Asking Questions in L2 English: An Elicited Production Study

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Abstract

The present study investigates the role of the syntactic properties of the first (L1) and the target language (L2) on second language learners' production of English main and embedded clause questions. The role of L1 was investigated by comparing the production of L2 learners whose L1s (Chinese and Spanish) differ from English and each other in terms of word order in main and embedded clause questions. The role of the target language was investigated by comparing L2 learners' production of yes/no and adjunct and argument *wh*-questions.

The results indicate that the L1 is not a predictor of L2 learners' production patterns for either main or embedded clause questions. The linguistic properties of the target language, on the contrary, predict learners' accuracy and inversion profiles. In line with data from the English L1 acquisition literature, L2 learners produced lower inversion rates in main clause yes/no than *wh*-questions, and particularly low inversion rates with *why*-questions. In line with data from non-standard varieties of English and preliminary evidence from L1 acquisition, L2 learners produced higher non-standard inversion rates in embedded clause *wh*-questions than yes/no questions. Taken together, these results highlight that L2 production is affected and constrained by the same factors at play in L1 acquisition and dialectal variation.

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1. Introduction

In this paper, we focus on the production of English main and embedded clause questions as a means of investigating the role of the syntactic properties of the first (L1) and the target language (L2) on the production of adult second language (L2) speakers.

In English main clause questions, an auxiliary verb precedes the subject ((1)-(2)), while in embedded clause questions ((3)-(4)) the relative order of the subject and the auxiliary is the same as in declarative clauses:

(1) What are you eating?

(2) Are you eating pizza?[1]

(3) Mary doesn't know what he is eating.

(4) Mary doesn't know if he is eating pizza.

The phenomenon in (1)–(2) is known in the early generative literature as subject-auxiliary inversion, and in the more recent generative literature as T-to-C movement. The first term refers to the fact that the relative surface order of the subject and the auxiliary is 'inverted' compared to that of declarative clauses, while the second refers to the (hypothesized) movement of a tense-bearing element from the head of Tense Phrase (TP) to the head of the Complementizer Phrase (CP). For simplicity, we will refer to the phenomenon in (1)-(2) as *inversion*, and to the phenomenon exemplified in (3)-(4) as *non-inversion*.

Productions of main and embedded clause questions in which the relative order of the subject and the auxiliary is no-targetlike (as in (5) and (6), respectively) will be referred to as *inversion errors*:

(5) *Why you are laughing?

(6) *Do you know what is she bringing?

Inversion errors in the speech of young children learning English as their first language have been documented from the first days of modern developmental psycholinguistics (e.g., Brown, 1968, Klima & Bellugi, 1966). This error is often long-lasting, and children's performance is non-adultlike until age 5 or 6 (Ambridge et al., 2006; Thornton, 2008). The sources of these errors are controversial and children's production of interrogative structures has been shown to be affected by a number of factors, among which are the presence of negation (Erreich, 1984; Guasti et al., 1995), the syntax of the question being produced (*wh-* vs. yes/no, see Bellugi, 1971; Rowland & Pine, 2000), the type of auxiliary (Santelmann et al., 2002; Stromswold, 1990) and *wh*-word present in the structure (de Villiers, 1991; Stromswold, 1990; Thornton, 2008), and the frequency of specific combinations of *wh*-words and auxiliaries in the adult input (Ambridge et al., 2006).

Albeit far less studied, inversion errors in embedded clause questions have also been reported in the spontaneous speech of English-speaking children of about the same age (Stromswold, 1990, but see Sarma, 1991 for a different finding in elicited production), perhaps indicating that children have trouble not with subject-auxiliary inversion or movement *per se*, but with the conditions under which inversion should and should not apply.

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Persistent inversion errors in the production of English questions by child and adult L2 learners of English have also been reported in the literature, and a number of factors have been claimed to affect inversion rates in production and acceptability rates of inverted and non-inverted questions. For example, it has been suggested that L2 learners' inversion rates in main clause questions are affected by the syntax of their L1 (Jackson, 1981; McDonald, 2000; Spada & Lightbown, 1999; Zobl, 1992), the syntax of the question being produced (yes/no vs. *wh-*, Eckman, Moravcsik, & Wirth, 1989; Pienemann, Johnston & Brindley, 1988), and the type of *wh-*word present in the structure (e.g., argument vs. adjunct, see Lee, 2008). The individual contribution of these factors, however, has yet to be systematically investigated.

In this study, we investigate the extent to which inversion errors in the production of English questions by L2 speakers are a product of the syntax of their native language. Additionally, we investigate the extent to which, on par with children acquiring a first language, L2 learners' production is affected by properties of the target language, such as the structure of the question they are producing (*wh-* vs. yes/no), and the presence of individual *wh-*words.

1.1. The role of L1 properties: Chinese vs. Spanish

The first goal of this study was to investigate the extent to which second language learners' non-target subject-auxiliary inversion patterns can be attributed to properties of their first language (L1).

Conflicting findings in the literature have been reported with respect to the influence of L1 on L2 word order in production. While some studies have report an effect of L1 on word order (e.g., Zobl, 1982), others do not find this effect, but, rather, posit an effect of universal principles (Fathman and LoCoco, 1989; Rutherford, 1983, but see Odlin, 1990 for the opposite claim).

With respect to L1 effects on interrogative word order, in particular, Johnston's (1985) seminal cross-sectional study of 16 adult L2 learners of English provided some evidence for the existence of L1-independent, fixed developmental stages in the acquisition of English questions. However, evidence that L2 learners might transfer L1 properties to their production of English main clause questions comes from Zobl's (1979, 1995) and Spada and Lightbown's (1999) findings with L1 French L2 learners of English. These studies showed that non-inverted questions were more likely to be accepted and produced when the subject was a full NP than when it was a pronoun. Inverted questions, on the other hand, were more likely to be produced and considered grammatical when the subject was a pronoun. Given that (stylistic) inversion in French is only possible with pronouns, this result suggested that L2 learners apply properties of French questions to English. However, in the absence of a comparison group (i.e., L2 speakers whose L1 properties differed from French and English), and in light of similar findings for the inter-language grammar of a speaker whose L1 (Turkish) and L2 (German) do not display a word order asymmetry for pronouns and full DPs (see Schwartz & Sprouse, 1994), this result cannot be unequivocally attributed to L1 transfer. Similarly, McDonald (2000) found that L1 Vietnamese early[2] L2 acquirers of English had difficulty with aspects of English syntax that differ from Vietnamese – the syntax of main clause *wh*-questions being one of them – while early L1 Spanish learners' performance was indistinguishable from that of native speakers, suggesting that structural similarities between the syntax of the L1 and the L2 have a significant effect on L2 mastery even for early acquirers.

At present, little is known about the acquisition of English embedded clause questions in general, and the effect of L1 on word order errors in these structures, in particular. Non-target word order in embedded clause questions has been reported for L2 *adult* learners of English with

L1 backgrounds as different as Polish and Vietnamese (Johnston, 1985), Hebrew (Bley-Vroman, 1997), Indonesian, Korean and Chinese (Mackey, Pienemann & Doughty, 1992), Chinese (Finegan, 1999), Spanish (Escutia, 2002), Russian (Markman, 2008) and Persian (Youhanaee, 2007), but these data are mainly based on anecdotal reports from very few speakers and productions, and the phenomenon has yet to be quantified. While adult L2 learners and monolingual children learning English as their first language have both been reported to produce inversion errors in English embedded clause questions, Argyri and Sorace (2007) found that eight-year-old English-Greek bilingual *children* were at ceiling in their production and acceptability judgments of English embedded *what*-questions, indicating that difficulties with word order in this structure might be confined to young children and late bilinguals/L2 learners.

In order to systematically explore the role of L1 transfer on English questions, we set out to study the production of main and embedded clause questions in intermediate/advanced L2 learners of English whose L1 was either Spanish or Chinese[3]. We chose to focus on intermediate/advanced learners because, while most L2 acquisition frameworks assume some influence of the native language at initial stages of proficiency, the degree to which inter-language grammars of more advanced learners are affected by L1 properties is less clearly understood[4]. Additionally, given that embedded clauses are "a fairly good index of overall structural sophistication" (Johnston, 1985: 245), learners who could reliably produce such structures were needed.

