Evidence of optional infinitive verbs in the spontaneous speech of Spanish-speaking children with SLI

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Abstract

The purpose of this study is to determine whether the occurrence of nonfinite verbs in the spontaneous speech of monolingual Spanish-speaking children with specific language impairment (SLI) distinguishes them from typically-developing children of the same age and to consider the Interface Deficit account of SLI, in contrast to other prominent accounts of the tense deficit, in light of current literature. To demonstrate that tense, a discourse-sensitive construction, is problematic for Spanish-speaking children with SLI, 42 monolingual Spanish-speaking children, 21 with SLI and 21 age-matched typically-developing children, were recorded for 20–35 min sessions of narrative speech, in Mexico City. The children's ages ranged from 58 to 76 months. Utterances were coded for compliance with obligatory context, defined as whether or not they agreed with plausibly associated subjects in the grammatical context. Our results show that children with SLI produced significantly more errors in verb finiteness, taking into account obligatory context, than did their typically-developing counterparts. We conclude that the type and frequency of finiteness errors produced by the children with SLI indicate that these children do indeed pass through an Extended Optional Infinitive (EOI) Stage. Our measure of obligatory context enables the identification of a bare stem, non-finite verb form, previously unidentified in spontaneous speech studies of Spanish-speaking children with SLI. Consequences of these findings for 3 prominent theories of SLI are discussed.
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A robust finding in studies of specific language impairment (SLI) is that children with this disorder have difficulty with tense marking. This has been shown for typologically diverse languages, including French (Jakubowicz and Roulet, 2004), Dutch (Wexler et al., 2004a,b), Hebrew (Leonard et al., 2000) and English (Rice et al., 1995, 1998; Leonard et al., 1997). Given this cross-linguistic generalization, it is tempting to conclude that difficulties with tense marking could be a universal characteristic of children with SLI, consistent with the biological, heritable nature of the disorder. If this were true, it would obviously be clinically advantageous because it would mean that there should be linguistic markers of SLI that are easy to identify, as Rice and Wexler (2001) have argued convincingly for SLI in child English. Nonetheless, if the tense deficit is of a biological nature, one might expect to find it in languages that are relatively well studied, such as Spanish, as

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we have argued in previous research (Grinstead et al., 2009a,b, 2013). This finding, however, has been disputed, primarily in studies of spontaneous production data (e.g. Bedore and Leonard, 2005; Sanz-Torrent et al., 2008). The question we address in this study is whether there is actual counter-evidence in spontaneous speech studies to the existence of a tense deficit in child Spanish SLI or whether the existing data has simply been misunderstood, as a result of the difficulties posed by the language-particular characteristics of Spanish. Further, we will argue, on the basis of evidence from existing studies, that a severe form of Interface Delay (Grinstead, 2004) in children with SLI, which we refer to as the Interface Deficit Hypothesis (IDH), is the most plausible current theory of the tense deficit in SLI. To argue that the Interface Deficit Hypothesis is most plausible, we will compare its predictions for discourse-insensitive constructions, such as noun plural marking and noun-adjective agreement, which children with SLI do not seem to struggle with, to those of three prominent theories of SLI, which do not draw a line between discourse-sensitive and discourse-insensitive constructions.

1. Obstacles to the identification of root nonfinite verbs in child Spanish

The two language-particular traits that are most relevant to determining whether child Spanish-speakers (both typically-developing and language-disordered) fail to consistently mark tense on verbs are: (1) the null subject nature of the language and (2) the portmanteau nature of its inflectional morphology (i.e. the fact that tense and agreement most often share a single morpheme for their expression). These two obstacles combine to make identification of the subject referent problematic in the following way: it is almost always true in child Spanish, because of the forms they appear to attempt to use (primarily present tense, singular), that one can only identify a tense error that is also an agreement error. However, agreement errors may be difficult to detect, given the dearth of overt subjects in child Spanish (less than 20% verbs occur with overt subjects, following Bel, 2001; Grinstead, 2004) and the fact that adult speakers accommodate, or fill-in, the communicative gaps caused by nonfinite verbs with what seems to be the most plausible, felicitous interpretation of an utterance, regardless of whether it is what a child intended.

Overt subjects are frequently, though not always, expressed in most dialects of Spanish for discourse-pragmatic reasons relating to information structure (see Otheguy and Zentella, 2012 for a review of the circumstances under which, especially, overt subject pronouns tend to occur). When null subjects are used, interlocutors must either read the identity of the subject referent off of the subject–verb agreement marker, which is unambiguous in 1st and 2nd person singular, or infer the subject referent from context when it is 3rd person or plural. The need to draw inferences from third person and plural forms results from the fact that these forms are compatible with multiple subject referents. Only by attending to what is salient in context can an interlocutor determine the speaker's intended referent in these latter cases.

Regarding the portmanteau nature of verbal inflection in Spanish, most verbs are like 1., in which both past perfective tense and aspect as well as 1st person plural agreement are expressed in one morpheme (-*mos*). This contrasts with the less common case, exemplified in 2, in which there is a tense-aspect morpheme (-*ba*-), which is separate from the agreement marker (-*mos*).

1. Cant- a   -mos.
    sing- theme vowel -tense/agreement 1st plural past perfective
    ''We sang.''

2. Cant- a   -ba   -mos.
    sing- theme vowel –tense/asp marker past imperfective -agreement 1st pl.
    ''We were singing.''

While the verb form in 1. is produced in 1st person plural, and is consequently only ambiguous as to who to include in the ''we'' form, most child utterances are not plural (e.g. Hoekstra and Hyams, 1998; Aguado-Orea, 2004), which makes the child Spanish-speaker's effective system consist of 1st, (sometimes) 2nd and 3rd person singular, with 3rd person singular forms making up the overwhelming majority of forms in most studies (e.g. Aguado-Orea, 2004; Bedore and Leonard, 2005).

Frequently, it seems possible to safely infer the identity of the unexpressed subject from context, as in this example from a 4 year-old Spanish-speaking child with SLI from this study, though the discourse-salient plural subject does not, in this case, agree with the apparently singular verb:

3. *The investigator asks the child about what the children in the movie Shrek do.*
    Investigator: Oye, y ¿qué hacen los bebés en la película?
                   Listen, what do the babies do in the movie?
    Child: Baña   tina.
                   bathe- (root + theme vowel) tub
                   Bathe tub.

