PLU-Stages: an independent measure of early syntactic development

Anne Vainikka
Géraldine Legendre
Marina Todorova

July 1999

Technical Report
JHU-CogSci-99-10

http://www.cogsci.jhu.edu/TechReports/

TR-Request@cogsci.jhu.edu
Abstract

This paper describes a new method for determining early syntactic stages. The method is related to the traditional notion of MLU (Mean Length of Utterance), and relies on the traditional idea of a one-word stage, a two-word stage, and a multiword stage. At each stage, the predominant length of utterance is determined, resulting in our PLU-stages (Predominant Length of Utterance). The proposed method reflects our best attempt to construct a standard of early syntactic development that is independent of the child's age, and is also independent of any particular syntactic construction. Such an independent measure should facilitate comparison of naturalistic data across children within the same language, as well as comparison of data across languages. The measure we have developed does indeed show promise in cross-linguistic comparison of syntactic development for languages such as French, Swedish, English, Polish and Russian.
PLU-Stages: an independent measure of early syntactic development

Anne Vainikka, Géraldine Legendre and Marina Todorova
Johns Hopkins University

avainikka@cogsci.jhu.edu, legendre@cogsci.jhu.edu, todrova@cogsci.jhu.edu

July 1999

JHU-CogSci-99-10

1 This research was supported by NSF grant IIS-9720412 "Optimization in Language and Language Learning". We wish to thank Paul Hagstrom for useful comments and discussion, as well as for compiling the information for Appendix B.
stage is. They turn to Brown (1973) and, based on his stages and associated MLUs, they identify an MLU-range for the very first syntactic stage. Brown defined his earliest stage (Stage 1) as involving recordings with an MLU below 1.75. Given Clahsen et al.'s approach, it appears that one should be able to reliably analyze the data from this first stage, and determine whether finite verbs are already used (which they are).

The problem with Clahsen et al.'s method of using the MLU is that the range used to determine the first syntactic stage is, in effect, totally ad hoc, given that it is not even exactly the range used by Brown for his Stage 1. This is because Brown's MLU of 1.75 was based on counting morphemes, while Clahsen's et al.'s MLU of 1.75 is based on counting words (both methods being in principle valid). Thus, Clahsen et al. cannot claim based on Brown's criteria that their Stage 1 is truly the earliest syntactic stage. In fact, carefully examining the data reported in Clahsen et al. suggests that for some of the children, their very early data look different from the general data at Clahsen et al.'s Stage 1. Thus, Julia at Stage 1 (with an MLU of 1.28-1.58) does not produce any utterances involving raised verbs, and Inga at Stage 1 (MLU 1.74) produces only one raised verb with correct agreement. The other four children at Stage 1, on the other hand, produce a good number of raised verbs with correct agreement.

Note that, following Brown, Clahsen et al. assume that the earliest syntactic stage involves a large proportion of two-word combinations, i.e. the traditional two-word stage. However, as will become clear from the following discussion, an early stage which is still predominantly a one-word stage (our PLU-stage 2) is already syntactically relevant, as can be seen in Table 2 in Section 4. Thus, it might well be that Julia's an Inga's early data reflect such an earlier stage.

Deciding which actual recordings constitute 'Stage 1' is crucial for Clahsen et al.'s argument. If the recordings that they categorize as Stage 1 were to accurately reflect the earliest syntactic stage, then the conclusion reached is valid (namely, that finite verbs are produced from the beginning of acquisition in German). If, however, the Stage 1 proposed by these authors should actually be treated as two separate stages, then it may be that the earlier one of these two stages will show that there is an early stage without finite verbs, contrary to the main conclusion of Clahsen et al.'s paper (but in accordance to what has been found for the closely related Dutch by Wijnen (1994)). The approach described in this paper attempts to make sense of such early stages without directly resorting to basically arbitrary MLU-ranges.