We chose L1 Spanish and Chinese learners because these two languages differ from English and from each other in terms of the order in which subjects and verbs appear in questions. In Spanish main and embedded clause questions, the subject follows the main auxiliary (when present) and the main lexical verb; *wh*-elements, if present, are placed clause-initially. This

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phenomenon has traditionally been analyzed in terms of subject-verb inversion or T-to-C movement (Torrego, 1984; Zagona, 2000; see Rizzi, 2001, 2006 for an analogous analysis of Italian interrogative structures).[5] However, while inversion is obligatory with argument *wh-*words (as in (7)), it has been argued to be optional in some adjunct *wh*-questions (as in (9) and (15); see Torrego, 1984 among others[6]) and in yes/no questions (as in (11) and (17)). The details of competing syntactic proposals for word-order phenomena in Spanish (and Romance languages in general) are complex and controversial, but for the purposes of this paper two facts are crucial and well accepted: in Spanish interrogative clauses, the tense-bearing verbal element (the main auxiliary, when present, or the main lexical verb) *can* always precede the subject and there is no word-order asymmetry between main and embedded interrogative clauses. In contrast, in Chinese, the verb can never precede the subject, in either main (see (8), (10), and (12)) or embedded contexts (see (14), (16), and (18)); *wh*-elements, if present, appear in the same position as their non-*wh* counterpart (i.e., Chinese displays no overt *wh*-movement). The word-order patterns for Spanish and Chinese interrogative structures are summarized below:

Clause Type	Question Type	Spanish Word Order	Chinese Word Order
Main Clause Question	*Wh-*argument	*wh-* + Verb + Subject (7) ¿Qué (*Maria) comió Maria? 　　What (*Maria) ate　Maria 　　*What did Maria eat?*	Subject + Verb + *wh-* (8) Bīng chīle (*Bīng) shénme? 　　Bing ate what 　　*What did Bing eat?*

	*Wh-*adjunct	*wh-* + (Subject) + Verb + (Subject)
		
		 (9) ¿Porqué (Maria) lloró (Maria)?
		
		  Why (Maria) cried Maria
		
		  Why did Maria cry?
			Subject + Verb + *wh-*
			
			 (10) Wèishénme Bīng kūle (*Bīng)?
			
			  Why Bing cried (*Bing)
			
			  Why did Bing cry?

	Yes/no	(Subject) + Verb + (Subject)
		
		 (11) ¿(Maria) Comió (Maria)?
		
		   (Maria) ate (Maria)
		
		  Did Mary eat?
			Subject + Verb
			
			 (12) Bīng chīle (*Bīng) ma?
			
			  Bing ate (*Bing) Q-particle
			
			  Did Bing eat?

Embedded Clause Question	*Wh-*argument	*wh-* + Verb + Subject
		
		 (13) Hector quiere saber qué (*Maria) comió Maria.
		
		  Hector wants to know what (*Maria) ate Maria
		
		  Hector wants to know what Maria ate.
			Subject + Verb + *wh-*
			
			 (14) Jiéxī xiǎng zhīdào Bīng chīle shénme.
			
			  Jessie wants to know Bing ate (*Bing) what
			
			  Jessie wants to know what Bing ate.

	*Wh-*adjunct	*Wh-* + (Subject) + Verb + (Subject)
		
		 (15) Hector quiere saber porqué (Maria) lloró (Maria).
		
		  Hector wants to know why cried Maria
		
		  Hector wants to know why Maria cried.
			Subject + Verb + *wh-*
			
			 (16) Jiéxī xiǎng zhīdào wèishénme Bīng kūle (*Bīng).
			
			  Jessie wants to know why Bing cried (*Bing).
			
			  Jessie wants to know why Bing cried.

	Yes/no	(Subject) + Verb + (Subject)
		
		 (17) Hector quiere saber si (Maria) comió (Maria).
		
		  Hector wants to know if (Maria) ate Maria
		
		  Hector wants to know if Maria ate.
			Subject + Verb
			
			 (18) Jiéxī xiǎng zhidào Bīng Bing chīle (*Bīng) ma?
			
			  Jessie wants to know Bing ate (*Bing) Q-particle
			
			  Jessie wants to know if Bing ate.

Theories of second language acquisition make different predictions with respect to the acquisition of English questions by native speakers of Spanish or Chinese, given the different syntactic properties of these two languages exemplified above.

If L2 learners at intermediate/advanced levels of proficiency do not transfer properties of their native languages to their L2, no systematic differences in terms of word order are expected

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between the two experimental groups. This prediction is compatible with accounts that do not assume L1 transfer to L2 in general (see, for example, Epstein, Flynn, & Martohardjono, 1996), and with accounts that do not assume L1 transfer of functional categories (see *Minimal Trees Hypothesis*, Vainikka & Young-Scholten, 1994, 1996; *Organic Grammar*, Vainikka and Young-Scholten, 2005, 2011) or feature strength (see *Valueless Features Hypothesis*, Eubank, 1993, 1996).

In contrast, if L2 learners at intermediate/advanced levels of proficiency do transfer word order properties from their L1 to their L2, the production profiles of native speakers of Spanish and Chinese should *differ* from each other. This prediction is, in very general terms, compatible with accounts that grant a role for L1 transfer throughout L2 development, whether ultimate attainment of L2 features not instantiated in the L1 is hypothesized to be possible with adequate exposure to positive evidence (see *Full Transfer/Full Access Hypothesis*, Schwartz and Sprouse, 1996; Schwartz, 1998; *Feature Assembly Hypothesis*, Lardiere, 2007, 2008, 2009), or whether L2 grammars are hypothesized to be permanently constrained by the native language (see *Full Transfer/No Access Hypothesis*, Bley-Vroman, 1990; Schachter, 1990; *Representational Deficit Hypothesis*, Hawkins, 2003; Tsimpli, 2003; Hawkins and Hattori, 2006; Tsimpli and Dimitrakopoulou, 2007). With respect to the direction of this difference between production profiles, L1 Spanish learners of English are expected to produce higher rates of target-like main clause questions,[7] given that Spanish main clause questions resemble English ones in that the tense-bearing element can always precede the subject. With respect to embedded clause questions, in contrast, L1 Chinese learners are expected to produce higher rates of target non-inverted structures than L1 Spanish speakers, given that Chinese resembles English in only allowing declarative word order in embedded clause questions.

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1.2.   The role of L2 properties: syntactic structure and *wh*-words

The second goal of this study was that of investigating the extent to which second language learners' non-target inversion patterns are affected by properties of (some of the) linguistic elements of the target language, i.e., syntactic structure (yes/no vs. wh-questions) and *wh*-words.

The role of L2 properties: syntactic structure (yes/no vs. wh-questions)

The materials in this study prompted speakers to produce both yes/no and *wh*-questions. The reason for this was two-fold: first, main yes/no questions without inversion are grammatical, albeit marked, in Standard English[8]; the existence of pragmatically governed contexts in which non-inverted yes/no questions are grammatical in the L2 input might lead learners to hypothesize that inversion is optional in English yes/no questions.

Second, a number of studies in the first language acquisition literature have found that inverted yes/no questions appear earlier than inverted *wh*-questions in development (Klima & Bellugi, 1966), and that yes/no questions tend to be associated with higher accuracy and inversion rates than *wh*-questions (Bellugi, 1971; Klima & Bellugi, 1966; Kuczaj and Brannick, 1979; Rowland 2007). These findings have traditionally been attributed to either structural or saliency factors. For example, Bellugi (1977) famously proposed that the higher rates of non-inversion errors found in *wh*-questions can be explained by the fact that *wh*-questions involve two movement chains (one for the *wh*-element, one for the auxiliary), and are thus more complex than yes/no questions, which involve only one chain (for the moved auxiliary). Differently, Gleitman, Newport & Gleitman (1984) noted that auxiliaries are particularly salient in yes/no

questions due to the fact that they appear in sentence-initial position and hence cannot be contracted, while in *wh*-questions auxiliaries are never sentence-initial and often contracted.

As for L2 acquisition of questions, a number of researchers (e.g., Pienemann & Johnston, 1987; Youhanaee, 2007) have found that the acquisition of word order in yes/no questions precedes that of *wh*-questions. However, just as in the L1 literature, this result is controversial: White, Spada, Lightbown, & Ranta (1991) found no significant difference between yes/no and *wh*-questions, while Eckman, Moravscik, and Wirth (1989) report the opposite finding. According to Eckman et al., this result supports the hypothesis that inter-language grammars respect linguistic universals, given the existence of an implicational universal between inversion in yes/no questions and inversion in *wh*-questions, according to which if a language has verb-subject order in yes/no questions, it will also have it in *wh*-questions, but not vice versa (Greenberg, 1963).

