Null Subjects in Child Language: Evidence for a Performance Account

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1. Introduction

This paper examines the structure of children’s early utterances in English, with a focus on which grammatical categories of the basic SVO structure are present and which are omitted. Although it is impossible to definitively determine the intended meaning of children’s utterances, virtually every theory regarding children’s syntactic structure assumes that the underlying range of meaning that the child can intend is similar to that of adults (at least that of adults’ simpler utterances), with, at minimum, an actor and an action. This means that there is a disjunction between what children intend to say and what they actually say during early stages of language acquisition. Even assuming that children’s thoughts are only as complicated as the simplest adult utterances, the one word (and, in the case of transitive verbs, the two word) stage clearly represents a situation where elements are excluded from the child’s overt production. There are two broad approaches in the literature that have been used to explain this disjunction. One approach proposes that the child’s syntactic system is different from that of the adults in their speech community. This may mean either that the child does not have a complete adult syntactic structure (e.g., they only have a verb phrase) or it may mean that they have a complete adult syntax, but some part of their grammar contains a structure that does not occur in the language they are learning but does occur in other languages (e.g., verb raising when learning English). The other approach proposes that limits in general cognitive processes cause the disjunction between intention and production. For example, children may omit a word

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because they do not have enough working memory to produce the entire sentence.

The current paper will focus on reexamining claims that have been made in the literature regarding the underlying cause of null subjects. The central hypothesis is that children omit subjects because of a processing constraint. To explore this claim, longitudinal data from parent-child interactions will be analyzed for a potential correlation between the percent of null subjects and null verbs (calculated over a session). If syntactic items are omitted in the child’s speech because of processing limitations, then as these limitations decrease, the rate of omitted words should also decrease, regardless of the syntactic category of the word. Critically, this should be seen whether observing subjects or other syntactic elements. On the other hand, if subject dropping is independent of processing limitations, as these limitations decrease, the rate of omitted verbs and objects (which are generally not claimed to be licensed as null elements) should decrease, but subjects should not be affected.

The paper is structured in the following way: Section 2 will discuss a number of interesting phenomenon that indicate that any explanation of this phenomenon must go beyond explaining only the omission of subjects. A number of dominant approaches to explaining this phenomenon are presented in Section 3. Section 4 presents an analysis of data from transcripts of children in the CHILDES database (MacWhinney 2000), which provide evidence supporting the notion that null subjects are the result of processing limitations.

2. The phenomenon

Although null subjects in child language have previously been equated with pro-drop, a phenomenon found in a number of adult languages (e.g., Spanish), as section 2.1 will demonstrate, the data do not support such a narrow interpretation of subject omission.

2.1. Beyond null subjects

A variety of studies have found interesting properties of children’s speech that would indicate that null subjects are part of a larger phenomenon. For instance, a number of researchers have found omitted direct objects, indirect objects, verbs, and locative arguments (Bloom, 1970; Bowerman 1973; Braine 1974, 1976; Brown 1973), demonstrating that subjects are not the only element that is omitted in child language.

Interestingly, a correlation has been found between the occurrence of null subjects and VP length (Bloom 1990), indicating that as the VP becomes longer, the child is more likely to drop a subject. Such a
correlation is consistent with the notion that children drop subjects because of processing limitations.

Moreover, Bloom, Miller and Hood (1975) and Bloom (1970) have shown that there is also a relationship between the absence of a subject and the presence of various elements such as negation, particles, and adjectives. These studies found that the production of these syntactic elements generally correlates with a decrease in the production of overt subjects, thus drawing a direct link between null subjects and processing load, suggesting that the use of null subjects may not be driven by the grammar of the language.

In addition, Mazuka et al. (1986) found that some children reduce the subject to a schwa instead of deleting it completely. This strategy is in line with processing limitations since it provides evidence that the child is actually representing what is not articulated in the output. The presence of the schwa (rather than the complete absence of the subject) indicates that the child is attempting to produce the subject while minimizing processing effort.

Taken together, the above studies present substantial evidence that null subjects should be investigated as part of a larger general phenomenon of word omission. They suggest that children do represent the underlying subject, even when it is overtly missing in its full form. Longer sentences and more complex sentences (containing more than simple nouns and verbs) increase the rate of subject omission, as would be expected in a performance-deficit approach.