In 3., the agreement error results from the use of an apparent bare verbal stem form with a discourse-salient 3rd person plural subject, expressed in the investigator's question.

Perhaps most convincingly for our thesis that children use bare stems as a nonfinite form, children will use bare stem verb forms with local pronouns that do not agree with them, as in the following example from another preschool child with SLI from our study.

4.   *The investigator talks to the child about what the child has asked Santa Claus for.*
        Investigator: Le hacen una carta a Santa Claus.
                            You write a letter to Santa Claus.
        Child: Y   yo pide   un   carro   de   *Batman   Inicia.*
                            And   I ask for (root + theme vowel)   a   car   from Batman   Begins
        Investigator: ¿Pediste un carro de *Batman Inicia* o lo vas a pedir apenas?
                            You asked for a Batman Begins car or you are about to ask for it?

Notice that the adult-like form for 4. would be *Y yo pedí un carro de Batman Inicia.* (And I asked for a Batman Begins car.) or possibly *Y yo pido/estoy pidiendo un carro de Batman Inicia.* (And I am asking for a Batman Begins car.). The apparent temporal underspecification of the child's utterance prompts a clarification question by the investigator about the completion of the event of asking, illustrating the point that these forms have a nonfinite character. Similar examples of bare stems being used with overt subject pronouns of a grammatical person other than third have been noted for younger, typically-developing children, as in the following from Grinstead et al. (2009a, p. 242, data from Grinstead, 1998).

5.   Eduardo – 3;0.28
        Yo quiere hacerlo.
        I want (root + "e" theme vowel) do-inf cl-acc-sg-masc
        "I wants to do it."

6.   Carlos – 3;3.28
        Yo va a buscar.
        I-nom go stem to look for-inf
        "I goes to look for."

7.   Graciela – 2;6.5
        Hace esto yo.
        do (root + "e" theme vowel) this I-nom
        "I does this."

As researchers, if we uniformly take utterances to be adult-like because a bare stem looks like an adult third person singular present tense verb, we risk failing to see the overwhelming pattern that emerges across studies, which is that bare stem errors are the preponderant error type, of the several types that have been documented for child Spanish. Ultimately, the obstacles we have described imply that spontaneous production data may not be the best way to study this question, which is why we have also tested children's judgments of these forms (Grinstead et al., 2009a) and also elicited finite verb forms from children (Grinstead et al., 2009b), which has lead to the same conclusion. In spite of these obstacles, however, we will argue that, even in the spontaneous production data considered here, evidence of the Extended Optional Infinitive Stage can be found.

2. Tense and SLI in Spanish

In previous work (Grinstead et al., 2009a,b, 2013), we have argued that the results of existing studies of tense marking in Spanish-speaking children with SLI are consistent with the contention that the Extended Optional Infinitive Stage exists in Spanish. Looking at Spanish-speaking children with SLI learning Spanish in a language contact situation with Catalan, Sanz-Torrent et al. (2008) report that the children with SLI in their sample use significantly more 3rd singular present forms than do age and language-matched control groups. Though the authors ascribe these contrasts to differences in the way that data was collected from the three groups, it seems at least possible that some proportion of these 3rd singular forms were bare stem verbs. Because they find very few morphological infinitives that are used in a non-adult-like manner, Sanz-Torrent et al. (2008) conclude that their data do not support an EOI account. Similarly, Bosch and Serra (1997) show that older Spanish-speaking children (mean age = 7;6), in contact with Catalan, make significantly more errors than do age

controls with third person plural, present tense forms. Though the authors attribute this difference to phonological processes, it is again possible that third person plural forms were produced as bare stem forms, such as *canta*, (e.g. plural *cantan* becomes bare stem *canta*), which is consistent with our proposal. Similarly, studying Spanish-speaking children with SLI being raised in a US language contact situation, this time with English, Bedore and Leonard (2005) show that in spontaneous production data, the children with SLI they studied produced more errors with their use of 3rd person, plural, present tense verbs than do age controls. It is possible that a large number of these errors consisted of bare stem errors, as well, though the report does not investigate this possibility directly. Though the authors do not take their study to count as evidence for the Extended Optional Infinitive Stage in Spanish, it would seem difficult to rule this out.

Moving from spontaneous production data to elicited production, Bedore and Leonard (2001, 2002) show that the Spanish-speaking children with SLI who participated in their study in a language-contact situation made significantly more errors of verb morphology than did age controls. Most relevant for our proposal, the greatest proportion of errors, produced by all groups of children in the study (SLI, age controls and MLU controls), consisted of producing 3rd singular present forms where a different person, number or tense was called for. Both the controls and the SLI children produced this kind of error, though the SLI children produced more. This is very strong evidence that a kind of bare stem form was being used when children could not produce the finite target, consistent with our hypothesis that these forms are nonfinite.

Working with monolingual Spanish-speaking children with SLI in Mexico, Grinstead et al. (2009b) showed that an SLI group was significantly less proficient than age controls at producing finite verb forms in an elicited production task. Moreover, of the 30 errors produced by the SLI group, 43% of them (13) were bare stem errors. Also working with Spanish-speaking children with SLI in Mexico, Grinstead et al. (2009a) used a Grammaticality Choice Task to show receptively that children with SLI judged bare stem (e.g. *Yo duerme.*) and morphological infinitive errors (e.g. *Yo dormir.*) to be grammatical when compared to the adult target (e.g. *Yo duermo.*) significantly more than age and MLU controls. Further, they showed that for a subgroup of children who took both the elicited production and grammaticality judgment task, their scores correlated, supporting the validity of both measures and the existence of the Extended Optional Infinitive Stage in child Spanish.

More recently, Grinstead et al. (2013) have shown, using a discriminant function analysis, that scores on the elicited production and Grammaticality Choice tests of tense marking, together with spontaneous speech measures such as Number of Different Words, Mean Length of Utterance and Mean Length of Terminable Unit, can identify monolingual Spanish-speaking children with SLI with fair to good sensitivity and specificity. The elicited production test by itself, in particular, showed 89% sensitivity and 89% specificity, which is on the verge of the 90% threshold for good sensitivity and specificity, conventionally accepted in the field (Plante and Vance, 1994).