The findings concerning the existence of differences in terms of accuracy and inversion rates between yes/no and *wh*-questions in the L2 literature are inconclusive at best. This study aimed at contributing further experimental evidence to the debate by manipulating this factor within participants and items and by presenting our participants with a sizeable number of tokens (16 per experimental condition).

We predicted that if L2 learners' grammars are sensitive to properties of the target language, L1 Spanish and L1 Chinese learners should invert more in yes/no than in *wh*-questions, given the added complexity and the lack of saliency of the auxiliary in *wh*-structures. Conversely, if learners' grammars are subject to the same constraints that result in a universal implicational relationship between *wh*-questions and yes/no questions, we might expect to replicate Eckman et al.'s (1989) finding that learners invert more in *wh*-questions than yes/no questions.

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In the present study, we also investigate the role of syntactic structure in embedded contexts. The reason is again two-fold. Initial evidence for the existence of an asymmetry in L1 acquisition between yes/no and *wh*-questions in embedded contexts comes from Stromswold's (1990) study, who found that children over-generalize inversion to embedded *wh*-questions, while the error is absent in yes/no contexts. While the acquisition of embedded clause questions in L2 English has received scarce attention in the literature, it is worth noting that none of the sources that mention the existence of inversion errors in embedded interrogatives reports errors for yes/no structures. A similar asymmetry between yes/no and *wh*-contexts is present in non-standard varieties of English (e.g., AAVE, Scottish English, Hiberno English, and Appalachian English, among others) that allow subject-auxiliary inversion in embedded contexts: while inversion in embedded *wh*-questions is always possible (see (19)), it is only available in embedded yes/no questions when the complementizer *if* is absent (Labov, 1972; Henry, 1995; Filppula, 1999; Green, 2002), [9] as the contrast between (20) and (21) shows:

(19) The police couldn't establish who had they beaten up (McCloskey, 1992:16)

(20) I wondered had they read the book (Henry, 1995:110)

(21) *I wondered if had they read the book (Henry, 1995:110)

(22) I wondered if they had read the book (Henry, 1995:110)

One explanation put forth in the literature (e.g., Filppula, 1999) is that in embedded *wh*-questions the head of the complementizer phrase (C^0) is not filled by any overt element, while in embedded yes/no questions this position is filled by *if*. Given that C^0 is arguably the goal of the movement

of the tensed auxiliary, this movement is blocked when it is filled by *if*, making inversion in embedded yes/no questions impossible.

We predicted that, if embedded inversion in L2 learners' grammars is to be considered a learner phenomenon, subject to the same constraints as L1 acquisition and dialectal variation, it should occur in the production of both L1 Chinese and L1 Spanish learners and should be restricted to *wh*-contexts.

1.3 The role of L2 properties: wh-words

The materials in this study prompted speakers to produce *wh*-questions in which the *wh*-word was either an argument or an adjunct because previous research has shown that the type of *wh*-word has an effect on the L1 and L2 acquisition of English interrogatives.

A number of studies focusing on the L1 acquisition of English main clause questions, in fact, have found that most argument *wh*-words (e.g., *what*, *who*) tend to be acquired earlier than some adjunct *wh*-words (e.g., *why*, *when*) and are associated with higher accuracy (e.g., Sarma, 1991; Stromswold, 1990): *what* is generally the first *wh-* to be used correctly (Bloom, Merkel & Wotten, 1982), while *why*, which is acquired later, is associated with exceptionally low inversion rates[10] (e.g., Berk, 2003, de Villiers, 1991; Labov & Labov, 1978; Thornton, 2004; 2008; Rowland & Pine, 2000). Some researchers attribute these findings to the particular semantics of *why* (e.g., Kay, 1980) and its similarity to *how come* (Berk, 2003), which does not trigger inversion. While *why* might indeed require a more complex answer than other *wh*-elements, it is unclear how this accounts in a direct way for differences in inversion rates. That is, it is unclear how semantic complexity interferes with a syntactic operation such as subject-auxiliary inversion. Additionally, if learners initially assume that *why* behaves like *how come*, one would expect their inversion rates in learners' productions to overlap, i.e. they should both never invert

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or invert to a similar extent, contrary to fact (Kuczaj and Brannick, 1979; Stromswold, 1990). In a different vein, Thornton (2008) proposed that *why* in English child grammar behaves like its adult Italian counterpart *perché*.[11] As opposed to other *wh*-words, both elements are compatible with contrastive focus elements, can be followed by topic phrases and do not consistently require inversion. Following Rizzi (2001), Thornton proposes that *why* in child grammar can be optionally base-generated in the specifier of IntP (Interrogative Phrase). IntP is located higher than CP in the structure and is endowed with a [+wh] interrogative feature, thus not requiring movement of the [+wh] auxiliary to C. Alternatively, *why* can also be base-generated in TP and move to Spec,FocP, thus requiring T to C movement of the auxiliary.

In the L2 literature, there is some initial evidence pointing to the existence of an asymmetry between argument and adjunct *wh*-words. Haznedar (2003) studied the acquisition of inversion in the spontaneous production of a Turkish-speaking child learning English at age 4 and found inversion rates to be higher for *what*, *who* and *where* than for *which*, *how* and *why*. With respect to the order of appearance of different *wh*-elements, children learning English as a second language seem to acquire arguments *what* and *who* before adjuncts *why* and *when* (Felix, 1976; Lightbown, 1978; Park, 2000), while the status of *where* and *how* is less clear. Spada and Lightbown (1999) investigated the acquisition of English questions by L1 French child L2 learners of English for different *wh*-words via a series of tasks (oral production, a scrambled questions task and a preference task). In the scrambled questions task, percentages of inversion were similar for *what* and *where* and lower for *when* and *how*. In the preference task, participants accepted ungrammatical–non-inverted *what* and *why* questions more often than grammatical ones, while they did not seem to show a clear preference in the case of *where* and *when* questions.

Finally, Lee (2008) conducted a grammaticality judgment study with adult L1 Korean L2 learners of English to see whether, in line with findings for children learning English as their L1, English second language learners' inversion rates would be influenced by the argument-adjunct status of *wh*-words. *What* and *who* were used as arguments and *how* and *why* as adjuncts. No argument-adjunct asymmetry was found for inverted questions, while an asymmetry for the learners was crucially found in non-inverted questions; specifically, non-inverted adjunct questions were considered more acceptable than non-inverted argument questions.

As we have seen above, the L1 literature has shown that children tend to produce more inversion errors in main adjunct questions, and in *why*-questions in particular; this topic has received less attention in the L2 literature, which is based mainly on acceptability judgment tasks, or production data from a small number of children. Our study was designed to contrast the production of argument and adjunct *wh*-questions in two groups of adult speakers whose L1s differ from English and from each other in relevant ways. We predicted that, if inversion errors in L2 learners' grammars are affected by the same factors that affect L1 acquisition, both L1 Spanish and L1 Chinese learners should display higher inversion rates for arguments than for adjuncts, in main and possibly in embedded clause questions.

In summary, the existent literature suffers from a number of shortcomings. First, experimental data on L2 acquisition of English questions in which learners' L1s differ from each other and from English in terms of word order is sparse. Second, existing data on L2 production of main clause questions and the role of different *wh*-words on inversion come primarily from children (e.g., Haznedar, 2003; Spada & Lightbown, 1999) and focus on emergence rather than mastery of English interrogative syntax (e.g., Pienemann, Johnston & Brindley, 1988). Third,

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previous work finds conflicting results with respect to the relationship between L2 acquisition of yes/no and *wh*-questions, perhaps due to differences in population (adults vs. children, different L1s) and data collection (e.g., spontaneous production, elicited production, scrambled word tasks, preference tasks, etc.).

The present study aims at clarifying the role of these different factors by providing quantitative data from different syntactic structures and from speakers whose L1s differ from English and from each other in terms of word order in main and embedded questions, keeping experimental protocol and the coding scheme constant.

