Compounds Triggering Prosodic Development

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1. Introduction

This paper argues against the commonly held view that structures that are less complex are easier to learn than more complex structures. Instead, it argues that the structures that are learned more easily are those for which the evidence is particularly clear to the language learner, independent of their grammatical complexity. To show this I will consider the acquisition of prosodic structure of both monomorphemic words and compounds restricting myself to nouns and nominal compounds in Dutch.

I will only use evidence from production data. The data come from a large database, currently available also through CHILDES (MacWhinney 1995), which contains spontaneous longitudinal data from 12 children acquiring Dutch as a first language (Fikkert 1994; Levelt 1994). The children were between 1 and 2 years old at the start of a one-year period of data collection. In addition, I will use some data from my oldest daughter Hilde.

Compounds are usually regarded as more complex than monomorphemic words, simply because they consist of at least two monomorphemic words. But are compounds consisting of two feet also more complex than monomorphemic words consisting of two feet? Often, such compounds are prosodically more complex than monomorphemic words, since they may, for instance, have intervocalic consonant clusters not allowed in monomorphemic words. In, for instance, the Dutch words *brand_slang* ['brant,slan] ‘fire hose’ and *vlieg_tuig* ['vli^toeyx] ‘airplane’ the underlined consonant clusters could never arise in a monomorphemic word, since in the latter no more than three consonants (a coda and an onset cluster) can occur after a short vowel, and no more than two (which must form an acceptable onset cluster) after a long vowel, as in *cen_trum* ['sen.trum] ‘centre’ and *ze_bra* ['ze:.bra:] ‘zebra’. Word-internal syllables always
contain two positions in the rhyme: a long vowel or a short vowel plus a consonant. Therefore, the syllable boundary in such monomorphemic words invariably falls after the vowel if it is long, otherwise after the first consonant of a sequence of consonants. Consequently, the consonants after the syllable boundary must form a possible onset of Dutch. Therefore, the $gt$ cluster, as in for example vliegtuig ['vliːgtʰuɪ̯] ‘airplane’, cannot arise in monomorphemic words, and indicates a compound. The constraints on possible word-internal consonant clusters are dictated by constraints on syllable structure; in particular, those determining well-formed onsets, and those determining possible rhymes.

On the basis of these structural prosodic observations one could argue that since compounds often contain more complex structures they will be learned later than monomorphemic words of the same length. It will be shown that this hypothesis is not borne out by the data. Rather, the acquisition of compounds guides the child in acquiring monomorphemic words consisting of more than one foot.

In this paper we will look at how children’s systems develop in the course of acquisition; and what kind of information or evidence in the input children use to build up their phonological (or, more general, their grammatical) system. I will show that children’s developmental stages can be well described in terms of parameter setting: if children discover particular cues in the input data, they use this information to set parameters from the unmarked (default) to the marked value; children do not necessarily use the whole input word from the start for their production forms, but they only use the segmental content contained in a prosodic category of the target (often smaller than a word); and children build upon their own systems, which gradually become more like the system of the adult.

In other words, the child’s grammar is never dramatically different from the adult’s (the same principles and parameters are at stake), but may differ in the sense that not all parameters are set, i.e. all or some may still have the default value or may still be irrelevant. Parameters are not all set simultaneously (as would have been done by the ideal (instantaneous) learner (cf. Dresher & Kaye 1990; Gillis et al. 1992), but are set when they become relevant and only after the required evidence for the marked setting is encountered.

The paper is organized as follows. § 2 gives a short description of the target grammar that children learning Dutch are to acquire. § 3 summarizes the main findings of Fikkert (1994), which describes the intermediate stages found in the acquisition of monomorphemic words. § 4 accounts for the first acquisition stages, based on Fikkert (1994). In § 5 it will be discussed how the acquisition of compounds fits into the developmental pattern. § 6 argues that the complex prosodic structure of compounds helps the child in learning to analyze the prosodic patterns of target words.
2. Background: The prosodic system of Dutch in a nutshell

Without going into details of the stress system of Dutch (see Kager 1989 or Booij 1995 for overviews) the main parameters that I assume to be relevant for describing the Dutch (both adult and child) stress patterns are given in (1). (1a) gives the parameters that determine the foot shape, (1b) those that determine the parsing of feet, (1c) those relevant for distinguishing between main and secondary stressed feet, and (1d) gives the parameter for compound stress.

\[
\text{(1) Stress parameters with settings for Dutch}^1
\]

\[\text{a. Foot-shape parameters}
\]
- **headedness parameter**: Feet are strong on the \text{LEFT}/right
- **quantity-sensitivity (QS) parameter**: Feet are quantity-sensitive/QUANTITY-INSENSITIVE
- **weight parameter**: Feet are QS to closed syllables/nucleus/rhyme

\[\text{b. Parameters of foot construction}
\]
- **directionality parameter**: Feet are built from the \text{right}/left
- **iterativity parameter**: Feet are built iteratively [yes/NO]

\[\text{c. Word tree dominance parameters}
\]
- **main stress parameter**: The word-tree is strong on the \text{right}/left
- **extrametricality parameter**: There is an extrametrical unit [yes/NO]
- **unit of extrametricality (EM) parameter**: The unit of EM is a [consonant C, a mora \(\mu\), a syllable \(\sigma\), a foot F, a monosyllabic foot, etc.]

\[\text{d. Compound stress parameter}
\]
- **compound stress parameter**: Stress the [left/right] prosodic word of a compound.