3. Theoretical perspectives

There are two aspects of null subjects in child language that have made them particularly interesting in terms of linguistic theory. The first is that it appears to be a universal phenomenon in language acquisition. Although the actual percentage of null subjects produced by children differs based on a number of factors (such as whether or not the adult language is a pro-drop language (Bates, 1976; Valian, 1991)), child null subjects are attested in studies of languages as typologically diverse as Italian (Valian, 1991), Portuguese (Valian and Eisenberg, 1996), English (Valian, 1991), Japanese (Nakayama, 1996), Korean (Kim, 2000), Cantonese (Kim, 2000), Mandarin Chinese (Wang et al., 1992), French (Pierce, 1994), and German (Hyams, 1986). The second theoretically interesting point is that child null subjects mimic, at least superficially, what is allowed in a number of adult languages. A number of approaches that aim to explain the presence of null subjects in child language are presented in more detail below.
3.1. Competence-based approaches

3.1.1. Full competence approaches

A number of researchers have explained child use of null subjects as a realization of Universal Grammar (UG), mainly in reference to a number of adult languages which have been identified as allowing null subjects (e.g. Spanish, Italian, Mandarin Chinese). (Such approaches have been referred to as “full competence” approaches.) One of the hallmarks of a UG property is its presence across a wide number of languages and cultures, and null subjects in child language do thus appear to be a prime candidate for a UG property. Based on this universality and its similarity to adult pro-drop, a number of researchers (e.g. Hyams 1986; Hyams and Wexler 1993) have proposed that children’s use of optional null subjects represents a competence deficit whereby the child has an adult syntactic system but is treating the language they are learning as a language that allows pro-drop. Under this approach, the child has not correctly assigned the properties specific to the language the child is learning.

Roeper and Rohrbacher (1995) put forward another proposal, based on the Economy of Projection hypothesis by Speas (1994). Speas proposes that functional projections (e.g., projections for agreement, tense, etc.) are only generated when needed, meaning when the items that fill those projections are present either overtly or underlyingly. Based on this, Roeper and Rohrbacher claim that children have a normal adult language and that their use of null subjects is related to them misassigning the properties of other languages to their input, particularly, they interpret the lack of overt agreement as meaning that there is no underlying agreement, and thus no projection needed.¹

3.1.2. Partial competence approaches

Other researchers (e.g., Rizzi 1993/1994, 1994; Radford 1988), have attempted to account for the universality of null subjects with a partial competence account, claiming that children have access to the adult UG, but only to part of the syntactic tree (specifically, the lower portion of the tree). This has been referred to as the Truncation hypothesis. Under this

¹ Although it is tempting to conservatively say that if they are not producing a morpheme, they are not representing it underlyingly, evidence from imitation studies such as the one conducted by Gerken, Landau and Remez (1990), indicates that the lack of an element in production does not necessarily indicate a lack of that element in the underlying representation.
proposal, some mechanism, such as a maturation process (e.g., Borer and Wexler 1987) may gradually reveal higher portions of the syntactic tree to the child.

3.2. Performance-based approaches

In contrast to competence accounts, performance-based accounts argue that children’s lack of overt subjects is not related to their knowledge or use of UG but rather represents a performance deficit, (e.g. Bloom 1990, 1993; Valian 1991; Valian and Eisenberg 1996) whereby the child knows that the sentence should have a subject but lacks the resources to produce one. As a child’s general cognitive resources grow, their ability to produce overt subjects will also grow. Valian (1991) tested this hypothesis by examining, among other things, the relation between null subjects and null verbs in children’s speech. She recorded parent-child conversations with a number of children of various ages and found that the rate of null subjects was correlated with the rate of null verbs across children and ages.

The central hypothesis presented in this paper (following works such as Valian (1991) and Bloom (1990)) is that missing elements are not licensed by the syntax. This means that the actual argument structure underlying a sentence with a missing subject is not different from the same sentence with an overt subject. Instead, the claim is that processing constraints limit the actualization of the argument structure, causing elements to be dropped from sentences in order to reduce processing demands. The study below re-examines the claims of Valian (1991) by attempting to replicate and expand on those findings, by utilizing longitudinal data as well as by examining the input that the child receives.