Our approach is in some sense an improvement over the MLU measure, and thus we have given it a related name, PLU (for Predominant Length of Utterance). The new measure is based on the traditional observation that children pass through three early stages observable in their production data: (1) a one-word stage, (2) a two-word stage, and (3) a multiword stage (involving sentences with more than 2 words). The proposed stages are thus less arbitrary than MLU-based stages (such as Brown's Stage 1) in that they reflect the widely assumed stages based on sentence length (i.e. the one-word, two-word and multiword stages). However, we found that it was impossible to identify these three
1. Introduction

A child's age is a notoriously poor indicator of syntactic development. Consider the famous case of Brown's (1973) Adam, Eve and Sarah: at the age of 2;3 when data collection started for Adam and Sarah, their syntactic development is just beginning, whereas Eve (whose data collection began earlier) has by the age of 2;3 acquired much of English syntax already. Although Adam and Sarah look similar at the beginning of data collection, Adam's language continues to develop much more rapidly than Sarah's.²

This paper describes our attempt to construct a standard of early syntactic development that is independent of the child's age, and is also independent of any particular syntactic construction. Such a measure would facilitate comparison of naturalistic data across children within the same language, as well as comparison of data across languages, at least ideally. The measure we have developed does indeed show promise even in cross-linguistic comparison of languages such as French, Swedish, English, Polish and Russian. Overall, the stages we have developed appear to correlate significantly with observable syntactic development in the earliest transcripts on the CHILDES Database (MacWhinney & Snow 1985).

The traditional measure for determining stages of development is the MLU (Mean Length of Utterance). The MLU is, in fact, a useful rough indication of how advanced a child's language development is. However, in order to be truly useful as a tool for the acquisition researcher, the researcher would need to know which ranges of the MLU correspond to meaningful syntactic stages. In a classical way of using the MLU, Brown (1973) provides ranges of MLU for the stages of development he comes up with for English; however, in the reality of work on the acquisition of syntax these ranges have not turned out to be very useful.³

A modern example of using the MLU in the acquisition of syntax is provided in Clahsen, Penke & Parodi (1993/4) on the acquisition of German. The authors are determined to answer once and for all the question of whether German children produce raised, tensed verb forms from the earliest syntactic stage of development, or whether there is an early stage where just root infinitives are produced (i.e. whether there is an early stage without functional projections). In order to answer their question, the authors must be able to determine independently of the phenomenon under discussion what the earliest syntactic

² Research reported in the psychological literature has shown that there is a reliable correlation between age and MLU (cf. e.g. Klee, Schaffer, May, Membrino & Mougey 1989). However, since this correlation is calculated over groups of children, its validity is less clear for comparisons between individual children such as is often conducted in research on the acquisition of syntax.
³ In work on abnormal language development, such as SLI children's language acquisition, using the MLU has been very useful in matching SLI subjects with non-SLI subjects.
clear two-word utterances, due to the fact that he produced a large number of partially unclear utterances. Furthermore, even with the margin of error raised to 10%, it was impossible to assign a developmental stage to several of the files under analysis, nor were some of the theoretically possible stages realized in the data.

At this point we gave up the search for the ‘pure’ word length stages, and gave up the idea of a fixed (small) margin of error. Rather, we looked for a different way of capturing the idea of the one-word stage, two-word stage and multiword stage, while at the same time making sure that the solution would allow us to make syntactically meaningful generalizations about the data. Here, the intuitively meaningful notion of a ‘predominant length’ of utterance presented itself to us in light of the patterns we were observing in the analyzed files: instead of being an absolute measurement, length of utterance is relativized to cover the most predominant pattern observed in the child’s speech at a given stage, while allowing shorter and longer utterances to exist at the same stage.

Since we arrived at the proportions included in the latest version of our PLU-classification after some intuitive guessing from our part, as well as a process of trial and error, these proportions are admittedly somewhat ad hoc; this, however, does not detract from their apparent usefulness as a tool in crosslinguistic comparison of syntactic development.

The following, then, is the classification of children’s early linguistic production data into stages based on our PLU measure. In the definitions, one-word, two-word and multiword utterances will be treated as three different sentence types.

