Early usage of DO in children with and without
Specific Language Impairment

By

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Submitted to the graduate degree program in Child Language
and the Graduate Faculty of the University of Kansas
in partial fulfillment of the requirements for the degree of
Master's of Arts.

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Date defended: August 25, 2009_

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ABSTRACT

This study examined the early uses of DO in the spontaneous language samples of 89 children, 37 with Specific Language Impairment, age 5;0-5;6, 37 age-equivalent control children, and 15 language-equivalent control children, age 2;6-4;10. Auxiliary DO has been examined in some studies of language acquisition because of its status a carrier of finiteness in questions and negations. However, DO has multiple functions which have received little or no attention in previous work on the early language abilities of children with and without SLI. This study sought to begin to fill that gap by documenting the affirmative DO uses in yes/no questions, wh- questions, proform contexts, elliptical contexts, and emphatic contexts. All DO uses in each child's spontaneous language sample were counted and categorized. Findings indicate that children with SLI showed lower levels of accuracy on both yes/no and wh- questions compared to the age-equivalent control group. Compared to the language-equivalent group children with SLI showed particular difficulty only with DO in wh-questions. Children with SLI showed remarkably high levels of accuracy on forms of DO where the DO carries semantic as well as syntactic information: proform and elliptical DO. The findings presented here are consistent with the Extended Optional Infinitive Account of SLI (Rice, Wexler, & Cleave 1995), and indicate that finiteness in the CP projection may be a particular area of weakness for children with SLI, as evidenced by poor performance on DO in questions.

ACKNOWLEDMENTS

The work presented here would not have been possible without the generous support of numerous individuals. First and foremost, I must thank my advisor, Dr. Mabel Rice. In addition to providing me with the data and resources to carry out this study, Dr. Rice has provided me with invaluable guidance and assistance throughout this process. Every meeting was enlightening and inspiring. I also must thank all members of the Language Acquisition Studies Lab, past and present, for collecting, transcribing, and coding all of the spontaneous samples analyzed here. Their consistent hard work is what made this project possible. I am also grateful to Denise Perpich for all of her assistance with data management. Thank you to all of the families in the longitudinal study for contributing their time towards participation. Thanks also to Patsy Woods for assistance with just about everything relating to finding my way through the first couple years of the Child Language Program. And thank you to my wonderful mother, who has been so supportive of my studies. I could not have finished this project without her help with babysitting. Thank you to Brady, for his constant support, and for helping me with the final stages of this document. Finally, I want to thank my little two-year-old son, Mateo for keeping me grounded throughout this process. Nothing piqued my interest in DO more than his well-timed first exclamation of emphatic DO: “I do got it Mommy!”

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Specific Language Impairment (SLI) is a disorder characterized by grammatical impairments in the absence of any other cognitive disorders, such as autism or mental retardation. A large body of work has demonstrated that children with SLI have particular difficulty with finiteness marking on verbs (e.g. Rice, Wexler, & Cleave, 1995 Rice & Wexler, 1996; Bedore & Leonard 1998; Conti-Ramsden, Botting, & Faragher 2001). In English, finiteness is realized as tense and agreement marking, overtly expressed by a small set of morphemes. This set includes third person singular and past tense forms of main verbs as well as the auxiliaries BE, DO, and HAVE. Auxiliary DO has been studied as a finiteness carrier in work examining children's mastery of this complex grammatical feature. However, the form DO has several additional grammatical functions that have been largely overlooked. On one level, DO is unique simply because it operates in so many different areas of the grammar. On another level, DO is unique because within each of its functions, the grammatical properties of DO present some language-specific exceptions to the general rules governing verb use. These unique features of DO will be discussed in the sections that follow. To demonstrate how DO provides a window into several different areas of the grammar consider the following:

(1) Do you want to make dinner?

(2) What do you want to eat?

(3) I'll do my famous chicken dish.

(4) She cooks better than he does.

(5) He does bake well though.

(6) Don't burn anything!

(7) They liked it, didn't they?

Clearly DO serves in many syntactic as well as semantic roles. The form DO has a complicated historical past, which is partly responsible for its appearance in so many different grammatical structures. DO first appeared as a lexical verb in Old English (Stein 1990). In Middle English and Early Modern English, it picked up functions that it no longer holds today including the causative (as in "he did the Duke see it") and as a semantically empty auxiliary, carrying tense in declaratives (as in "He did invade" meaning "He invaded") (Stein, 1990). Sometime after the introduction of these functions, the current functions came into play: as a structural requirement in questions and negation. Additionally, causative DO took on the semantic loading of emphasis and became emphatic DO (Stein, 1990). Lightfoot (1999) argues that the introduction of DO as solely a structural requirement was triggered by changes in the verb movement system of the English language. The result of this rich historical past is a current system where a single set of phonological forms operates under different grammatical constraints in different functions. The complex development of DO in the English language in some ways mirrors the complex set of problems it poses to young learners of English.

The central question guiding this project is: how is the grammatical knowledge of children with SLI similar to the grammatical knowledge of their language-equivalent and age-equivalent peers, and how is it different? DO presents an opportunity to address this question because it serves a variety of grammatical roles in the verb phrase although the phonological properties of the form remain constant across grammatical roles. If children with SLI show marked deficits in one grammatical role for DO over others, this could provide important information regarding the nature of the deficit in SLI. Alternatively, if

children with SLI show a deficit in DO use for all of its grammatical functions that would suggest that reported weaknesses in auxiliary DO are driven by an overall weakness with the phonological form. Thus, examining DO across all of its functions, with an inherent control for phonological representation, allows for further clarification of the grammatical versus phonological dimensions of the morphosyntax of children with SLI. Formally, the set of research questions this study was designed to address are:

1. What are the early usage patterns of DO in all of its functions in children with and without SLI?
    a. Do children in these groups use DO in all of its categories early on?
    b. Are children with SLI consistently less accurate than comparison groups of children across all functions of DO or do they show similar levels of performance for some DO functions and not others?
2. If/when children make errors relating to DO use, are there differences in the types of errors made by children with SLI compared with unaffected children?

To address these research questions, this study examined DO use in all of its functions in the spontaneous language samples of children with SLI as well as two control groups of children: those equivalent to the SLI group based on age and those equivalent to the SLI group based on language ability, in this case, mean length of utterance in morphemes (MLU). This three-group design allows for a number of comparisons, highlighting both the ways in which children with SLI show delays in language as well as the possible deviations from the expected course of development, referenced to utterance length. Because children with SLI are known to perform more

poorly on finiteness tasks than unaffected children their age, differences between the age-equivalent group and the SLI group are expected. How children with SLI will differ from the language-equivalent group on previously undocumented functions of DO, however, is largely an open question. Additionally, there is the possibility that children with SLI will not differ from the control groups for some of the functions of DO because children with SLI perform accurately on some properties of the grammar, such as plural derivational morphology (e.g. Oetting & Rice, 1993). Such a finding would reveal additional areas of the grammar that are intact in children with SLI.

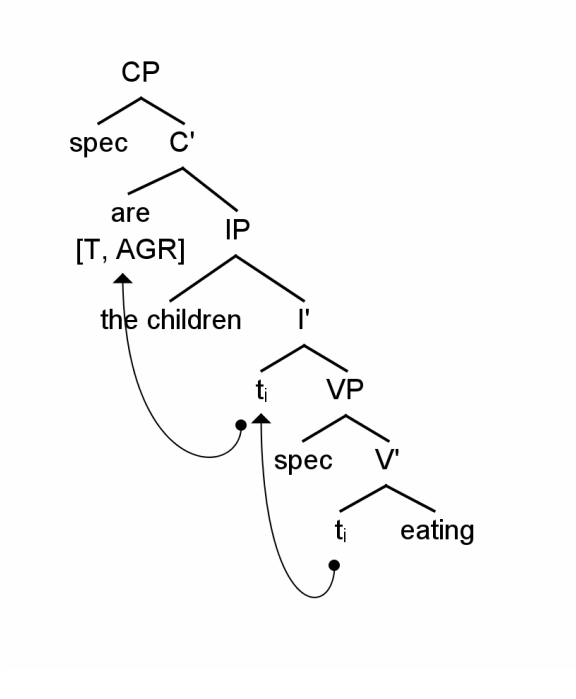
In the sections that follow I will describe the grammatical properties of each category of DO examined in this study in addition to any relevant prior research on the acquisition and early use of DO forms, with the goal of demonstrating that the plurifunctional nature of DO makes it ideal for examining possible accounts of the grammatical deficit in SLI.

*Functions of DO*

Because auxiliary DO is a finiteness carrier, bearing tense and agreement in questions and negations, it has generated interest in studies of language acquisition. Auxiliary DO is often referred to as a "dummy" operator, inserted solely as a structural requirement (but see Penhallurick, 1985; Schütze, 2004 for alternate analyses of auxiliary DO). Government and Binding theory provides a framework to describe the relationships between finiteness and clause structure (Chomsky, 1981). Pollock (1989) elegantly laid out the syntactic properties of auxiliaries in English and the basic architecture described there will be adopted here. Briefly, clauses consist of a verb phrase (VP) containing the

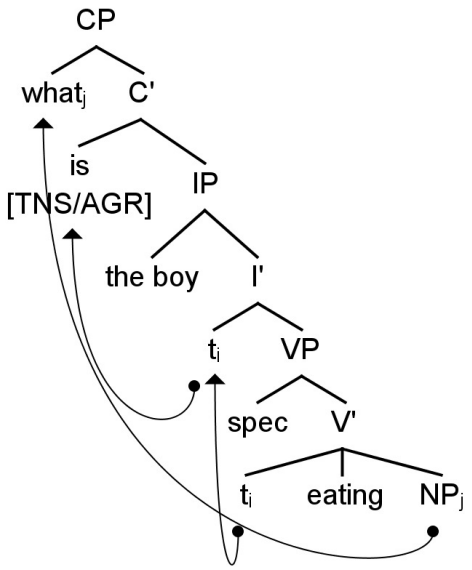
matrix (lexical) verb, and a noun phrase consisting of the subject. Tense (TNS) and agreement (AGR) features, necessary for clause structure, are checked in the functional projection Inflection Phrase (IP). One of Pollock's (1989) contributions was to suggest that the IP is complex and each feature was contained on a separate functional projection. However for simplicity, in the model used here, there will be only one functional projection, IP, for all of these features (Guasti, 2002). Verbs are generated in VP. Auxiliaries (BE, HAVE, and the modals) move out of VP and raise to IP. Lexical verbs however, cannot overtly raise out of VP (with the possible exception of copula BE, if one considers copula BE a lexical verb). This restriction on verb movement for lexical verbs is what necessitates DO-insertion in question formation. Question formation in English involves the process of subject-auxiliary inversion. In the framework adopted here, this process is formalized as movement of the auxiliary, carrying finiteness, to the functional projection, Complementizer Phrase (CP), where it occupies the head position of C (see Figure 1). This I-to-C movement applies to auxiliary BE, copula BE, auxiliary HAVE, and the modals.

Figure 1: I to C movement with VP-internal auxiliary BE




Movement of the auxiliary to the head of C is identical in both yes/no and wh- questions, although wh-questions involve the additional movement of the wh- element to the specifier of C (see Figure 2).

Figure 2: I to C movement with auxiliary BE in a wh-question




In clauses where there is no auxiliary, and finiteness is carried on the main verb, the features comprising finiteness cannot raise out of the VP because of the verb movement restriction in English. Here is where auxiliary DO is inserted to carry finiteness in the head of C and "save" the clause (see Figures 3 and 4). This function of DO is often referred to as DO-support.