4. The current study

Although the findings from Valian (1991) are compelling, they leave open various questions, which this paper will explore. As a result, a number of crucial extensions from the Valian experiment are tested below. First, whereas Valian obtained cross-sectional data, the current study uses longitudinal data. This is very important for a number of reasons. Although a correlation may hold for a given population, that does not mean that the correlation also exists within each individual in that population. In terms of Valian’s data, the correlation between null subjects and null verbs across children may only represent a difference between parent-child dyads. As such, longitudinal data allows one to observe both the change in, and the correlation between null subjects and null verbs within one child. In addition, cross-sectional data tends to have few groups, with each age or MLU group having a considerably different mean age/MLU than the next closest group. Because of this configuration, it is often difficult, if not
impossible, to tell whether the correlation is truly a linear correlation, rather than a series of discrete steps. By employing a longitudinal analysis, the above issues can be addressed.

Second, in the current study, a parallel analysis is carried out on the adult data. This was not done in Valian (1991), but it serves a very important purpose. Normal adults are a perfect preliminary test case for a theory based on performance-deficits since, by definition, any utterances missing subjects or verbs can only be the result of performance effects. Analyzing the dropping phenomenon in adults allows a separation between effects that could be caused by errors in the grammar (children) and those that could only be caused by performance effects (adults).

Third, if a correlation is found between the percent of null subjects and null verbs for both children and adults, then one would want to verify that a child-internal process causes this correlation in the children’s data. One greatly studied phenomenon that could interfere with this internal process is linguistic echoing. It has long been noted that people tend to use the syntactic structures that they recently heard, either from themselves, or from their interlocutors. If it is found that adults as well as children drop subjects and verbs, it could be that children’s behavior is due to their echoing the adult structures. One way to examine if this is a potential confound is to look for correlations between the input and the output of the child within a given recording session. This would mean, for instance, looking at the correlation between the null subjects produced by adults and those produced by children, session by session. Therefore, the input and the output for the child are compared to ensure that linguistic echoing is not responsible for children’s dropped items. If the correlation between null subjects and null verbs is internally driven for children, then it would be expected that this is independent from effects of the input.

Fourth, if children and adults drop subjects and verbs for the same reason (i.e., performance effects), but to a different degree, then one would expect the correlation between null subjects and null verbs to be similar for both groups. This means that not only would one expect there to be a correlation between null subjects and null verbs, but one would expect there to be no difference between the correlation for the children and that for the adults. Therefore, in this study, the relation between null subjects and null verbs for children are compared to that for adults. In summary, this study extends the Valian (1991) study in the following crucial ways: longitudinal data are used, adult data are analyzed, the gross relationship between the

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2 A classic example is that if someone asks another person, “at what time does the store open,” the second person is more likely to say, “at ten” than simply “ten,” whereas the reverse is true if the first person asks, “what time does the store open?”
child’s input and output is examined, and the relationship between null subjects and null verbs for adults and children is compared.

4.1 Methods

4.1.1 Data

The data analyzed was obtained from longitudinal transcripts from the CHILDES database (MacWhinney 2000). Transcripts from Eve (Brown 1973), Nina (Suppes 1974), and Peter (Bloom, Hood and Lightbown 1974; Bloom, Lightbown and Hood 1975) were used because they provide data at close, regular intervals and contain a large number of files recorded during the age/MLU range where pro-drop is often encountered.

A selection of approximately 250 consecutive conversational turns were selected from the medial portion of each of Eve’s twenty transcripts, the first twenty transcripts for Nina, and the first ten transcripts for Peter, for a total of approximately 12,500 turns (see Table 1).