**Stage 1: Predominantly one-word stage**
- Almost all utterances (90%) are of the one-word sentence type

**Stage 2: Intermediate stage between one-word and two-word stages**
- The one-word sentence type is still very common (60%-89% of the utterances are of the one-word sentence type)

**Stage 3: “Two-word” stage**
- The one-word sentence type no longer clearly predominates (i.e. fewer than 60% of all utterances are one-word utterances)
- Of the three sentence types, the multiword sentence type is not the most common one

**Stage 4: Predominantly multiword stage**
- Of the three sentence types, the multiword sentence type is the most common one

---

6 An earlier version of the definitions for our PLU-stages was used in Legendre, Vainikka, Todorova & Hagstrom (1998) as well as in the Durham lectures presented by Vainikka in April 1999; the difference in definitions does not affect the conclusions drawn in those works.
stages in the data by e.g. looking for a stage where almost all of the utterances combined one word (at the one-word stage), or two words (at the two-word stage), or more than two words (at the multiword stage). A more complex way of finding these stages was devised, as will be described in detail in the following section.

2. The PLU-Stages

Two assumptions have guided our reasoning in arriving at our PLU-stages. First, we assume that the traditionally observed stages based on utterance length (e.g. the two-word stage) reflect the development of syntax, such that the child’s syntactic component is only able to project phrases of a certain complexity at each stage. Thus, at the two-word stage it is the child’s syntactic competence which does not yet allow projection of multiply embedded structures, rather than some sort of a performance limitation. Given such an assumption about the development of syntactic complexity, we would expect that each of the word length stages correspond to related syntactic developments. For example, we might expect that at the onset of the multiword stage, which is presumably related to the possibility of projecting functional projections, we would expect various functional elements such as Tense and Agreement to rear their head.\(^4\)

The second assumption concerns the special status of verbs in developmental syntax. Children’s earliest words are nouns, with verbs entering only after quite a few nouns have been acquired (Gentner 1982).\(^5\) Since verbs are central in the structure of sentences, we assume that it is only with the acquisition of verbs that true syntactic development begins to occur. Thus, in addition to determining our stages based on the overall length of sentences, we have also included as a measure the proportion of verb-containing sentences in the data.

As mentioned above, we initially looked for ‘pure’ one-word, two-word, and multiword stages. As a first approximation we established a fixed 5% margin of error, where, for example, at the two-word stage 95% of the utterances would consist of two words; as the next approximation we tried a fixed 10% margin of error. However, the resulting classification of the early files (under either margin) that we examined from various languages turned out not to correspond to any of the obvious syntactic changes that we had observed. This was perhaps partly due to the lenient way that partially unclear utterances were treated (see Section 3 below). For example, the Swedish child Harry was wrongly classified as being at an intermediate stage when he had only uttered a couple of

---

\(^4\) It need not be the case, however, that a particular functional projection be associated with a specific stage in terms of our PLU-measure. In fact, interesting differences in the point at which a functional projection is projected during development can be observed across languages.

\(^5\) This generalization has recently been challenged for languages such as Korean and Tzeltal; see the special issue of Linguistics on early verbs (1998). However, the central status of verbs for syntax remains unchallenged, and the proportion of verbs in early syntactic development can still be expected to be revealing.
3. Methodological decisions

In our project, we have calculated PLU-based stages of development for eight children from different linguistic backgrounds whose transcribed files are available on CHILDES. Determining the stage that a particular recording belongs to is labor-intensive since most of the relevant searches and calculations have to be done by hand. However, this method allows the researcher to make careful decisions about the types of utterances that are included in the analysis, by for example excluding utterance types such as rote-learned phrases and imitations.

In our analysis we have completely excluded the following utterance types:

1. **direct imitations of preceding utterance** (preceding utterance spoken by someone other than the child)
2. **immediate self-repetitions** (i.e. child repeats herself with no one speaking in between, or with another speaker saying something but this is ignored by the child)
3. **non-speech sounds** such as laughing or coughing
4. **clearly rote-learned segments** such as portions of songs, nursery rhymes, proverbs, greetings, etc.
5. **non-transcribed utterances** (e.g. those marked as www, xxx, yyy in CHILDES)

The excluded utterance types were not included in any of the calculations; they are not even counted in the total count “all utterances”. On the other hand, we included in our total count partially unclear utterances that have been transcribed, even if the transcriber or we cannot figure out what the child meant. The rationale behind this decision is that such partially unclear utterances were most likely intended as speech by the child, and they are most likely not utterances of any of the first four excluded types listed above (as it is typically easy to transcribe an imitation, repetition, or a rote-learned segment).

