Variation in children's early production of multisyllabic words: The case of truncations

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1 Introduction

Young children often truncate words: they omit whole syllables from multisyllabic words, as exemplified in (1):

(1) [olwant] (Maarten, 1;10.19)
adult form: /ˈoliˌfɑnt/ 'elephant'

Typically unstressed non-final syllables in the adult target words are truncated (see Fikkert, 1994 for Dutch; Echols & Newport, 1992, Gerken, 1994 and Kehoe & Stoel-Gammon, 1997 for English; Lleo & Demuth, 1999 for German and Spanish). How can this phenomenon be explained? In the literature two possible sources for truncations have been established: the child's lexical representation ('a lexicon account'), and the child's grammar ('a grammar account').

1.1 'Lexicon' and 'grammar' accounts of truncations

A lexicon account stipulates that the child's lexical representation is deficient or underspecified. Consequently, the child's production reflects this immaturity in a truncated rendition of the adult word. The immature lexical representations are hypothesized to stem from a perceptual bias (i.a. Gleitman & Wanner, 1982; Peters, 1983; Echols & Newport, 1992): children have difficulties extracting non-final weak (or unstressed) syllables from the input. This relative difficulty is probably due to the lack of acoustic salience of non-final weak syllables. Consequently if those syllables are not salient for children in the earliest stages of lexical acquisition, they may simply fail to extract them from the input. As a result, weak syllables may not be represented in the child's lexical entry of a word. When this defective representation is fed into the word production process it leads to the syllable's omission in production.

Echols & Newport (1992) point at several other causes of truncations related to the child's lexical representation. In addition to a failure to extract non-final weak syllables from the input, a defective lexical representation may be due to an as yet immature ability to build fully specified representations. The unstressed syllable is represented in this case, but the syllable's segmental content is not fully specified. Or, truncations may be caused by an inability to retrieve lexical representations from memory during the production process.

Thus in this perspective, truncations can stem from a failure to extract information about the entire adult word from the signal, or from a representation failure, or from an extraction failure.

In a grammar account, truncations are explained as a way to accommodate words to prosodic templates, which correspond to the child's limited knowledge of the prosodic regularities of the language (Fikkert, 1994; Demuth, 1995; Gerken, 1996; Pater, 1997; Bernhardt & Stemberger, 1998). The initial prosodic template is a trochaic foot (Sw) and children adapt words to that template, hence, wSw words are rendered as Sw words and wS words as S words as shown in (2).

(2) a. [bɑutə] (Maarten, 1;10.14)
adult form: /kaˈbɑutər/, 'gnome'
b. [vɛt] (Maarten, 1;10.14)
adult form: /baˈvɛt/, 'bib'

Crucially, 'grammar accounts' (such as the Universal Grammar account proposed by Fikkert, 1994; or the Optimality Theory account elaborated by Pater, 1997), assume that the child has an adult-like lexical representation. From that representation, the grammar generates a form, which corresponds with the prosodic template. Thus, truncations are not due to a lexical process, but they are produced by the child's grammar.

In sum, truncations have been reported to occur in (very) young children's renditions of adult words. This phenomenon has been dealt with in essentially two ways: either the child's lexical representation is defective or the child's limited grammatical competence yields truncations. In this paper we focus on variation in children's truncation patterns, a phenomenon that poses a serious challenge to both the 'lexicon' and the 'grammar' account.

1.2 Variation and truncation

In the literature anecdotal evidence of intra word variation has been reported (i.a. Ferguson & Macken, 1983; Scollon, 1976; Macken, 1979): a child's renditions of a particular word may vary considerably. For instance, the Spanish speaking girl Si utters the word *'elefante'* at age 1;9 as in (3) (Macken, 1979: 33):

(3) hwantuti pfantındı panti bantındi bate

In this example the child's renditions of the target word *'elefante'* differ considerably. One characteristic is that Si truncates the adult word *'elefante'*: the target word has four syllables, but in Si's renditions, there are two or three syllables. This type of intra word variation poses serious problems for the 'lexicon account' as well as for the 'grammar account'. In both accounts, it is hard to see how intra word variation, i.e. the fact that the child produces a particular word in different ways at a specific point in time, can be accounted for.

The difficulty for a lexical account is caused by the hypothesis that truncations result from defective or underspecified lexical representations (see Wijnen, Krikhaar, & Den Os, 1994; Kehoe & Stoel-Gammon, 1997). If a truncation results from an incorrect lexical representation, we do not expect that a child alternates between correct and truncated productions. Instead, we expect that a word is produced consistently as a truncation at a particular point in time. Thus, if the lexicon contains a single entry for a particular word, how can a single entry lead to different word productions?