Our reading of the existing literature, then, suggests that the "3rd singular present" forms documented in many studies may in fact be bare stem, nonfinite forms. Further, the claims by many researchers that do not find evidence of an Extended Optional Infinitive Stage appear to arise from the fact that many of them were primarily using the occurrence of morphological infinitives (e.g. *Dormir*. To sleep.), which do occur in child Spanish, though rarely, as the primary criterion for judging whether or not the Extended Optional Infinitive Stage could be observed. On this basis, one could reasonably conclude that child Spanish speakers with SLI do not pass through such a stage. However, broadening the array of verb forms we are willing to count as nonfinite to include the bare stem, and, as we will see below, bare progressive participles (e.g. *Durmiendo.* Sleeping.), the Extended Optional Infinitive Stage in child Spanish comes into clearer relief.

3. Accounts of the Extended Optional Infinitive Stage

The longitudinal study of the Extended Optional Infinitive Stage in English-speaking children with SLI by Rice et al. (1995, 1998, 1999) and Rice and Wexler (1996, 2001) substantially advanced our understanding of the grammatical characteristics of SLI. While a range of syntactic accounts have been proposed to explain the phenomenon, we take it to be the case that while the problem manifests itself in the syntax of tense, it is not actually rooted in syntax proper, but in the inability of syntax to communicate with the domain of cognition dedicated to discourse pragmatics. Below, we will argue that there are conceptual reasons for reaching this conclusion. First, however, we will review some of the empirical reasons that syntax-specific accounts do not seem adequate.

The Grammatical Agreement Deficit Hypothesis, of Clahsen et al. (1997), identifies agreement among phrase structure features as the source of difficulty for children with SLI. Making use of the formal features proposed in the Minimalist Program (Chomsky, 1995), Clahsen et al. hypothesize, following their earlier Control Agreement Principle, that agreement is impaired in children with SLI and that it is the cause of their grammatical difficulties. Specifically, the Agreement Deficit Hypothesis asserts that the optional uninterpretable agreement features of verbs and adjectives are impaired in SLI child grammar and are left unchecked. The result of leaving these features unchecked is the substitutionary use of non-finite verb forms, which, lacking agreement features, pose no problem for checking. Clahsen et al. note that this theory also predicts (Clahsen et al., 1997, p. 154, fn 1) that children with SLI should struggle with noun-adjective agreement. However, Grinstead et al. (2008) show that Spanish-speaking children with SLI are not significantly different from age controls at

noun-adjective agreement. Bedore and Leonard (2001/2002) show different results for noun plural marking with Spanish-speaking children with SLI in the US, which we suspect may be related to the children's language contact situation with English.[1] Under these assumptions, the predictions of the Grammatical Agreement Deficit Hypothesis for noun-adjective agreement in child Spanish SLI are disconfirmed.

Another well-known explanation for the EOI stage in children is based on the account of the OI stage in Wexler (1998), which is also cast in the terms of the Minimalist Program (Chomsky, 1995). Following Wexler (1998), Rice et al. (1998) propose the Unique Checking Constraint (UCC). This constraint is conceived of as a universal, biological constraint on syntactic development, which restricts children's verbs to checking the D features associated with either tense or agreement but not both. The UCC interacts with a second constraint, *Minimize Violations*, which requires children's verbs to check both tense and agreement D features in the adult-like way. Following Optimality Theory (Prince and Smolensky, 1993), the competition between these constraints produces the optional behavior observed with respect to finiteness marking, depending on which constraint is obeyed. This competition continues for a longer period in children with SLI, which Rice and Wexler (1996) refer to as the Extended Optional Infinitive Stage. With respect to the Optional Infinitive Stage in the typical development of null subject languages, Wexler (1998) includes a stipulation in his set of assumptions to account for the, as we have seen, mistaken generalization that there is no such stage in typically-developing Spanish. This stipulation consists of claiming that the nature of Spanish grammar is such that Tense *is* a D feature, as opposed to *having* a D feature, as in languages that show Optional Infinitive stages. This is problematic because the empirical generalization that Spanish does not have an Optional Infinitive Stage is false and because including such a stipulation in a syntactic theory is ad hoc, which reduces the power and elegance of the hypothesis.

If we assume a simple modification to the 1998 account, for example, asserting that Tense in Spanish, too, *has* a D feature as opposed to *being* a D feature, like the other EOI languages, the empirical coverage of the theory can be expanded to cover Spanish and an unnecessary stipulation is removed. Allowing such a modification in the theory of tense and agreement in Spanish, we can evaluate the predictions of the UCC for the grammar of Spanish-speaking children with SLI. If this modified view of the UCC in Spanish is not simply a descriptive account of only the Extended Optional Infinitive phenomenon, then it should account for other feature checking constructions in which multiple features could be checked, but only one actually is checked some of the time. Wexler et al. (2004a) have in fact proposed this to account for the difference between typically-developing child Spanish and child Catalan object clitic development, though see Pérez-Leroux et al. (2012) for an argument that a large component of clitic omission in child Spanish is a function of lexical, and not syntactic, development, which makes the relevance of the UCC for the development of this construction unclear.

For Spanish-speaking children with SLI, however, let us consider noun-adjective agreement. On a Minimalist account, in the Chomsky (1995) framework, adjectives in Spanish must agree with nouns for both number and gender, which would be handled by checking number and gender phi features of the adjective against those of the noun. The construction, with respect to its syntactic mechanics (the essence of the UCC), seems quite parallel within the Determiner Phrase (DP), to the situation within the Inflectional Phrase (IP) for Tense and Agreement. Where tense and agreement are functional features of inflection checked against the verb in IP, gender and number are functional features of inflection checked against the noun in DP. At the conceptual level, one could certainly point out, of course, that there are semantic differences between the two cases. However, the UCC attempts to capture the Optional Infinitive and Extended Optional Infinitive stages in terms of syntactic, and not semantic, mechanics. Consequently, semantic differences between the DP and IP domains should not serve as a means for explaining why the UCC should not apply to DPs.