We predicted that, if inversion errors in L2 learners are mainly due to L1 transfer of word order, L1 Spanish learners will be more accurate than L1 Chinese learners in main questions, while L1 Chinese learners will be more accurate than L1 Spanish learners in embedded questions. On the other hand, if inversion patterns in L2 learners are instead better understood as a learner phenomenon, L1 Chinese and L1 Spanish learners' production profiles should not differ significantly from each other and should resemble the patterns seen in L1 acquisition and dialectal variation. Under this hypothesis, we expected L2 learners to show particular difficulties with inversion in main *wh*-questions (particularly adjunct *why*-questions), and to produce structurally-constrained inversion in embedded *wh*-contexts (e.g., only in the absence of an overt complementizer).

2. Current Study

2.1. Method

2.1.1. Participants

L2 participants and native speaker controls were recruited through online and paper advertising, personal contacts, and the Introduction to Psychology subject pool at Queens College (CUNY), which allowed for language background screening. Participants either received course credit, or were compensated $10 for their participation.

A total of 88 participants were tested. Six participants were excluded because of experimenter error, software malfunctioning, or data loss; two additional participants were excluded because they arrived in the U.S. around age six and considered themselves dominant in English. Data from a total of 80 participants (16 English native speakers, 32 Chinese native speakers, and 32 Spanish speakers[12]) were analyzed.

L2 participants were judged to be intermediate/advanced with respect to their English proficiency. Proficiency was assessed through the oral portion of the Michigan Test of English Language Proficiency (MTELP) designed to assess listening proficiency.

Table 1 provides a summary of participants' proficiency scores, age, age of arrival, and length of stay in an English-speaking country. Spanish and Chinese participants did not differ in terms of age and age of arrival (t (62) = 1.4, p = .17, and t (62) = .76, p = .45, respectively), but they differed in terms of length of stay in the U.S. (t (62) = 2.7, p=.009) and, marginally, in terms of English proficiency (t (62) = 1.9, p =.06), as measured by the MTELP. On average, L1 Spanish speakers had spent more years in the U.S. and scored higher on the MTELP.

Insert Table 1 here

2.1.2 Materials

The study consisted of a computerized elicitation task, administered through E-Prime software (Psychology Software Tools, Inc.). In order to elicit main clause questions (Part 1), participants

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were told that they needed to help a shy student ask his teacher some questions. In items intended to elicit yes/no questions, a prompt such as "Maybe Gloria called Jim. Ask Miss Brainy." appeared written in a speech bubble on the screen. Participants were instructed to advance to the next screen after reading the prompt. The second screen showed a teacher in front of a blackboard, and participants were instructed to produce a question aloud; they were not able to return to the previous screen to revisit the prompt so their questions would be constructed in the absence of the non-inverted declarative prompt. In the final screen, the teacher provided a written answer to the participant's question. Items eliciting *wh*-questions followed the same general format, differing only in the prompt (e.g., "Gloria called Jim. Ask Miss Brainy why."). Screenshot examples of slides aimed at eliciting main yes/no and *wh*-questions are provided in Appendix A.

In order to elicit embedded clause questions (Part 2), participants were introduced to a new character, Sarah, who was curious about the questions that Phil asked. The first screen showed Phil asking his teacher a question written in a speech bubble. Participants were asked to read the question aloud. The second screen showed Sarah asking either "What did Phil not know?" or "What did Phil want to know?" in a speech bubble. The participant's task was to produce an embedded clause question in response to Sarah's question (e.g., "Phil wanted to know where John had gone.") As in the main clause questions task, participants were not able to return to the previous screen once they had advanced to the next so as to reduce the likelihood of a direct quotation of the prompt. They were also instructed to produce "complete sentences," i.e., to always start their answers with either "Phil wanted to know…" or "Phil didn't know…" Screenshot examples of slides aimed at eliciting embedded yes/no and *wh*-questions are provided

in Appendix B. Participants always completed Part 1 before Part 2, to avoid exposing them to the main questions used as prompts for producing embedded questions in Part 2.

The fully *within* factor was question type (yes/no vs. *wh-*); type of *wh*-word was a within-subjects but a between-items factor.[13] Four types of *wh*-words were elicited: arguments *what* and *who* and adjuncts *why* and *where*.[14] Each participant was presented with a total of 32 experimental prompts (16 yes/no, 16 *wh*-questions (4 *who*, 4 *what*, 4 *where*, 4 *why*)). Filler items were not included, because pilot testing indicated that the experimental session was fairly long (about 50 minutes to 1 hour) and participants' debriefing responses indicated that they were not aware of the experimental focus[15]. To investigate whether lack of fillers caused speakers to adopt a metalinguistic response strategy and was the source of learning effects within the experiment, we compared the inversion rates produced in the first and second half of the each of two studies. Inversion errors did not differ significantly between the first and the second half in either study, (t_1 (63) = 1.6, p = .12, t_2 (31) = 1.8, p = .09; t_1 (63) = 0.87, p = .39, t_2 (31) = 0.85, p = .4 for main and embedded clause questions, respectively).

In one fourth of the prompts, the subject was in second person (e.g., your brother). This was to ensure that, in Part 2, participants were producing authentic embedded clause questions and not quotative questions (e.g., *She wanted to know "Where are you going?"*). Productions were thus only considered as 'target' if the second person possessive pronoun in the prompt was transformed into a third person possessive pronoun. So, for example, if the question in the prompt was: "What is *your* husband cooking?," the target response would be "Phil wanted to know what *her/Miss Brainy's* husband was cooking", while a response like "Phil wanted to know what *your* husband was cooking" would be considered non-target.

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Experimental items were pseudo-randomized so that no more than two consecutive experimental sentences shared any of the features relevant to the investigation (i.e., yes/no, *wh*-type). To control for order effects, two additional lists in which the order of the experimental items was reversed were created. Examples of experimental materials for main and embedded clause questions are given in Appendix C and D, respectively.

2.1.3. Procedure

After reading and signing the consent forms, participants were seated in front of a computer. The experimenter guided the participant through the six practice items and provided clarifications, but did not provide corrective feedback. After the practice session, the experimenter turned on a digital recorder and left the room. Participants were given the option of taking a break between Part1 and in Part 2. At the end of this experimental session, a questionnaire on biographical data, language background, and language use was administered. Non-native participants were also administered the oral portion of a Standard English language assessment test (MTELP). The study took approximately 50-55 minutes.

2.1.4. Transcription and coding

The authors transcribed and coded participants' responses. A subset (30%) of the responses was transcribed independently by each of the authors, and no major disagreements were found. Coding was performed independently. Inter-coder agreement was high (> 96%) and disagreements were resolved by discussion.

Each production was coded as either correct (native-like) or incorrect (nonnative-like) with respect to word order, verbal morphology, and presence of target lexical items (e.g., subject and *wh*-element). For ease of comparison with previous studies in the literature, we followed

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Ambridge et al.'s (2006) coding scheme: incorrect questions were coded in four further categories. Examples of errors are given for both main and embedded clause questions:

- Subject-auxiliary inversion errors:

  (23) Why your brother fired Mark?

  (24) Phil wanted to know what is Ms. Brainy's brother drinking for dinner.

- Double tense/double auxiliary errors:

  (25) Who did the boss complimented?

  (26) Phil want to know who did her husband hired.

- Omitted auxiliary/morphology errors:

  (27) Why you call Jim?

  (28) Phil want to know who the math teacher helping now.

- Other errors: Other errors included questions that differed in type from the target (yes/no instead of *wh*-question, and vice versa), subject *wh*-questions instead of object *wh*-questions, productions that differed from the target in the lexical items used, and questions without a subject. Embedded clause questions in which a second person pronoun in the prompt failed to be substituted with a third person pronoun were also included in this category:

  (29) Phil didn't know where your brother forgot his keys.

  (30) Phil wanted to know where does your brother wash his clothes.

This latter type of production was rare (88% accuracy overall), indicating that, in general, participants understood and were able to perform the task. In some occasions (5% for main and

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6% for embedded clause questions), learners produced more than one response for a trial. In these cases, we counted the second response, because the first one was either not a complete response, and as such could not be scored (as in (31)), or it was judged to be a clear attempt to correct the first response (as in (32)):

(31) Why..why Mrs Brainy's brother..Why did Mrs Brainy's brother fired Mark?

(32) What did the teacher bought- I mean…- what did the teacher buy?

2.2. Results

Two sets of analyses were performed on all data: the first set of analyses used arcsine transformed mean percent *correct* (inverted) productions as the dependent variable. This was calculated by dividing the number of correct responses by the *total* number of productions. The second set of analyses used arcsine transformed mean *inversion* rates as the dependent variable, and this was calculated by dividing the number of correct responses by inverted and non-inverted responses only; productions that provided no evidence one way or the other with respect to inversion or that contained errors unrelated to subject-auxiliary inversion (i.e., auxiliary omission, different structure, morphological errors, etc.) were thus excluded from this second set of analyses.