In a grammar account, intra word variation is difficult to explain for the following reason. An essential characteristic of most current grammar accounts is that the child's grammar allows only *one* grammatical form, and rejects all others (Fikkert, 1994; Prince & Smolensky, 1993; Tesar & Smolensky, 1998). This form remains the 'optimal form' until the grammar further develops. But, if the grammar generates only one optimal form, how can we explain the occurrence of two or more different forms, unless the existence of competing grammars is assumed (see Demuth, 1997; Boersma, 1997)?

Moreover in a 'grammar account' the problem turns up that words belonging to the same prosodic pattern, should in fact be treated in the same way. For instance, if the child operates with a template, all words with a particular rhythm should undergo the same truncation. Again, this does not seem to be the case. In (4) we show the renditions of swS words by the Dutch speaking child Maarten. At age 1;10.10, he produces words that consist of the sequence a syllable with secondary stress (s), an unstressed syllable (w) and a syllable with primary stress (S) in various different ways.

(4)
a. [pɑpəɣɑj]
adult form: /ˌpɑpəˈɣaj/, 'parrot'
b. [pɑpəɣɑi]
adult form: /ˌpɑpəˈɣaj/, 'parrot'
c. [ətəlat]
adult form: /ˌʃɔkoˈlɑt/, 'chocolat'
d. [sinəkɑs]
adult form: /ˌsɪntərˈklas/, proper name
e. [dɔmnik]
adult form: /ˌdomiˈnik/, proper name
f. [lɛlɑt]
adult form: /ˌʃɔkoˈlɑt/, 'chocolat'
g. [kɔkɔl]
adult form: /ˌkɔlɑrˈɣɔl/, proper name
h. [fon]
adult form: /ˌteləˈfon/, 'telephone'
i. [lɑt]
adult form: /ˌʃɔkoˈlɑt/, 'chocolat'

The examples in (4) show that even words with the same prosodic pattern are not produced in the same way at a particular age. Some renditions are not truncated while others are reduced to bisyllabic or even monosyllabic words. Hence the question arises how in a 'grammar account' this type of variation can be explained.

That variation is an important issue has largely been disregarded in the language acquisition literature: if treated at all, intra word variation is most of the time exemplified by anecdotal evidence. Most students of phonological acquisition have been concerned with what is considered to be their core business, i.e. explaining children's patterns of language use in terms of competence models. Variation in children's production patterns, such as variation in their truncations of multisyllabic adult words, has largely been disregarded within this research tradition. Within a cognitive approach (i.a. Ferguson & Macken, 1983; Garnica & Edwards, 1977) the phenomenon has been explored, but a thorough quantitative investigation is basically lacking. Recently this neglect of variation has been questioned: how is variation to be dealt with in models of language acquisition? Demuth (1997: 77) phrases the issue as follows: "One of the problems (...) with applying an optimality theoretic analysis to the area of language acquisition involves the issue of variation." In this paper we take up Demuth's lead: taking for granted that variation is a problem to be accounted for, how important is it? More specifically, we want to present a quantitative assessment.

1.3 Variation: a quantitative assessment of truncations

In the previous paragraphs we discussed truncations in children's renditions of multisyllabic target words. Two potential explanations of truncation patterns were elaborated on, a lexical and a grammatical one. Variation was indicated as a problematic factor for both accounts: how to explain the fact that children utter a specific word in different ways (even on the same day)? The question addressed in this paper is not primarily which account better explains the data, but what are the data to be explained: what is the volume of variation? Variation in children's renditions of adult targets has been reported anecdotally in the literature, however, a systematic quantitative assessment of variation is still lacking. In this paper we want to provide a systematic assessment of variation, restricted to the children's truncations of multisyllabic words. Our aim is in the first place to provide basic quantitative data that will permit us to address the following questions:

(1) What is the extent of variation within prosodic patterns? Is variation within prosodic patterns the default or the exception?

(2) Is variation within prosodic patterns typical for a specific stage in development? How do prosodic patterns evolve?

(3) How wide spread is intra word variation in children's production? Is variation a rare or a common phenomenon?

(4) Is intra word variation typical for a specific stage in lexical development? Does a word progress in a single step from a truncated form to a full form?

(5) Which factors can account for the observed variation?

In this paper we present a fine-grained analysis of the intra word variation in early word use. For this purpose we analyze naturalistic longitudinal data from a Dutch-speaking boy, Maarten, between the ages of 1;8.29 and 1;11.15.