In any case, child Spanish-speakers with SLI do not appear to be different from typically-developing age controls with respect to noun-adjective agreement. At least this is the case for the Spanish-speaking children reported in Grinstead et al. (2008) acquiring Spanish in a Spanish-predominant context, without the influence of English. Bedore and Leonard (2001, 2002) report different results for children, who are learning Spanish in a language contact situation in the US. Again, we assume that language contact accounts for the major differences between the two studies, as the elicitation techniques and participant ages seem identical across the two studies. Returning to the point of considering noun-adjective agreement, the fact that the UCC appears to incorrectly predict that noun-adjective agreement should be problematic in Spanish-speaking children with SLI suggests that the conceptual distinction between noun inflection and verb inflection that needs to be made is not simply a function of the mechanics of syntax. Below, we will argue that the more likely distinction between the two cases stems from tense being discourse-sensitive, and therefore vulnerable to what we refer to as Interface Delay, in typically developing children, and Interface Deficit, in children with SLI; while noun-adjective agreement, and also plural marking on nouns, are not discourse-sensitive, accounting for their relatively intact status in the grammars of children with SLI.

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[1] We note that similar differences have been shown for article errors, which were shown to be abundant in language contact varieties in the US (Restrepo and Gutierrez-Clellen, 2001), but rare in a non-contact variety spoken in a Spanish-predominant context (Anderson and Souto, 2005).

Before moving on, we note that another possible test of the difficulty that children with SLI have with the syntactic computation of multiple functional features could be found in simple noun plural marking, depending on one's syntactic account. Picallo's (2008) account of plural marking, in a *Derivation By Phase* (Chomsky, 2001) framework, also assumes that two functional features, number and word class, probe the noun, which would seem to mean that this should be problematic by the UCC. However, child Spanish-speakers with SLI in Mexico are not significantly different from age and language controls in marking plural on nouns (Grinstead et al., 2008).

Finally, Jakubowicz and Nash (2001) propose the Computational Complexity Hypothesis, which distinguishes the functional syntactic head of person, which they claim expresses tense in the present, from the functional structure expressing past tense, which they take to be more complex. The Computational Complexity Hypothesis evaluates the complexity of functional features by their relative necessity and by whether they are syntactically or semantically motivated. For Jakubowicz and Nash, present tense is represented by person morphology, which is syntactically required in French in all tenses and is not semantically motivated. In contrast, an overt tense marker, such as the past tense marker is not syntactically required in all tenses and is expressed for specifically semantic reasons. They argue that the non-obligatory and semantically motivated nature of past tense causes it to be computationally more complex and, as a result, delayed in its development in the grammars of French-speaking children with SLI.

As with the Extended Optional Infinitive theory, the Computational Complexity Hypothesis, as we understand it, appears to run into difficulty in accounting for the distinction we find between discourse-sensitive vs. discourse-insensitive constructions in the grammars of child Spanish speakers with SLI, i.e. tense vs. noun-adjective agreement and noun plurals, respectively. In particular, it could be argued that a parallel exists between tense marking in the present in Spanish and French, in the sense that Spanish has no tense-specific (i.e. non-portmanteau) present tense morpheme, but rather, in Jakubowicz & Nash's terms, could be viewed as marking tense through person morphology. In an attempt to verify the predictions of such an account in the nominal domain, one could then argue that number marking on plural nouns adds a morpheme, which is semantically required, to the noun, which is not always required by syntax, for example in singular nouns. This would seem to predict that, as a computationally more complex form, plural marking on nouns should be impaired in children with SLI, which does not seem to be the case for child Spanish SLI (Grinstead et al., 2008) or child English SLI (e.g. Oetting, 1993; Rice and Oetting, 1993; Oetting and Rice, 1993).

4. Interface Delay

A different approach to explaining typically-developing children's delayed acquisition, and language-impaired children's severely delayed acquisition, of discourse-sensitive constructions, including tense marking, is Interface Delay for typically-developing children (Grinstead, 1998, 2004) and Interface Deficit for children with SLI. The idea behind Interface Delay assumes a modular architecture for both linguistic and non-linguistic cognition (Chomsky, 1975; Fodor, 1983; Jackendoff, 1997).[2] In such a system, the cognitive symbols of one system are specific to that system and not directly accessible to the computations of other systems. Symbols for angle or hue, from the visual system, for example, should not be directly accessibly by the systems for music, grammar or number (see Jackendoff, 1997 for further argument). Nonetheless, we are able to use language to talk about angle and hue in vision, about pitch and affect in music and about numerosity in number. This implies that there must be some means of expressing information that is native to one system in terms of other systems, particularly in terms of the linguistic system.

With respect to language development, the observation is that the constructions that seem to cause children the greatest difficulty are those that are not limited to an interaction between syntax, phonology, morphology, lexicon and semantics, but rather those that require an interface between these grammar-internal domains of language and the grammar-external domain of discourse-pragmatics, a domain that is characterized by the representation in the mind of the speaker of the interlocutor's linguistic knowledge. Some accounts that begin with this observation claim that children have difficulties with these constructions because discourse-pragmatics itself, independent of grammar, is delayed in its development (e.g. Avrutin, 1994; Schaeffer, 2000). However, what evidence there is seems to suggest that even infants as young as 15 months know a great deal about the beliefs of their interlocutors, as in the study of the belief tracking component of Theory of Mind (Onishi and Baillargeon, 2005), that 12 month-olds are able to track the intentions of those surrounding them (Woodward et al., 2009) and that preschoolers seem to know a great deal about the computation of new vs. old information (Baker and Greenfield, 1988). These facts suggest that situating the delay in the discourse-pragmatic component itself may not be on the right track.

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[2] I will not here attempt to motivate this assumption, which I believe to be correct, but rather refer readers to the original Chomsky, Fodor and Jackendoff references, as well as recent counterpoints from Cognitive Grammar: Fauconnier (2003) and Enfield (2010).