The underlined value is the value required for Dutch. The parameters for which a universal default value\(^2\) can be assumed are in capitals.

In other words, Dutch has quantity-sensitive (QS) trochaic feet built iteratively from right to left. Closed syllables count as heavy for stress. Although vowel length is contrastive in Dutch, long vowels do not count as heavy. Main stress is on the last foot, unless this foot consists of a heavy syllable. In that case the final foot would be extrametrical, and main stress would be on the pre-final foot. Superheavy syllables (-VVC and -VCC) are not made extrametrical, and receive stress in the unmarked case. Compounds have stress on the main stressed syllable of the first prosodic word.
With regard to syllable structure it is important to mention that although Dutch has a vowel length contrast in closed syllables, this contrast mainly manifests itself in word-final position where superheavy syllables are allowed. Word-internal superheavy syllables are rare; in general, word-internal rhymes either consist of a long vowel or of a short vowel plus a consonant. Thus, usually only -VC or -VV rhymes occur word-internally, whereas in word-final position -VVC and -VCC rhymes can also be found.

Given the default values in (1), children acquiring Dutch have to learn that Dutch is a QS language. They also have to learn what determines quantity. Furthermore, they have to learn that feet are built iteratively, that main stress is right, and that final feet consisting of a heavy syllable are extrametrical, i.e. they cannot receive main stress. Let us now review the earlier findings regarding the acquisition of prosodic structure in monomorphemic words.

3. Acquiring the prosodic structure of monomorphemic words: A description

All early production forms of children are monosyllabic, and they usually correspond to adult monosyllabic forms, showing that children are able to select those input forms for production that match their phonological system (Schwartz & Leonard 1982; Schwartz et al. 1987). Hilde, for example, for a long time had no disyllabic forms (other than ‘papa’ and ‘mama’), and most of her forms corresponded to monosyllabic targets. Shortly before she produced disyllabic forms, she had monosyllabic forms corresponding to disyllabic targets (2a), and barely two weeks later, she produced them as disyllabic (2b). Crucially, if disyllabic targets are reduced, it is always the stressed syllable of the adult target that surfaces in the child’s production form. (2c) shows that at this stage monosyllabic target words are sometimes produced as disyllabic. Thus, at stage 1, words can be both monosyllabic or disyllabic, as long as they form a single foot.

(2)  

Monosyllabic Stage (STAGE 0)

a. vakantie ‘vacation’ /vaːˈkansi:/ → [kaːsi:] Hilde (1;4.15)  
zitten ‘to sit’ /ˈzitən/ → [tiːs]  
appel ‘apple’ /ˈapəl/ → [ap]

One Foot Stage (STAGE 1)

b. vakantie ‘vacation’ /vaːˈkansi:/ → [ˈkaːʃi:] Hilde (1;4.30)  
zitten ‘to sit’ /ˈzitən/ → [ˈtiːtaː]  
appel ‘apple’ /ˈapəl/ → [ˈapaː]

c. koek ‘cookie’ /ˈkʊk/ → [ˈkʊkə] Hilde (1;4.30)  
kop ‘cup’ /ˈkɔp/ → [ˈkʊpə]
Insofar as stress and number of syllables is concerned, disyllabic adult words with initial stress are produced correctly from a very early stage by most children. Disyllabic words with final stress are not only significantly more often truncated, but also show significantly more stress errors (Fikkert 1994; Archibald 1995). This is in line with observations brought up in the literature on the acquisition of stress: namely, that children seem to have a bias for a trochaic pattern, and are most likely to retain stressed and final syllables in their own production of target words (cf. Allen & Hawkins 1978, 1980; Echols 1987, 1988; Echols & Newport 1992; Gerken 1994a,b, 1996; Fikkert 1994, 1995; Demuth 1995, 1996a,b; Demuth & Fee 1995; Wijnen et al. 1994; Lohuis-Weber & Zonneveld 1996).

On further inspection the disyllabic target words with final stress show a clear pattern of development, as shown in (3a–d).