2 Method

This study is based on the longitudinal corpus of a Flemish, Dutch-speaking boy, Maarten (Gillis, 1984; available through CHILDES, MacWhinney, 1999). The Maarten corpus was chosen because of its high density: 19 sessions over a period of approximately 80 days (from 1;8.29 until age 1;11.15) are available. The number of the child's word tokens ranges from 269 to 1890 word tokens (mean 1025, SD = 579) and from 48 to 318 word types (mean 158, SD = 92). The child's MLU in the first session is 1.28 words (SD = 0.54), MLU in the last session is 2.55 (SD = 1.50). In the observation period, Maarten's vocabulary size, as measured by means of a cumulative count of the types in each session, increased from 49 to 933 types.

The child's rendition of a multisyllabic target word was coded as a truncation if it contained less syllables than the target item. The prosodic pattern of each target word was extracted from the CELEX lexical database (Baayen, Piepenbrock, & Gulikers, 1995). The CELEX information on the location of primary stress was supplemented with the location of secondary stress on the basis of the description of Booij (1995).

3 Results

The child utters 5907 tokens of multisyllabic target words. 4886 of these have a correct prosodic form, 994 (17%) are truncated, and 27 (0.5%) have an additional syllable. The number of truncations decreases dramatically during the three month observation period: from 61% in the first 20 days to 7% in the last 20 days. The extent of variation in the use of truncations will be described on two different levels: first, we will discuss the occurrence of variation within prosodic patterns, then we will proceed to intra word variation, and finally we will discuss the causes of variation.

3.1 Variation within prosodic patterns

According to a grammar account of truncations, the prosodic pattern is the major determinant of variation. Consequently we expect variation between prosodic patterns, but not variation within a particular prosodic pattern. That the latter is not the case was already illustrated in (4).

Figure 1 provides a comprehensive overview of variation within prosodic patterns. The nine most common prosodic patterns are represented in figure 1. The X-axis shows the progression over time: four time intervals of equal length are distinguished. The Y-axis gives the percentage of truncated wordforms per prosodic pattern. There are two crucial observations. First of all, truncation percentages of 100% never occur, not in the early sessions nor in the late sessions. This means that there is always an alternation between correct and truncated productions. Secondly, there is no abrupt change in the curves, but a

gradual decline of the slopes. This means that on the whole prosodic patterns undergo a very gradual evolution from predominantly truncated to predominantly correct productions.

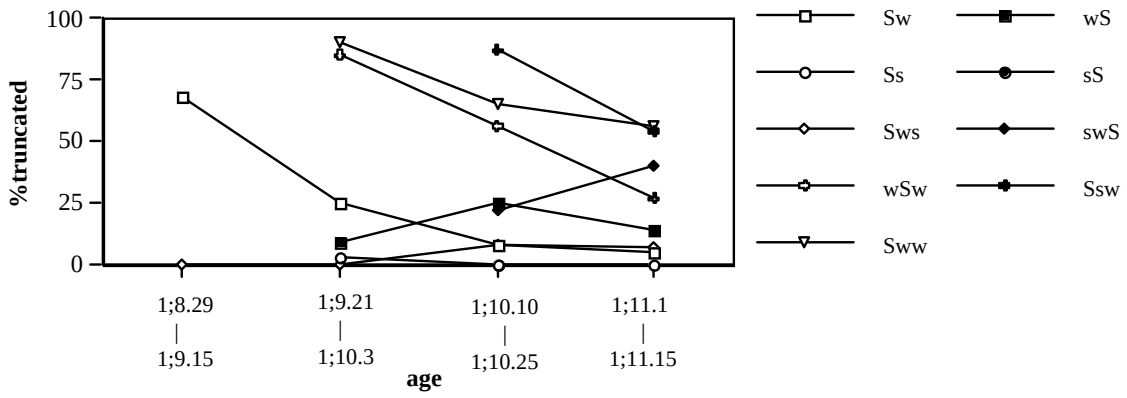

Figure 1: Evolution of the 9 most common prosodic patterns

These observations bear on the first two research questions. First of all, we can conclude that truncation is not an all-or-nothing matter: variation within prosodic patterns is not the exception, but the default. Secondly, variation occurs over the whole observation period. The occurrence of variation is not limited to a short 'experimental' stage followed by stable productions. Rather, the different prosodic patterns are gradually less prone to truncation.

3.2 Intra word variation

In (5) and (6) all the child's renditions during one session of a particular adult target word are enumerated. The child's renditions of the target words *'Colargol'* and *'Dominiek'* (both proper nouns), differ considerably in their segmental composition (e.g. *[kɔlɑ]* versus *[əɣon]*) as well as in their syllable length (e.g. *[mik]* is monosyllabic and *[domənik]* contains three syllables).