2.2.1. Part 1 (Main clause questions)

English native speakers produced 100% target inverted main clause questions and were thus excluded from further analyses.

Two 2 (L1: Spanish vs. Chinese) x 2 (syntactic structure: *wh-* vs. yes/no) mixed design ANOVAs with accuracy and inversion rates as respective dependent variables showed

significant effects of L1 (for accuracy: F_1 (1, 62) = 5.9, p =.02; F_2 (1, 31) = 30.3, p <.0001; for inversion: F_1 (1, 62) = 4.6, p = .04; F_2 (1, 31) = 25.2, p <.0001) and syntactic structure (for accuracy: F_1 (1, 62) = 39.6, p<.0001; F_2 (1, 31) = 20.4, p<.0001; for inversion: F_1 (1, 62) = 36.2, p<.0001; F_2 (1, 31) = 32.5, p<.0001), indicating that L1 Chinese speakers produced higher rates of target-like and inverted responses than L1 Spanish speakers and that yes/no questions were associated with higher accuracy and inversion rates than *wh*-questions. There was no interaction between question type and L1 (for accuracy: all *Fs* <1; for inversion: F_1 <1; F_2 (1, 31) = 2.2, p = .15).

Table 2 reports the raw number and percentage of productions in each coding category by syntactic structure for L1 Chinese and L1 Spanish learners.

*****Insert Table 2 here*****

In order to investigate the effect of *wh*-word on learners' production of main questions, two 2 (L1: Spanish vs. Chinese) x 4 (*wh*-word) mixed design ANOVAs with accuracy and inversion rates as respective dependent variables showed significant effects of *wh*-word (for accuracy: F_1 (3, 186) = 4.1, p = .008; F_2 (3, 28) = 3.8, p = .02; for inversion: F_1 (3, 168) = 12.2, p<.0001; F_2 (3, 28) = 14.6, p = .001) and no interaction between *wh*-type and L1 (for accuracy: F_1 (3,186) = 2.5, p=.06; F_2 (3, 28) = 1.7, p=.2; for inversion: all *Fs* <1).

The raw number of inverted responses along with percent correct and percent inversion by *wh*-word and L1 are reported in Table 3.

*****Insert Table 3 here*****

Pairwise comparisons were carried out to explore the effect of individual *wh*-elements on correct and inverted responses. Bonferroni correction was applied to prevent Type I error inflation. The first set of analyses (performed on *percent correct*) revealed a marginally

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significant difference between *what* and *who* (p = .07) and *where* and *who* (p = .06) both in the subject and item analyses, with *who* being associated with fewer correct responses. The second set of analyses (performed on *percent inversion*), showed a significant difference between *why* and all other *wh*-elements (subject means: *what* vs. *why* (p<.0001), *where* vs. *why* (p<.0001), *who* vs. *why* (p =.04); item means: *what* vs. *why* (p =.004), *where* vs. *why*, (p<.0001), *who* vs. *why* (p =.001)), with *why* being associated with lower inversion rates. This is the only case in which the percent correct and percent inversion analyses revealed a different pattern of responses. The reason for this difference is likely to be due to the high number of 'other error' responses with *who* (18.8% for L1 Chinese and 31.3% for L1 Spanish) and the relative low number of 'other error' responses with *why* (12.5% for Chinese and 7% for Spanish). It is worth noting that most "other error" responses with *who* were subject questions in place of non-subject questions (e.g., *Who saw Sarah for brunch?* instead of the target *Who did Sarah see for brunch?*). This might be due to the fact that *who* is exclusively used for human referents, and that learners have a preference to assign an agent/subject role to the [+animate +human] sentence-initial *wh*-word. This pattern would follow the canonical sentence bias found for child learners of English (Bever, 1970), according to which children have the tendency to interpret sentences with the surface order NVN as agent-action-object sequences. The analysis on inversion rates shows that, once 'other error' responses were removed, the difference between *who* and other *wh*-words disappeared (*who* vs. *what*, p =.22; *who* vs. *where*, p=.17).

2.2.2. Part 2 (Embedded clause questions)

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English native speakers produced only 1 inverted structure and 14 other responses[16] over a total of 1378 embedded clause questions and were excluded from further analyses.

Two 2 (L1: Spanish vs. Chinese) x 2 (syntactic structure: *wh-* vs. yes/no) mixed design ANOVAs with accuracy and non-inversion rates as respective dependent variables showed no effect of L1 (for accuracy: $F_1 < 1$; F_2 (1, 31) = 2.9, p = .09; for non-inversion: all $Fs < 1$) and a significant effect of syntactic structure (for accuracy: F_1 (1, 62) = 66.7, p < .0001; F_2 (1, 31) = 105.6, p<.0001; for non-inversion: F_1 (1, 62) = 133.7, p < .0001; F_2 (1, 31) = 139.6, p < .0001), indicating that yes/no questions were associated with higher accuracy and non-inversion rates than *wh*-questions. A significant interaction between L1 and syntactic structure (for accuracy: F_1 (1, 62) = 10.6, p = .002; F_2 (1, 31) = 9.9, p=.004; for non-inversion: F_1 (1,62) = 3.9, p = .052; F_2 (1, 31) = 7.7, p = .009) indicates that L1 Spanish speakers produced significantly higher rates of target-like responses than L1 Chinese speakers in the yes/no (t_1 (62) = 2.5, p = .01; t_2 (31) = 3.6, p = .001), but not in the *wh*-condition (t_1 = .86; t_2 (31) = 1.5, p = .1). In particular, Chinese speakers produced more auxiliary and morphology omission errors than L1 Spanish speakers in embedded yes/no questions (for accuracy: t_1 (62) = 3.3, p = .002; t_2 (31) = 5.7, p<.0001; for non-inversion: (t_1 (62) = 1, n.s.; t_2 (31) = 2.3, p= .03), but not embedded *wh*-questions (for accuracy: t_1 (62) = 1.1, p = .3; t_2 (31) = 1.7, p = .9; for non-inversion: t_1 (31) = 1.3, p = .2; t_2 (31) = 1.8, p = .08)). Table 4 reports the raw number and percentage of productions in each coding category by syntactic structure for L1 Chinese and L1 Spanish learners.

*****Insert Table 4 here*****

To sum up, on average, yes/no questions were associated with higher rates of correct non-inverted productions than *wh*-questions. Overall, Spanish speakers and Chinese speakers did not differ in terms of their overall accuracy and non-inversion rates. However, L1 Spanish speakers

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produced on average higher rates of target-like responses than L1 Chinese speakers in the yes/no condition. On the other hand, L1 Spanish speakers did not differ from L1 Chinese speakers in terms of rates of target-like responses in the *wh*-condition. Table 4 reports the raw numbers and percentages of productions in each category by syntactic structure for L1 Spanish and L1 Chinese learners.

In order to investigate the effect of *wh*-word on learners' production of embedded questions, two 2 (L1: Spanish vs. Chinese) x 4 (*wh*-type) mixed design ANOVAs with accuracy and non-inversion rates as respective dependent variables showed a significant effect of *wh*-type (for accuracy: F_1 (3, 186) = 11.9, p < .0001; F_2 (3, 28) = 7.7, p =.001; for non-inversion: F_1 (3, 186) = 11.7, p < .0001; F_2 (3, 28) = 6.7, p =.001), and no interaction between *wh*-type and L1 (for accuracy: F_1 (3,186) = 1.9, p =.13; F_2 (3, 28) = 1.8, p =.16; for non-inversion: F_1 (3, 186) = 1.6, p = .2; F_2 (3, 28) = 1.4, p=.3).

Pairwise comparisons were carried out to explore the effect of individual *wh*-elements on correct and non-inverted rates. Bonferroni correction was applied to prevent Type I error inflation. The first set of analyses (performed on overall *percent correct*) revealed a significant difference between *who* and *what* and *who* and *why* (subject means: *what* vs. *who* (p<.0001), and *why* vs. *who* (p<.0001); item means: *what* vs. *who* (p=.04), *why* vs. *who* (p<.0001)). *Who* was associated with lower rates of target-like responses. The second set of analyses (performed on *non-inversion* rates), showed a significant difference between *why* and all other *wh*-elements (subject means: *what* vs. *why* (p=.001), *where* vs. *why* (p=.002), *who* vs. *why* (p =.001); item means: *why* vs. *what* (p =.01), *why* vs. *where*, (p=.02), *why* vs. *who* (p =.002)), with *why* being consistently associated with lower inversion rates. This difference between the two analyses is likely to be due to the fact that *who* was associated with higher rates of 'other error' responses.