(3) **Stages of development (all data from Robin)**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Word</th>
<th>Target</th>
<th>Phonetic</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>ballon /ba'lon/</td>
<td>[momə], [bɔmə]</td>
<td>(1;7.13)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>konijn /ko'nein/</td>
<td>[tœin], [tœin]</td>
<td>(1;7.27)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trompet /trɔm'pet/</td>
<td>[put]</td>
<td>(1;9.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>banaan /ba'naan/</td>
<td>[pɑn]</td>
<td>(1;10.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>muziek /my'sik/</td>
<td>[sik]</td>
<td>(2;0.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>banaan /ba'naan/</td>
<td>[ban]</td>
<td>(2;1.7)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>ballon /ba'lon/</td>
<td>[bʊːn]</td>
<td>(2;1.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gitaar /gi'tar/</td>
<td>[sɪtə]</td>
<td>(2;1.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>giraf /gi'raf/</td>
<td>[fiəf]</td>
<td>(2;1.26)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>ballon /ba'lon/</td>
<td>[ba'nɑn]</td>
<td>(2;1.26)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kasteel /ka'stel/</td>
<td>[tɑs'tɛl]</td>
<td>(2;1.26)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>banaan /ba'naan/</td>
<td>[ma'nɑn]</td>
<td>(2;2.27)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>misschien /mys'chin/</td>
<td>[pɪ'zin], [mɪ'zin]</td>
<td>(2;3.10)</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>meneer /mə'neər/</td>
<td>[mə'nɛr]</td>
<td>(2;2.22)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>misschien /mys'chin/</td>
<td>[mɪ'sɪn]</td>
<td>(2;3.10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>konijn /ko'nein/</td>
<td>[ko'neɪn]</td>
<td>(2;4.8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kameel /ka'meəl/</td>
<td>[ko'mɛw]</td>
<td>(2;4.29)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>muziek /my'sik/</td>
<td>[my'sik]</td>
<td>(2;4.29)</td>
<td></td>
</tr>
</tbody>
</table>

As is clear from these data, the transitions from stage to stage are always gradual. There will be forms from both the previous and following stage, which may obscure the developmental pattern. Nevertheless, these four stages can be
clearly distinguished. They are also attested in the data of other children (cf. Fikkert 1994). The developmental pattern for disyllabic words with final stress that can be detected from the data can (albeit in a simplified fashion) be summarized as in (4):

(4) **Summary of developmental pattern for disyllabic targets with final stress**

**Stage 1:** Adult disyllables with final stress are truncated to monosyllables. The final syllable — the stressed one — is kept in the child’s realization. An extra syllable is sometimes added.

**Stage 2:** Both syllables of the adult target word are realized. However, contrary to the adult pattern, they are produced with initial stress.

**Stage 3:** Again both syllables of the adult target word are realized, but receive an equal amount of stress, resulting in level stressed forms.

**Stage 4:** In respect to the number of syllables and stress patterns, the child produces the word in an adult-like manner.

For disyllabic target words with initial stress, no developmental pattern can be detected. They are produced correctly insofar as the stress pattern and the number of syllables is concerned. In other words: \((\sigma_s \sigma_w)_{\text{wd}} \rightarrow (\sigma_s \sigma_w)_{\text{wd}}\) during all stages, except the first monosyllabic stage.

Two observations about the data are crucial. First, the stressed syllable of the adult word is always maintained, and second, the stressed syllable of the adult word is not necessarily stressed in the child’s form. These observations indicate that stress in the adult target is important, since it guides the child in selecting material from the adult target. Furthermore, the child could not be picking out a prosodic constituent from the adult target with its segmental material, because then the attested stress errors would not be expected. That is, foot structure is not copied along with the segmental material: stress and segmental structure are largely independent. If we look at the child’s production of trisyllabic adult words, the pattern in (5) surfaces:

(5) **Adult target**

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Trisyllabic words with penultimate stress</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pantoffels ‘slippers’</td>
<td>/pæntˈoʊfəls/</td>
<td>/pæntˈoʊfəls/</td>
<td>/pæntˈoʊfəls/</td>
</tr>
<tr>
<td>spaghetti ‘spaghetti’</td>
<td>/ˈspætəhi/</td>
<td>/ˈspætəhi/</td>
<td>/ˈspætəhi/</td>
</tr>
</tbody>
</table>
b. *Trisyllabic words with final stress*

- **telefoon** 'telephone' [ˈtɛləˈfɔːn] [ˈteːməʃuːn] [ˈteləˌfɔːn]
- **krokoːdil** 'crocodile' [ˈdiːw] [ˈkoːw] [ˈkeːkətw] [ˈkɔkədiw]

At the first two stages one trochaic foot is produced. At the third stage a second foot is produced, where both feet receive an equal amount of stress. The forms in (5b) and (5c) show a similar developmental pattern, although the adult forms differ in the location of main stress: in (5b) main stress is final and the antepenultimate syllable has secondary stress; in (5c) main stress is on the antepenultimate syllable and the final syllable has secondary stress. At the first stage, the rightmost foot is produced, or rather the segmental material of the rightmost foot is selected for production, independent of the stress level in the adult word. It is not the main stressed foot, but the rightmost foot (bearing at least secondary stress) that is selected. At stage 2, the initial syllable is adjoined to the monosyllabic form of stage 1, and the resulting string of segments is produced as a trochee. At stage 3 two feet are produced, both with an equal amount of stress. At stage 4 main stress is assigned; it is, however, not assigned to the rightmost foot (the normal location for main stress in Dutch), but to the leftmost foot.