For a concrete example of a discourse-sensitive construction, take definite articles in child English. Though they are omitted frequently, their syntax and morphology appear to be relatively adult-like in children, when they are produced (Perez-Leroux and Battersby, 2009). Thus, important dimensions of the syntax of the construction appear relatively adult-like, and, as we have seen, there is evidence that children of this age appear to know a great deal about the cognitive prerequisites in discourse-pragmatics that govern their use. If these generalizations are correct, a logical alternative that suggests itself in a modular cognitive architecture is that there is something about the means by which cognitive domains communicate with one another that is not yet adult-like.

From this perspective, the phenomenon we have referred to as Interface Delay would appear to be a general phenomenon of cognitive development. One example of how Interface Delay plays out, is in the delay in learning to count in the conventional way, which does not begin until about 3;0 (e.g. Wynn, 1992). In spite of not being able to count, children nonetheless manage to distinguish numerosity as infants and also to use numbers in their language, though not in a conventional count routine, from very early in language development (Grinstead et al., 1998). Children, it seems, possess the cognitive prerequisites in both the domain of cognition dedicated to number and also in the domain dedicated to language, but are delayed in integrating the two. Linguistic Interface Delay, then, is a sub-case of the general Interface Delay phenomenon, which plays out in constructions that require the use of grammar, as a function of a very different kind of knowledge, which grammar does not appear able to access consistently in development.

An example of Linguistic Interface Delay would be the range of constructions requiring nominal anaphora, which children overuse during development. This overuse across constructions that are definite appears to stem from the mistaken assumption by children that their interlocutors share their presuppositions about what is prominent in what Stalnaker (1974) refers to as the Conversational Common Ground. While we will not review all of these constructions here, for reasons of space, we note that child English speakers have been shown to overuse definite articles (e.g. Maratsos, 1974) and pronouns (Avrutin, 1994) and child Spanish and Catalan speakers have been shown to overuse null subjects (Grinstead, 2004). Similar phenomena have been noted in adult L2 acquisition (e.g. Sorace, 2007) and in language transfer (e.g. Tsimpli et al., 2004). Given the uncontroversial existence of a delay in the syntax-discourse pragmatic interface with respect to nominal anaphora in child language, it seems logical to conclude that at least one aspect of the problem with the overuse of nonfinite forms is rooted in temporal anaphora. In both cases, children mistakenly assume familiarity on the part of their interlocutors with their own representations. In the nominal case, it is familiarity with the antecedent noun, which causes children to overuse definites. For example, a child sitting in the middle of a room covered with plastic dinosaurs asks an adult watching the scene, "Have you seen the dinosaur?" The child has a specific dinosaur in mind and assumes that the adult knows which one he means. In the verbal case, it is familiarity with the speech-time/event-time relationship that has been established in discourse. For example, in the common conversational exchange "What is Gromit doing, Wallace? Eating cheese.", the verb "eating" receives its temporal specification from discourse. Children in the root nonfinite stage use nonfinite forms like "eating" assuming incorrectly that their interlocutors share the presuppositions of familiarity with speech-time/event-time relationships (see Bittner, 2011 for a formal account of this idea).

In the case of verb finiteness, our argument is that temporal anaphora requires the coordination of morphosyntactic knowledge in the domain of grammar with discourse-pragmatic knowledge. As a result of children's immature and sporadic ability to manage this coordination, they sometimes use adult-like finite verb forms and other times assume that, because adults share their presuppositions about which tense is prominent in discourse, a minimal verb form, which takes different nonfinite forms within and across different languages, is sufficient. In contrast with other accounts of the Optional Infinitive Stage, this hypothesis does not simply account for the occurrence of nonfinite verbs, but rather accounts for other child language phenomena related to non-adult-like anaphora, as well. As a simpler explanation with equal or greater empirical coverage, we take it to be favored by Occam's razor.

5. Objectives

In the review of the literature that we have presented, we suggested that the Extended Optional Infinitive Stage in child Spanish might best be measured with either receptive or expressive methods that allow researchers to control the identity of the subject and/or the tense morpheme with which it co-occurs. Nonetheless, we will attempt to demonstrate that even in spontaneous production data, evidence of the phenomenon can be found, if great care is taken with contextual coding.

With this objective in mind, we will investigate two specific research questions:

1. Does greater attention to context allow for the identification of nonfinite verbs in the spontaneous production of Spanish-speaking children with SLI?
2. Taking into account bare stem verbs as well as other nonfinite forms, do Spanish-speaking children with SLI produce more nonfinite verbs than typically-developing children?

6. Methods

6.1. Participants

42 monolingual child Spanish-speakers in Mexico City participated in this study. 21 children were diagnosed with SLI, using conventional criteria (Leonard, 1997), whose ages ranged from 55 to 79 months (mean age = 66 months, mean MLUw = 3.1) and 21 children formed the age control group, whose ages ranged from 58 to 76 months (mean age = 66 months, mean MLUw = 5.4).

Children's nonverbal IQs were determined using a Spanish translation of the WPPSI (Weschler Preschool and Primary Scale of Intelligence). In order to be included in the sample, children had to have scores above 85. The Batería de Evaluación de la Lengua Española or BELE (Rangel et al., 1988) was the standardized language test used. The BELE was locally developed and normed in Mexico City and contains seven subtests. Four were used in the identification process, the criterion being that the children have a score of at most 6 (-1.25 SDs below the mean, see Leonard, 1997) on at least one comprehension test ("Comprensión Gramatical" Grammatical Comprehension or "Adivinanzas" Riddles) and at least one production test ("Producción Dirigida" Elicited Production or "Definiciones" Definitions). Because it has been shown to have good sensitivity and specificity in identifying Spanish-speaking children with SLI, children were also given the family questionnaire of Restrepo (1998) and were only included in the SLI sample if they were so identified by the questionnaire. Finally, the children were also given a phonological screen in which they were asked to repeat 24 nonce words that tested their ability to pronounce the segments used in Spanish which represent tense in word-final position with appropriate stress. In order to be included in the study, children had to produce at least 4 out of 5 correctly from each category. This ensured that deficits observed in verb production were due not to phonological phenomena but rather to syntax. Children were given ASHA protocol hearing tests and required to pass them at conventional levels. Also, parental report and medical history had to suggest no recent episodes of otitis media with effusion in order for a child to be included. Similarly, neurological tests determined that the children had no frank neurological damage. With respect to oral structure and oral motor function, initial examination ruled out structural anomalies and assured normal function. Parental report and family history interviews ruled out concerns pertaining to social and physical interactions.

