

The “Critical Mass Hypothesis”: Morphosyntax Development among Typically Developing Child and a Child with Developmental Language Disorder

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Abstract Mass Critical Hypothesis is a new concept in the study of child language and/or developmental language disorder. The hypothesis states that the morphosyntax of children can develop only if they have acquired (or can produce) a certain amount of different words. The goal of the present research was to test the generalizability and reliability of the hypothesis. For this, one typically developing child and one child with developmental language disorder from Child Language Data Exchange System/CHILDES (MacWhinney, 2000) were taken. The CHAT file was non-elicited and non-directed spontaneous speech. Computerized Language Analysis (CLAN) v.30 for Windows was employed to analyze the non-elicited spontaneous speech of the typically developing child and the child with developmental language disorder. For both cases, Mean Length of Utterance (MLU) and Pearson product moment correlation coefficient (r) were calculated. Based on observed range of number of types of morpheme produced, the present study supports the notion of ‘Mass Critical Hypothesis’ existence in both typically developing child and the child with developmental language disorder.

Keywords: *critical mass hypothesis, developmental language disorder, morpheme, MLU*

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1. Introduction

The modern study of child language development owes much to the methodological and conceptual advances introduced by Brown (1973). In his study of the language development of Adam, Eve, and Sarah, Brown focused on a variety of core measurement issues, such as acquisition sequence, growth curves, morpheme inventories, productivity analysis Grammar formulation, and sampling methodology. The basic question that Brown was trying to answer was how one could use transcripts of interactions between children and adults to test theoretical claims regarding the child’s learning of grammar. Like many other child language researchers, Brown considered the utterances produced by children to be a remarkably rich data source for testing theoretical claims. At the same time, Brown realized that one needed to specify a highly systematic methodology for collecting and analyzing these spontaneous productions.

In the literature on language development and developmental language disorder one comes across the Mass Critical Hypothesis. The hypothesis states that the morphosyntax of children can develop only if they have acquired (or can produce) a certain amount of different words. The Mass Critical Hypothesis is mentioned by

Bassano, Laaha, Maillochon and Dressler (2004) where the authors state that:

[...]developments within morphosyntax are triggered by an increase in the size of the lexicon beyond a given level, thus providing support for the interdependence of lexical and morphosyntactic developments (Bassano et al. 2004, 36.)

The MLU is crucial not only for research on morphosyntactic development, but also for the development of automatic ways of evaluating children’s level of grammatical development (Whitney, 2000). Several recent studies have demonstrated strong relationships between lexical acquisition and subsequent developments within the domain of morphosyntax. However, a number of studies have identified continuities, rather than dissociations, in rate and style of acquisition across phonological, lexical and grammatical milestones (Goldfield & Snow, 1985; Nelson, Baker, Denninger, Bonvillian & Kaplan, 1985; and Marchman and Bates, 1994). Such continuities would not be predicted if acquisition were guided by separable mechanisms or processors. For example, in the earliest phases of acquisition there is considerable evidence to suggest that the phonological repertoire of children’s babble serves as the basis for the subsequent organization of their lexicon (Locke & Pearson, 1990; Vihman, Ferguson, & Elbert, 1986).

The present paper is, therefore, to test the hypothesis that the types of phoneme/words children determine the morphosyntax development produced that there is a certain amount of lexical items (types) needed to start the development of morphosyntax.

2. Method

The present paper used the Joseph, Serratrice, & Conti-Ramsden (2002) from Child Language Data Exchange System/CHILDES (MacWhinney, 2000) as a child with language disorder, and transcript file created by Lieven, Salomo & Tomasello (2009) as typically developing child. Both files have been used as a longitudinal case study on language acquisition of children. Since, the data is longitudinal and the objective of the paper is to see types and MLU, much emphasis is given to match both child with DLD and typically developing child with MLU. Therefore, the present analysis is done by taking 17 conversations on different time. Both files are non-elicited, spontaneous speech, and non-specified. In both cases, the corpora were selected by length of data collection.

The data was downloaded and analyzed by Computerized Language analysis/CLAN (Version 30 for Windows). To see the total number of different words or types within 100 phonemes “freq @ +t*CHI +z100u +d3” command was employed for each session. Identifying how much different words used alone cannot show us the number of words or morphemes in each of their spontaneous utterances. Accordingly, to see the morphosyntactic development,” mlu @ +t*CHI +z100u +d” command, since as Whitney (2000), MLU is one way to show the grammatical and morphosyntactic development. Pearson product moment correlation coefficient (r) was also calculated at different points to see the existing relationship between types of phoneme/words and MLU for both cases.