For the data in (5b) there is a fifth stage in which the stress pattern is as in the adult words: final main stress and antepenultimate secondary stress. Some more data are given in (6), (7), and (8).

(6) **Tirza: trisyllabic words with penultimate stress**

a. **Stage 1 and 2**
- vakantie 'vacation' /vaːˈkænsi/ → [ˈtaːsiː] (1;8.5)
- kabouter 'gnome' /kaːˈbautə/ → [ˈbautə] (2;1.7)

b. **Stage 3**
- tracteren 'to treat' /traːkˈtɛrə/ → [ˈtakˈtɛːrə] (2;5.21)
- kabouter 'gnome' /kaːˈbautə/ → [ˈkaːˌbautə] (2;5.21)

c. **Stage 4**
- tracteren 'to treat' /traːkˈtɛrə/ → [ˈtakˈtɛːrə] (2;5.21)

(7) **Tirza: trisyllabic words with final stress**

a. **Stage 1**
- telefoon 'telephone' /ˈtɛləˈfɔːn/ → [ˈχoːn] (1;9.11)
- paraplu 'umbrella' /ˌpəraˈpluː/ → [ˈpərəˈpluː] (1;10.22)
b. **Stage 2**

boerderij ‘farm’ /burda’rei/ → ['podei] (1;11.19)

c. **Stage 3’**

muzikant ‘musician’ /myzi:kant/ → ['tik’tunt] (1;11.19)

boerderij ‘farm’ /burda’rei/ → ['py:haj] (2;0.18)

boerderij ‘farm’ /burda’rei/ → ['bur’dai] (2;1.17)

d. **Stage 3**

papegaai ‘parrot’ /papɔ’xaj/ → ['papɔ’xaj] (2;2.12)

koningin ‘queen’ /kɔni’gin/ → ['kɔni’gin] (2;5.5)

indiaan ‘Indian’ /indi’jan/ → ['indi’janə] (2;5.5)

telefoon ‘telephone’ /tei’a’fon/ → ['tei’nə’on] (2;5.21)

e. **Stage 4**

Amsterdam idem /a’mstə’dəm/ → ['emsta.dem] (2;3.27)

koningin ‘queen’ /kɔni’gin/ → ['kɔni’gin] (2;5.5)

(8) **Tirza: trisyllabic words with initial stress**

a. **Stage 1**

olifant ‘elephant’ /’o:li:,fant/ → ['ant], ['aunt] (1;11.19)

b. **Stage 2**

Gideon name /'gi:de:jon/ → ['gi:i] (2;0.5)

olifant ‘elephant’ /’o:li:,fant/ → ['oiləsant] (2;0.18)

kangoeroe ‘kangaroo’ /’kaŋɡəru:/ → ['kanto:] (2;1.17)

ooievaar ‘stork’ /’o:jə,vər/ → ['oja:] (2;2.12)

c. **Stage 3’**

olifant ‘elephant’ /’o:li:,fant/ → ['oimfəsant] (2;0.18)

d. **Stage 3**

goochelaar ‘conjurer’ /’go:ʃə,lær/ → ['soi’ʃər] (2;2.12)

olifant ‘elephant’ /’o:li:,fant/ → ['oila’sənt] (2;2.25)

e. **Stage 4**

allemaal ‘all’ /’aλə’məl/ → ['a:no,sa:] (2;1.17)

olifant ‘elephant’ /’o:li:,fant/ → ['oila’limp] (2;3.12)

ooievaar ‘stork’ /’o:jə,vər/ → ['oja’fər] (2;6.12)

These data also show an intermediate stage 3’. This stage can only be accounted for by assuming that the child’s own output forms at each stage play a crucial role in further development. The data in (7c) and (8c) typically precede stage 3, but already have the level stress, which is characteristic of stage 3. Apparently the child’s segmental structure of the word does not change dramatically from stage 2 to 3’, but the prosodic structure does, whereas the difference between stage 3’ and 3 is not in prosodic but in segmental structure.

How can we explain the developmental patterns? What triggers the transition from one stage to the next? I claim that the transitions from one stage to the next
can be understood as (a) the setting of one or more parameters from the default (unmarked) value to the marked, and/or (b) the extension of the child’s template.

4. Accounting for the developmental patterns: Part one

At the stage (stage 0) at which children only have monosyllabic words (mostly corresponding to monosyllabic targets) none of the stress parameters need to be set, since they simply are irrelevant. However, as we saw, disyllabic words (with initial stress) enter their active vocabularies relatively early; and then, some of the stress parameters become relevant. When the child compares his/her mono-syllabic production forms with the disyllabic target forms, i.e. comparing ['ap] with target apple ‘apple’ /'apəl/, s/he may detect a mismatch in the number of syllables and produce an extra syllable, and it is in this way that the foot-shape parameters (1a) need to be considered.5