(5) 'Colargol', /ˌkɔlɑrˈɣɔl/, proper name (1;10.25)
[okol] [kɔlɑ] [əɣon] [ɣon] [kol]

(6) 'Dominiek', /ˌdomiˈnik/, proper name (1;11.8)
[domənik] [domnik] [əmik] [mənik] [dənik] [mik]

The high density of the database permits a thorough analysis of the extent of variation in the production of multisyllabic target words. Most sessions contain multiple target words which are produced at least 10 times during that session (imitations excluded). In figure 2 we present an analysis of the variation in the use of these frequent target words. Target

words that are produced correctly throughout by the child are labeled ‘correct’, targets that are consistently truncated are labeled ‘truncated’, and targets with both correct and truncated renditions are labeled ‘variable’. The figure displays the number of ‘correct’, ‘truncated’ and ‘variable’ target words per session.

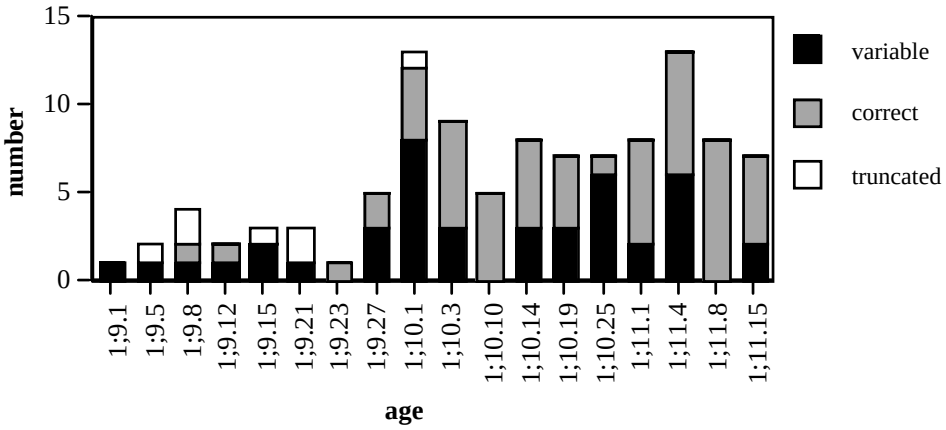

Figure 2: ‘Correct’, ‘truncated’ and ‘variable’ renditions of target words (f > 10)

Figure 2 shows that a high proportion of words is ‘variable’: 41% of the word types in the corpus have a variable form (43/106 word types). In some sessions variable types even largely outnumber consistently ‘correct’ and ‘truncated’ ones. For instance, at age 1;10.25 only 1 of 7 words shows a fixed form. However it is not the case that ‘variable’ targets are characteristic of the earlier sessions: ‘variable’ types occur in the early sessions as well as in the later ones. Overall, consistently ‘truncated’ targets are less frequent (7%) and they are more frequent in the earlier sessions. Consistently ‘correct’ targets are the most frequent type (53% overall), their proportion increases over time: from 0% in the first session to 71% in the last session.

The main conclusion of this analysis is that intra word variation is frequent throughout the corpus.

3.3 Intra word variation in a developmental perspective

The analysis in the previous session lumps together the development of individual words. In this section the developmental profiles of individual words will be scrutinized: does every word show a gradual developmental progression from consistently truncated to correctly rendered?

An analysis of the three most frequent multisyllabic words, viz. *‘auto’ (car), ‘Steven’ (proper name)* and *‘sleutel’* (*key*) supports the hypothesis that words undergo a gradual development. The most frequently uttered word, *‘auto’ (/ˈauto/, car, 783 tokens*) is almost never truncated and, hence, not very relevant for this analysis. The development of the words *‘Steven’* and *‘sleutel’* is displayed in figures 3 and 4. Both words are consistently truncated during the first sessions in which they occur. The word *'Steven' (/ˈstɛvə/, proper name, 394 tokens)* is consistently truncated to *[stes]* until the 6th session (child’s age:

1;9.21). The word *'sleutel' (/ˈsløtəl/, key, 245 tokens)* is consistently truncated to *[søt]* during the first session (child's age 1;8.29). After this initial stage of consistent truncation, both words display a gradual evolution: first a stage in which correct and truncated renditions alternate ('*Steven'* at 1;10.1 and 1;10.3; '*sleutel*' at 1;10.1), followed by a stage in which the correct form predominates.