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Once responses that were uninformative with respect to inversion were excluded, the effect of *who* disappeared and the effect of *why* emerged, as the second set of analyses shows. The raw number of correct responses along with percent correct and percent non-inversion by *wh*-word and by L1 are reported in Table 5.[17]

*****Insert Table 5 here*****

3. General discussion

The purpose of this study was to investigate the role of L1 and L2 properties on the production of English questions by L2 learners. To do this, we administered an elicited production study to intermediate/advanced L2 learners of English whose native languages differed from each other and from English in relevant ways, prompting learners to produce main and embedded yes/no and *wh*-questions. Our main findings can be summarized as follows:

Part 1: Main clause questions

- A significant effect of L1 was found, with L1 Chinese learners producing on average higher rates of target-like inverted responses than L1 Spanish learners.

- A significant effect of syntactic structure was found, with learners producing on average higher rates of target-like inverted structures in yes/no than in *wh*-questions.

- A significant effect of *wh*-word was found, with *why*-questions being associated on average with lower inversion rates than other *wh*-elements.

Part 2: Embedded clause questions

- L1 did not have a significant effect; L1 Chinese and L1 Spanish learners produced comparable rates of target-like non-inverted responses.

- A significant effect of syntactic structure was found, with learners producing on average higher rates of target-like non-inverted responses in yes/no than in *wh*-questions.

- A significant effect of *wh*-word was found, with *why*-questions being associated with higher rates of target-like non-inverted responses than other *wh*-questions.

In the following section, we discuss our findings in more detail in light of previous research and the questions that were raised at the outset.

3.1   The role of L1 properties: Chinese vs. Spanish

Part 1 showed that L1 Chinese learners were in general more accurate than L1 Spanish learners at producing target-like inverted main clause questions. This difference is not likely to be due to differences in proficiency, age of acquisition (AoA), or length of exposure to English, given that the two groups did not differ in terms of AoA and that L1 Spanish speakers' proficiency scores (as measured by the MTELP) and length of stay in the US were on average higher than those of L1 Chinese speakers. This difference is also unlikely to be due to dialectal differences among Spanish speakers for two reasons. First, only four L1 Spanish speakers were native speakers of Caribbean Spanish varieties (see note 12) in which subject-verb inversion in questions is dispreferred (Suñer, 1994; Toribio, 2000). Three of them never produced inversion errors. Second, although inversion is dispreferred in these dialects, it is nonetheless grammatical, while in Chinese it is never grammatical.

This result is unexpected both under hypotheses of L2 acquisition with and without a role for L1 transfer because the latter predict no significant L1 effect on inversion rates, while the former predict the opposite direction of the effect, given that Chinese lacks inversion in questions altogether, while Spanish allows subject-verb inversion in all questions. While this result is problematic, it might be possible to account for it by hypothesizing that properties that are present in learners' L1s but require restructuring (subject-verb inversion in L1 Spanish) are more difficult to acquire than those that are entirely absent in the L1, which might be particularly salient due to a "surprise effect" (Kleinmann, 1977). In other words, it might be that superficial similarities between the L1 (subject-verb inversion in Spanish, in this case) and the L2 (subject-auxiliary inversion in English) obscure the fact that the L2 pattern is different from that of L1 and that the L2 pattern needs to be acquired (Oller & Ziahosseiny, 1970; Ringbom, 1987).

In Part 2, we found that L1 Chinese and L1 Spanish learners' accuracy and non-inversion rates for embedded *wh*-questions were comparable. On the other hand, L1 Chinese learners produced slightly higher rates of inversion errors than L1 Spanish speakers and higher rates of morphology omission errors in embedded yes/no questions. This latter pattern might be a result of L1 transfer, since Chinese, differently from Spanish, has no inflectional morphology (see Rehak and Juffs, 2011 for differences between these two L1 groups in terms of morphological priming and Lardiere, 1998, for discussion of one advanced Chinese speaker's omission of tense morphology), although it is unclear why these morphology omission errors would increase from *wh*- to yes/no contexts (12% vs. 21%, see Table 4).

Taken together, the general findings of this investigation are compatible with no-transfer accounts and with transfer accounts that do not posit L1 transfer at intermediate/advanced stages of L2 acquisition[18]. On the other hand, it is unexpected under the view that transfer continues (or

increases) in later phases of acquisition, given that Spanish allows subject-verb inversion in embedded clause questions and Chinese lacks inversion in questions altogether. While it is clear that null effects should be interpreted with caution, the existence of a null effect in the context of two significant main effects in the same study (syntactic structure and *wh*-word,) argues against a transfer interpretation of embedded inversion errors in L2 learners' production.

The fact that inversion errors in embedded *wh*-questions occur in the speech of both L1 Spanish and L1 Chinese speakers, together with the finding that this type of production occurs in the speech of children learning English as their L1 (Stromswold, 1990) and is attested in a number of non-Standard English varieties, suggests that inversion in embedded questions is not a product of L1 transfer, but possibly the result of structurally constrained over-generalization of inversion from main to embedded clauses. If this is true, we might expect that elements that are associated with higher (target-like) inversion rates in main questions will be associated with higher (non-target-like) inversion rates in embedded clause questions and vice versa. This prediction is borne out in our data in the significant correlation between inversion rates in main and embedded questions across *wh*-words (r=.45, p=.01).

3.2   The role of L2 properties: syntactic structure

In both studies, we found higher accuracy rates in yes/no than in *wh*-questions. The findings from Part 1 are in line with other findings from the L2 literature (Spada & Lightbown, 1999; Pienemann & Johnston, 1987) showing that subject-auxiliary inversion emerges and becomes productive in yes/no questions earlier than in *wh*-questions (Stage 4 vs. Stage 5). In order to compare our results with this research, we grouped our learners based on whether they acquired inversion in both, one or none of the two structures (see Appendix D). Mastery of inversion was operationalized by using both 80% (Cancino, Rosansky, and Schumann, 1975; Irwin and

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Weston, 1975), and 90% inversion as a cutoff (Brown, Cazden, Bellugi, 1973; Eckman, Moravscik, & Wirth, 1989). We found that learners who have acquired inversion in *wh*-questions have also acquired it in yes/no questions. There are no exceptions to this generalization when using the 80% criterion, while there is one exception using the 90% criterion. Conversely, there are thirteen and eighteen participants that have not acquired inversion in *wh*-questions but that have acquired it in yes/no questions according to the 80% and 90% inversion criteria, respectively.

This result contrasts sharply with what was found by Eckman and colleagues, who observed the opposite implicational relationship (i.e., whenever learners have acquired inversion in yes/no questions, they have also acquired it in *wh*-questions), and is surprising considering that non-inverted yes/no questions (e.g., *She likes it?)* are present in the native input, while non-inverted *wh*-questions aren't (e.g.,**What she likes?*). One possibility to account for the sharp contrast between the present results and those reported by Eckman et al. (1989) has to do with differences between the tasks used in the two studies to elicit questions. In Eckman et al.'s (1989) study, participants saw a series of drawings constituting a story and had to guess the story by asking questions; this type of context might have met the pragmatic conditions for non-inversion in yes/no questions, given that participants might have been trying to confirm their own guesses (see note 7). In the present study, the context did not meet such pragmatic conditions, a fact that is supported by the 100% inversion rate in native English controls' productions. It should also be noted that in Eckman et al.'s (1989) study, yes/no questions were elicited before *wh*-questions[19], so practice effects might account for the difference in inversion rates. Conversely, yes/no and *wh*-questions were interspersed in this study.

The fact that L2 learners, independently of their L1, inverted at higher rates with yes/no than with *wh*-questions does not follow from the syntactic properties of learners' native languages; as we have shown above, in fact, Chinese does not use different syntax in the two structures, and Spanish allows non-inversion to occur more freely with yes/no than with *wh*-questions. On the other hand, this finding is consistent with results from first language acquisition research on English questions which attribute inversion errors in *wh*-questions to reduced saliency of the auxiliary (Gleitman, Newport, and Gleitman, 1984) or to higher structural complexity (Klima & Bellugi, 1966), and is thus consistent with claims that L2 development, at least in this area of the grammar, is similar to L1 development in terms of developmental stages and in terms of the hypotheses that learners entertain.