On the hypothesis that the child expands his/her system in a systematic way by making use of the basic prosodic constituents, the prediction is that when the child adds a syllable to the monosyllabic template, it could either be added to the right or to the left of this template, thus creating a disyllabic foot, which could in principle be either left- or right-headed. When the input contains both trochaic ($\sigma_s \sigma_w)_{wd}$ words, like baby /'bei/ ‘baby’ and iambic ($\sigma_w \sigma_s)_{wd}$ words, like banaan /'bɑːnən/ ‘banana’, the child knows that one of these forms contains more than one foot. At this point a decision has to be made about headedness and direction of parsing. If the child starts parsing from a word edge until the parse includes a stressed syllable, the possibilities in (9) arise, where right-to-left parsing results in a left-headed foot, and left-to-right parsing in a right-headed foot:

$$\begin{align*}
(9) \quad & \text{Target words: } (\sigma_s \sigma_w)_{wd} \quad ['beibi:] \quad (\sigma_w \sigma_s)_{wd} \quad [ba'nan] \\
& \text{a. D:RL, H:L } (\sigma_s) \quad ['beibi:] \quad (\sigma_s) \quad ['nan] \\
& \text{b. D:LR, H:R } (\sigma_w) \quad ['be:] \quad (\sigma_w \sigma_s) \quad [ba'nan]
\end{align*}$$

$D =$ Directionality, $H =$ Headedness, $L =$ Left-headed, $R =$ Right-headed

Only the settings of (9a) explain the observed pattern characterizing stage 1 in child language. The child seems to have left-headed feet parsed from the right, or from the word’s ending. Biases towards word endings and stressed syllables are commonly found in the literature on child language (cf. Slobin 1973; Echols 1987, 1988; Echols & Newport 1992). They are often viewed as performance properties. In Fikkert (1994) I hypothesized that this performance property is reflected in the universal default value for directionality as [right-to-left]; but research from language change shows that it is more likely that the default value
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is [left-to-right] for trochees (Lahiri et al. 1999). Under this hypothesis the child has already discovered an important feature of the Dutch stress system: directionality of foot parsing. It also indicates that the child has already learned that not all target words have initial stress, even though the child’s output forms all have initial stress (because they contain only one foot). The existence of target \((\sigma_s\sigma_w)\) and \((\sigma_w\sigma_s)\) words is therefore not yet used for the QS parameter (see below), but is used to determine the directionality of footification. Stress\(^6\) in the adult target guides the child in the acquisition process. The child seems to know that stress in the adult target word indicates the boundary (the strong branch) of a foot.

The literature on acquisition of phonology also frequently mentions biases towards trochaic feet. Some assume that the basis for this bias lies in UG, where the trochee is viewed as universally unmarked or default. Typologically the only quantity-insensitive feet are trochaic. Others argue that this bias reflects the much higher frequency of trochaic forms in the target language — an argument that surely holds for the Germanic languages. It is therefore important to look at data from other languages that either have trochees parsed from left to right, or have an iambic stress pattern; for these may give us more clues about default values.

The fact that the child’s template consists of minimally one and maximally two syllables, which form exactly one initially-stressed foot, indicates that s/he has a binary left-headed (trochaic) foot, of which at least the head is filled. That a foot maximally contains two syllables is clear from the following data, which are invariably reduced to disyllabic forms with initial stress:

(10) *Trisyllabic target words with initial stress only (data from Elke)*

- tekenen ‘to draw’ /tekənə/ → [kaikə] (1;8.13)
- → [ˈkekiː] (1;8.31)
- → [ˈkeikei] (1;9.24)
- andere ‘others’ /ˈandaɾə/ → [ˈana] (2;0.25)

The fact that exactly one foot is produced suggests that the iterativity parameter (1b) — ‘Are feet built iteratively? [yes/no]’ — has a default value [no].\(^7\) The child seems to take the segmental material from the rightmost foot of the adult target word and map this onto his/her own trochaic foot template. If the target word consists of more than one foot, the remainder of the adult target word is not realized, because it does not fit into the child’s template. If the target foot consists of two syllables, both syllables are realized in the child’s output form (explaining why disyllabic target words with initial stress are produced correctly). If the target foot consists of one syllable, the child’s realization can be either monosyllabic or disyllabic. In the latter case (as in (2c)), a syllable can be added to the right of the selected material to fill both positions in the foot. The child
does not copy the foot structure of the adult word, since this extra syllable is not present in the adult target foot.8

This does not mean that children cannot sometimes incorporate more material into their template than just the segmental material of the final stressed foot: As shown in Fikkert (1994) and Levelt (1994), children build up representations, which initially are largely underspecified: only those features that are necessary to discriminate different words in the child’s lexicon are represented. When the final target foot begins with a coronal consonant, but the target word with a labial or dorsal consonant, the child often produces the word with an initial labial or dorsal place of articulation. On the assumption that coronal is underspecified (cf. Paradis & Prunet 1991) the child is able to incorporate a place specification from elsewhere in the target word, because there then is an empty slot for a place feature to dock on to. Some data are given in (11):

