1 is similar to English shows results more similar to those of the English native speakers, then it is likely that the learners in the present study are constrained by the properties of the L1 and thus providing support for Inagaki's (2002) proposal.

Next, we turn to a discussion of the passive sentences. Learners again showed a preference for the indefinite-wide scope reading, but not as strongly as in the active sentences. In order to examine these results further, we investigated whether the learners' acceptance of the universal-wide scope reading in L2 English was related to (a) their proficiency level in English or (b) their individual acceptance of the universal-wide scope reading in the L1 Chinese. This analysis can potentially allow us to see whether the results are related to development in English or transfer from the L1. However, a regression analysis revealed that both factors were significant predictors of the acceptance of the universal-wide scope reading of the English passive. As shown in Table 5, in model 1, the acceptance of the universal-wide scope reading with passives in Chinese was entered independently ($F(1, 26) = 4.66$, $p < .05$) and the model is significant. In model 2, English proficiency is entered while controlling for the acceptance of the universal-wide reading in Chinese; the model is still significant.

Table 5. Regression models on the acceptance of English passives with universal-wide scope

		B	SE B	β
Model 1	(Constant)	6.312	.697	
	Chinese Passives: Universal-wide reading	1.149	.532	.390*
Model 2	(Constant)	-1.744	3.556	
	Chinese Passives: Universal-wide reading	1.178	.493	.400*
	English Proficiency	.228	.099	.385*

$R^2 = .152$ for Step 1, $\Delta R^2 = .148$ for Step 2 ($p < .05$). * $p < .05$

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[7] One possible reason that we did not replicate Lee et al.'s (1999) findings may be due to task differences. In their task, the participants were provided with the target sentence as in (i) together with written interpretations as in A, B, and C, and their task was to rate the compatibility of each interpretation on a four point scale (0 to 3).

(i) *Two balls bounced to every corner in the room*.
   (A) There were only two balls. One ball bounced to all the corners in the room. The other ball also bounced to all the corners in the room (each-all).
   (B) There were only two balls. One ball bounced to some corners in the room. The other ball bounced to the other corners (cumulative).
   (C) Each corner had two balls bouncing in it. Different corners in the room had different balls. There were more than two balls (object-wide scope).

When analyzing the data, the researchers considered 0 as unacceptable and 1, 2, 3 as acceptable. This lenient rating scale may be partially responsible for the participants' target-like performance on the task.

The results of the regression suggest that both the acceptance of universal-wide scope reading in Chinese with passives and the learners' level of English proficiency are significantly related to the acceptance of the universal-wide scope reading with passives in the L2 English. Therefore, whether transfer plays an important role remains an open question.

In conclusion, our results show that both native speakers and L2 learners distinguish between active and passive sentences in terms of quantifier scope interpretation. Moreover, the results suggest that there may be transfer from the L1 and difficulty in convergence on to the target property in the L2, suggesting that the positive evidence available might not be robust enough for the leaners to acquire the new property in the L2. Future research with an additional L1 learner group can help to tease apart the effects of L1 influence from other factors.

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