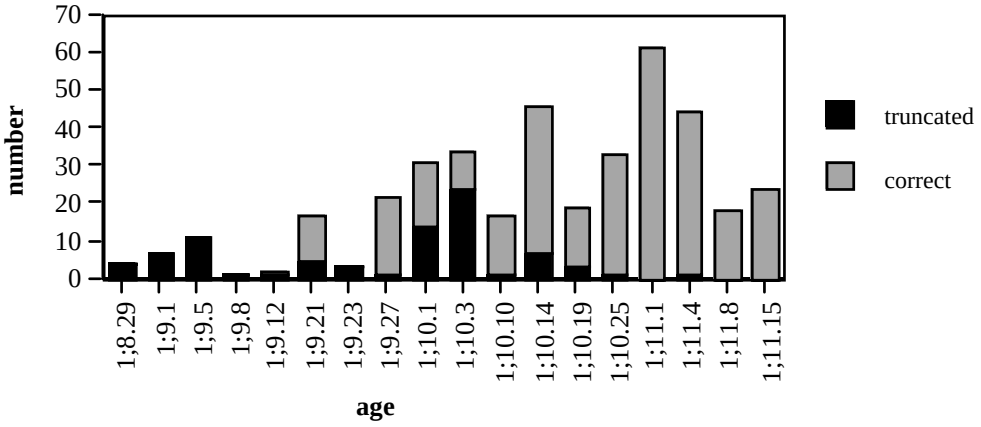

Figure 3: The evolution of *'Steven'*

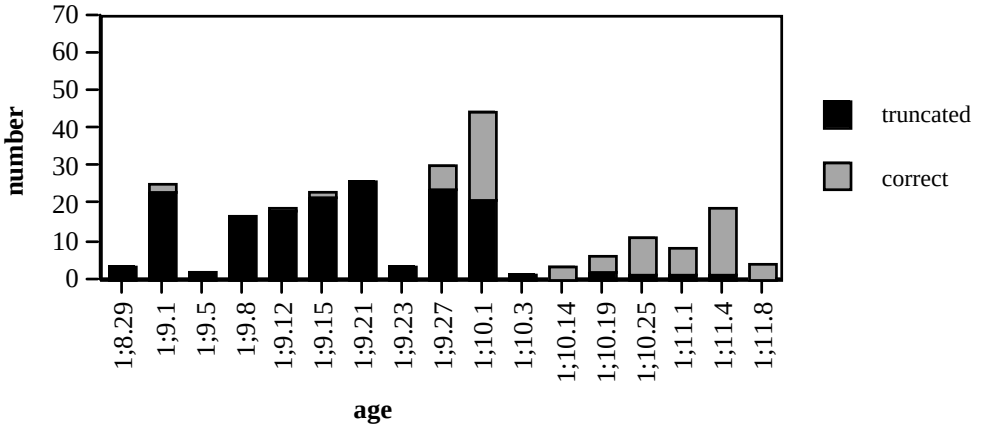

Figure 4: The evolution of *'sleutel'*

But, how do the other words in the corpus develop? We distinguish three possible scenarios of development. (1) There is a gradual change. The word passes through a relatively long transitional period during which truncations and correct forms alternate (e.g. *'sleutel'* or *'Steven'*). (2) There is a very short transitional stage: variable productions occur in only one session, after which the word is rendered correctly. (3) The transition from truncated to full forms is abrupt. In this case, variable productions do not occur at all:

sessions with consistently truncated productions are immediately followed by sessions with consistently correct productions.

Most words fit in the first scenario. They pass through a transitional stage in which both truncations and correct forms are produced. This conclusion is based on an analysis of the 51 target words which occur at least twice correctly and twice truncated in the corpus. A comparison of the age of the last truncated production with the age of the first correct production, reveals that for 6 of the 51 words, the age of the first correct form is after the age of the last truncated form. Thus, these 6 words provide evidence for the third scenario: an abrupt change from truncated to full forms. For 11 words, the first correct form and the last truncated form are produced at the same age. These data support the second scenario, which assumes a short transitional stage. For 34 of the 51 words the age of the first correct production is before the age of the last truncated production. This means that these words pass through a transitional stage, which displays an overlap between the last truncated form and the first correct form (the first scenario). Thus, the majority of the words undergo a gradual development.

In summary, most words pass through a stage in which correct and truncated forms alternate. Thus, variation appears to be an essential characteristic of the learning curve.

3.4 Causes of variation

In this section we turn to the determinants of intra word variation. In the literature a word's prosodic pattern is considered to be the major determinant of truncations. In this section we will analyze non-prosodic factors, viz. factors related to phonemic structure, lexical history, and utterance and interactional context.

3.4.1 The phonemic structure

Although the prosodic structure is generally seen as the major determinant of truncations, our investigation reveals that also the phonemic level is relevant for truncations. Considering only Sw words, it appears that the vowel of the final syllable has a considerable effect on the truncation rate. In Dutch, the vowel in the final (weak) syllable of Sw words can be a schwa (7a - 7b) or a full vowel (7c).