Partially unclear utterances were treated in the following way: any unclear string was counted as one word. For example, in an utterance \(xxAyyB\) where \(A\) and \(B\) are recognizable words and the rest is unclear, the utterance is counted as a 4-word utterance. If, instead, the utterance was \(ABxxyy\), it would be counted as a 3-word utterance, even if the transcriber felt there was a word boundary between the two unclear segments \(xx\) and \(yy\).

As a general illustration, consider the exchange in (1) from the second recording of the English child Nina (age 1;11.29; Suppes 1974; CHILDES Database) between Nina and her mother:

\[\]
At the earliest stage, basically only one-word utterances occur; the 90% figure can be thought of as 100% modified by a 10% margin of error. Even at Stage 2, one-word utterances still predominate; here, the lower bound 60% can be thought of as 50% plus a 10% margin of error (the margin of error should be calculated in this direction because certain one-word utterances are grammatical even in the adult language; only if one-word utterances form a very clear majority can we assume that the file in question represents an early stage).

Due to the intermediate status of Stage 3, occurring between the clear one-word stages (Stages 1 and 2) and the clear multiword stage (Stage 4), this stage is the most difficult one to define. If we think of the increasing complexity of sentence type as a continuum, the one-word stages fall at one end of the continuum and the multiword stage falls at the other end of the continuum. The two-word stage, however, falls in the middle of the continuum and thus faces “competition” from both sides.

It turns out that the last stage\(^7\), Stage 4, can most simply and reliably be defined as given, where multiword utterances form the most common sentences type. Given the definitions of Stages 2 and 4, then, Stage 3 must be defined as anything falling in between Stages 2 and 4. The first clause under Stage 3 excludes Stages 1 and 2, while the second clause excludes Stage 4. In practice it turns out that Stage 3 represents a stage at which the 2-word construction is a very productive one, even though two-word sentence type does not figure in the definition of Stage 3 as given.

In addition to the stages defined above, each stage is divided into secondary stages (a-c) based on the proportion of verbs\(^8\) observed in the child’s utterances at the relevant stage. (a) refers to a secondary stage with basically no verbs, and (c) refers to a secondary stage where the majority of the utterances contain a verb:

*Secondary stage a: at most 10% of all utterances contain a verb*

*Secondary stage b: 11%-60% of all utterances contain a verb*

*Secondary stage c: more than 60% of all utterances contain a verb*

After a brief methodological section, we provide all the classifications that we have made for the data on the CHILDES Database, along with our observations about syntactic changes that correlate with our stages.

---

\(^7\) It should be pointed out that our Stage 4 actually represents the *beginning* of complex syntax, and our stages 1-4 represent the earliest syntactic stages. Thus, further more advanced stages will undoubtedly be required to describe the development of e.g. various CP-related constructions.

\(^8\) The term “verb” may not carry over to some languages, where finiteness can occur on other parts of speech, as well. What is relevant for our purposes are elements which are capable of carrying finiteness, in particular tense marking.
development is the proportion of non-finite verbs used in finite contexts (e.g. the so-called root infinitives). In addition, we have analyzed the data for the occurrence of tense marking, agreement marking, and empty subjects (see Appendix A for the set of forms used as tools for analyzing each file).

The main aim of the PLU-stages was to capture the traditional notions of one-word stage, two-word stage, and multiword stage in a precise fashion that also makes intuitive sense. It turns out that the resulting stages are also successful in capturing meaningful syntactic developments. In particular, a good fit exists between our PLU-stages and a sharp decrease in the usage of non-finite root forms (NRFs) such as root infinitives in languages such as French and Swedish, in which the use of NRFs is a pervasive phenomenon. A somewhat less reliable correlation exists for English; however, this may be due to the fact that root infinitives are difficult to identify in English because of the impoverished system of agreement marking. Similarly, the NRF measure is not a revealing one for the Slavic languages (Russian and Polish in our study), given the very low proportion of NRFs in general. For English and the Slavic languages, other measures of development – such as case-marking on pronouns – seem to also correspond well with our PLU-stages (see Table 2 below).