Figure 3: DO insertion at IP in yes/no question

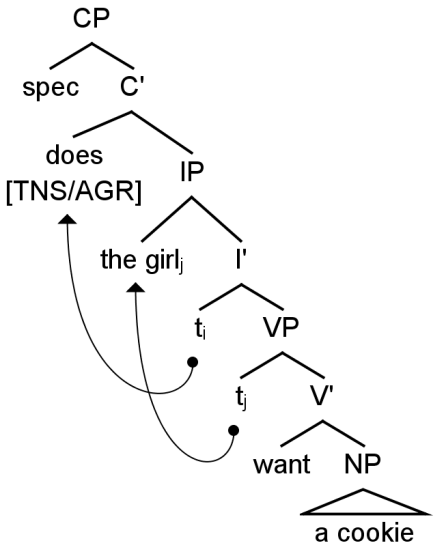
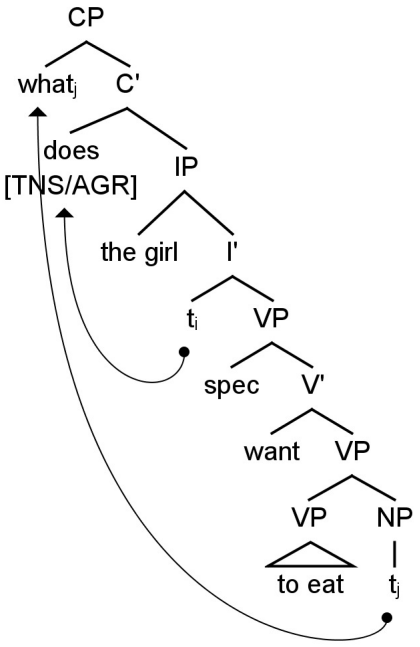



Figure 4: DO insertion at IP in a wh-question



This insertion of DO has been referred to as a "jerry-rigged" feature of English that is in place to get around the rules prohibiting the main verb to raise (Stromswold, 1990). The point of insertion of auxiliary DO however is not well understood. Pollack (1989) argues that the auxiliary DO is inserted at the level of AGR, which is part of the IP, and then it raises like any other auxiliary verb to the CP in question formation. Chomsky (1995) also makes this assumption, although he acknowledges that the exact mechanism allowing for DO-insertion is unclear (see footnote 20, p. 164).

The other context for auxiliary DO use is in negation, where it is structurally required as an operator for the negative particle "not" or "n't". In the case of negation, it seems fairly straightforward that DO is inserted at the level of IP when no other auxiliary is available to carry the negative particle. However, this assumption is not as clear for declarative questions because when affirmative DO is inserted at the level of IP, the DO carries the semantic loading of emphasis. Consider the following:

(8) She does want dinner.

(9) Does she want dinner?

In the interrogative form, there is no trace of emphasis on the auxiliary DO. Therefore the assumption of Pollack (1989) and Chomsky (1995) that auxiliary DO is inserted at IP requires the additional assumption that it then sheds its semantic loading when it raises to the CP in subject-auxiliary inversion. So while the general framework for auxiliary DO is generally understood, some details are unresolved, possibly due to the rich history of DO in the English language (Stein, 1990; Lightfoot, 1999).

Auxiliary DO shares some grammatical features with copula BE in that both present language-specific exceptions to the general rules regarding question formation. Copula BE, unlike auxiliary BE, functions as a main verb in declarative sentences as in:

(10) He is happy.

DO can function as both a main verb and an auxiliary as well, which will be discussed at length below. However for DO forms, the auxiliary form and the main verb form are semantically and syntactically distinct. The fact that both forms present exceptions to verb movement rules has prompted some scholars to suggest that copula BE and auxiliary DO will pattern together during language acquisition. In this way auxiliary DO has received focus in tandem with other auxiliary forms in studies examining early auxiliary use and question formation to determine what syntactic knowledge is available at the beginning of the acquisition process.

Generally, these studies indicate that auxiliary DO poses a particular challenge to learners, possibly more so than copula BE (Stromswold, 1990). In some of the earliest work comparing unaffected control children to linguisitically impaired children, auxiliary DO in questions was one of only a few areas that showed significant differences between the two groups (Morehead & Ingram, 1973). In more recent studies of both SLI children and unaffected children, there is evidence that auxiliary DO is mastered later than other auxiliaries. Some studies have found evidence that early uses of auxiliary DO pattern with copula BE possibly because both present exceptions to the verb movement rules in English. For example, Santelmann, Berk, Austin, Somashekar, and Lust (2002) found that in an elicited imitation task with yes/no questions, young children age 2;0-3;0 performed significantly worse on questions where DO-support was required compared to

declaratives where no DO-support was necessary. They showed a similar pattern for questions where copula BE must raise compared to declarative copula BE sentences. For auxiliary BE and modal auxiliaries there were no differences in performance for questions compared to declaratives. Notably, auxiliary BE and modal auxiliaries follow the rules of English verb movement. Therefore these findings suggest that children have an early knowledge of basic parameters of English, but the exceptions to the rules, such as copula BE and DO-support must be learned later.

In contrast, Rowland, Pine, Lieven, and Theakston (2005) found that auxiliary DO and the modal auxiliaries together attracted the most errors in the wh-questions in spontaneous language samples of children age 1;10-2;11. However, in the analysis of these data auxiliary DO and modals were grouped together. The difference in usage patterns for auxiliary DO and the modals compared to the other auxiliaries (auxiliary and copula BE and auxiliary HAVE) may have been driven by difficulty with DO rather than difficulty with the modals. This possibility cannot be ruled out. Of course it is also possible that this effect was driven by a particular difficulty with modal auxiliaries, but considering other data on this topic, that possibility is less likely. For example Rowland (2007) reported that in yes/no questions in spontaneous language samples, children produce significantly more errors with auxiliary DO than with modal auxiliaries. This difference was driven by poorer performance for auxiliary DO in yes/no questions, while children had equal error rates for auxiliary DO and modals in wh-questions. Despite some inconsistencies, these findings point towards possible weaknesses in the acquisition of auxiliary DO in questions.

Studies of other populations, including both children with SLI and children who are learning English as a second language (ELL), provide additional evidence that auxiliary DO may present a particular challenge to the acquisition system. Paradis, Rice, Crago, and Marquis (2008) found that typical children, children with SLI, and ELL children were more accurate at producing BE forms than DO forms. In comparisons between those groups, Paradis et al. (2008) found that the ELL group had particular difficulty with auxiliary DO. This finding reinforces the notion that auxiliary DO is an unusual feature of English and is particularly challenging to learners.

When considered using the syntactic framework described above, the findings of Paradis et al. (2008) can be taken to suggest that the primary area of difficulty is the CP layer of the clause. Despite the overall advantage for BE over DO, Paradis et al. (2008) found that for children with SLI, BE in questions, where it is located in the CP layer, was more vulnerable to errors than BE in declaratives, where it is located in the IP. Notably, auxiliary DO, which was overall weaker than BE, only appears in the CP layer in questions, and not in the corresponding declaratives. Therefore while children with SLI show difficulty with finiteness marking in general, it seems finiteness in the CP is particularly susceptible to weaknesses in the SLI grammar. If being located in the CP is the factor that drives weakness with auxiliary DO, then equal difficulty with yes/no and wh- questions would be predicted.

Rice, Hoffman, and Wexler (in press) provide further evidence that auxiliary DO is particularly unstable in the grammar of children with SLI. This study tracked children with SLI over nine years beginning at age six. The variable of interest was their grammaticality judgments of yes/no and wh- questions, both correctly produced, and with

omitted BE or DO. Rice et al. (in press) found that children with SLI show a protracted lag behind their language-equivalent peers on this measure that continues well into adolescence. Children with SLI start out significantly lower in correct judgments than the language-equivalent group and they have not caught up by the time they are 15 or 16 years old. This willingness to accept omitted BE and DO in questions for such an extended period of time indicates that although finiteness marking appears to resolve in the IP (Rice, Wexler, and Cleave, 1995; Rice, Wexler, and Hershberger, 1998) difficulty with finiteness in the CP projection does not. This may indicate that the CP projection is particularly vulnerable in the grammar of children with SLI, and may provide a useful clinical marker for identification of SLI.

Besides showing that children with SLI have a persistent difficulty with finiteness marking on auxiliaries in questions, this study also suggests that auxiliary DO in particular may be a more robust clinical marker than BE forms. Rice et al. (in press) found that at the onset of the study, DO was at lower levels of performance than BE forms which might make early auxiliary DO performance a more specific measure of risk for SLI. Rice et al. (in press) contributes additional data to the general finding across studies of acquisition that auxiliary DO operates slightly differently from other auxiliary verbs.

The story of emergence of auxiliary forms as reported by Hadley and Rice (1996) presents a somewhat different story. Hadley and Rice (1996) examined the initial emergence and usage of auxiliary DO, copula BE, and auxiliary BE in typical children and children with SLI. This study found that copula BE and DO pattern together, but actually emerge before auxiliary BE. This possible early advantage for DO however does

not appear to last, as demonstrated by the findings in Rice et al. (in press). Other studies that have examined auxiliary DO also demonstrate that auxiliary DO poses a challenge to acquisition (Santelmann et al. 2002, Rowland et al. 2005, Rowland 2007, Paradis et al. 2008).

Whether DO in its other functions poses a challenge to acquisition is very much an open question. One possibility is that the plurifunctional nature itself is what drives difficulty with auxiliary DO. Perhaps children have difficulty sorting through the many functions (recall examples 1-7) that share the phonological forms and these increased processing demands affect their ability to produce it accurately. If that were the case, then we would expect to see difficulty with DO in all or most of its functions in the very early productions of both typical children and children with SLI. One influential theory of SLI proposed that items that are of low perceptual salience are most vulnerable in Specific Language Impairment (Leonard, 1989; Leonard & Eyer, 1996), referred to as the Surface Account because surface properties of phonology and prosody are thought to account for omission of morphemes. The Surface Account would predict weakness of auxiliary DO as being due to its low perceptual salience as a single syllable lexical form carrying grammatical properties and possibly meaning. The Surface Account proposes that phonologically reduced morphemes and lexical items carrying more information pose the most difficulty. If this is the case, proform, emphatic, and elliptical DO might be expected to be weakest as they carry both syntactic and semantic information. The design of the current study allows for testing these possibilities in addition to the hypothesis of an extended period of optional finiteness in the CP projection, as laid out in Rice et al. (in press). If it is the case that the finiteness marking is a particular point of weakness in the

grammar of children with SLI, then we would expect to see lower levels of accuracy for auxiliary DO forms that appear solely to carry the requirements of TNS/AGR marking (questions) than those in contexts where DO is aligned with semantic functions (negations, proform, ellipsis, and emphatic DO). However if DO is equally weak in all of its functions for children with SLI compared to unaffected control children, then this suggests that possibly the shared phonological form and/or the multiple functions contribute to low levels of accuracy in children with SLI. If contexts where DO is aligned with semantic function are found to be the weakest, the Surface Account would most neatly explain the findings.

This study is the first to directly compare early auxiliary DO use with DO use in other categories. Of particular interest is the proform use of DO. The other uses of DO all have some auxiliary-like properties that will be discussed below. Proform DO, however, operates exclusively under the rules that govern all main verbs. It cannot raise out of the VP, it carries finiteness when there is no auxiliary, and it can be combined with auxiliaries. Consider the following:

(11) He does his homework every night.

(12) *Does he his homework every night?

The ungrammaticality of the second example above is in stark contrast to the auxiliary use of DO, as the entire purpose of auxiliary DO is to be inserted into this position in questions.

Only a few previous studies have examined the early uses of proform DO. Hadley and Rice (1996) found evidence that main verb uses of BE and DO emerged before the auxiliary forms, but this difference was only statistically robust for the BE forms.

However, a small sample size may have obscured the advantage for main verb DO in this study. Rice and Bode (1993) found that children with language impairments make use of General All Purpose (GAP) verbs, a set of 11 verb forms that included proform DO. They proposed that children with SLI utilize GAP verbs, which are all somewhat semantically underspecified, more frequently than their control children. This may indicate that they use a small set of familiar and semantically flexible forms to avoid the challenges of tense and agreement marking on unfamiliar or less frequent verb forms. Rice, Watkins, and Moltz (1993) also found evidence that children with SLI frequently used proform DO in their productions compared to control children. None of these studies reported a more detailed investigation of proform use of DO.

Closely related to proform DO is the elliptical use of DO. Proform DO can be distinguished from the elliptical use because it can occur in both finite (*do, does,* and *did*) and nonfinite forms (*to do, doing,* and *done*), while elliptical DO can only occur as a finite form (Quirk, Greenbaum, Leech, & Svartvik, 1985). Additionally, in American English proform DO is always a transitive verb, while elliptical DO can stand in for a wider variety of verbs, including intransitive. In this study the distinction between proform and elliptical DO was made primarily on the presence of a direct object. Proform uses of DO with a direct object were taken to be substitutions of the semantically underspecified DO for a transitive verb as in:

(13) She chopped the onions and he did the potatoes.