(11) a. Elke
konijn ‘rabbit’ /koːˈnein/ → [ˈkeɪn] (2;3.27)
banaan ‘banana’ /baˈnaːn/ → [ˈmaŋ] (1;8.13)
konijn ‘rabbit’ /koːˈnein/ → [ˈŋoŋ] (1;8.31)
formuis ‘stove’ /fɔrˈmøːs/ → [ˈmøːs] (2;2.6)
konijn ‘rabbit’ /koːˈnein/ → [ˈkɛ] (1;10.21)

b. Noortje
banaan ‘banana’ /baˈnaːn/ → [ˈmaːm] (2;2.22)
konijn ‘rabbit’ /koːˈnein/ → [ˈŋeːi] (2;2.22)
meneer ‘sir’ /moːˈnɛr/ → [ˈmuː] (2;3.7)
konijn ‘rabbit’ /koːˈnein/ → [ˈkaː], [ˈkeɪn], [ˈkei] (2;3.21)
bananen ‘bananas’ /baˈnaːnən/ → [ˈmaːma], [ˈmaːa] (2;7.17)
meneer ‘sir’ /moːˈnɛr/ → [ˈmeːa] (2;8.29)

c. Jarmo
ballonnen ‘balloons’ /baˈlɔːnən/ → [ˈpɔmə] (2;0.28)
kadootje ‘gift’ dim /kaˈduːtʃə/ → [ˈkoːʃə], [ˈkoːʃə] (2;1.8)
kadootje ‘gift’ dim /kaˈduːtʃə/ → [ˈkoːʃə], [ˈkoːʃə] (2;1.8)
gitaar ‘guitar’ /ɡiˈtaːr/ → [ˈkaː] (2;1.22)
meneer ‘sir’ /moːˈnɛr/ → [ˈbeːa], [ˈmeːə] (2;3.9)

On the assumption that the default value for the quantity sensitivity (QS) parameter is that feet are quantity-insensitive (QI), the child seems to have default values for all stress parameters that are relevant at this stage, except perhaps for the directionality parameter. The motivation for the QI default value comes from several facts. First, whereas both rhyme structure and the number of syllables are important for QS languages, QI languages only consider the number of syllables, and therefore require less knowledge from the learner. Second, if we look at the data from stage 2 we see that there are ‘heavy’ and ‘superheavy’
stressless syllables, clearly indicating that the system is QI. If QS were the default value, the parameter would be set to the marked value QI at stage 2. However, on the assumption that learning is deterministic, children would never again arrive at the required value QS. Third, there is a strong positive cue to detect QS, namely, the existence of words in the input with an equal number of syllables but different stress patterns.

It is important to note that, although the cue for QS is available at stage 1, quantity does not seem to play a role yet. This illustrates how children are incremental mode learners: although the relevant cues are in principle available from the start of the acquisition process, the cues are only used to determine parameter values when the child is ‘ready’ to use the cues. That is, children build up the stress system incrementally, rather than focusing on all parameters simultaneously.

Another important point is the following. Suppose that the child is building metrical structure on the segmental strings of the input (= target) forms to test the current settings of the parameters. We then expect that disyllabic target words with final stress will be realized as disyllabic words with initial stress, given the default values of the parameters. Although there is a stage at which this prediction is borne out (namely stage 2), this is not the first stage in the development. Rather, the first stage is the stage at which these words are typically reduced to the stressed (monosyllabic) foot of the adult target. Only when metrical trees are not built on the whole string of segments of the adult target with final stress, but on the segments in the final foot of the adult word, do we expect the forms typical of stage 1. Only if the final foot is considered as input to the learning system, do the output forms created on the basis of the parameter settings match the input forms with respect to stress; and thus, the child will not change any stress parameters, there being no evidence for the marked settings.

The child may not have detected any stress errors in his/her output as compared with the input at stage 1, but s/he has discovered that his/her output forms and the target forms do not always match in the number of syllables. To solve this mismatch between input and output, the next step in the development is to produce an extra syllable in words that have one syllable in the output form, and two (or more) in the adult target form (stage 2). If the child’s form at stage 1 consists of one syllable the child takes another syllable of the target word — if available the (secondary) stressed syllable; otherwise, the leftmost one. The segmental content of that syllable is adjoined to the child’s previously monosyllabic form. This segmental material is mapped onto the same foot template of the previous stage: a quantity-insensitive (QI) trochaic foot, resulting in an initial-stressed disyllabic foot. Interestingly, sometimes the segmental material of the
leftmost syllable is adjoined to the right of the child’s previous template resulting in metathesis, as in (12a). A second syllable can also be produced by reduplication, as in (12b). This shows that the child builds on his/her own previous representation of the word.

(12) a. **Metathesis**

\[ \text{papier ‘paper’ /paːˈpiər/} \rightarrow [ˈpiːpaː] \quad \text{Catootje (1;10.25)} \]
\[ \rightarrow [ˈpiːˈpaː] \quad \text{Catootje (1;11.10)} \]

b. **Reduplication**

\[ \text{ballon ‘balloon’ /baˈloon/} \rightarrow [ˈpoʊm] \quad \text{Noortje (2;5.23)} \]
\[ \text{konijn ‘rabbit’ /koˈnein/} \rightarrow [ˈkeɪˈkeɪn] \quad \text{Noortje (2;7.2)} \]
\[ \text{ballon ‘balloon’ /baˈloon/} \rightarrow [ˈpaːˈboʊn] \quad \text{Catootje (1;11.10)} \]

So far, there has been no evidence that any of the stress parameters are inappropriately set. Therefore, the parameter values at stage 2 still have the same values as at stage 1.