All the data come from the CHILDES Database (MacWhinney & Snow 1985). The Swedish data of Markus and Harry belong to the Strömqvist & Richtoff corpus (Plunkett & Strömqvist 1992, Strömqvist, Richtoff & Anderson 1993). The French data of Grégoire were collected by Champaud, while Philippe’s data belong to the Leveillé corpus (Suppes, Smith & Leveillé 1973). Stéphane’s French data come from the Rondal corpus (Rondal 1985; Rondal, Bachelet & Peree 1985). The Russian data of Varvara were collected by Protassova, and the Polish data of Bartosz were donated by Weist (Weist & Witkowska-Stadnik 1986; Weist, Wysocka, Witkowska-Stadnik, Buczowska & Konieczna 1984). The Nina corpus was collected by Suppes (Suppes 1974).

Table 1 provides the stages which we have assigned to the files of our eight children, along with the proportions of various sentence types used to determine a stage.

Unless otherwise noted, where files have been combined, each of the individual files also conforms to the stage indicated for the combined files. Five of the children had one file each representing borderline data that we reclassified as belonging to a stage represented by an adjacent file, contrary to our definitions; each of these cases have been described in the footnotes below. In addition, one of Stéphane’s files (6f), although not a borderline case, seems to fit an adjacent stage better, as indicated in footnote (viii) below. Thus, the stage classification for 6 out of about 50 files that we have analyzed did not straightforwardly work out as expected. For the remaining files, however, the stages work out very nicely, as can be seen from the syntactic correspondences in Table 2.
(1)
MOT: that's a baby goat.
NIN: baby goat eating.
MOT: yes.
NIN: baby goat eating.
MOT: the baby goat is eating.
NIN: eat my food.

Nina's first utterance is straightforwardly included, as it is not an imitation or a repetition of the previous utterance. Her second utterance, however, is a literal repetition of her previous utterance (and she seems to be ignoring mother's acknowledgement), and it is thus excluded. Nina's third utterance is again included.

An example of a partially unclear utterance by Nina is provided in (2) (file 9, age 2;1.6):

(2)  NIN: give a rabbit xxx here.  (Nina 9, 2;1.6)

As outlined above, this utterance would be counted as a 5-word utterance, despite the fact that one of the 'words' is unclear. Consider the example in (3) from Swedish, uttered by Markus at age 1;10.25 (Plunkett & Strömqvist 1992, Strömqvist, Richoff & Anderson 1993; CHILDES Database):

(3)
MAR: gummiband gren.
    rubber.band green

    MAR: gummiband engk rak.
    rubber.band ?    ?

    FAT: ja de e ett grönt gummiband ja.
    yes it is a green rubber.band yes

The second utterance of Markus' in (3) contains two unclear segments next to each other; according to the guidelines explained above, this utterance was counted as a two-word utterance.

4. PLU-stages in our data and corresponding syntactic developments

The main objective behind our PLU-measure is to allow classification of a child's naturalistic production data into non-arbitrary stages which can be assumed to correspond to actual changes in the child's overall syntactic development. In our project, we have focused on the emergence of finiteness in the verbal system as indication of an increase in syntactic sophistication, conceived as the competence or ability to build expanded syntactic structure. That is, for our purposes an important measure of syntactic
In Table 2, brief summaries of syntactic observations at each stage for each child have been provided. This constitutes a sampling of the observations that we have made; for more detail on the French and Swedish data, see Legendre, Vainikka, Todorova & Hagstrom (1998). It should be noted that each of our main stages 1-4 were instantiated in the data; although not all of the possible secondary stages were attested, even the secondary stages correlated with observable syntactic changes.

In Table 2, the term “NRF” refers to Non-Finite Root Forms, which include any non-finite forms used as non-adult-like main verbs; this includes not only the traditional “root infinitives” but also “root participles”, “root gerunds”, and stem forms used as the main verb.
Table 1. PLU-stages for the 8 children.