The 21 children who formed the control group all scored within 1 standard deviation of the mean for their ages, which eliminated language-impaired children. They were also given the phonological screen and passed to eliminate possible skewing of the results for phonological reasons. Interactions with them as well as their parents' and teachers' reports did not suggest any abnormalities in their speech or language.

6.2. Procedures

A parent of each child signed US and Mexican institutional review board-approved informed consent documents in order to participate. All children were recorded producing roughly 20–35 min of spontaneous, mostly narrative, speech typically about what they had done that same day, what kinds of games they played, who they played with or the plots of their favorite movies.

6.3. Transcription reliability

The videos recorded of each child were transcribed by native speakers of the same dialect (the Spanish of Mexico City). Transcribers were initially normed on a set of common transcriptions. Every recording session was transcribed by a transcriber. Then, a second transcriber checked this transcription. Finally, a second transcriber of the same dialect re-transcribed 10% of half of the recordings in order to calculate reliability. Thus, the second transcriber re-transcribed 50–60 utterances from half of all the transcripts used in the study. Agreement between transcribers, calculated by word, ranged from 90 to 99% with a mean agreement percentage of 95.4%. The inter-rater reliability between the original transcriber and the second transcriber was calculated using Krippendorf's Alpha coefficients for interval data (Hayes and Krippendorf, 2007). The range of the coefficients was .904–.998, with a mean value of .974.

6.4. Coding

To determine the obligatory context for the verbs considered in this study, three criteria were used:

- *Criterion 1 – Local agreement* – agreement between an explicit subject and verbal inflection together in the same utterance.
- *Criterion 2 – Discourse agreement* – agreement between verbal inflection and a subject that is either mentioned just previously to or just after the utterance in question (this implies that the subject is prominent in the Conversational Common Ground in the mind of a native speaker).

- *Criterion 3 – Subject existence* – upon a change of topic, an overt subject, normally required by discourse for verbs in the third person, must be present.

The first Criterion for scoring compliance with obligatory context consists of noting explicit disagreement between a verb and its local, overt subject, illustrated in the following example from a six year-old child with SLI.

8.   INV: ¿Y cómo juegan?
            And how do you play?
     CHI: A las escondidas.
            At hide and seek.
     INV: ¿Y cómo juegan a las escondidas?
            And how do you play hide and seek?
     CHI: Ah **uno cuentan.**
            Uh, one count (plural marked verb with singular subject-explicit disagreement).

For Criterion 2, discourse agreement, the subject is available, although not localized to the child's own utterance. Instead the subject is clear from the immediate previous context, as in the following.

9.   INV: ¿Y quién te dio esa calcomanía?
            And who gave you that sticker?
     CHI: Tola maly.
            (The child's teacher)
     INV: ¿Por qué te la dio?
            Why did she give it to you?
     CHI: Porque **se portó** muy bien.
            Because he/she behaved (disagreement with discourse-salient subject for person) very well.

Even though the child appears to be referring to herself in her statement about having received a sticker, she uses *se portó*, a third person preterit verb, in response to a question directed to her about herself by the investigator, though an adult would likely have used first person singular past marking (e.g. Me porté muy bien. I behaved myself very well.).

The following is an example, from a 5 year-old with SLI, of Criterion 3 in that children fail to introduce the subject of a third person singular verb when pragmatically required to do so by the discourse. An adult producing the last utterance made by the child might have said "Los metes (tú) en la máquina y ya viene el metro." Or "Uno los mete en la máquina y ya viene el metro." or possibly "Se mete en la máquina y ya viene el metro.", among other possible variants of similar ideas. Though a subject referent is established by the investigator's question as a 2nd person singular of arbitrary reference (as in "You need good ingredients to make a good cake." in English.), a response with any of these three grammatically distinct subject types (2nd singular familiar, 3rd singular, 3rd singular with a subject clitic) is possible.

10. INV: ¿Y cuál es el más rápido de todos?
            And which is the fastest of all?
     CHI: El metro.
            The metro.
     INV: ¿El metro?
            The metro?
     INV: A ver.
            Let's see.
     INV: Me estabas platicando qué tienes que hacer para entrar al metro.
            You were talking to me about what you have to do to get on the metro.
     CHI: Boletos.
            Tickets.
     INV: ¿Qué haces con los boletos?
            What do you do with the tickets?
     CHI: A **mete** a maquina ya viene beto.
            Put (bare stem) in the machine and then the metro comes.

Finally, a reduced group of SLI children produced bare progressive participles, reminiscent of forms produced in child English, especially by Nina of the Suppes corpus (Suppes, 1974), e.g. "I sliding down." (2;1.15), which appear to lack a finite auxiliary verb, *estar* in the case of the 6 year-old with SLI in this example.

11. INV: ¿Y cuéntame a qué juegas con tus hermanos?
         And tell me what do you play with your brothers?
     INV: ¿A qué te gusta?
         What do you like to do?
     CHI: **Estudiando.**
         Studying (bare participle).
     INV: ¿Estudiando?
         Studying?
     INV: ¿Pero a veces juegan?
         But sometimes do you all play?
     INV: ¿A poco nada más estudian todo el día?
         You really don't do anything else but study all day?
     INV: No, yo no te creo.
         No, I don't believe you.
     CHI: **Comiendo.**
         Eating (bare participle).
     INV: Comiendo también.
         Eating too.
     CHI: Y **jugando.**
         And playing (bare participle).
     INV: Y cuando juegan ¿a qué juegan?
         And when you all play, what do you play?
     CHI: A los cubos.
         Blocks.