<table>
<thead>
<tr>
<th>Child</th>
<th>Corpus</th>
<th>Number of Files</th>
<th>Age</th>
<th>MLU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eve</td>
<td>Brown</td>
<td>20</td>
<td>1;6 – 2;1</td>
<td>1.52 - 3.39</td>
</tr>
<tr>
<td>Nina</td>
<td>Supes</td>
<td>20</td>
<td>1;11 – 2;4</td>
<td>1.84 – 3.33</td>
</tr>
<tr>
<td>Peter</td>
<td>Bloom</td>
<td>10</td>
<td>1;9 – 2;3</td>
<td>1.21 – 3.01</td>
</tr>
</tbody>
</table>

4.1.2. Coding

Both the children’s and the adults’ speech were coded for null subjects and null verbs (see Table 2 for examples of each). Any non-imperative sentence that was missing a subject, regardless of its colloquial acceptability, was considered a case of null-subject because it forms part of the statistics of the input for the child (similar conditions applied for null verbs). Questions where the wh-item would be considered a moved object and the grammatical subject (under that analysis) would be missing (e.g., *What does John want?*) were not included in the child data because it is unclear whether the wh-item would be interpreted by the child as an object because of its surface position, or a subject. Only sentences whose obligatory subject and verb(s) could be unambiguously interpreted as missing based on context were included in the coding.
Table 2: Examples of missing subjects and missing verbs

<table>
<thead>
<tr>
<th>Null Subjects</th>
<th>Null Verbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Want some food.</td>
<td>You car.</td>
</tr>
<tr>
<td>Am happy.</td>
<td>You having a hard time?</td>
</tr>
<tr>
<td>Like some food?</td>
<td>Mommy happy.</td>
</tr>
</tbody>
</table>

The null subject score was obtained by taking the number of obligatory subjects missing divided by the total number of required subjects. For null verbs, a similar process was followed, with a slight modification. The percentage of null verbs was calculated in two different manners. First, a percentage of sentences that had no verbal element (both coding schemes included auxiliaries and modals as verbal elements) was calculated, and this will be referred to as the *verbless* condition, since it represents the percentage of sentences without verbs. Second, another percentage was calculated that counted each obligatory verb in a sentence as either present or missing. This is the *null verb* condition, since it represents the percentage of null verbs. Unlike the *verbless* coding, this coding allowed a given sentence to have a fraction of null verbs (i.e., if one verb is present and one is missing then the null verb score for that sentence would be .5). Under both coding schemes, percentages were calculated for the entire session by averaging across scores given for each sentence. This means that, under the verbless coding scheme, if 75 sentences had at least one verb and 25 sentences had no verbs, then the percentage of verbless sentences (and the subsequent data point analyzed) would be 25%. Similarly, if out of 60 sentences 25 verbs were missing and 75 verbs were present, then the percentage of null verbs for that session (i.e., the data point) would be 25%. See Table 3 and 4 for examples of the coding schemes.

Table 3: Example coding for the verbless condition.

<table>
<thead>
<tr>
<th>Does it have a verb</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>He is going to the store</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>He ice cream</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>He is to the store</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

3. In cases where the number of verbs missing depends on intended meaning (e.g., *John to the store* could mean *John is going to the store* or *John goes to the store*), the verb was coded as missing based on the smallest number of possible verbs (in the example above, one).
Table 4: Example coding for the null verb condition

<table>
<thead>
<tr>
<th>How many verbs are</th>
<th>Present</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>He is going to the store</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>He ice cream</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>He is to the store</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

4.2. Results

To test the hypothesis that processing limitations cause a correlated amount of subjects and verbs to be omitted, the adult data will be examined first. Because adults cannot, by definition, have a competence deficit, any correlation between null subjects and null verbs would have to be the result of performance effects. These results are followed by the child data, both for all the children combined and for each child individually.

4.2.1. Adult data

The average percentage of null subjects, verbless sentences, and null verbs for the adults was 12%, 10%, and 12%, respectively. Since, by definition, any “ungrammatical” utterances by adults could only be attributed to performance effects, the adult data is a good starting point to investigate whether performance effects do, as proposed above (and by others such as Valian 1991), result in a correlation between the percent of null subjects and null verbs across files. As predicted, such a correlation was found in the present data under both the verbless ($r = .78$, $p < .0001$) and the null verb ($r = .81$, $p < .0001$) coding scheme (see Figure 1). Thus it does appear reasonable to claim that the correlation is driven by performance effects.