If the output forms of stage 2 are compared with the target forms, two things may be detected: (a) disyllabic and trisyllabic targets with final (main or secondary) stress are produced with the wrong stress pattern at stage 2, while disyllabic and trisyllabic target forms with penultimate stress have the right stress pattern; and/or (b) the number of syllables is lower in the output forms than in the trisyllabic target forms. If the child focuses on the number of syllables first, the prediction is that all trisyllabic target forms are produced as trisyllabic at the next stage (stage 3), where the (unchanged) parameter settings create the following stress pattern: cr (cts ctw)f. However, this is not borne out. We have seen that sometimes the child keeps a disyllabic realization, but with two stressed feet, clearly showing that the number of syllables has not changed, but the prosodic system has (stage 3'). Moreover, we saw above that children first focus on feet, and only later on the number of syllables. This is not different at this stage. Since disyllabic and trisyllabic target words with penultimate stress are not changed, let us focus on the types with final stress, starting with the disyllabic ones.

The child now has encountered words with an equal number of syllables (two) but a different stress pattern \((\sigma_s \sigma_w)_f\) and \((\sigma_w \sigma_s)_w\), and thus has access to the cue for quantity-sensitivity. Although at stage 1 the child’s input (the adult forms) already contained both types of words, only one type of disyllabic word was completely selected by the child then. Of the other type only the segmental material of the final stressed monosyllabic foot was realized in the child’s output. At stage 3 the child has discovered that the difference between the two types of disyllabic words — those with initial stress and those with final stress — is linguistically significant. Therefore, the child now is able to use the cue for the
QS parameter and set it to its marked setting [QS]. Now, the child also has to determine what counts as a heavy syllable (weight parameter of (la)). Children seem to regard any closed syllable as heavy, independent of the length of the vowel and independent of the nature of the final consonant(s), since all closed syllables, whether heavy (-VC) or superheavy (-VCC and -VVC), are now stressed in the child’s output forms.

Besides setting the QS parameter to the marked value the child also has to make a decision about the value of the iterativity parameter at this stage, since s/he now knows that some target words consist of more than one foot. Moreover, the produced forms at stage 3 can contain two feet, whereas previously the child’s production forms all consisted of exactly one foot. It seems that the iterativity parameter is set to its marked value [yes] at stage 3. Although now the main stress parameter is relevant, it is still not set. The fact that the child produces forms with two feet where both feet receive an equal amount of stress indicates that the parameter is simply not yet considered.

Thus, all foot-shape parameters and all parameters of foot construction have been set at stage 3. Only the word-tree dominance parameter(s) (1c) and compound parameter (1d) still have to be fixed. The account for the transitions from stage 3 to further stages differs from that given in Fikkert (1994). We will therefore postpone further discussion and first look at the acquisition of nominal compounds.

5. The acquisition of compounds

On the hypothesis that simple structures are acquired before complex structures one could hypothesize that children first learn monomorphemic words and that compounds are at first treated like monomorphemic words. At first sight, compound words seem to show essentially the same pattern as bipedal monomorphemic words, as shown in the data in (13), where for each stage an example of bipedal monomorphemic words with final and initial main stress is given, followed by an example of a compound. This seems to confirm the hypothesis that compounds and monomorphemic words are treated alike.

(13) All data from Tirza

a. Stage 1

<table>
<thead>
<tr>
<th>Monomorphemic Word</th>
<th>Compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>telefoon ‘telephone’ /teːləfoːn/</td>
<td>[‘çoun] (I;II)</td>
</tr>
<tr>
<td>olifant ‘elephant’ /ɔli:fant/</td>
<td>[‘unt] (I;II)</td>
</tr>
<tr>
<td>hobbelpaard ‘rocking horse’ /hɔbəlpɑːrd/</td>
<td>[‘pant] (I;II)</td>
</tr>
</tbody>
</table>
COMPOUNDS TRIGGERING PROSODIC DEVELOPMENT

b. STAGE 2

telefoon ‘telephone’ /te:laˈfon/ → [ˈpfom] (2;0)
olifant ‘elephant’ /oːˈlifənt/ → [ˈɔlfənt] (2;0)
schildpad ‘tortoise’ /ˈsxil[t],pat/ → [ˈstap] (2;0)
c. STAGE 3

papegaai ‘parrot’ /paːˈɡaːj/ → [ˈpapaˈχæj] (2;1)
ooievaar ‘stork’ /ˈoʊjəˌvaːr/ → [ˈojoˌsauə] (2;1)
hobbelpaard ‘rocking horse’ /ˈhɔbəˌpɔːt/ → [ˈhAbəˌpait] (2;1)
d. STAGE 4

krokodil ‘crocodile’ /ˌkRoikɔˈdil/ → [ˈkoiku:,diw] (2;2)
olifant ‘elephant’ /oːˈlifənt/ → [ˈɔləˌlæmp] (2;3)
hobbelpaard ‘rocking horse’ /ˈhɔbəˌpɔːt/ → [ˈopaˌpait] (2;2)

Thus, children who truncate (almost) all final stressed words should, under this hypothesis, do the same with compound forms. Remember that words like *olifant*, with initial main stress and secondary stress on the final syllable (which look very similar to compound stressed forms) were truncated to the final foot by most children. If compounds and monomorphemic words are treated in the same way by children, the question arises: How and when do children treat them differently? After all, they have, among others things, different prosodic structures.