In this example "did" is understood to mean "chopped." Elliptical uses were restricted to when DO was inserted as an operator when no other auxiliary was available as in the original clause:

(14) I hope she remembered the peppers.

(15) Yeah she did.

This construction is known as ellipsis, where a portion of the sentence, in this case the verb phrase (VP) is omitted. Strictly speaking, ellipsis describes when a portion of a clause is omitted, but is fully recoverable, and where the meaning of the unreduced sentence is preserved. Additionally, when the elided portion is added back in, the resulting sentence is grammatical (Quirk et al., 1985). VP ellipsis can occur with any auxiliary. When the main verb is omitted, only the auxiliary remains to carry finiteness:

(16) He was helping with dinner and she was too.

When there is no auxiliary verb available, DO is inserted, just as it is inserted in questions when no other auxiliary is available. Once DO is inserted, however, if the elided portion is added back in the resulting clause is not grammatical:

(17) He was walking to the store and she was too.

(18) He was walking to the store and she was walking to the store too.

but

(19) He walked to the store and she did too.

(20) *He walked to the store and she did walk to the store too.

(20) is only grammatical if the emphatic reading of DO is intended. Therefore, when DO insertion is required in VP ellipsis, it is not an example of true ellipsis, but rather "quasi-ellipsis" (Quirk et al. 1985). In the child speech analyzed in the current study, elliptical DO typically occurs in responses to previous utterances such as:

(21) Examiner: So who gets to sleep here?

(22) Child: He does.

Elliptical DO use is multifaceted in that several grammatical features must be properly understood in order for correct use. The child must first determine what is being elided and then know to insert DO rather than another auxiliary. The child must be aware of the tense of the elided portion of the clause and must be able to mark it for subject- verb agreement. Therefore, if processing demands are an important factor in SLI, errors in early elliptical DO use might be expected.

Emphatic DO was also examined in this study. Emphatic DO involves insertion of DO just as in auxiliary DO and elliptical DO use. However in this case there is no structural reason for DO insertion; rather emphatic DO is inserted only when it carries the semantics of emphasis on the main verb. Once it is in place, however, it functions like any other auxiliary form, carrying finiteness:

(23) He wants gelato.

(24) He does want gelato.

Emphatic DO can only operate in the affirmative because the negative form would appear as simply a negative declarative:

(25) He doesn't want gelato.

Of course, stress and intonation might indicate emphasis in the sentence above, but these characteristics are beyond the scope of this study. Formally, within the X' framework adopted above, emphatic DO is inserted in the IP layer, and the verb remains in VP. Including emphatic DO in this examination of DO allows for an additional function of DO that does not involve the CP layer.

Finally there are two important categories of DO use that were considered in this study, but will not enter into all analyses. The first of these is negation, one of the most

common uses of auxiliary DO. Negation in English involves placement of the negative particle "not" or its contracted form "n't" after the first auxiliary in the clause:

(26) He is running.

(27) He isn't running.

As in questions and ellipsis, DO in negation is inserted when no other auxiliary is available to precede the negative particle. In this case DO carries the semantics of negation:

(28) He ran.

(29) He didn't run.

In this position, DO shares the auxiliary property of carrying finiteness while the main lexical verb appears in its nonfinite form. Mastery of negation involves not only an understanding of auxiliary use, but also knowledge of how the negative particle interacts with the auxiliary. It is common in child speech to see errors of this type:

(30) *I not want that.

In this case it is not clear whether this is an omission of the auxiliary DO or if it is a substitution of "not" for "don't". In this way, interpretation of negation errors is not always straightforward.

An additional reason to differentiate between negative and affirmative uses of auxiliary DO is that the negative uses frequently involve the contracted negative particle "n't" rather than the full "not". This means that negation with DO often involves a different phonological form than the affirmative uses (*don't, doesn't,* and *didn't).* Just because a child uses one of these negative forms does not necessarily indicate that the child has separate representations for the DO form and the negative particle; these forms

may be acquired as single lexical items. This possibility is particularly plausible for "don't" which involves a vowel change from the affirmative "do".

Proper negation use can also require an understanding of scope relationships in clauses. For example, consider the following:

(31) *Nobody doesn't like him.

An error like this is not similar to any potential errors in an affirmative sentence. Whether to categorize it as an error of auxiliary DO is unclear, as it seems to demonstrate a lack of understanding of the semantic relationship that is introduced by the word "nobody". For these reasons, it is crucial to analyze affirmative and negative uses of DO separately. In the current study, DO use in negation will be included in the initial count and summary of how DO is used in early child speech as part of a general description of the extent of DO usage. However because of the complexities of interpreting the errors and the difference in phonological form in negative compared to affirmative DO, accuracy rates for negative DO uses will not enter into comparative analyses with other categories of DO use. Note that not all categories of DO use can involve the negative DO form, because proform DO and emphatic DO do not allow negation. Negative yes/no questions, negative wh- questions, and negative DO in ellipsis will be counted separately from affirmative uses and will not enter into the final analysis. Further detailed analyses of negative DO use in these transcripts will be reported in a separate study.

The other category of DO use that will not be considered in this analysis is tag questions. Tag questions are yes/no questions that follow a statement, generally asking for confirmation of the previous statement. The general rules of yes/no question formation apply: if there is an auxiliary present in the statement, it is used in the tag, if

not then DO is inserted. One feature of tags is that in some usages, if the statement is positive, then the tag is negative, and if the statement is negative, then the tag is positive (Quirk et al. 1985):

(32) He doesn't want that, does he?

(33) She arrived, didn't she?

In this study, tag questions were noted, but because of the complex relationship with negation, early tag question use with DO will not be included here, and will be part of future work examining negation.

*Summary*

Most research regarding the acquisition of DO forms has focused on auxiliary DO as a structural requirement to mark finiteness in question formation. Proform DO has received some mention, but no studies have attempted to examine children's early DO use across all of its various functions. The current study aims to fill a gap in the literature regarding how DO is used in the early spontaneous productions of children both with and without SLI. By examining DO, it is possible to examine a single form that functions both as a semantically empty structural requirement (questions) as well as a carrier of semantic information (proform, ellipsis, emphatic DO). In addition to varying in the syntactic structures they operate in, the different functions of DO also vary semantically and in their general complexity of use. This multi-layered plurifunctionality means that DO offers a particularly unique window into the developing grammar of children with and without SLI.

# METHODS

*Participant Selection*

All data analyzed in this study was originally collected as part of previous longitudinal studies examining the development of morphosyntax in children with SLI and unaffected children (Rice, Wexler, and Hershberger, 1998; Rice, Wexler, and Redmond, 1999). Children in this study were recruited through schools in Kansas and Missouri. Affected children (probands) met the following criteria: a) identified as language impaired by a certified speech-language pathologist b) MLU based on a spontaneous language sample of at least 150 utterances below one standard deviation of age expectations, using the age norms of Leadholm and Miller (1992) c) normal intellectual functioning defined as an age deviation score of 85 or above on the Columbia Mental Maturity Scale (CMMS; Burgemeister, Blum, & Lorge, 1972) d) a passing score on the phonological probe of the Test of Early Grammatical Impairment (TEGI; Rice & Wexler 2001), which assesses final –*t*, -*d*, -*s*, and –*z* e) none had other diagnosis of autism, intellectual, behavioral, or social impairments f) their speech-language pathologists reported their social development to be within normative expectations. Children also received an omnibus language measure, either the Test of Language Development-Primary for children age four years or older at entry (TOLD-P2; Newcomer & Hammill, 1988), or the Test of Early Language Development Second Edition or Third Edition for younger children (TELD-2; TELD-3; Hresko, Reid, & Hammill, 1991 & 1999). All children entered into the study as probands had omnibus language standard scores below 85, with a few exceptions for children who met other

inclusionary criteria. All subjects passed a hearing screening at 25 dB (30 dB in noisy environments) at 1000, 2000, and 4000 Hz.

Unaffected control children were also recruited from the same schools and attendance centers as the affected children. Unaffected children met the following criteria: a) identified as typically developing by their teachers and parents b) receptive language scores within normal limits (i.e. above 85 standard score) on the Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn 1981) c) MLU based on a spontaneous language sample of at least 150 utterances within normal limits (i.e. one standard deviation below the age level mean was the minimum performance) based on the age norms of Leadholm and Miller (1992) d) normal intellectual functioning, defined as an age deviation score of 85 or above on the CMMS e) normal articulation as assessed by the phonological probe of the TEGI f) none had any diagnoses of intellectual, social, or behavioral impairments or autism. All unaffected children entered into the study passed the hearing screening and scored within normal limits (above 85 standard score) on omnibus language measures (either the TOLD-P2, the TELD-2, or TELD-3 depending on age of entry).

As the morphosyntax longitudinal study is a family study, siblings of probands and controls were included in the study. Siblings were classified as affected if they received an omnibus language standard score (either the TOLD-P2, the TELD-2, or TELD-3 depending on age of testing) of 85 or below at any time of measurement. Siblings were classified as unaffected if they consistently performed within normal limits (above 85 standard score) on omnibus language measures. Any siblings included in the current study met additional criteria, detailed below.

From this large archive of data from probands, controls, and siblings, three groups of children were selected for the current study: the SLI group, a language-equivalent control group, and an age-equivalent control group. The SLI group consisted of children who entered the longitudinal study as probands in addition to any siblings who fit the following criteria of affectedness: a) classified as affected based on at least one omnibus language standard score below 85 (either the TOLD-P2, TELD-2, or TELD-3 depending on age and time of testing) b) normal intellectual functioning, defined as an age deviation score of 85 or above on the CMMS c) normal articulation as assessed by the phonological probe of the TEGI d) no diagnoses of intellectual, social, or behavioral impairments or autism and e) passed the hearing screening. The control groups consisted of children who were entered into the longitudinal study as unaffected controls in addition to any siblings who had never scored below 85 standard score on an omnibus language measure and met all of the other criteria applied to the siblings in the SLI group. In the final set of participants, there were four siblings in the SLI group, four siblings in the language-equivalent group, and eight siblings in the age-equivalent group.

Because the central goal of this study was to examine early uses of DO, the first step in selecting participants from the large available sample of children was to identify a group of SLI children within a narrow age range who were attempting DO in their transcripts and could be matched with a group of younger language-equivalent children who were also attempting DO in their transcripts. The variable used to determine language equivalence was mean length of utterance in morphemes (MLU). Use of MLU to form groups of language-equivalent children in studies of SLI has strong precedence in the literature (Leonard, 2000; Rice, Redmond, & Hoffman, 2006). By searching the

database of children with an affected status, it was determined there were 77 SLI children between 5;0 and 5;6 who were at least attempting auxiliary DO in questions in their spontaneous language samples. These children had an average MLU of 4.08. To form the language-equivalent control group, 37 younger unaffected children with a similar MLU who were also attempting auxiliary DO in questions in their language samples were identified. To form the age-equivalent group, 60 unaffected children between 5;0 and 5;6 who were using auxiliary DO in questions were identified. Following this initial identification of potential children, several additional criteria, detailed below, were used to settle upon a final set of participants.

As this study is a cross-sectional design looking specifically at a finiteness carrier, performance on TEGI was used to validate finiteness marking ability in the groups. Because the focus was on examining whether children's errors on finiteness were restricted to certain functions or pervasive across functions, children in the SLI group were screened to include children with low finiteness accuracy at the time of the spontaneous language samples used here. Additionally, as this was a study using spontaneous language samples as the data source, it was necessary that the affected children had an MLU in the affected range and the unaffected children had an MLU in the unaffected range. An MLU z-score was computed for each child based on local norms (Rice, Smolik, Perpich, Thompson, Rytting, & Blossom, in press) where the z-score yields a mean of 0, a standard deviation above the mean as +1.0, and a standard deviation below the mean as -1.0. Affected children with an MLU z-score above -1.0 and unaffected children with an MLU z-score below -1.0 were not included in the study.

To enhance validity and reliability of measurement a minimum of five instances of DO attempts in the transcripts was necessary (Ingram, 1989). Therefore all transcripts were screened for number of DO attempts and only those with five or greater DO attempts were included in the study. It is important to note here that these transcripts were collected with the purpose of targeting finiteness carriers. All examiners were carefully trained to elicit third person singular and past tense forms as well as auxiliary forms in a play setting. These samples were not collected expressly for examining DO usage, rather they targeted a variety of grammatical forms relevant to language acquisition and SLI. Each language sample lasted approximately 25 minutes with a target of 200 complete and intelligible child utterances per sample. Each sample was then transcribed and coded by the examiner who collected it. The Language Acquisition Studies Lab maintains an inter-transcriber reliability of over 85% on utterance, word, code, and morpheme levels based on regular monitoring. In sum, these samples are robust estimates of children's grammatical abilities, assessed in a valid, naturalistic play setting.