3. Results

This longitudinal data of MLU and Types of lexicons (Table 1) shows the increase of MLU is increasing the types of lexicons. However, it would be very infant to generalize one is depending on another. Increasing of types of lexicons and MLU in both typically developing child and the child with developmental language disorder is different. It would also be important to note that, by looking to this longitudinal data, it is very difficult to take a point which can be considered a critical mass.

Table 1. Summary of MLU and types of words produced for both typically developing child and child with developmental language disorder

| MLU/Typical | Types/Typical | MLU/Clinical | Types/Clinical |
|-------------|---------------|--------------|----------------|
| 1.51 | 34 | 1.242 | 39 |
| 1.86 | 40 | 1.433 | 42 |
| 1.85 | 37 | 1.704 | 55 |
| 2.18 | 70 | 2.204 | 77 |
| 1.9 | 80 | 2.612 | 85 |
| 2.26 | 89 | 3.153 | 82 |
| 2.11 | 93 | 2.946 | 101 |
| 2.17 | 95 | 3.705 | 116 |
| 2.51 | 109 | 3.051 | 97 |
| 2.95 | 124 | 3.421 | 105 |
| 3.34 | 136 | 3.73 | 115 |
| 3.09 | 124 | 3.646 | 102 |
| 3.63 | 146 | 3.514 | 125 |
| 3.73 | 158 | 4.354 | 146 |
| 4.21 | 166 | 4.248 | 120 |
| 4.13 | 174 | 4.149 | 149 |
| 4.25 | 166 | 3.723 | 126 |

To see the morphosyntax development and types of words produced, two different illustrative graphs for the typically developing child and the child with developmental language disorders have been utilized. In both cases Pearson correlation coefficient (r) calculated by cutting the raw data into different section of which based on rough observation on the regression line of the graphs. First we will see the typically developing child and the child with developmental language disorder second.

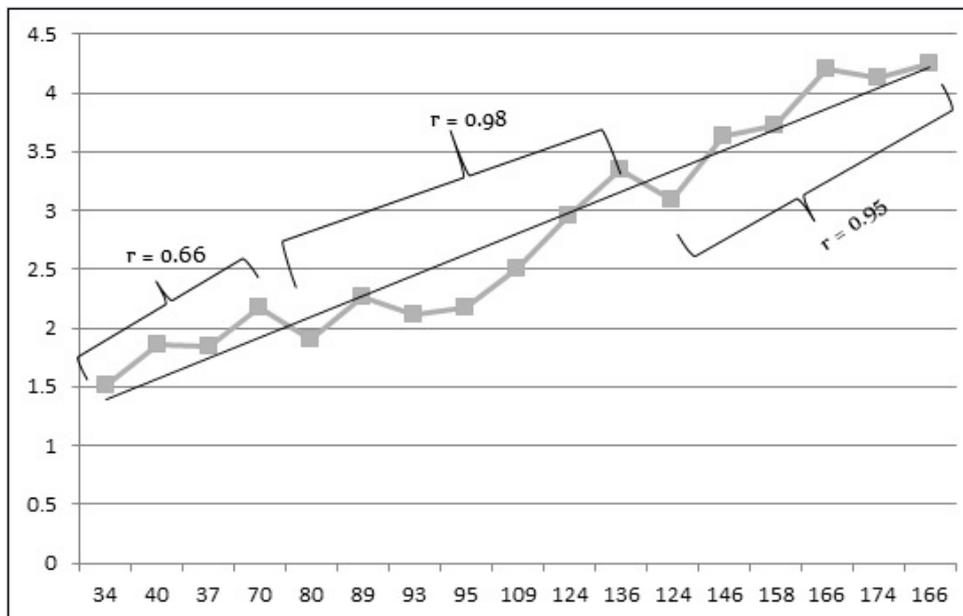


Figure 1. The total number of different words used by the typically developing child from the first 100 sample words across MLU

Statistically speaking, any result or number, which describes anything, above the regression line (trend line) is supposed to be the fundamental change through time with any variable and the regression line can be taken as a mean change. Therefore, as depicted on the above figure, the trend of the contribution of total number of different words produced to the morphosyntax development is increasing over time. Even though, there is an increase in morphosyntax development, while the types of words increase, there is a visible change that the regression line is above the mean. The effects of types of words on morphosyntax development start steadily increasing and reach at the MLU of 4.25. Based on the regression line,