In Part 2, we found that learners were also more accurate with yes/no questions than with *wh*-questions. This result is in line with our initial predictions based on structural considerations and data from L1 acquisition (Stromswold, 1990) and dialectal variation (Labov, 1972; Henry, 1995; Filppula, 1999; Green, 2002; McCloskey, 2006). As has been hypothesized for these varieties of English, we propose that embedded inversion in L2 grammars cannot take place due the presence of an overt complementizer *if* in the position targeted by inverted auxiliaries (C^0). As an initial indication of the fact that inversion and presence of a complementizer are intimately connected, it is perhaps informative that, although participants in this study virtually always produced a complementizer in embedded yes/no questions, inversion occurred when a complementizer was not present (7/8 contexts) and a complementizer was absent whenever inversion occurred (7/7). We take this as an initial indication that inversion errors are structurally constrained.

3.2   The role of L2 properties: wh-words

In Part 1 and Part 2, a *why*-effect emerged: *why*-questions were uniformly associated with lower inversion rates than other *wh*-elements, i.e. *why* was associated with low inversion and accuracy rates in main clause questions and low inversion and high accuracy rates in embedded clause questions.

The results from Part 1 follow a well-established pattern in L1 acquisition (Labov & Labov, 1978; Berk, 2003; de Villiers, 1991; Rowland & Pine, 2000; Thornton, 2008). This result is, on the other hand, only partially in line with the findings from the most in-depth L2 study on the effect of *wh*-words in the recent L2 literature (Lee, 2008). In that study, Lee found an argument-adjunct asymmetry with ungrammatical non-inverted adjunct questions being judged as more acceptable than non-inverted argument questions. Our results from Part 1 indicate, on the other hand, the existence of an asymmetry between *why* and other *wh*-words, and not between arguments and adjuncts *tout court*. At this point, it is not possible to determine whether this difference reflects an asymmetry between production and acceptability judgment tasks, an L1 effect (L1 Korean in Lee's study, L1 Chinese and Spanish in our study), or a w*h*-word effect (Lee used *why* and *how*, while the present experiment used *why* and *where)*.

It should be noted that the existence of a *why*-effect in adult learners of English undermines explanations attributing low rates of inversion with *why* in child English to difficulties with its conceptual complexity, given that, among other things, these speakers have the conceptual abilities to ask all types of complex *wh*-questions in their first languages (see Clancy, 1989; Bloom, Merkel and Wotten, 1982; Park, 2000 for similar arguments). Difficulties with *why* are instead compatible with first language acquisition and cross-linguistic research attributing *why*'s behavior to its particular syntactic properties: for example, Thornton (2008), based on Rizzi (2001), proposed that in child English, *why* is base-generated in a dedicated position in the

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structure [Spec, IntP] already endowed with an interrogative feature, making the movement of a [+interrogative] auxiliary to the left periphery optional.[20]

In summary, the results of the present study show that accuracy and inversion patterns in intermediate/advanced L2 learners differ from those of adult native speakers, with non-target productions occurring at non-trivial rates in main and embedded clause questions, respectively. More importantly, the results of the present study suggest that the influence of learners' native language is not the main factor affecting inversion errors.

In contrast, we found that L1 Spanish and L1 Chinese learners of English are similar to one another in that both are more accurate at producing yes/no than *wh*-questions in main and embedded clauses alike, and display particularly low inversion rates when producing main and embedded *why*-questions. These findings are in line with child English acquisition data and suggest that learners' grammars are sensitive to fine-grained linguistic properties of the language they are acquiring.

While the present study confirms the existence of structural factors affecting accuracy and inversion rates in English adult learners independent of native language (Spanish vs. Chinese), we leave open the crucial question of exactly what properties of the English input and grammatical system cause these difficulties.
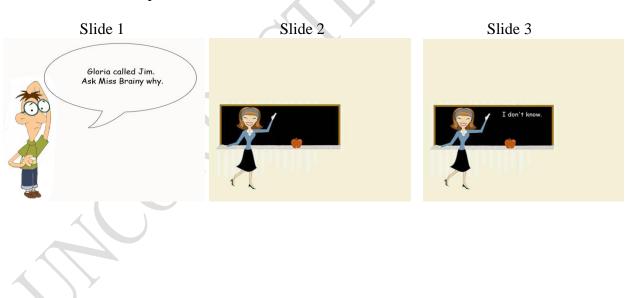
Appendices

Appendix A

Protocol for main yes/no questions:

Slide 1	Slide 2	Slide 3

Protocol for main *wh*-questions:

Slide 1	Slide 2	Slide 3

Appendix B

Protocol for embedded yes/no questions:

Slide 1	Slide 2

Protocol for embedded *wh*-questions:

Slide 1	Slide 2

Appendix C

Examples of main- clause question prompts:

Practice Items:
Someone is yelling upstairs. Ask Miss Brainy who
Someone usually plays the piano next door. Ask Miss Brainy who.
Maybe Miss Brainy's son is painting a picture. Ask her.
Maybe Miss Brainy's husband usually drives her home. Ask her.

Experimental items:
Maybe Gloria called Jim for advice. Ask Miss Brainy.
Maybe Miss Brainy's friends have invited her to dinner. Ask her.
The boss has complimented somebody. Ask Miss Brainy who.
The student read something. Ask Miss Brainy what.
Miss Brainy's brother fired Mark. Ask Miss Brainy why.
Juan teaches Spanish somewhere. Ask Miss Brainy where.

Appendix D

Examples of embedded-clause question prompts.

Practice items:
Who is yelling upstairs?
Who usually plays the piano next door?
Is your son painting a picture?
Does your husband usually drive you home?

Experimental items:
Did Gloria call Jim for advice?
Have your friends invited you to dinner?
Who has the boss complimented?
What did the student read?
Why did your brother fire Mark?
Where does Juan teach Spanish?

Appendix E

Summary of mastery data for main clause questions at the 80% and 90% accuracy thresholds.

Inversion acquired in main *wh-*?	Inversion in acquired in main yes/no?	N (for the 80% threshold)	N (for the 90% threshold)
Yes	Yes	48 (27 Chinese, 21 Spanish)	42 (24 Chinese, 18 Spanish)
Yes	No	0	1 (1 Spanish)
No	Yes	13 (5 Chinese, 8 Spanish)	18 (8 Chinese, 10 Spanish)
No	No	3 (3 Spanish)	3 (3 Spanish)

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Tables

Table 1: L2 Learners' average MTELP scores and other measures (SD)

Measure	L1	
	Spanish (N=32)	Chinese (N=32)
MTELP	39.5 (5)	37.2 (4)
Age	28.6 (10)	25.7 (6)
Years of stay in US	7.4 (8)	3.1 (4)
Age of arrival to US	21.2 (8)	22.6 (7)

Table 2: Main clause questions: percent productions (and SD) by L1, syntactic structure and coding category.

	L1			
	Chinese		Spanish	
Response-type	*Wh*-	Yes/No	*Wh*-	Yes/No
correct	78.5 (18)	91 (12)	64.6 (28)	79.3 (19)
non-inverted	5.7 (8)	0 (0)	12.5 (17)	2.7 (6)
double tense	0.7 (2)	2.3 (6)	3.1 (6)	5.3 (9)
no auxiliary	1.8 (3)	0.3 (1)	3.1 (6)	1 (3)
other errors	13.3 (14)	6.4 (10)	16.7 (20)	11.7 (17)

Table 3: Main clause questions: percent correct and inverted productions by L1 and *wh*-word

	L1			
	Chinese		Spanish	
Wh-type	correct	inverted	correct	inverted
what	79.7 (22)	94.4 (14)	73.4 (29)	90.4 (17)
where	87.5 (15)	100 (0)	68 (29)	87.8 (25)
who	76.6 (28)	94.2 (16)	54.7 (37)	87.5 (32)
why	70.3 (30)	84.1 (27)	62.5 (38)	71.4 (27)

Table 4: Embedded clause questions: percent productions by L1, syntactic structure and coding category.