The Goldman-Fristoe Test of Articulation (GFTA; Goldman & Fristoe 2000) was used to screen for articulation and phonological difficulties for all children in order to ensure sufficient intelligibility for coding. All children scoring above the 15$^{th}$ percentile were included in the current study. For those that scored below the 15$^{th}$ percentile, the low score in all cases considered for this study stemmed from a difficulty with consonant blends particularly in initial position. It was determined that this would not interfere with an examination of their use of grammatical morphemes, so these children were kept in the study.

Group composition was determined by equivalency of MLU or age to the SLI group. For the language-equivalent group, each child within the language-equivalent group had an MLU that was within 0.1 of at least one member of the SLI group. For the age equivalent group, only children who were between 5;0 and 5;6 were included. Table 1 summarizes the inclusion criteria.

Table 1: Inclusion Criteria

| | TEGI z-score | MLU z-score | Number of DO attempts in transcript | GFTA screened | Age range | MLU range |
|---|---|---|---|---|---|---|
| SLI | < -1.0 | < -1.0 | > 5 | yes | 5;0-5;6 | 3.3-4.11 and within 0.1 of at least one language equivalent child |
| Language-equivalent | > -1.0 | > -1.0 | > 5 | yes | any | 3.3-4.11 and within 0.1 of at least one SLI child |
| Age-equivalent | > -1.0 | > -1.0 | > 5 | yes | 5;0-5;6 | any |

Note that the TEGI composite z-score was used as an inclusion criterion, collapsing accuracy across third person singular –*s*, past tense -*ed*, copula and auxiliary BE and auxiliary DO. However the subtest of the TEGI that focuses specifically on auxiliary DO use was not a factor in selecting participants. As DO usage in the spontaneous language samples is the dependent variable of interest, it was important not to restrict our groups based on auxiliary DO use on the TEGI. Therefore, there is variation in the *do* probe z-scores from the TEGI in each group. Table 2 presents the number of children in each group, the means for each of the measures used in participant

selection and the means of the TEGI *do* probe score. Additionally the mean score on the omnibus language measure is included to verify that the SLI group differs from the control groups on overall language performance. The omnibus language score for each participant that contributed to this mean was collected within six months of the language sample being analyzed in the current study, therefore four children in the language-equivalent group received the TELD-2, and three children in the language-equivalent group received the TELD-3. All other children received the TOLD-P2. Note that the number of children in the language-equivalent group is much lower than the other two groups. This was due to the relatively stringent inclusion criteria and the fact that there are not as many children in the database who entered at younger than 5 years of age.

Table 2: Group Descriptive Information: Means (SD) of Inclusion Criteria, *do* Probe, and Omnibus Language Measures

| | N | Age | MLU in morphemes | MLU z-score | TEGI composite z-score | GFTA percentile rank | *do* Probe z-score | Omnibus Language Standard Score |
|---|---|---|---|---|---|---|---|---|
| SLI | 37 | 5;3 range: 5;0-5;6 | 3.67 (0.32) | -1.70 (0.44) | -4.73 (1.97) | 27.28 (16.05) | -3.40 (1.81) | 79.73 (7.04) |
| Language-equivalent | 15 | 3;8 range: 2;6-4;10 | 3.81 (0.20) | -0.39 (0.55) | 0.11 (0.55) | 78.47 (22.85) | -0.08 (0.86) | 113.47 (15.9) |
| Age-equivalent | 37 | 5;3 range: 5;0-5;6 | 5.12 (0.49) | 0.32 (0.68) | 0.35 (0.54) | 70.72 (17.38) | 0.20 (0.74) | 105.7 (10.73) |

*Counting Procedures*

For each transcript, a concordance of all uses of DO was generated using Systematic Analysis of Language Transcripts program (SALT, Miller & Chapman, 2002) by searching for all utterances that contained *do, does, did, doesn't, didn't,* or *don't.* Additionally, *doos, dos, doed*, *dooed,* and *doon't* were searched for as potential ways that transcribers might have indicated that the child used an overregularized form. *Done* was also searched for, as it could have appeared as an error for *did* as a proform (i.e. "I done it"), or as a past participle proform ("I have done my homework"). However, *done* did not appear as either form in any of the transcripts. The only instances where *done* appeared in these transcripts was with copula BE as in "I'm done." For this reason, uses of *done* were not considered in this study.

Each utterance listed on the concordance listing was then coded within the original transcript. Coding occurred on six possible dimensions: polarity, category, accuracy, person, number, and tense. Not every utterance received a code on each dimension, which will be described in detail below. Errors were categorized in a separate error table for each transcript. Examples of all categories and error categories are in Appendices A and B. Transcripts were coded by a single coder; however a second coder was trained to evaluate the reliability of the coding scheme. Over 90% reliability between the two coders was reached on a subset of the transcripts. Once transcripts were coded, a concordance listing of DO use by category was generated and the number of uses in each category was counted, separated by polarity, person, number, and tense. Appendix C contains the counting sheet used to count and categorize all DO uses.

*Polarity*

Every utterance received a code for polarity, indicating either positive or negative DO use. Because negative DO use mostly involves the phonologically distinct contracted form (i.e. *don't, doesn't,* and *didn't*), all analyses kept negative and affirmative uses separate. Non-contracted and contracted negative DO uses were both coded with the negative polarity code. Importantly, the polarity code referred to the polarity of the DO use, rather than the utterance. A negative utterance such as the following would be coded with an affirmative polarity code because the proform DO itself is affirmative:

(34) I can't do that.

*Category*

Every utterance received a code indicating the category of DO use. There were ten possible mutually exclusive categories: yes/no questions, wh- questions, negative declaratives, negative imperatives, proform, elliptical, emphatic, tag questions, multiple DOs, and inappropriate DO use. Examples of all of these categories are presented in Appendix A. The categories that were of interest to this study were affirmative DO uses in yes/no questions, wh-questions, proform, elliptical, and emphatic contexts. Negative uses of DO were categorized and counted, but did not enter into comparative analyses between groups.

It is important to note that there is a distinction between the negation category and the negative polarity code. The negative polarity code occurred with a negative DO use in any category (except for proform DO and emphatic DO which do not allow negative use):

(35) Don't you want one?

An instance such as this would be coded with the negative polarity code, and the category code for yes/no questions. The negation category refers to utterances where the only purpose of the DO is to serve as an auxiliary in negation formation in declaratives and imperatives such as:

(36) I don't want any.

(37) Don't put that there!

Further coding distinctions regarding negations will be discussed in detail below.

Some categories were developed to keep the instances of DO use that are relevant to the empirical goals of this study separate from those that are not relevant. Multiple DO use, inappropriate DO use, negations (declaratives and imperatives), and tag questions were counted so that no DO uses were left out of the complete picture of children's early DO use. However, these categories were not coded on all dimensions and they did not factor into any comparative analyses between groups because including them raised a series of complex issues.

For example, utterances with multiple DO occurrences were not coded for accuracy or tense, because it was impossible to distinguish one DO use from the other in the coding scheme. This became only more complex if the child made an error with one of the DO uses, but not the other:

(38) *Do she do that?

By keeping utterances with multiple DOs separate, the coding scheme allowed for them to be analyzed separately. However, there were not sufficient instances to warrant evaluation.

Inappropriate DO use referred to instances where the child used a DO form where they should not have. The counts of DO in all categories are based on the practice of counting children's attempts at producing a form where that form is required (Brown 1973). Therefore, instances where a child produced a DO form where it does not or cannot appear in the adult grammar were kept separate from all other categories. Inappropriate DO use was exceedingly rare in these samples.

For this study, negations as well as negative uses in other categories were not included in comparative analyses. The negation category, both declarative and imperative, referred to DO uses where the only purpose of the DO is as a structural requirement with the negative particle. Negations in declaratives were kept separate from negations in imperatives because there is no overt TNS/AGR marking on negative DO in imperatives: it can only be *don't.*

Finally, tag questions were kept separate from analyses because they involve a close relationship with negation, and they often involve multiple DO uses:

(39) He went to the store, didn't he?

(40) She doesn't like that, does she?

All affirmative DO use in tag questions such as the example above were categorized as multiple DO uses. However, tag questions can also occur in response to an examiner's utterance:

(41) Examiner: She wants to play with those guys.

(42) Child: Oh does she?

These were coded as affirmative tags, but were kept separate from all analyses. Negative tags, being negative DO uses, were kept separate for all of the reasons mentioned above.

*Accuracy*

All utterances, with the exception of inappropriate DO uses and multiple DO uses received an accuracy code. The accuracy code always referred to the accuracy of the DO itself. Sentences that were malformed, but where the DO use was correct were counted as correct DO uses, although they received a code indicating there was another, non-DO error in the sentence. Omissions referred to utterances where the DO form was necessary or intended but had been omitted. Although an omitted proform DO or elliptical DO was highly unlikely, these were considered as possibilities in the coding scheme. The notion of an omitted emphatic DO however is impossible; if a child intended to use emphatic DO, but omitted it, the utterance would be identical to a simple declarative. Consider:

(43) I do want cookies.

(44) I want cookies.

There is no reason to assume that the child intended to insert emphatic DO in (44). Therefore, for emphatic DO, the only possible accuracy codes were correct or error. Omissions in 2nd person yes/no questions were counted, but were not considered as errors in any analyses because these types of utterances are common in the adult grammar.

(45) You want a cookie?

(46) Want a cookie?

These utterances were considered grammatical, and marking them as missing a DO form would penalize the child speaker for using a very common form. Examples such as the ones above do not indicate an immature grammar.

The error code referred to errors of the DO form itself. DO errors could be either errors of tense (i.e. *do* for *did*), agreement (i.e. *do* for *does*), be/do substitution errors (i.e.

*is* for *does*), or other errors. Other DO errors included errors such as overregularizations of the DO form such as "doos" for *does*. See Appendix B for examples.

Negations and negative uses all received accuracy codes; however, omissions and errors were collapsed for negative uses, hence any error of the DO in a negative use was counted as an error. This was done because of the difficulty in determining whether the following is an example of an omitted "do" or a substitution error:

(47) *He not like it.

In the regional dialect of this sample, *don't* can occur with a third person subject, therefore uses such as the following were counted as correct negations:

(48) He don't want any birthday cake.

*Person, Number, and Tense*

Each utterance containing an affirmative DO in a yes/no question, wh-question, proform use, elliptical use, or emphatic use, was coded for person (1st, 2nd, or 3rd), number (singular or plural), and tense (present or past). Nonfinite contexts for proform DO, the progressive (*doing)* use or the infinitival use (*to do* or *do* in nonfinite context), were coded as nonfinite and did not receive any codes for person, number or tense. The person, number, and tense codes referred to the intended person, number and tense of the DO form itself and not necessarily the utterance. In the following example, the child intended to produce a 2nd person form, but produced the 3rd person form. This would be coded as a DO agreement error with a person code for 2nd person.

(49) *Does you go to school?

In (50), the subject of the sentence is 3rd person singular, but the subject of the DO form is nonfinite, therefore no person, number, or tense codes are included. This utterance would be coded as a correct, nonfinite proform use.

(50) He wants them to do it.

While person, number, and tense were all kept independent in the counting and data entering phase of the study, for analysis, these dimensions were collapsed as there were not sufficient examples in each cell to be analyzed separately. Therefore, analyses were conducted on the number of DO uses per category, without comparing uses across different subjects or tense. However, this information is available, and may be the subject of follow-up studies.

*Non-DO Errors*

Utterances containing errors other than an error of DO itself received an "other error" code. All utterances containing a DO use were given an other error code where applicable, even those categories of use that were not part of the analyses (multiple use, inappropriate use, and negative uses). These other errors were then categorized into several different categories. Examples can be found in Appendix B. The main purpose of the other error code was to identify instances where the child made an error regarding finiteness marking in other parts of the sentence other than the DO, as these would indicate an incomplete understanding of the way DO operates. Lower verb finiteness errors, where the child inappropriately marked finiteness on the main verb when DO is functioning as an auxiliary (questions, negations, emphatic), fell into four categories. The child could mark finiteness on the main verb with either a correct DO, an omitted DO, a DO AGR error, or any other DO error. These different possibilities were kept separate,

as they could each arise from different grammatical systems. A lower verb finiteness error with an omitted DO such as the following might indicate that the child simply does not know to insert DO to carry finiteness in the CP:

(51) *What he wants to play?