6.5. Coding reliability

Using the measure of obligatory context specified above, each verb produced in every sample was coded for the child's success or failure to comply. Each verb was also coded for person, number, and tense, as well as for whether or not it was accompanied by an overt subject. Two native speakers of Mexico City Spanish separately coded each utterance for obligatory grammatical context, as did a third coder, who was a native speaker of English also competent in Spanish. In the analyses that follow, for each verb, compliance with the obligatory context was defined as the judgment made by the majority of the raters. Fleiss' Kappa (Fleiss, 1971) was used to determine the inter-rater reliability among the three Spanish speakers coding for obligatory context. The calculated Kappa of 0.68 was in the category of substantial agreement, according to Landis and Koch (1977).

6.6. Statistics

For each child in the study, we calculated proportions of various verb form types (tense, number, person, and presence of overt subject), in obligatory context, over the total number of verbs produced by the child in question. The mean proportion for each group was then calculated over each child's percentage of a particular type (e.g. third person singular, out of obligatory context) over all verbs. In this way, more talkative children were not given more weight than they would have been, had we calculated the mean percentage from the group's total production of a form over the group's total number of verbs. This is important because children with SLI produced significantly less speech than age controls. The production of the two groups was then compared across SLI and typically-developing groups using non-parametric Mann Whitney U tests, because the data were not normally distributed, nor did they have equal variances. All tests were performed with a significance level of 0.05. Data analysis was performed using SAS® Version 9.2.

7. Results

In Table 1, we see that Spanish-speaking children with SLI produce more nonfinite verbs, as a proportion of all verbal utterances, than do typically-developing age-matched controls.

More specifically, bare stem verbs, occurring with no identifiable subject antecedent or with a subject that they failed to agree with, were the most common error type. Further, bare stems by themselves and bare participles by themselves also distinguished children with SLI from age-matched controls, though not all children with SLI produced tokens of all error types. Bare stem errors were the most widely distributed (17/21 children produced at least one). Because not all children

Table 1
Mean proportions for groups of nonfinite forms compared by Mann–Whitney U test.

	TD mean (SD) n = 1623 verbs	SLI mean (SD) n = 956 verbs	Test statistic	p-Value
Bare stem	.007 (.002)	.031 (.043)	364.5	*.019
Infinitive	.0003 (.001)	.005 (.003)	429.0	.277
Bare participle	.000 (.000)	.018 (.043)	388.5	*.010
Participles and infinitives	.0003 (.001)	.023 (.050)	385.0	*.015
Participles, infinitives and bare stems	.007 (.003)	.053 (.057)	320.5	*<.001

* Means significant at the .05 alpha level.

produced all error types, it could be useful to think of nonfinite verb errors in terms of composites, or combinations of nonfinite forms, as potential constructs for representing the Extended Optional Infinitive Stage.

Two different composites of error types (bare participles and infinitives; bare participles, bare stems and infinitives), among others, were produced significantly more by children with SLI, as a percentage of all verbs, than by TD age matches.

Fig. 1 illustrates that the composite of nonfinite verb forms, consisting of bare stems, bare participles and infinitives, is broadly represented across the sample of children with SLI.

8. Discussion

8.1. Summary

Returning to our first research question of whether paying greater attention to context would allow us to identify more nonfinite verbs in the production of Spanish-speaking children with SLI, our answer would appear to be affirmative. The proportion of bare stem nonfinite verbs, which are the forms most likely to be overlooked in Spanish spontaneous production data, was shown to be significantly higher in children with SLI than in age-matched controls. Also, bare stems seemed relatively evenly distributed across children. When all nonfinite forms are taken into consideration, as illustrated in Fig. 1, the generality of occurrence of these forms is broad and consequently of potential clinical value. In answering our
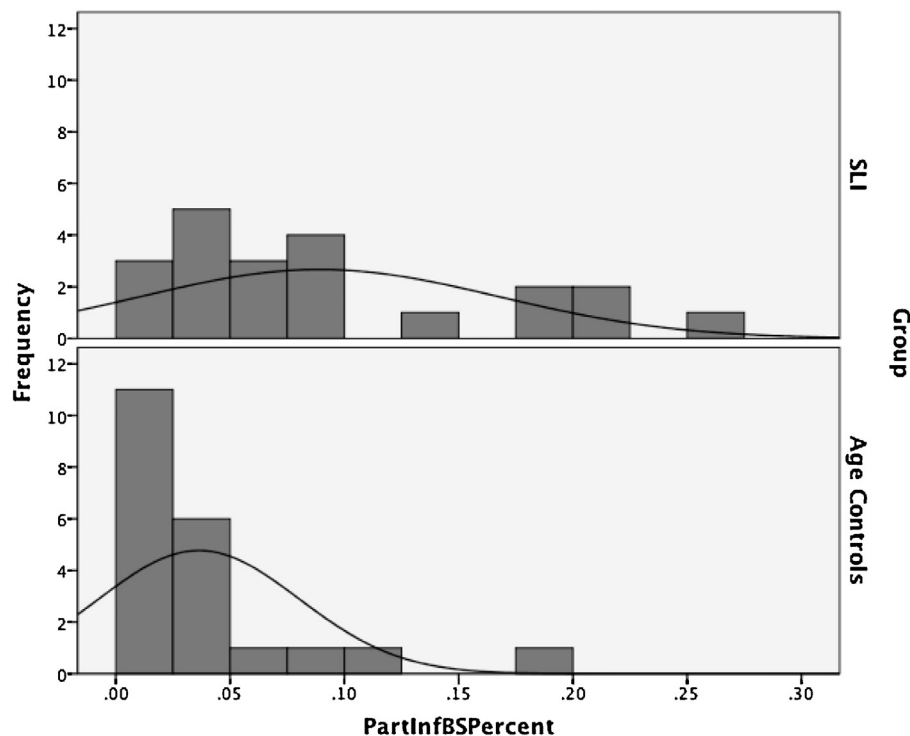

Fig. 1. A histogram of participle-morphological infinitive-bare stem composite percentages across SLI and age control TD groups.

first research question, we have also answered our second, which is whether the occurrence of nonfinite forms is sufficient to distinguish children with SLI from typically-developing children, which it is.