	L1			
	Chinese		**Spanish**	
Response-type	*Wh-*	**Yes/No**	*Wh-*	**Yes/No**
correct	47.9 (27)	63.5 (18)	44.9 (23)	75.6 (20)
inverted	21.1 (22)	13.7 (9)	26 (21)	1.8 (4)
double tense	0 (0)	0 (0)	0.4 (1)	0.2 (1)
no auxiliary/morphology	12.1 (12)	20.7 (17)	9 (9)	9.6 (8)
other errors	18.9 (16)	12.1 (13)	19.7 (15)	12.9 (14)

Table 5: Embedded clause questions: percent correct and non-inverted productions by L1 and *wh*-word

	L1			
	Chinese		**Spanish**	
Wh-type	**% correct**	**% non-inverted**	**% correct**	**% non-inverted**
what	43.8 (31)	63.6 (37)	52.3 (31)	67.7 (33)
where	48.4 (34)	67.4 (42)	45.3 (31)	63 (36)
who	37.5 (31)	57.1 (43)	30.5 (28)	45.3 (40)
why	61.7 (30)	88.8 (27)	51.6 (32)	76.7 (35)

Notes

[1] Inverted main yes/no questions are strongly preferred in pragmatically neutral 'out of the blue' contexts; non-inverted main clause yes/no questions are acceptable under specific pragmatic circumstances, see note 8.

[2] Early acquirers of English had been exposed to English before age 5.

[3] For ease of exposition, we refer to L1 speakers of Mandarin, Cantonese, and Shanghainese as L1 Chinese speakers. These varieties do not differ from each other on the relevant properties for this study (i.e. syntax of questions).

[4] Some studies have shown that L1 transfer increases with development (e.g., Hyltenstam, 1984; Klein & Perdue, 1993), while others have argued that it decreases as learners become more proficient (e.g., Jansen, Lalleman, & Muysken, 1981; Seliger, 1978; McClure, 1991; Sjöholm, 1995; Major, 1986).

[5] It has been proposed in the literature (e.g., Suñer, 1994; Goodall, 1991) that Spanish may in fact not display T-to-C movement, but, rather, failure of the subject to raise to Spec, TP (see also Alexiadou & Agnastopolou, 1999 for an analysis of inverted orders in Greek and Romance languages in terms of VP internal subjects, and Cardinaletti, 2007 for an analysis of Italian post-verbal subjects in interrogative structures in terms of marginalization). For the purposes of this investigation, we will follow the classic proposal that Spanish displays verb movement in main and embedded clause questions.

[6] According to a number of researchers (e.g., Baauw, 1998; Rutten, 1995), most native speakers of peninsular Spanish consider inversion with adjuncts other than *why* obligatory.

[7] The view that L1 transfer is most likely when the learner's L1 and L2 are similar has been advocated by a number of researchers (see Andersen, 1983; Kellerman, 1983; Ringbom, 1987; Wode, 1978; Zobl, 1980). The opposite view, represented by the Contrastive Hypothesis (Fries, 1945; Lado, 1957; Stockwell, Bowen &Martin, 1965) assumes that "the greater the linguistic difference between some aspect of the L1 and the L2, the greater the likelihood of interference" (Kellerman, 1995: 126).

[8] Specifically, according to the Cambridge Grammar of the English Language (Huddleston & Pullum, 2002; see also Green & Roeper, 2007), non-inverted yes/no questions have an epistemic bias towards an answer "with the same propositional content as the question" (2002: 881). That is, the expected answer to (i) is (ii), while the expected answer to (iii) is (iv).

i.   They've finished?

ii.   Yes, they've finished.

iii. They haven't finished?

iv.   No, they haven't finished.

[9] An *apparent* counterexample if offered by McCloskey (2006), in which he shows that embedded inversion can happen in Irish English embedded yes/no questions headed by the complementizer *if* (as in v.). However, the structure is only grammatical if an adverbial phrase intervenes (see the ungrammaticality of vi.), which indicates the presence of a second CP in the structure:

v.   Patsy asked him if, when he was sent to college, was it for a clergyman or a solicitor.

vi.   *I asked them if would they like a cup of tea.

[10] The empirical findings with respect to *wh*-words like *where*, *which*, *whose* and *how* remain more controversial (see, for example, Erreich, 1984; Stromswold, 1990; Valian, Lasser, & Mandelbaum, 1992)

[11] *Why* elements show a behavior that distinguishes them from other *wh*-words in many languages, including Spanish (Torrego, 1984), French (Rizzi, 1990), Irish (McCloskey, 2006), Korean, Japanese and Chinese (Ko, 2005). In Spanish, adjunct *wh*-elements do not give rise to obligatory V-to-C movement, while in French, *pourquoi* does not allow 'stlylistic inversion'. Rizzi (1990) hypothesized that *why* elements in different languages are base-generated in Spec, CP. Ko (2005) proposes a similar analysis for *why* elements in Korean, Japanese and Chinese, due to the lack of intervention effects when *why*-elements are preceded by scope-bearing elements.

[12] The majority of Chinese speakers were native speakers of Mandarin (four speakers were native speakers of Cantonese). Four L1 Spanish speakers were native speakers of Caribbean Spanish varieties in which subject-verb inversion in questions is dispreferred (Toribio, 2000; Suñer, 1994).

[13] Verb-type (lexical verb vs. auxiliary) was also manipulated as a fully within factor. However, on a large number of occasions (about 30%), participants did not use the auxiliary that was provided in the prompt (e.g., they substituted *have* with *did*, or *is* with *does* or vice versa). Preliminary analyses showed inversion rates to be uniform across prompts with an auxiliary or a lexical verb (96% and 97% for L1 Chinese and 93% and 94 for L1 Spanish in main questions, respectively), and this factor was not included in further analyses.

[14] While *where* can function either an argument (e.g., Where did you put the book?) or an adjunct (Where did you have dinner?) depending on the verb, it always functioned as an adjunct in our experimental materials.

[15] The vast majority of participants' responses during debriefing interviews indicated their belief that the experiment was investigating (a) their ability to correctly remember the exact words used in the prompts, (b) their correct usage of tense in embedded contexts (e.g., whether they should say "She was wondering what he had eaten" rather than "She was wondering what he ate"), or (c) their ability to correctly transform the 2nd person pronoun provided in the main prompts into a 3rd person pronoun when producing an embedded clause structure.

[16] 'Other error' responses were all change of structure (e.g., a yes/no question produced in place of a *wh*-question). The single inversion error and three other errors were all produced by the same speaker.

[17] It is important at this point to consider the possibility raised by an anonymous reviewer that inversion rates in Part 2 might be somewhat inflated as the result of priming from main clause questions in Part 1 and, more worrisomely, from the main clause question prompt used to elicit embedded clause questions. We believe that inversion errors in our study are not the result of an experimental artifact for a number of reasons. First, non-target-like inversion has been reported in the spontaneous speech and written production of L2 learners, albeit not quantified, in a number of studies in the literature. Second, as already mentioned in Section 2.1.2., in order to ensure that learners were not directly quoting the main clause question prompt and thus adopting a "plug in" strategy for their production of embedded clause questions, one third of the experimental materials contained a second person pronoun that needed to be transformed into a second person pronoun. Learners were able to operate this transformation in the vast majority of the cases (88%), showing that they were not simply quoting the prompt. Third, if embedded inversion were an experimental artifact, it should also be found, to some degree, in the production of native speaker controls and should be comparable across structures, both of which are contrary to fact: embedded inversion is virtually absent in the control group and extremely rare in yes/no questions (1.4%).

[18] It has been proposed in the literature (Taylor, 1975a,b) that as learners move to later stages of acquisition, errors that can be imputed to L1 transfer diminish, while errors of overgeneralization increase. Future work focusing on speakers with low/intermediate proficiency in English should investigate this possibility.

[19] "In the beginning, only yes/no questions were allowed to be asked and then later questions of the more efficient type—that is, *wh*-questions" (Eckman et al, 1989:178)

[20] It should be noted that it is also possible that the *why*-effect observed in the present experiments stems from L1 transfer, because *why*'s counterpart has been shown to behave idiosyncratically in both Chinese and Spanish. For example, Lin (1992) and Ko (2005) claim that *weishenme* (*why*), differently from all other *wh*-elements is generated in Spec, CP. With respect to Spanish, Goodall (1991) hypothesizes that similarly, Spanish *porqué* 'why' is base-generated in a position higher than other *wh*-elements, and as such, does not trigger obligatory subject-verb inversion. Further investigation with speakers of a language that does not evince a *why*-distinction is needed to address this question.