<table>
<thead>
<tr>
<th>Language/Child/Files</th>
<th>1-word</th>
<th>2-word</th>
<th>Multiword</th>
<th>Verbs</th>
<th>PLU-stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swedish/Markus 7</td>
<td>93%</td>
<td>7%</td>
<td>6%</td>
<td>9%</td>
<td>1a</td>
</tr>
<tr>
<td>Markus 8</td>
<td>71%</td>
<td>23%</td>
<td>6%</td>
<td>21%</td>
<td>2b</td>
</tr>
<tr>
<td>Markus 9</td>
<td>65%</td>
<td>22%</td>
<td>13%</td>
<td>40%</td>
<td>2b</td>
</tr>
<tr>
<td>Markus 10</td>
<td>43%</td>
<td>32%</td>
<td>25%</td>
<td>45%</td>
<td>3b</td>
</tr>
<tr>
<td>Swedish/Harry 5-6</td>
<td>90%</td>
<td>9%</td>
<td>0%</td>
<td>6%</td>
<td>1a</td>
</tr>
<tr>
<td>Harry 7-9</td>
<td>84%</td>
<td>12%</td>
<td>3%</td>
<td>6%</td>
<td>2a</td>
</tr>
<tr>
<td>Harry 11-12</td>
<td>69%</td>
<td>13%</td>
<td>19%</td>
<td>19%</td>
<td>2b</td>
</tr>
<tr>
<td>French/Grégoire 1-4</td>
<td>42%</td>
<td>34%</td>
<td>24%</td>
<td>35%</td>
<td>3b</td>
</tr>
<tr>
<td>Grégoire 5-7</td>
<td>51%</td>
<td>27%</td>
<td>43%</td>
<td>40%</td>
<td>4b</td>
</tr>
<tr>
<td>Grégoire 8-10</td>
<td>26%</td>
<td>10%</td>
<td>69%</td>
<td>65%</td>
<td>4c</td>
</tr>
<tr>
<td>French/Stéphane 1</td>
<td>33%</td>
<td>34%</td>
<td>33%</td>
<td>17%</td>
<td>3b</td>
</tr>
<tr>
<td>Stéphane 2</td>
<td>48%</td>
<td>30%</td>
<td>23%</td>
<td>15%</td>
<td>3b</td>
</tr>
<tr>
<td>Stéphane 3</td>
<td>32%</td>
<td>37%</td>
<td>31%</td>
<td>18%</td>
<td>3b</td>
</tr>
<tr>
<td>Stéphane 6a</td>
<td>32%</td>
<td>31%</td>
<td>37%</td>
<td>22%</td>
<td>4b</td>
</tr>
<tr>
<td>Stéphane 6f</td>
<td>38%</td>
<td>33%</td>
<td>29%</td>
<td>17%</td>
<td>3b</td>
</tr>
<tr>
<td>Stéphane 8a</td>
<td>13%</td>
<td>15%</td>
<td>72%</td>
<td>50%</td>
<td>4b</td>
</tr>
<tr>
<td>French/Philippe 1-3</td>
<td>13%</td>
<td>22%</td>
<td>65%</td>
<td>53%</td>
<td>4b</td>
</tr>
<tr>
<td>Russian/Varvara 1-3</td>
<td>37%</td>
<td>36%</td>
<td>27%</td>
<td>35%</td>
<td>3b</td>
</tr>
<tr>
<td>Varvara 4-5</td>
<td>26%</td>
<td>25%</td>
<td>49%</td>
<td>41%</td>
<td>4b</td>
</tr>
<tr>
<td>Polish/Bartosz 1-3</td>
<td>63%</td>
<td>27%</td>
<td>10%</td>
<td>51%</td>
<td>2b</td>
</tr>
<tr>
<td>Bartosz 4-6</td>
<td>57%</td>
<td>27%</td>
<td>16%</td>
<td>50%</td>
<td>3b</td>
</tr>
<tr>
<td>English/Nina 1-9</td>
<td>44%</td>
<td>27%</td>
<td>29%</td>
<td>28%</td>
<td>3b</td>
</tr>
<tr>
<td>Nina 10</td>
<td>41%</td>
<td>18%</td>
<td>41%</td>
<td>40%</td>
<td>4b</td>
</tr>
</tbody>
</table>