7 (a) [søt] (1;9.21)
adult form: /ˈsløtəl/, 'key'
(b) [to] (1;11.8)
adult form: /ˈtorə/, 'tower'
(c) [kɔfi] (1;9.27)
adult form: /ˈkɔfi/, 'coffee'

In figure 5 the truncation rate of the two types of Sw words are plotted. The top line shows the percentage of truncations of word tokens with a schwa in the final syllable, the line at the bottom shows the percentage of truncations of words with two full vowels. It is clear that there is a huge discrepancy between the two: words with two full vowels are

hardly ever truncated, whereas words with a schwa show a truncation rate of about 90% at the beginning. Even in the last subperiod, the difference is statistically significant ($\chi^2(1)=12.89$; $p<.001$).

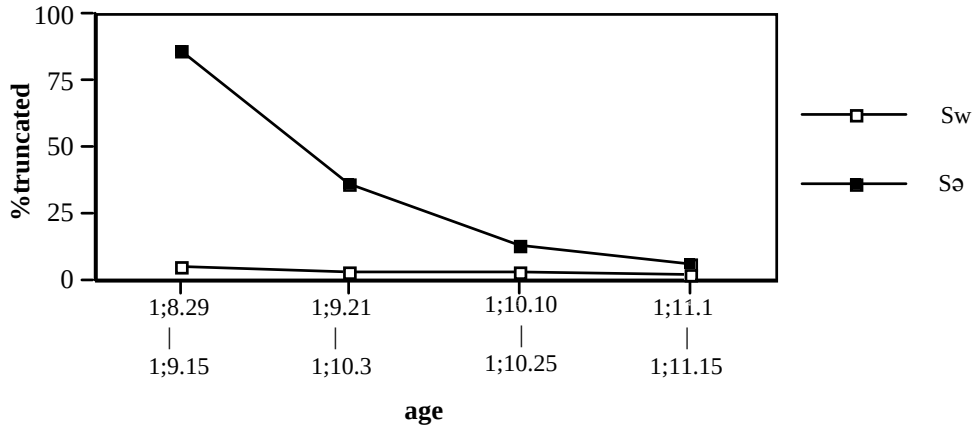

Figure 5: Sw words with a schwa (Sə) versus Sw words with two full vowels (Sw).

In previous research (Taelman & Gillis, 2000) other non-prosodic effects were reported: (1) An effect of syllable structure: weak initial syllables with a coda are never omitted in the corpus. (2) An effect of sonority: the medial syllable of swS words and Sws words is more often truncated if it starts with a sonorant consonant than if its onset is not sonorant.

Thus, the sensitivity to truncation is not only determined by the syllable's prosodic status, but also by the segmental content: effects of the presence of the schwa, of the syllable structure and of sonority were established. This leads to the conclusion that, with respect to the levels of the sonority hierarchy which are deemed to be irrelevant, such as the segmental level, major sonority categories, and syllable structure, all of them appear to have an influence on variation in the child's truncation patterns.

3.4.2 The lexical history

In addition to purely phonological factors, also factors related to a word's lexical history can be shown to exert an effect on truncations, and to have an influence on intra word variation.

Consider Sw words again, and within that prosodic pattern only words with a schwa in their final syllable. There are importance differences between S-schwa words. For instance, the evolution curves of *'open' (/ˈopə/, open, 62 tokens)* and *'toren' (/ˈtorə/, 'tower', 130 tokens)* depicted in figure 6, demonstrate that *'toren'* has a much higher truncation percentage than the word *'open'*.