However, a lower verb finiteness error where the child had an agreement error on the DO form might indicate that they know to insert DO, but not that finiteness must be carried by the DO:

(52) *Do he wants to play?

A lower verb finiteness error with a correct DO form could indicate that the child knows to insert the correct DO form, but lacks a clear understanding of the relationship between finiteness in the auxiliary and finiteness in the main verb:

(53) *He does wants to play.

Finally, lower verb finiteness errors with other DO errors such as be/do substitution or tense errors may or may not shed light on the child's understanding of the finiteness relationships between auxiliaries and verbs. Consider (54) and (55):

(54) *Is he wants to play?

(55) *Does he went to the store yesterday?

Interpretation of these types of lower verb finiteness errors is more complex. Although separating these different potential types of lower verb finiteness errors is theoretically important, in analyses these were collapsed because there were so few errors of each type. However, the different types of lower verb finiteness errors are recoverable from the data, and may be useful for follow-up analyses and studies.

In addition to lower verb finiteness errors, there were several other possible non-DO errors that could occur in sentences containing a DO form. Some of these other errors were relevant to the wellformedness of the clause and some were not. Errors that were not relevant to the clause structure were categorized as nonrelevant and included a wide variety of errors such as omitting a plural marker on a noun, using the wrong preposition in a phrase, or omitting an article before a noun. The other relevant error categories included omitted subjects, missing modals, subject-auxiliary inversion errors, other inversion errors, extra finiteness, and a broad category for any other errors that may be relevant but did not fit into any defined category.

Examples of all non-DO error categories can be found in Appendix B. Some of these categories are worthy of some explanation and clarification here. The subject-auxiliary inversion error category referred to non-DO subject-auxiliary inversion errors, and typically occurred with proform DO. Subject-auxiliary inversion errors occurred in questions:

(56) *What you are doing?

The extra finiteness category was reserved for situations where the child provided an extra finiteness marker in the clause besides the DO or the main verb. These were exceedingly rare in the transcripts. For example:

(57) *What does he's want?

The broad "other" category included errors such as "got" for "have" errors. In English, it is fairly common to substitute "got" for "have" where the meaning is "to possess." When "got" is the main verb in a clause with an auxiliary DO, however, the grammaticality of such a substitution is questionable. Consider:

(58) I got the crayons now.

(59) #Do you got the crayons?

Coding the example as a lower verb finiteness error is inappropriate, because it is qualitatively different from examples such as:

(60) Does he wants the crayons?

Therefore, “got” for “have” errors were counted in the “other” other errors category. In addition to these, the "other" other category included missing elements that were important to the clause structure such as wh- words, copulas, etc:

(61) *Let's see this does. (intended: let's see what this does).

(62) *All you have to do like that. (intended: all you have to do is like that).

This level of detail in the error coding system was designed to enable careful probing of the nature of the errors in children’s speech, if such an examination was warranted by the data.

# RESULTS

Following the coding and counting procedures, each child's total number of correct, omissions where applicable, and errors for each category were calculated. Reports on the patterns of use for each group will be presented in two stages. The initial data summaries are intended to address the first research question, by presenting a descriptive overview of the usage patterns of all children included in the study. For completeness, all uses (i.e. both affirmative and negative) in each category are included. In the second phase of data analysis, the dataset was reduced to allow for meaningful comparisons across categories and between groups. First, for the reasons mentioned above, only affirmative uses of DO are included. Second, a minimum DO attempt criterion was adopted for each category to ensure that group comparisons were made based on valid estimates of children's DO accuracy in each category. Each child had to have a minimum of 3 DO attempts in a given category in order for that child to enter into to comparisons for that category (Ingram, 1989). The second set of analyses present one-way Analyses of Variances (ANOVAs) and pairwise comparisons between groups to address research questions 1b, and 2.

*Question 1a: Do children in these groups use DO in all categories in their early spontaneous speech?*

To address the first research question, two sets of descriptive measures were computed from the dataset. First, the proportion of children who attempted a DO form in each category for each group was calculated. Note that all categories except for the

"Negative Uses" category include only affirmative uses of DO. The "Negative Uses" category includes DO negations in declaratives and imperatives, as well as negative yes/no questions, negative wh-questions, and negative elliptical DO uses. Negative DO uses in yes/no questions, wh-questions, and elliptical utterances comprise only a small number of the instances in this category, as declarative negations were the most common category of DO use. These proportions are presented in Table 3.

Table 3: Proportion of participants who attempted each category of DO use

| | SLI n=37 | Language-equivalent n=15 | Age-equivalent n=37 |
|---|---|---|---|
| Yes/no Questions | 0.51 | 0.73 | 0.54 |
| Wh- Questions | 0.76 | 0.73 | 0.84 |
| Proform | 0.76 | 0.60 | 0.92 |
| Elliptical DO | 0.59 | 0.53 | 0.57 |
| Emphatic DO | 0.14 | 0.07 | 0.16 |
| Negative Uses | 1.00 | 1.00 | 1.00 |

With the exception of negative uses, it is certainly not the case that all children are attempting DO in all of the categories in their spontaneous samples. Note that there is a wide range in the number of children who attempt to use DO across categories. For example, more than half of the children in all groups attempt DO in questions as well as proform DO, but very few attempt DO when used for emphasis. This disparity is important to consider when comparing the mean proportion correct for each category, as

the N varies by variable. Because all children did not attempt DO in all categories, within-group analyses were impossible to carry out. Therefore, all analyses in stage 2 of data analysis will involve between-group differences.

For the second set of descriptive measures, the average number of correct uses, DO omission, and DO errors were calculated to provide an overview of the general patterns of usage in these three groups. These means are presented in Figures 5-7.

Figure 5: Mean number of correct DO uses, DO omissions, and DO errors in all categories: SLI Group

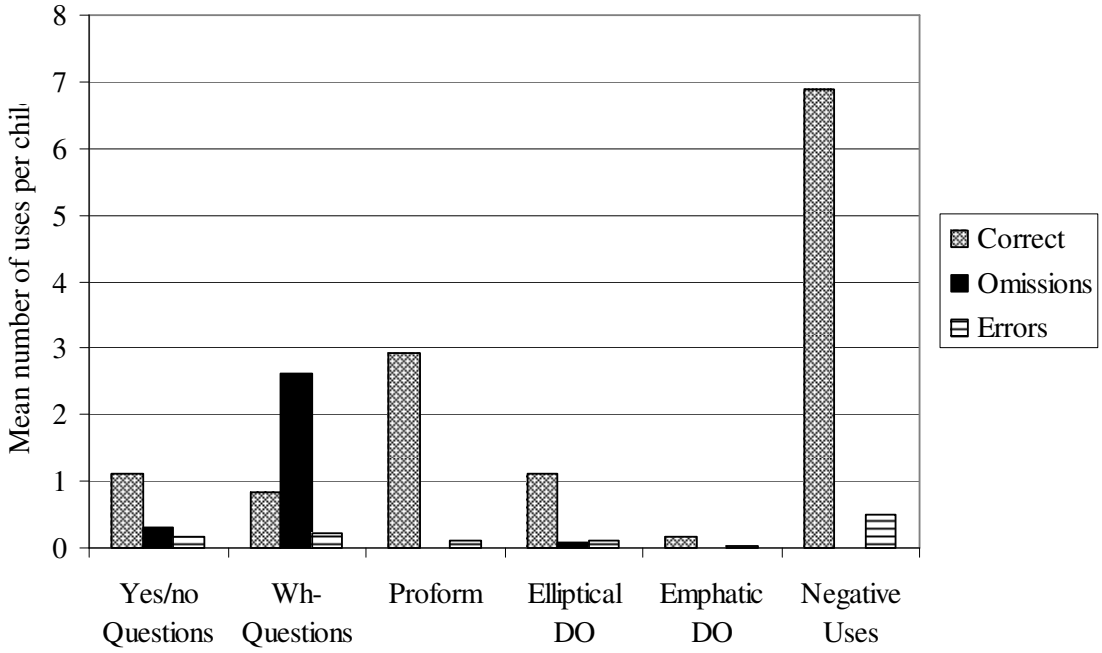


Figure 6: Mean number of correct DO uses, DO omissions, and DO errors in all categories: Language-equivalent Group

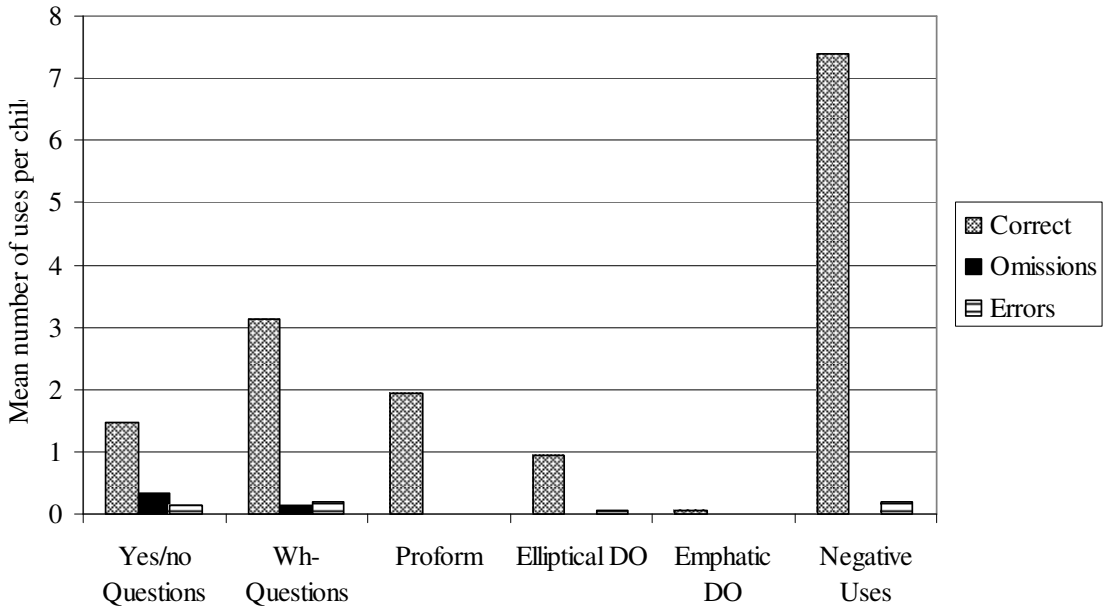
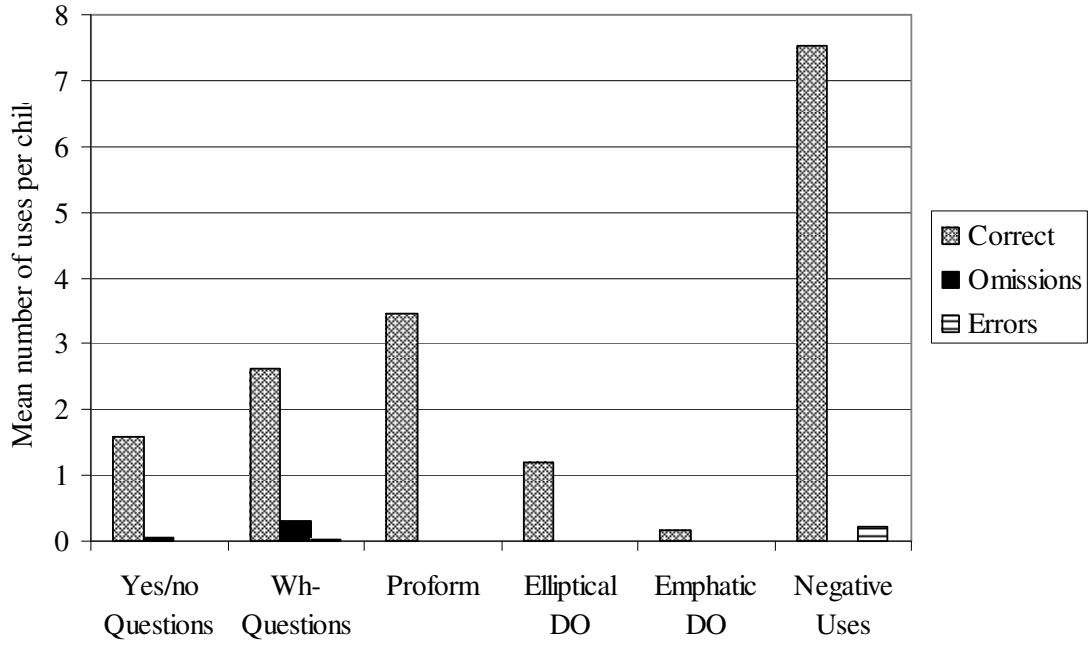



Figure 7: Mean number of correct DO uses, DO omissions, and DO errors in all categories: Age-equivalent Group



From this descriptive overview, it is clear that the SLI group differs in some ways from the age-equivalent and language-equivalent groups, but overall, the pattern of usage appears very similar across all groups. All groups have, on average, more omissions than errors in each category (note that for emphatic DO, omissions were not a possible category and for Negative uses, omissions and errors are combined). Additionally, across categories, each group shows a similar pattern with the highest mean number of uses for negative uses and more wh- questions than yes/no questions. All groups had a higher mean number of proform use than elliptical use and all groups used emphatic DO the least frequently. Note that these figures are provided solely to provide a descriptive overview of the patterns of use. Statistical comparisons between groups were conducted as part of the second stage of analysis, using a reduced set of the data.