9 In Legendre et al. (1998), this borderline file was treated as belonging to Stage 3b due to the grammatical properties attested in this file, and it will be so treated here.
10 Grégoire’s file 8 has fewer verbs (51%) than the cutoff point of 60%; due to the grammatical properties apparent in this file (see Legendre et al. 1998), this file will be treated as 4c rather than 4b.
11 Under the definitions used in Legendre et al. (1998), Stéphane’s files 6a, 6f, and 8a all came out as Stage 4b. Under the revised definitions, file 6f now comes out as Stage 3b. However, the other syntactic measurements discussed in Legendre et al. suggest that these files represent Stage 4b. In addition, data from a file not previously analyzed, file 7a, supports the Stage 4b classification: in file 7a, multiword utterances are clearly predominant (48%), while one-word utterances occur 30% of the time, and 2-word utterances 22% of the time. Note, however, that Stéphane’s early files may not be as reliable as data from the other children, given the unusually low proportion of verbs, and the fact that Stéphane moved from France to the U.S. when he was 1 year old.
12 Although files 2 and 3 have fewer than 60% verbs, file 1 has 62% verbs; this would technically put file 1 at Stage 4c, as opposed files 2-3 which represent Stage 4b. All three files are here treated as Stage 4b.
13 Technically, Bartosz 5 falls at Stage 2b, since there are 60% of one-word utterances. However, given the fact that the previous file represents Stage 3b, and that the 60% is a borderline figure (Stage 2 being 60-89% one-word utterances), we will classify Bartosz 5 as Stage 3b.
14 Of Nina’s files 1 to 9, all but one straightforwardly fall under Stage 3b. The exception is file 3, which technically falls under Stage 4b. However, given the borderline data of file 3 (35% one-word, 29% two-word, 36% multiword), and the fact that the preceding files and several following files represent Stage 3b, we will also treat file 3 as being an instance of this stage.
At Stage 3 (i.e. the two-word stage), there is still a sizable proportion of NRFs, as well as some evidence of tense marking; this is particularly clear in the French and English data. The Russian and English data also reveal that this is a stage without productive nominative case marking; in the Polish data at this stage, there is evidence of correct use of the non-nominative cases. At Stage 4 (the multiword stage) we find few NRFs, and agreement begins to emerge, especially in the French data. Nominative case is now productively used by the Russian speaker Varvara and the English speaker Nina.

5. Final thoughts

A potentially desirable result for our PLU-based approach would be to establish some correlation between the stages we have assigned to the CHILDES files using the PLU measure and the traditional MLU measure, as calculated by the CLAN program of the CHILDES Database. Such correlation, if found, could then be used to define ranges of MLU that would identify syntactically meaningful stages.

Appendix B provides the MLU-counts for most of the files that we have analyzed, and a comparison with our PLU-stages suggest that surprisingly there is apparently no correlation between the two measures. For example, attempting to determine the MLU range for Stage 2b is impossible given the data: Harry’s and Markus’ MLU at this stage is under 2, while Bartosz’s MLU at the same stage is about 3. Similarly, for Stage 3b: Grégoire’s MLU at this stage is under 2, Nina’s around 2, Varvara’s and Stéphane’s between 2 and 3, and Bartosz’s over 3. At Stage 4b, the MLUs look most uniform: over 3 for Grégoire, Philippe and Varvara (but only 2.3 for Nina). However, Varvara’s and Bartosz’s earlier data is difficult to distinguish from this stage. We conclude that it is not possible to derive our PLU-stages directly from the MLUs.