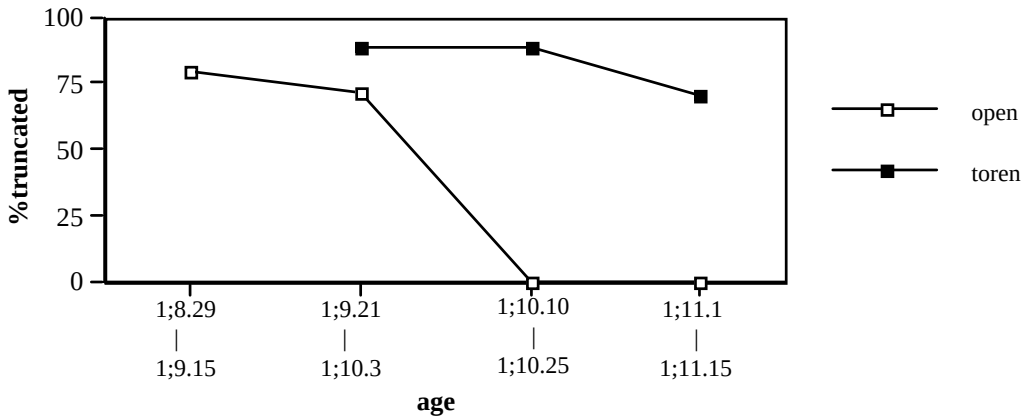

Figure 6: The evolution curves of *'open'* and *'toren'*

The observed variation may be due to differences in the child's 'experience' with the individual words. In this respect four factors will be examined: (1) 'Word age': some words are recently acquired, whereas other words are already 'old'. 'Old' words are more familiar and may be less prone to truncation than 'new' ones. (2) 'Intensity of use': the child utters some words more often than others, and the relative frequency of use may have an effect on the truncation rate. (3) 'Input frequency': words that are frequent in the adult's language may be less prone to truncation than words that occur less often in the input. (4) 'Prior truncation rate': words will be more easily truncated if truncated more often before.

In order to analyze these four factors, the multisyllabic words of the last period (1;11.1-1;11.15) were selected. For each word the word age was defined as the time lapse between the last period and the period of the word's first occurrence in the corpus. A word's intensity of use was computed as the number of productions prior to the last period, divided by the word's age. The frequency in the adult speech was determined by means of a frequency count on the adult utterances in the corpus. 'Prior truncation rate' was computed as the number of truncations prior to the last period, divided by the number of productions.

A regression analysis was run with the truncation rate in the last period as the predicted variable. The analysis reveals that the 'word age' is a significant effect, which means that older words are less often truncated than new words ($F(1, 283)=7.5$; $p < .01$). The second significant effect is the 'prior truncation rate': words with a high prior truncation rate are still more liable to truncation ($F(1, 283)=31.9$; $p < .001$). 'Intensity of use' and 'frequency in the input' are not significant according to the analysis.

The regression analysis shows that particular lexical factors play a role in the child's truncations: older words are truncated less easily, words with a high prior truncation rate are still more liable to truncation. The child's experience with individual words appears to contribute to the variation between individual words.

3.4.3 The context

In addition to "phonemic structure" and "lexical history" also the context in which the child uses a word was investigated. Context was understood as (1) the 'interactional context' and (2) the 'utterance context'.

An aspect of the interactional context is the effect of imitation: if a word is present in the immediately preceding adult utterance, it may be less difficult to reproduce it than when the word is not present in the interactional context (Leonard, Schwartz, Folger, & Wilcox, 1978). This is why we expected less truncations in cases of imitation than in spontaneous utterances. The presence of the correct model in the preceding adult utterance, has indeed an effect on the child's truncations: 13% of the imitated productions are truncated, versus 18% of the spontaneous productions ($\chi^2(1)=20.02$; $p<.001$). The effect is small but significant.

The second 'contextual' factor investigated is 'utterance length'. The planning of a long utterance may demand more from the child's production resources than a short one. This additional call on resources may occur at the expense of attention for the pronunciation of individual words (see Johnson, Lewis, & Hogan, 1997). Consequently the prediction was tested that more truncations occur in multi-word utterances than in one-word utterances. This prediction was tested in each of the four subperiods, in order to avoid the influence of age on utterance length (the older, the more multi-word utterances and the less truncations). In figure 7 the percentage of truncations in one-word and multi-word utterances is displayed. Trochaic target words, i.e. words with initial primary stress, are not significantly more often truncated when they occur in one-word utterances than in longer utterances. However, there is a significant effect of utterance length on the truncation of iambic words, i.e. words without initial primary stress (2^d period: $\chi^2(1)=14.59$, $p<.001$; 3^d period: $\chi^2(1)=13.69$, $p<.001$; 4^{th} period: $\chi^2(1)=6.94$, $p<.01$, Yates' correction). Thus, utterance length plays a role, but only for the iambic words.

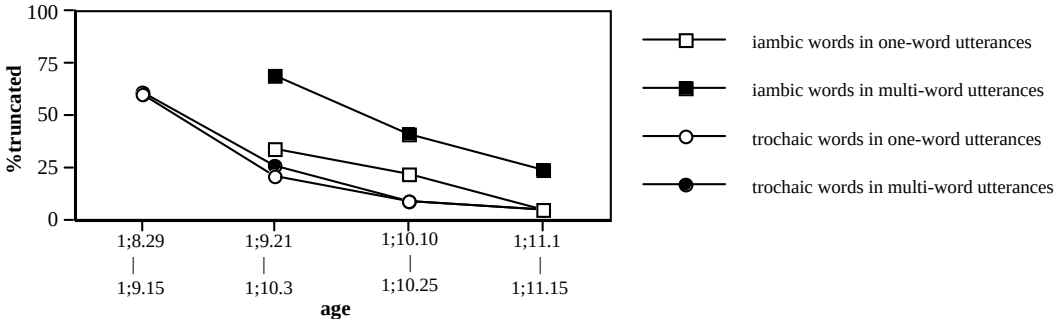

Figure 7: The influence of utterance length on truncation

In summary, imitation and utterance length play a role in the child's truncation of multisyllabic words. Both effects are processing factors, which diminish (in the case of imitation) or increase (in the case of utterance length) the production load.