4.2.2. Test of linguistic echoing

Since the predicted correlation between null subjects and null verbs was found for adults, there is a risk that any correlation in the data of the children could be the result of linguistic echoing of the immediate input. This would mean that the child is dropping subjects and verbs because the surrounding adults are dropping subjects and verbs and the adult, not the child, determines the rate of each. To test for linguistic echoing, Pearson’s correlation was calculated between the child’s utterances and those of the adults present in a session for null subjects, verbless sentences, and null verbs. The results indicate that there is no evidence that linguistic echoing is driving the rate of null subjects, verbless sentences, or null verbs, in children, with all analyses failing to produce significant correlations ($r = .21$, .3, and .28, respectively, all $p$’s n.s.).
4.2.3. Child data

The average percentage of null subjects, verbless sentences, and null verbs for the children (combined) was 48%, 42%, and 49%, respectively. The main prediction that the present experiment set out to examine is whether children’s production of null subjects and null verbs was correlated across sessions. To test this hypothesis, Pearson’s correlation was calculated using the combined data from all the children. This revealed a significant correlation for both the verbless (r = .79, p < .0001) and the null verb (r = .82, p < .0001) condition, thus confirming the prediction (see Figure 1). As with a cross-sectional analysis, these results also have the potential problem that the correlation could hold true for the group, but not hold within each child. To address this, further analyses were conducted for each child. As shown in Table 5, the correlation is also significant for each child.

Table 5: Correlation between null subjects and null verbs for each child.

<table>
<thead>
<tr>
<th>Child</th>
<th>r value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eve</td>
<td>r = .83</td>
<td>p &lt; .00001</td>
</tr>
<tr>
<td>Nina</td>
<td>r = .81</td>
<td>p &lt; .0001</td>
</tr>
<tr>
<td>Peter</td>
<td>r = .96</td>
<td>p &lt; .00001</td>
</tr>
</tbody>
</table>

Figure 1: Correlation between the percentage of null subjects and verbless sentences across all children and adults.

4. Note that not only are all correlations significant, but the r values for each is remarkably high.
4.2.4. Children and adults combined

Since neither children nor adults have unlimited resources, if the only difference between the rate of word omission in children and adults is one of degree, one would expect that the correlation between null subjects and null verbs would not differ significantly between children and adults. To test this, Pearson’s correlation was calculated based on the percentage of omitted subjects and verbs across all of the child and adult data combined. The results indicated a significant correlation for both the verbless (r = .92, p < .0001) and the null verb (r = .93, p < .0001) condition. In addition, the data for children was compared with that of adults. A bootstrap analysis comparing the correlation between null subjects and null verbs for adults and children did not reveal a significant difference between the two groups (confidence intervals = -.24, .32 and -.38, .15 for the verbless and null verb coding schemes, respectively). The data are shown in Figure 1. Thus, it appears that children and adults behave similarly, strongly suggesting that both groups omit subjects because of processing limitations.

5. Discussion

As would be expected in a performance-deficit approach, a significant correlation was found between null subjects and null verbs. Verb dropping cannot be accounted for under the competence approaches (which do not predict any verb dropping), but both null subjects and null verbs are easily explained under a performance-deficit approach. In addition, even if separate motivation was proposed to allow for verb dropping, it would be difficult to explain the correlation between null subjects and null verbs, which follows directly from the predictions of a performance-deficit account.

Interestingly, the correlation between null subjects and null verbs for children and adults appears to be very similar, if not the same. This is consistent with a perspective by which processing limitations affect both children and adults. A performance-deficit approach would predict exactly

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5. This analysis should not be confused with that testing linguistic echoing. The test of linguistic echoing examines how the rates of null subjects and null verbs for adults and children are related in a given file, whereas this analysis examines the relationship between null subjects and null verbs averaged across all files, which does not indicate any similarity between adults and children in a specific file.

6. Although it is possible that the adult production addressed to the children could be different than normal adult-directed speech, this is not a problem for the proposed conclusion, because, although one could claim that the adult increases the number of omitted words when speaking to the child, this would not explain the correlation between the rate of omitted subjects and objects.
the results found above because, under this approach, subjects are not dropped because they are subjects, but rather because resources are limited. In summary, the data presented in this paper indicate that there is a significant correlation between null subjects and null verbs, both in children and adults. The results from the child data do not appear to be driven by the adult data, and this would support the notion that the rate of null subjects and null verbs in children is an internally driven process. The similarity in the correlation between the omission of these two syntactic categories for children and adults supports the notion that this phenomenon is caused by processing limitations. These results strongly suggest that the presence of null subjects in child speech is the result of performance effects.

References