Although the PLU-measure appears promising in analyzing languages of various morphological complexity, such as Swedish (with very little morphology) and Russian (rich morphology), it may face a challenge with polysynthetic languages such as West Greenlandic. While the notion of ‘word’ is quite different in these languages, it is interesting that Fortescue & Lennert Olsen (1992) describe what look like the traditional one-word and two-word stages in the acquisition of West Greenlandic. This suggests that although the PLU-stages may need to be modified for dealing with polysynthetic languages, the measure may be a realistic one even for such languages.
<table>
<thead>
<tr>
<th>Lang/Child</th>
<th>File</th>
<th>Age</th>
<th>Stage</th>
<th>Syntactic Developments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swedish/Markus</td>
<td>7</td>
<td>1;9</td>
<td>1a</td>
<td>(too few verbs)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>1;10</td>
<td>2b</td>
<td>82% NRFs; still no tense</td>
</tr>
<tr>
<td></td>
<td>9-10</td>
<td>1;10-1;11</td>
<td>3b</td>
<td>58% NRFs; some evidence of tense</td>
</tr>
<tr>
<td>Swedish/Harry</td>
<td>5-6</td>
<td>1;10-1;11</td>
<td>1a</td>
<td>(too few verbs)</td>
</tr>
<tr>
<td></td>
<td>7-9</td>
<td>2;0-2;2</td>
<td>2a</td>
<td>Verbs non-finite or 3sg copula</td>
</tr>
<tr>
<td></td>
<td>11-12</td>
<td>2;3-2;4</td>
<td>2b</td>
<td>72% NRFs; still no tense</td>
</tr>
<tr>
<td>French/Gregoire</td>
<td>1-4</td>
<td>1;9-1;10</td>
<td>3b</td>
<td>28% NRFs; tense acquired, but not agreement; postverbal subjects common</td>
</tr>
<tr>
<td></td>
<td>5-7</td>
<td>2;0-2;3</td>
<td>4b</td>
<td>18% NRFs; agreement emerges; dip in tense; postverbal subjects common</td>
</tr>
<tr>
<td></td>
<td>8-10</td>
<td>2;5</td>
<td>4c</td>
<td>1% NRFs; postverbal subjects rare</td>
</tr>
<tr>
<td>French/Stéphane</td>
<td>1-3</td>
<td>2;2-2;3</td>
<td>3b</td>
<td>48% NRFs; tense acquired, but not agreement; postverbal subjects common</td>
</tr>
<tr>
<td></td>
<td>6-8</td>
<td>2;6-2;8</td>
<td>4b(^{15})</td>
<td>13% NRFs; some agreement; dip in tense; postverbal subjects occur</td>
</tr>
<tr>
<td>French/Philippe</td>
<td>1-3</td>
<td>2;1-2;2</td>
<td>4b</td>
<td>22% NRFs; some tense and agreement; postverbal subjects common</td>
</tr>
<tr>
<td>Russian/Vavara</td>
<td>1-3</td>
<td>1;6-1;9</td>
<td>3b</td>
<td>Some accusative in 1st person; nom. pronouns without lexical verbs</td>
</tr>
<tr>
<td></td>
<td>4-5</td>
<td>1;11-2;1</td>
<td>4b</td>
<td>Nominative pronouns with lexical verbs emerge and nom. use increases drastically; acc. use in various persons; more overt subjects with finite verbs</td>
</tr>
<tr>
<td>Polish/Bartosz</td>
<td>1-3</td>
<td>1;7-1;8</td>
<td>2b</td>
<td>Case errors attested (overuse of nominative in place of other cases)</td>
</tr>
<tr>
<td></td>
<td>4-6</td>
<td>1;8-1;11</td>
<td>3b</td>
<td>Case errors no longer attested</td>
</tr>
<tr>
<td>English/Nina</td>
<td>1-9</td>
<td>1;11-2;1</td>
<td>3b</td>
<td>Nominative case, modals, auxiliaries, tense or agreement not yet acquired; NRFs common</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>2;1</td>
<td>4b</td>
<td>Nominative case acquired; some tense</td>
</tr>
</tbody>
</table>

Table 2 reveals an early Stage 1, where there are too few verbs to provide meaningful analyses of verb forms and related syntactic phenomena. At Stage 2 (which was characterized as still being a clear one-word stage), the majority of the verb forms are NRFs (mainly root infinitives), and there is no evidence of tense marking; most of the data for this stage come from the two Swedish children analyzed (note that adult Swedish exhibits no agreement marking on finite verbs). The Polish data from Bartosz reveal that the case system has not yet been acquired at Stage 2.

\(^{15}\) The status of Stéphane’s files 6a/6f is somewhat unclear; see Table 1 and footnote (11).
References