In the second stage of analysis, a measure of each child's proportion correct in each category was computed. Studies looking at patterns of use of specific morphemes or lexical items will usually calculate the proportion correct in obligatory context as the dependent measure in order to control for unequal frequencies of obligatory contexts that affect raw error counts (Brown, 1973). This was not possible for all categories in this study, as there is no obligatory context for proform, ellipsis, or emphatic DO. Therefore, the dependent measure used for all subsequent analysis was the child's proportion correct out of all DO attempts for that category. For auxiliary DO in questions, DO attempts included correct uses, omissions, and errors. For proform DO and elliptical DO use, the possibility of an omitted DO was included as part of the coding scheme, although there were no instances of omitted DO in either context for any children. As mentioned, for emphatic DO, omission is not a possible error. Therefore, the number of DO attempts for

proform, elliptical DO, and emphatic DO was comprised of each child's number of correct uses and the number of DO errors. Simply put, the dependent measure, proportion correct DO attempts, was computed for each category as:

Total correct/ Total correct + Total omissions (if applicable) + Total errors

*Question 1b: Are children with SLI consistently less accurate than their typical peers across all categories?*

In order to address research question 1b, a one-way ANOVA was conducted to identify effects of group on the mean proportion correct for each category. The number of children who attempted to use DO at least 3 times in each category as well as the mean proportion correct and standard deviations are reported in Table 3. For yes/no questions, there was a significant effect of group ($F[2,21] = 4.96$, $p = 0.02$). Additionally, there was a significant effect of group for wh- questions ($F[2,41] = 73.27$, $p < 0.001$). For proform and elliptical DO use, all unaffected control children had perfect accuracy, with no variation in the accuracy levels. Therefore an ANOVA was inappropriate for these categories. No meaningful statistical comparisons can be made when two groups are operating completely at ceiling. It appears that both control groups are operating at the adult level with regards to proform DO and elliptical DO. The SLI group scored trivially lower than the controls on proform use. For elliptical DO use, five children in the SLI group had perfect accuracy, one had a proportion correct DO use of 0.8, two had a proportion correct of 0.67, and one had a proportion correct of 0.5. There

were no children who had more than three emphatic DO attempts, therefore this category was not included in this analysis. To further examine the group differences in yes/no questions and wh- questions, pairwise comparisons between the groups on these measures were conducted.

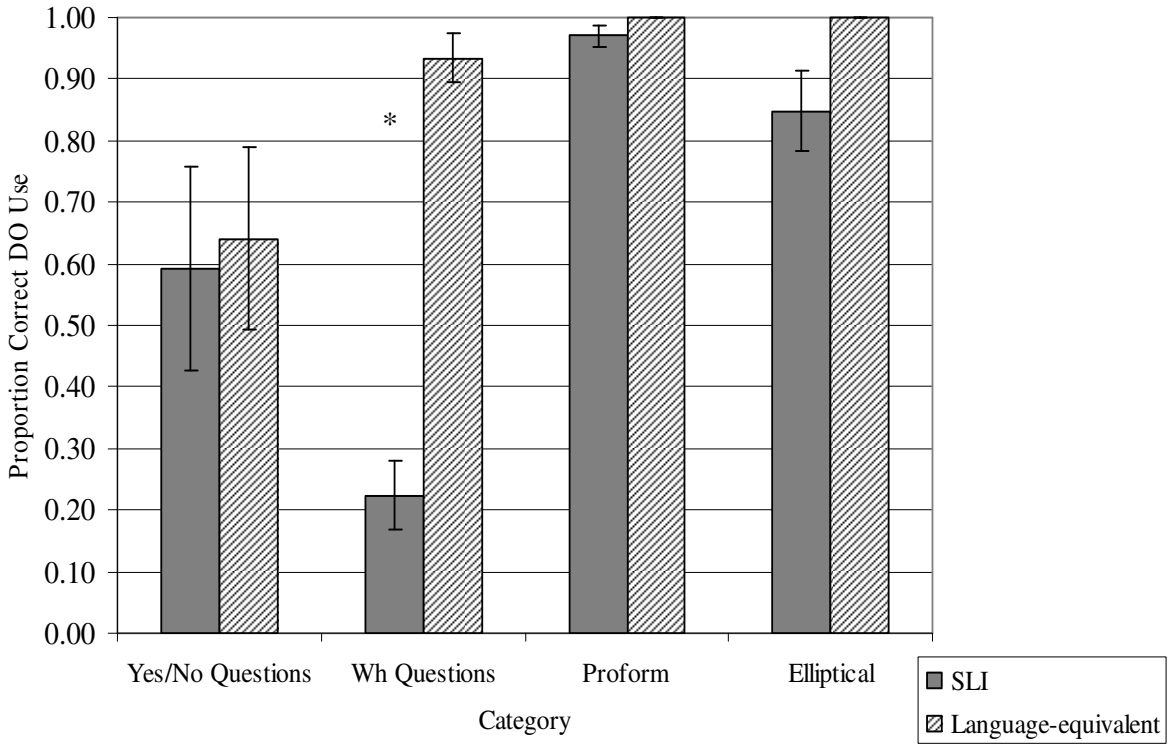
Table 4: Mean (SD) Proportion of Correct DO use

| | | SLI n=37 | Language-equivalent n=15 | Age-equivalent n=37 |
|---|---|---|---|---|
| Yes/No Questions* | N | 7 | 5 | 12 |
| | Mean | 0.59 (0.44) | 0.64 (0.33) | 0.97 (0.06) |
| Wh Questions* | N | 20 | 6 | 18 |
| | Mean | 0.22 (0.24) | 0.93 (0.40) | 0.91 (0.03) |
| Proform | N | 15 | 5 | 20 |
| | Mean | 0.97 (0.07) | 1 (--) | 1 (--) |
| Elliptical | N | 9 | 2 | 7 |
| | Mean | 0.85 (0.20) | 1 (--) | 1 (--) |

** indicates significant group differences with $p < 0.05$*

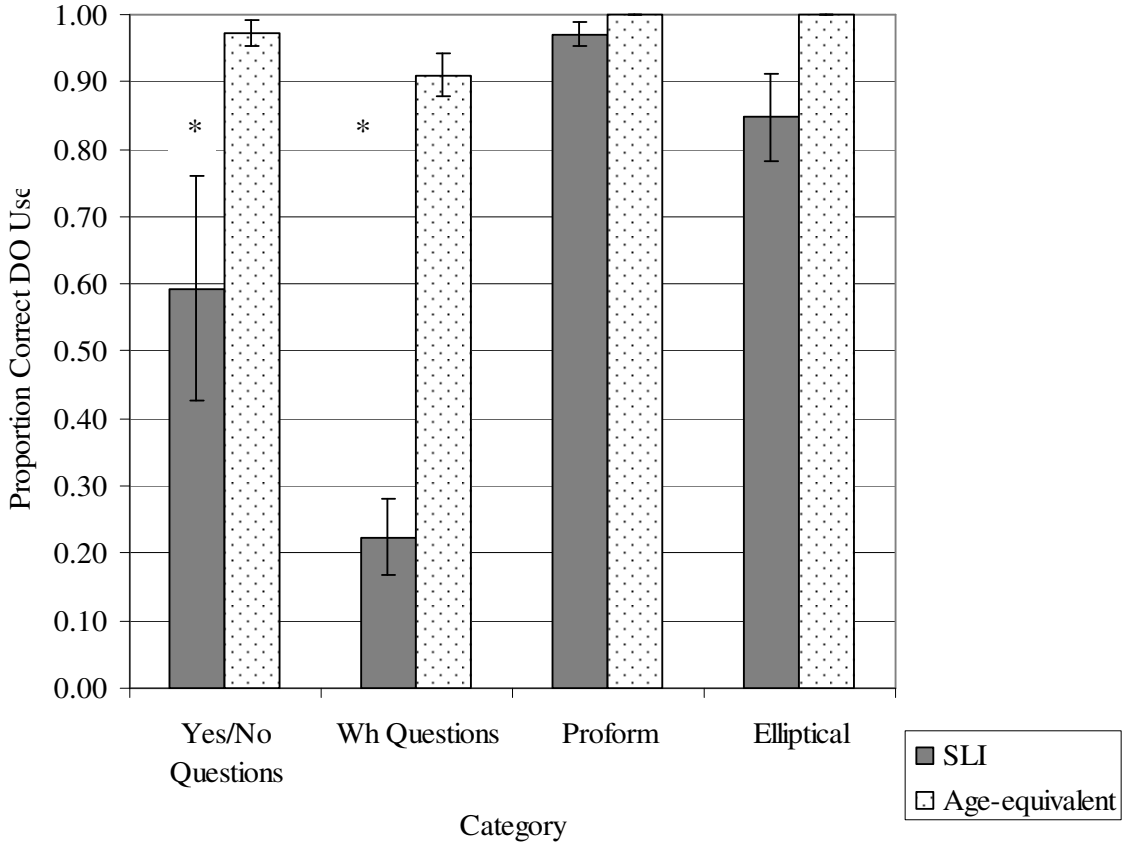
Two-tailed independent samples T-tests were conducted for each category of question use to compare the proportion correct in the SLI group to the proportion correct in the language-equivalent control group. Overall, these two groups show very similar patterns of usage (see Figure 8 for means for all categories), with the only exception being a significant difference in accuracy for wh-questions ($t[24] = -6.73$, $p < 0.01$). Although there was a significant effect of group on accuracy in yes/no questions, the difference between the SLI Group and the language-equivalent group was not significant on this variable ($t[10] = -0.21$, $p = 0.84$).

Figure 8: Mean Proportion Correct DO Use: SLI and Language-equivalent Groups




Two-tailed independent samples T-tests were also conducted to compare the proportion correct in each category of question use between the SLI group and the age-equivalent group. See Figure 9 for a graphical display of the means of these two groups. There was a significant difference between the two groups on the proportion correct for yes/no questions ($t[17] = -2.93$, $p < 0.01$), as well as for wh- questions ($t[36] = -10.40$ $p < 0.001$). The significant difference between the SLI and the age-equivalent group for proportion correct DO use in yes/no questions indicates that the group effect for that variable in the overall ANOVA was driven by differences between the SLI and age-equivalent groups rather than SLI and MLU-equivalent groups.

Figure 9: Mean Proportion Correct DO Use: SLI and Age-equivalent Groups




This study is the first to examine early uses of proform DO for finiteness marking in children with SLI and unaffected language-equivalent and age-equivalent children. Although statistical comparisons between groups were impossible to conduct, it is notable that both groups of typically developing children achieved perfect accuracy on proform while the children with SLI did not. The coding scheme was designed to allow for careful probing not only of the accuracy of DO use, but also the nature of DO use. Proform uses can be divided into finite and nonfinite uses. Considering all children who had at least three proform uses in either context revealed that the SLI children achieved

perfect accuracy with proform DO in nonfinite contexts, but not with finite forms, where they have a mean proportion correct of 0.81 (*SD* = 0.36). Reducing the sample to consider only children who had at least three proform DO uses in finite contexts resulted in only four SLI children, whose mean proportion correct in finite contexts was 0.91 (*SD* = 0.17). Once again, the lack of variation in proform accuracy for the control groups precluded any meaningful statistical comparisons. It can only be noted for children with SLI, there was a difference in performance for proform DO depending on the context, while children in the other groups had perfect performance in both finite and nonfinite contexts. Importantly, even though finite proform use was not perfect, it had a much higher level of accuracy than auxiliary DO for the children with SLI.