8.2. The Extended Optional Infinitive Stage in Spanish

The results of this experiment follow from a line of research that has taken the perspective that child Spanish-speakers in general, and child Spanish-speakers with SLI in particular, could pass through a stage in which they use root nonfinite verbs that is difficult to perceive for language-particular reasons. The severity of this Extended Optional Infinitive Stage in Spanish appears diminished in comparison to English. This may be due to the regularity and productivity of tense morphology in Spanish. From this perspective, while the Interface Deficit could be a locus of the SLI deficit, the regularity and productivity of tense morphology in particular languages could mitigate or exacerbate the perceived severity of the deficit.

It is worth noting that the proportions of nonfinite utterances used by the children studied here are quite low, especially when compared to results from different methodologies, used in previous attempts to measure the same construct (tense) in roughly the same population, as illustrated in the following table.

In Table 2, though all differences between SLI and TD groups are significant, it seems that the less control children have over the choice of lexical items, the worse their performance is.

This makes sense under the assumption of Grammatical Conservatism (Snyder, 2007) that children limit themselves to using expressions that are already an active part of their grammars. When faced with expressions that are not active in their grammars, as is likely for an elicited production format, and even more so for a Grammaticality Choice experiment, children begin to look less adult-like. Restrepo (p.c.) also points out that more structured spontaneous production collection techniques, including story retelling, can produce different results than did our relatively unstructured narrative spontaneous production data. In Restrepo's (1998) study using more structured spontaneous production data, she showed that Spanish-speaking children in the US were identifiable as a function of number of errors per T-unit, with good sensitivity and specificity. In our monolingual sample, using unstructured spontaneous production data, there was no significant difference between the SLI and age controls for this measure (Grinstead et al., 2013). This methodological difference between studies appears to be further evidence that the greater the degree of control exercised by children over their choice of linguistic form, methodologically, the more typically-developing they appear.

It is also interesting to note how different the proportions of finite verbs used are cross-linguistically, between Spanish and English, for children with SLI at 5;6. In our results, Spanish-speaking children with SLI are at around 95% correct, while in the spontaneous production data from Rice et al. (1998, p. 1421, Fig. 8), English-speaking children with SLI appear to have a composite tense score of around 50%. This kind of difference is likely what motivated many to conclude that Spanish had no Optional Infinitive Stage and that children with SLI had no Extended Optional Infinitive Stage. As we have argued previously, if this were true, it should not be possible to identify child Spanish-speakers with SLI with fair to good sensitivity and specificity on the basis of knowledge of tense (Grinstead et al., 2013). The most likely explanation of the difference between the two cases would appear to be the high degree of regularity and productivity of the Spanish verbal tense morphology vs. that of English. A complete explanation of the root infinitive phenomenon, then, is unlikely to be simple. While we take Interface Delay to be an important component of the SLI deficit, children must also acquire the lexical items, including tense morphemes, necessary to express discourse-sensitive dimensions of language, such as tense. This kind of learning will inevitably be sensitive to frequency in the input, differential processing demands (e.g. copula *BE* is likely to require less processing resources than auxiliary *BE*) and other considerations, including regularity, as suggested by Yang's Variational Learning Model (Yang, 2002; Legate and Yang, 2007).

8.3. Theoretical accounts of the SLI deficit

In the current study, we have argued that the tense deficit in children affected by SLI is better explained by the Interface Delay Hypothesis than it is by exclusively syntactic accounts, including the UCC, the Computational Complexity

Table 2
Cross-methodological comparison of tense scores and SLI/TD comparisons.

Method	Study	μ age	SLI (%)	*n*	Age controls (%)	*n*	*p*
Grammaticality Choice	Grinstead et al. (2009a)[a]	5;6	43	9	81	9	<.001
Elicited Production	Grinstead et al. (2009b)	5;7	82	21	95	21	.001
Spontaneous Speech	Current study	5;6	95	21	99	21	<.001

[a] Grammaticality choice scores are of bare stem forms only, though children's judgments for morphological infinitives were similar.

Hypothesis or the Grammatical Agreement Deficit Hypothesis. This is additionally true with respect to the predictions that these accounts make for discourse-insensitive morphosyntactic relations, such as noun plural marking in Spanish and English and noun-adjective agreement in Spanish. While these empirical cases appear difficult for the theories just referred to, they seem consistent with the IDH. We have provided novel data here confirming the existence of a tense deficit in the language of child Spanish-speakers diagnosed with SLI, which is also consistent with the IDH.

There are certainly other constructions that the IDH makes predictions about, which we have not investigated here, including indefinite and definite articles, along with all other definite descriptions (tonic pronouns, clitic pronouns, names, etc.), VP ellipsis and many others. In short, any construction that requires syntax to interact with discourse-pragmatics should be problematic. Examples of discourse-sensitive constructions that are problematic for children with SLI include definite articles in Spanish–English bilinguals in the work of Restrepo and Gutierrez-Clellen (2001), though, as mentioned above, this raises the question of language contact, given the absence of such problems in the definite article use of monolingual Spanish-speaking children with SLI in Puerto Rico in Anderson and Souto (2005). De la Mora (2004), working with monolingual Spanish-speakers with SLI in Mexico, shows that both direct object clitics and definite articles are problematic for children with SLI. Bedore and Leonard (2001) also show, in their sample of Spanish-speaking children with SLI in the US, that object clitics are problematic. While these findings are generally consistent with the IDH, direct object clitics are not merely a function of syntax-discourse pragmatics, but rather are critically dependent on lexical development. This has been elegantly demonstrated in Pérez-Leroux et al. (2012), who show that in a large sample of monolingual, typically-developing Colombian children ($n = 110$), vocabulary development negatively correlated with clitic omission, as one might expect, given that knowledge of whether a verb is obligatorily transitive (e.g. *devour*) vs. optionally transitive (e.g. *eat*) is clearly a function of lexical development. This finding makes it unclear whether the problems Spanish-speaking children with SLI have with clitics stem from discourse-syntax interface problems, as the IDH predicts, or from deficits in lexical development, which would be independent of IDH-type problems.

A range of other constructions could similarly provide opportunities to test the IDH. In many cases, their investigation is complicated by factors other than syntax proper or the interface between syntax and discourse, including working memory, lexical development, input frequency and others. As we come to understand more about the interaction among these factors for particular constructions, more insightful accounts will hopefully be produced. Advancing these goals will have to wait for further research.

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