4 Discussion

In this paper we discussed children's truncation of multisyllabic words. An in-depth case study of truncations in a Dutch speaking Flemish boy was presented. The main aim of the analysis was to provide a systematic and quantitative assessment of the variation in the use of truncations. This is a critical issue for two important current accounts of truncation, referred to as the grammar account and the lexicon account, since both accounts have problems to deal with the phenomenon of variation.

Five empirical questions were investigated. For each question, we summarize the relevant observations.

(1) What is the extent of variation within prosodic patterns? A prosodic pattern is never truncated consistently: truncated productions occur next to correct productions. Thus, variation within prosodic patterns is not the exception, but the default.

(2) Is variation within prosodic patterns typical for a specific stage in development, or: How do prosodic patterns evolve? The different prosodic patterns undergo a very gradual evolution, during which the proportion of truncated productions diminishes bit by bit. Thus, variation is not typical for a specific stage of development. In other words, we do not find an evolution pattern in which stable periods are followed by short experimental (variable) stages.

(3) How wide spread is intra word variation in children's production? We found many examples of variation during one session (41% of all frequently produced targets). Intra word variation is wide spread throughout the database. It forms a fundamental characteristic of the data.

(4) Is intra word variation typical for a specific stage in lexical development, or: How do individual words evolve? Most words pass through a stage in which correct and truncated forms alternate. Thus, variation is an essential characteristic of the learning curve. Most words undergo a gradual evolution.

(5) Which factors can account for the observed variation? We have indicated a number of factors that are not easily explained by just referring to the metrical structure of the words. First of all, we observe influences of the phonemic structure. For example, syllables with a schwa are more liable to truncation than other syllables. The variation within prosodic patterns is also due to the influence of the lexical history of individual words (the word age). Intra word variation is partly explained by the influence of the interactional context and the utterance context. Words that are imitated are less frequently truncated than spontaneously uttered words, and words in multi-word utterances are more often truncated than words in one-word utterances.

What do these findings tell us about the 'grammar account' and the 'lexical account' of truncations? The least we can say is that the types of variation that we identified as well as the amount of variation pose some challenges to both accounts.

The crucial observation for the *grammar account* is the high frequency of variation within words and within prosodic patterns. If the grammar licenses only one optimal output for each prosodic pattern, how is variation within prosodic patterns accounted for? Variation can possibly be accounted for in the framework of Optimality Theory provided that gradual learning and stochastic variation are incorporated in the learning theory (Boersma, 1997).

Also the influence of a word's lexical history should be integrated in some way in a grammar account. In this paper, the effect of 'word age' and of 'prior truncation rate' on a word's truncation rate were established. But, it is unclear how these factors can be dealt with in a grammar account.

Another problematic observation concerns the effect of the context in which a word is used. A grammar account cannot explain why children more easily produce a correct form in case of imitation, or a truncated form in case of a longer utterance. These factors are in fact performance limitations, and again the question crops up how a competence account can deal with those.

A positive point for the current grammar account, Optimality Theory, is its flexibility to combine effects/constraints from different levels of the phonological representation. This paradigm enables us to incorporate the effect of the prosodic level and the observed effects of the segmental structure in one model.

The *lexicon account* faces similar problems. Problematic again is the observed intra word variation. A truncation cannot be explained by means of a deficit in the lexical representation, when the child produces the non-truncated form next to the truncated form. The hypothesis that the lexicon account fits better with truncations at an early age (Echols & Newport, 1992), stands square on the observation of correct as well as non-correct forms in the earliest stage of word use. Thus, a lexical deficit may not be the most appropriate explanation of the early truncations because of the occurrence of correct, non-truncated renditions of multisyllabic words.

Another problematic observation is the effect of utterance length, because this factor exerts its influence only after retrieval from the lexicon. On the other hand, the observed lexical factors are more compatible with a lexicon account. It is plausible that 'older' words are better represented in the lexicon than newly acquired words.

We conclude that since variation is an essential characteristic of children's language use, models of children's language acquisition should be able to account for it. Variation is not 'free', but influenced by lexical, phonemic and contextual factors which should be incorporated in models of acquisition.

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