*Question 2: If/when children make errors relating to DO use, are there differences in the types of errors made by children with SLI compared with typical children?*

To address the final research question, an analysis of the error patterns for each group was conducted. Four types of errors were considered, DO errors (TNS, AGR, Other, and BE/DO substitution errors), DO omissions, lower verb finiteness errors, and other, non-DO errors that are relevant to the clause structure (see methods section and Appendix B for full description and examples). In order to evaluate error rates, proportions of each error type were calculated and compared across groups.

In these analyses the denominator for the calculation of proportion of errors reflected only the opportunities for that error type, such that the denominator in the calculation of proportion of errors depended on the type of error being analyzed. DO

omissions can occur in any context where the DO form is structurally required, either as an auxiliary or as a main verb. Because emphatic DO is never structurally required, it did not factor in to the calculation of proportion of DO omissions. Therefore the denominator for the proportion of DO omissions was each child's total number of DO attempts in yes/no questions, wh-questions, proform, and elliptical contexts. For theoretical reasons, if a child produces a DO form, it is important to know whether the child used DO correctly. The DO errors category refers to errors of commission, where a DO form appeared, but was incorrect either because the child made an error of TNS/AGR marking, confused the DO form with a BE form, or used an overregularized form (see Appendix B for examples). Because DO errors can occur in any utterance containing a DO form, the denominator for DO errors was each child's total number of DO attempts. Additionally, other non-DO errors occurred in any utterance containing a DO attempt, so the denominator for other non-DO errors was also each child's total number of DO attempts. Finally, because lower verb finiteness errors can only occur where the DO is functioning as an auxiliary, the denominator for the proportion of lower verb finiteness errors was each child's total number of DO attempts in yes/no questions, wh- questions, and emphatic contexts. These proportions were then averaged for each group.

Table 5 contains the group means of these proportions in addition to the total number of each error type and the total number of contexts for each error type. A one-way ANOVA was conducted to evaluate group differences in proportion of errors. There was a significant effect for group on the proportion of DO omissions ($F[2,86] = 12.35$, $p < 0.001$), DO errors ($F[2,86] = 3.45$, $p < 0.05$), lower verb finiteness errors ($F[2,80] =$

8.89, $p < 0.001$), and other non-DO errors ($F[2,86] = 8.66$, $p < 0.001$). Pairwise comparisons to probe these overall group effects were subsequently conducted.

Table 5: Mean (SD) Proportion of Errors and Total Errors and Error Contexts

| | SLI n=37 | Language-equivalent n=15 | Age-equivalent n=37 |
|---|---|---|---|
| DO Omissions* | 0.28 (0.28) | 0.11 (0.26) | 0.04 (0.09) |
| Total DO omissions | 111 | 7 | 13 |
| Total DO omission contexts | 354 | 125 | 342 |
| DO Errors* | 0.04 (0.09) | 0.03 (0.05) | 0.002 (0.01) |
| Total DO errors | 13 | 5 | 11 |
| Total DO contexts | 361 | 126 | 348 |
| Lower Verb Finiteness Errors* | 0.18 (0.24) | 0.04 (0.08) | 0.02 (0.09) |
| Total lower verb finiteness errors | 47 | 4 | 3 |
| Total lower verb finiteness error contexts | 201 | 82 | 176 |
| Other non-DO Errors* | 0.18 (0.25) | 0.05 (0.08) | 0.02 (0.05) |
| Total other non-DO errors | 54 | 7 | 6 |
| Total DO contexts | 361 | 136 | 342 |

**indicates significant group effects, where p < 0.05*

Independent samples t-tests were conducted to compare the error patterns of children with SLI to those of the language-equivalent group. Levene's test for equality of variances was found to be violated for the proportion of lower verb finiteness errors ($F[1,$

45] = 15.63, $p < 0.001$) and for the proportion of other non-DO errors ($F[1, 50] = 7.37$, $p < 0.01$). This is likely due to a ceiling effect where language-equivalent control children are performing near or at adult-level, while the children with SLI lag behind. For this reason, the *t*-statistics for these variables were computed without assuming equal variances. For comparisons on proportion of DO omissions and proportion of DO errors, equal variances were assumed. For this pairwise comparison, differences between the SLI and the language-equivalent control group were significant for the proportion of DO omissions ($t[50] = 2.07$, $p < 0.05$), the proportion of lower verb finiteness errors ($t[45] = 2.9$, $p < 0.01$), and the proportion of other non-DO errors ($t[50] = 2.86$, $p < 0.01$). There were no significant differences between the SLI group and the language-equivalent group on DO errors ($t[50] = 0.27$, $p = 0.79$). This finding is consistent with the general profile that children with SLI are not making errors that deviate significantly from the typical course of development. Rather, the dominant error type for children with SLI is omission of the DO form, consistent with the EOI account. The ceiling effect for the language-equivalent group on lower verb finiteness errors and other non-DO errors reflects that these children have reached adult-level mastery of the basic clause-level requirements, while the children with SLI continue to make errors of these types.

The error patterns of the age-equivalent group compared to the SLI group were also compared using independent samples t-tests. Because the age-equivalent children had reached adult-level mastery, they performed at ceiling with minimal numbers of errors for each error type. Levene's test for equality of variances was found to be violated for proportion of DO omissions ($F[1, 72] = 42.05$, $p < 0.001$), for the proportion of DO errors ($F[1, 72] = 18.45$, $p < 0.001$), the proportion of lower verb finiteness errors

($F[1, 67] = 42.35$, $p < 0.001$), and the proportion of other non-DO errors ($F[1, 72] = 26.78$, $p < 0.001$). For this reason, all *t*-statistics for comparisons of error rates between the SLI group and the age-equivalent group were computed without assuming equal variances. There were significant differences between the two groups on the proportion of DO omissions ($t[72] = 5.14$, $p < 0.001$), the proportion of DO errors ($t[72] = 2.47$, $p < 0.05$), the proportion of lower verb finiteness errors ($t[67] = 3.68$, $p < 0.01$), and the proportion of other non-DO errors ($t[72] = 3.74$, $p < 0.05$). The significant differences between the age-equivalent and the SLI groups on all error types indicates that the group effect found for the proportion of DO errors was driven by differences between the SLI group and the age-equivalent control children. Combined with the findings from the comparison between the language-equivalent group and the SLI group, these findings demonstrate that children with SLI remain on a delayed trajectory, as evidenced by the significant differences between the SLI group and the age-equivalent group.

# DISCUSSION

This study was the first to document the early usage patterns of DO in several of its functions in children with SLI and unaffected children. Previous work has indicated that auxiliary DO poses a particular challenge to learners of English, including children with SLI (Rice at al., in press), unaffected children acquiring English as their first language (i.e. Rowland, 2007), and children acquiring English as a second language (Paradis et al., 2008). This study compared the early DO uses of children with SLI to two groups of unaffected control children: an age-equivalent group and a language-equivalent group. The results from this study confirm that auxiliary DO is a particular challenge for children with SLI, as evidenced by overall group effects for the proportion correct DO usage in yes/no questions and wh- questions, the two auxiliary DO categories included in this study. However, it is also important to note the ways in which the groups do not appear to differ.

Studies examining the grammar of children with SLI compared to the grammar of unaffected, age-equivalent control children very often find significant differences in the grammatical abilities of children, particularly with regards to finiteness marking on verbs (e.g. Rice, Wexler, & Cleave 1995; Rice & Wexler, 1996; Rice, Wexler, & Hershberger, 1998). For this reason, it is highly notable that in this study, the children with SLI showed very similar mean proportion correct for overall proform DO use (0.97 for SLI group, 1.00 for both control groups). Although the groups cannot be compared using statistical methods because of the lack of variance in the control groups' performances, the difference between the SLI group and the control groups on mean proportion correct for

proform DO is trivial. For elliptical DO, children with SLI show notably higher performance than for DO in questions (0.85 mean proportion correct for elliptical DO vs. 0.59 for yes/no questions and 0.22 for wh-questions). This asymmetry cannot be statistically evaluated because not enough children produced three or more DO attempts in questions *and* elliptical utterances. This inability to evaluate within-group differences was a general limitation of this study. Despite this limitation, the asymmetry in performance across categories, with an apparent advantage for elliptical DO is noteworthy.

As a proform, DO can carry finiteness, or it can occur in a nonfinite context, and elliptical DO always occupies the finiteness slot in the clause. Considering that finiteness (Rice & Wexler, 1996) and auxiliary DO use (Rice et al., in press) are known areas of weakness for children with SLI, their apparent strength on proform and elliptical DO in this study is striking. These findings for proform DO are consistent with the possibility first suggested in Hadley and Rice (1996) that proform DO emerges earlier than auxiliary forms of DO. An earlier emergence of proform DO may indicate that children in this study had already reached mastery, while other forms of DO were still in the acquisition stage. It is certainly apparent that mastery in one category of DO does not transfer to other categories of DO, as evidenced by asymmetries in mean proportion correct for proform compared to questions for all groups.

The findings from elliptical DO are more difficult to interpret, in part because there was more variation in the SLI group's performance in addition to fewer children: only 9 SLI children had at least three DO attempts in elliptical utterances. Of those nine, five had perfect performance, and four did not. This comes down to a question of

individual differences, and no conclusion on the early use of elliptical DO in children with SLI in general can be drawn. There appears to be an asymmetry where elliptical DO reaches mastery before other categories of DO, but this will have to be the subject of future work.

While these similarities between groups indicate relative strengths for the SLI children, the groups also differed in important ways. The overall between-groups ANOVA revealed significant group effects for proportion correct on yes/no and wh-questions. Pairwise comparisons between the SLI group and the age-equivalent control group showed that these two groups differed significantly on both question types, with lower mean proportion correct uses for the SLI children. This difficulty with questions is consistent with the findings in Rice et al. (in press) where children with SLI show a protracted difficulty judging the grammaticality of questions with omitted BE and DO forms. In their interpretations of their findings, Rice et al. (in press) suggested that children with SLI have a particular difficulty with finiteness marking in the CP projection. The findings presented here support that possibility.

Pairwise comparisons between the SLI group and the language-equivalent controls only showed significant differences for proportion correct on wh-questions. This finding highlights the importance of including both age-equivalent and younger, language-equivalent children in studies of SLI. The comparisons with the age-equivalent group demonstrate that children with SLI do not show grammatical abilities that are typical of children their age, possibly indicating a delay in language development. However, as Rice et al. (in press) demonstrated, in some ways children with SLI do not catch up to their peers. By comparing children with SLI to language-equivalent controls,

it is possible to see the ways in which the children with SLI veer off the typical path in grammatical development. The results from this study suggest that children with SLI show accuracy rates similar to younger MLU-equivalent on auxiliary DO in yes/no questions, but the difficulty with wh-questions goes beyond a simple delay. Difficulty with DO in wh- questions may indicate that children with SLI are operating with a grammar that remains in an immature state. Early work examining question formation in young unaffected children (Adam, Eve, and Sarah from the Brown corpus) found that subject-auxiliary inversion was acquired first in yes/no questions and later in wh-questions (Bellugi 1971). This may indicate that wh-questions pose more of a challenge for acquisition. If this is the case, the findings of this study are consistent with the general profile that the grammar of children with SLI is immature in some specific ways.

It is important to consider the nature of the difficulty with wh- questions. The error analysis showed that children with SLI made significantly more errors of every type when compared with the age-equivalent group. When compared with the language-equivalent group, the significant differences were the rates of DO omissions, lower verb finiteness errors, and other non-DO errors. Additionally, recall that the most obvious difference between groups on the initial descriptive figures was that children with SLI showed more omissions than correct uses on wh- questions. The actual DO error rates, such as agreement errors or tense errors, were very low in all groups. It appears then, that the difficulty children with SLI have with wh- questions is a tendency to omit the DO form when forming a wh-question leading to errors such as:

(64) *What you want?