Pearson correlation coefficient was calculated. As indicated on the above figure, there is very strong change on correlation coefficient. The correlation coefficient of the first four combinations of X-axis and Y-axis is 0.66, which to mean there is a positive relationship between morphosyntax development and types of morpheme. In another words, when the number of different words produced increases the morphosyntax (MLU) increases. There is a very strong relationship found, however, on the second combination of X-axis and Y-axis ($r=0.98$), which to mean there is a very sharp increment of morphosyntax, while the number of different morpheme increases.

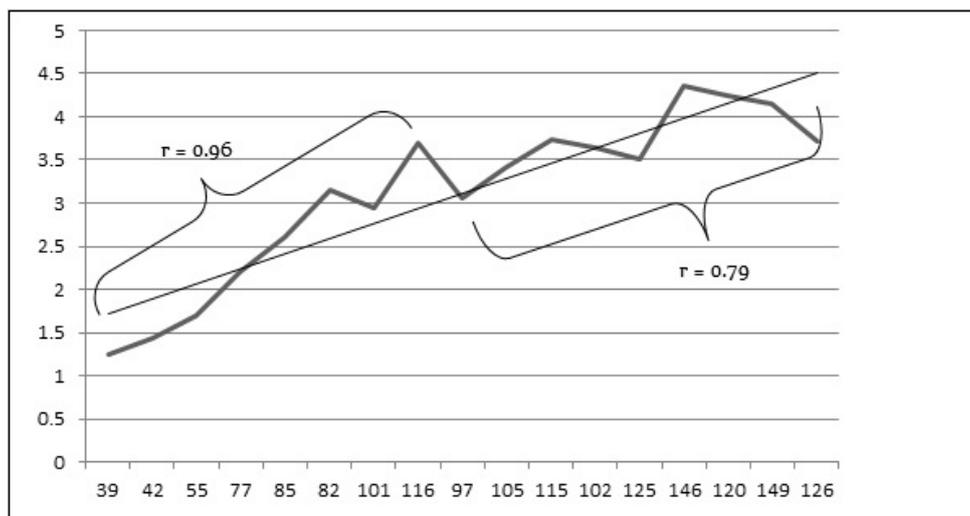


Figure 2. The total number of different words used by the child with developmental language disorder from the first 100 sample words across MLU

As [Figure 2](#) uncovered, there is again a steadily increasing morphosyntax development when the total number of different words produced. There is a very consistent increase of MLU up to the types of words produced reach to 116 and slow progress then afterwards. There is a very strong positive relationship ($r = 0.96$) of the first combination until the graph start to slow down. To go further into it, the total numbers of different morpheme produced have a direct relationship to increase the morphosyntax development. However, the growth start to decrease and the relationship between the morphosyntax development and types of morpheme ($r = 0.79$). However, in both cases there are ups and downs on the total number of different words produced.

4. Discussion

Is there a critical point in both typically developing child and a child with DLD?

[Figure 1](#) and [Figure 2](#), in general, reveals that there is a very strong relationship between morphosyntax development and total number of different words produced. The relationship of morphosyntax and types of morpheme on the typically developing child and child with DLD is different. For the typically developing child, the strongest positive relationship was observed when total number of types of morphemes relies between 89 and 136 ($r = 0.98$), which is the critical point for this child.

However, for the clinically developing child, the highest observed positive relationship was when the total

number different morpheme reaches in between 39 and 116 ($r = 0.96$), which is very safe to conclude morphosyntax (MLU) development is highly dependent on types of morpheme produced and the critical point relies on the area.

5. Conclusion

It is possible to say that there is a critical point on both cases (clinically developing and typically developing child). One question arises, however. There is no room to argue or pick up a single point as a mass critical point, rather arguing based on observed range of number of types of morpheme produced. Thus, the critical point for the clinically developing child is when the child total number of different morphemes reaches in between 89-136, whereas for the child with DLD relies between 39-116. The two figures clearly illustrates about the different words used and the mean length of utterances. The mean length of utterance increases, when the total number of different words increases; which to mean the number of words or morphemes and morphological development over age depends on the total number of different words used. However, the decrease of the relationship between morphosyntax/MLU and types of morpheme after some point (or the point considered critical) remains unclear and needs further investigation.

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