(65) *Where he goes?

Children with SLI make these types of omission errors significantly more than both control groups. It is important though, that while the children with SLI deviate from the typical grammatical development path because their omission rates in wh-questions are significantly higher than the language-equivalent group, it is not the case that children with SLI are producing DO errors that are unattested in unaffected child speech. Rather, they are producing omission errors, common in unaffected early child speech, but for a longer period of time than unaffected children. This finding fits neatly with the EOI account of SLI (Rice & Wexler, 1996).

The findings here suggest that children with SLI have a particular difficulty with DO in wh-questions. Previous work on the wh- questions has shown that movement of the wh- element poses a particular challenge to children (Roeper & de Villiers, 1992). However, the children in this study appear to have mastered the movement requirements on the wh- element, as the incidence of wh- word errors were exceedingly rare. This study indicates that even after mastery of wh- movement, children with SLI appear to have difficulty with finiteness marking in the CP projection in wh- questions. Rice et al. (in press) did not find a significant difference in performance for yes/no versus wh-questions in the longitudinal judgment data. However, BE and DO questions were collapsed in the comparison of performance on yes/no and wh- questions. They also found poorer performance on DO than BE when the question types were collapsed. It could be that particularly low performance on DO in wh-questions was driving the effects in Rice et al. (in press), which would be consistent with the findings here.

This study provides important data contributing to the theoretical debates regarding the nature of the deficit in SLI. If the surface properties of the form alone are

what drive poor performance, across-the-board difficulty would be expected. The only way for the findings presented here to be construed as consistent with an account where the phonological form itself is the source of difficulty would be if DO as an auxiliary in questions was perceptually less salient than DO in other categories of use. No studies have reported this type of data, and this possibility remains open, if unlikely.

One of the most noteworthy aspects of the descriptive data is that children with SLI appear to have much better accuracy with forms of DO that carry both semantic information (proform, ellipsis, and negations) and syntactic information, than when DO is operating only as a structural requirement. The Surface Account argues that one reason why children have particular difficulty with inflectional morphology such as third person singular -s, but not with word final phonemes such as -s and -z, is because the inflectional morphology carries so much information, both syntactic and semantic. The Surface Account is essentially a general processing account of SLI, where items with low perceptual salience are particularly affected when producing them requires the alignment of multiple types of information (Leonard, 1998). In this way, the Surface Account might predict poorer performance on forms of DO where the DO carries both semantic and syntactic information. This study provides evidence to the contrary. Although within- group differences cannot be statistically assessed, it is remarkable that children with SLI show a mean proportion correct of 0.22 for wh-questions and 0.97 for proform DO.

The data here fit most neatly within the EOI account of SLI (Rice & Wexler 1996), where children with SLI remain in an earlier stage of grammatical development. With regards to DO forms it appears the immature grammar involves DO omissions,

particularly in wh- questions. However, this generalization is not fully supported by the data presented here from the language-equivalent children. If the immature grammar involves difficulty with wh- questions, we might have expected to see more difficulty with wh- questions as compared to yes/no questions in the language-equivalent group. Descriptively, this was not the case. The language-equivalent children performed roughly equally on wh- questions as yes/no questions. It is possible that these children had passed the point of asymmetries in wh- versus yes/no questions. The generalization that children with SLI show particular difficulty with DO in wh- questions is based on between group differences with the language-equivalent children. The argument would be strengthened by within- group analyses to determine conclusively if children with SLI show a marked deficit in wh- questions compared to their performance in other categories of DO. Nonetheless, the significant between- group effect for wh- questions indicates that wh-questions are point of vulnerability.

Rice et al. (in press) suggest a modification to the Unique Checking Constraint (Wexler, 1998) that accounts for not only a particular difficulty with wh- questions, but also accounts for the general profile of extended optional infinitives. The UCC suggests that children have difficulty when double checking (i.e. checking both TNS and AGR) is required, and therefore they omit one. Because TNS and AGR are contained on the same morphophonological form in English, the result is a period where children drop TNS/AGR marking. The proposed extension to the UCC in Rice et al. (in press) suggests that wh- movement is also subject to UCC violations. In trying to avoid UCC violations, children omit the TNS/AGR marking in wh-questions. The details of this proposal have not been fully explored, but the findings presented here, where children with SLI show a

marked difficulty with wh- questions compared with both control groups, support the possibility and warrant further examination.

This study used spontaneous language samples as the source of all data to be analyzed, which led to some limitations in the types of analyses that were statistically feasible. Because all of the different categories of DO use were not specifically targeted during data collection, and because some categories are simply less frequent in natural speech than others (for example, emphatic DO will always occur less frequently than DO in negations), it was impossible to look at within- group differences on performance in each category. In order to get valid estimates of proficiency within a category, it was necessary to only consider performance for those categories in which children had three or more DO attempts. This criterion greatly reduced the number of children who entered into analyses.

This limitation was a necessary one however, because this study examined grammatical contexts for DO that are extremely difficult to elicit. Question elicitation is difficult in young children and eliciting proform or elliptical DO would be even more challenging. Because this study was concerned with early proficiency of several different categories of DO, spontaneous samples were the only option for analysis. While statistical comparisons within groups are not feasible, descriptively it is noteworthy that all children showed very high accuracy with proform and elliptical DO, and lower accuracy for questions. This finding can guide future work looking more closely at early grammatical development, both in children with SLI and unaffected children.

The possibility that the difficulty with DO in wh-questions for the children with SLI was an example of these children persisting in an immature state of the grammar

requires further investigation. First, a study examining DO in yes/no questions versus wh-questions where there are enough instances to examine within group effects is necessary. It may be that children with SLI perform equally poorly on DO in both question types. If this is the case, it would indicate that difficulty with finiteness marking in the CP projection is a particular source of difficulty for children with SLI, as suggested by Rice and colleagues (in press). If it is the case that wh- questions are more difficult than yes/no questions for children with SLI, it needs to be determined whether early difficulty with DO in wh-questions over yes/no questions is a hallmark of typical development. Future work examining these questions will help illuminate the nature of the deficit in SLI and possibly support DO use in questions as a clinical marker for SLI.

This study was designed to examine DO use in very fine-grained detail, but due to low instances, some dimensions had to be collapsed (person, number, and tense). Examining the distribution of DO use across these dimensions may provide some additional information about how these groups of children are using DO. Additionally, within wh-questions, an exploration of the different types of wh-questions that are being used may provide some useful information (i.e. subject, object, or adjunct wh-questions). Within the dataset examined here, these types of detailed analyses would have to be descriptive in nature, due to the low numbers of instances. However, these details may help to inform what areas of the grammar warrant further work with regards to DO use.

Finally, the major next step in this line of study is to examine early negation use. The descriptive information on negative DO uses presented here indicates that children may achieve a level of mastery with negative uses of DO earlier than for other categories. Negative uses were the most frequently used DO category, and all children attempted

negative uses. A careful analysis of the errors associated with negative DO use may reveal group differences, but it is also possible that the children in this study had already mastered negation. To identify potential differences between groups on negative uses, it may be necessary to look at younger children.

This study makes important contributions to not only characterizing the nature of the deficit in SLI, but also identifying areas of relative strength in the grammatical systems of children with SLI. It is not the case that children, with or without language impairments, operate under a one form- one function assumption. Rather, children appear to honor multiple layers of grammatical requirements on a single set of phonological forms, as demonstrated by asymmetries in the early proficiency of different DO functions in all groups. The findings presented here are generally consistent with the EOI Account of SLI, where children with SLI show the most difficulty when DO is functioning as only a structural requirement. Additionally, this study has identified some questions worthy of future work, particularly with regards to determining whether finiteness in the CP projection is a particularly weakened area for children with SLI. Finally, early DO use has potential to be an informative clinical marker for SLI, as suggested by Rice et al. (in press). This study provides further support for that suggestion, and also points to DO use in wh-questions as a potentially more specific clinical marker. This possibility warrants further investigation. DO may be a small word, but it offers a significant opportunity to study children's developing grammatical abilities. This study is the first to take up that opportunity and begin to examine early DO use comprehensively.

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Appendix A: Functions of DO and Examples

| Function | Example |
|---|---|
| Yes/No Question | *Do you like candy?* |
| Wh- Question | *What do you want to play?* |
| Negation-declarative | *She doesn't know anything..* |
| Negation-imperative | *Don't throw that!* |
| Proform | *I did my homework last night.* |
| Elliptical | *He likes to play more than she does.* |
| Emphatic | *We do like pizza.* |
| Tag Question | *She wants some pizza, doesn't she?* |
| Multiple DO use | *What do you want to do?* |
| Inappropriate DO | **What do you did want to play?* |

Appendix B: Error Types and Examples

| Error Type | Example | Groupings for error analysis |
|---|---|---|
| Omission | **She like candy?* | DO Omissions |
| DO AGR error | **Does they like candy?* | DO Errors |
| DO TNS error | **What do you play yesterday?* | |
| BE/DO error | **Is she want some?* | |
| DO other error | **He doos it.* | |
| Lower verb finiteness error with correct DO | **Does he wants any?* | Lower Verb Finiteness Errors |
| Lower verb finiteness error with omitted DO | **What you wants?* | |
| Lower verb finiteness error with DO AGR error | **Do he wants some?* | |
| Missing subject | **Why did that?* | Other non-DO Errors |
| Subject/Aux Inversion error | **What he can do?* | |
| Missing modal | **He do it tomorrow.* | |
| Extra finiteness | **Do we're get that?* | |
| Other non-DO error | **Does she got a new toy?*<br>**What do you go running?* | |
| Non relevant | **Do you read on school?*<br>**Does she want an popsicle?* | Not included in error analysis |
| Negation errors | **He not want any.*<br>**Why doesn't they want that?*<br>**They doesn't.* | |

## Appendix C: Counting Sheet

| yes/no Questions [Qyn] | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Correct [C] | Omission [O] | Error [E] | Other error [R] | Total | Grand total |
| present | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |
| past | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |
| | NEG | | | | | | |
| wh- Questions [Qwh] | | | | | | | |
| present | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2pl | | | | | | |
| | 3 pl | | | | | | |

| | | Correct [C] | Omission [O] | Error [E] | Other Error [R] | Total | Grand total |
|---|---|---|---|---|---|---|---|
| past | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |
| | NEG | | | | | | |
| Declarative Negations [Neg-dec] | | | | | | | |
| | total | | | | | | |
| Imperative Negations [Neg-imp] | | | | | | | |
| | total | | | | | | |
| Pro-verb [Pro] | | | | | | | |
| present | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |
| past | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |

| | | Correct [C] | Omission [O] | Error [E] | Other Error [R] | Total | Grand total |
|---|---|---|---|---|---|---|---|
| | prog | | | | | | |
| | nonfinite | | | | | | |
| Elliptical [Ell] | | | | | | | |
| present | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |
| past | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |
| | NEG | | | | | | |
| Emphatic [Emp] | | | | | | | |
| present | 1 sg | | | | | | |
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |
| past | 1 sg | | | | | | |

| | | Correct [C] | Omission [O] | Error [E] | Other Error [R] | Total | Grand total |
|---|---|---|---|---|---|---|---|
| | 2 sg | | | | | | |
| | 3 sg | | | | | | |
| | 1 pl | | | | | | |
| | 2 pl | | | | | | |
| | 3 pl | | | | | | |
| Tag Questions [Tag] | | | | | | | |
| | Aff | | | | | | |
| | Neg | | | | | | |
| Multi [Multi] | | | | | | | |
| | total | | | | | | |
| Inappropriate DO use [InapDO] | | | | | | | |
| | total | | | | | | |
| I don't know: | | | | | | | |
| I don't think: | | | | | | | |
| Errors/Ambiguous/Other: | | | | | | | |

**Error Table**

| Error Type | | |
|---|---|---|
| DO Error | AGR error | |
| | TNS error | |
| | Other error | |
| Lower Verb Finiteness Error | w/ correct DO | |
| | w/ omitted DO | |
| | w/ DO AGR error | |
| | w/ DO Other error | |
| Negation Errors | All negation errors | |
| Other Errors | BE/DO substitution error | |
| | missing subjects | |
| | Subj/Aux inversion errors | |
| | Other inversion errors | |
| | missing modal | |
| | extra finiteness | |
| | non relevant | |
| | Other | |