On closer inspection there are two striking observations to be made concerning compounds. First, not all children who do truncate monomorphemic words also truncate compounds. Second, compound words appear relatively late in children’s productive vocabulary, though they appear before bipedal monomorphemic words and are produced as such. Let us consider both observations in more detail.

Although some children only realize the final foot of compounds at the early stages, as shown by the data from Noortje in (14), this is not true for all children.

(14) *Noortje’s realization of target compounds (in early production forms)*

<table>
<thead>
<tr>
<th>Compound</th>
<th>Realization</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>vliegtuig ‘airplane’</td>
<td>/ˈvliːtˌχəʊˈχə/ → [ˈhauχ]</td>
<td>(2;3.20)</td>
</tr>
<tr>
<td>sneeuwpop ‘snow man’</td>
<td>/ˈsneːwˌpɔp/ → [ˈpɔp]</td>
<td>(2;4.4)</td>
</tr>
<tr>
<td>theeppot ‘tea pot’</td>
<td>/ˈteːˌpɔt/ → [ˈpɔt]</td>
<td>(2;4.4)</td>
</tr>
<tr>
<td>vliegtuig ‘airplane’</td>
<td>/ˈvliːtˌχəʊˈχə/ → [ˈhauχ]</td>
<td>(2;4.4)</td>
</tr>
</tbody>
</table>

Eva, Elke, Jarmo and Tirza are among the children that truncate almost all final stressed words. However, none of these children seem to truncate compounds systematically to the final stressed foot. Some examples of Eva are given in (15):
One immediate question is whether Eva perhaps already knows one or both of the members of the compound, in which case she simply realizes both words. In the forms of (15a) Eva may have known some of the members of the compounds as separate words, like *wagen* /ˈvaːxn/ ‘wagon’, *molen* /ˈmoːln/ ‘mill’ etc., but this is certainly not the case for all compounds in (15a), some of which are, certainly for children, not entirely transparent, like *vliegtuig* /ˈvliːxtœyɡ/ ‘airplane’. Tirza’s data from the early stages of the production of compounds show that semantic factors may play a role in determining which part of the compound is realized. At the early stages she only realizes one part of the compound, as shown in (16). Interestingly, she realizes the word that is known to her (*tuin* /ˈtoyn/ ‘garden’, *zee* /ˈzeː/ ‘sea’, *zak* /ˈzak/ ‘bag’, *paard* /ˈpart/ ‘horse’ and *glijden* /ˈxleidə[n]/ ‘slide’ are all part of her active vocabulary); it does not seem to matter whether the word is in head or in complement position.

(16) *Tirza’s earliest realizations of target compounds*

- **dierentuin** ‘zoo’ /ˈdirtɔːtœyn/ → [ˈtoyn] (1;8.5)
- **zeehond** ‘seal’ /ˈzeːhɔnt/ → [ˈseː] (1;10.22)
- **zakdoek** ‘handkerchief’ /ˈzakduːk/ → [ˈsak] (1;11.8)
- **hobbelpaard** ‘rocking horse’ /ˈhɔbəlˌpaːrt/ → [ˈpɔnt] (1;11.19)
- **glijbaan** ‘slide’ /ˈxleiˌbæn/ → [ˈxei] (1;11.19)

Although semantic factors thus may play a role, the data in (15) cannot be explained this way. Of interest is the fact that Eva distinguishes between words in (15a) and (15b), the former being treated as two prosodic words, the latter as one. Interestingly, words like *olifant* ‘elephant’, which she unfortunately has only a very little of, are realized like those in (15b), as shown in (15c). Apparently, Eva is able to distinguish some, but not all, compounds from monomorphic words with more than one stress. The difference between the targets in (15a) and (15b) is that the latter could have been monomorphic with regard to syllable
phonotactics\textsuperscript{10} — i.e. they look similar to words like \textit{olifant} ‘elephant’, whereas the former could not: the first word of the compound forms a superheavy syllable which is only found at word edges. However, the difference between heavy and superheavy syllables is learned very late. Moreover, in the word \textit{zakdoek} /\textipa{za\textsubscript{3}d\textsubscript{o}e\textsubscript{k}}/ ‘handkerchief’ the first word does not contain a superheavy syllable, but it nevertheless patterns with the compounds that do have a superheavy first syllable. However, there is another prosodic difference between the forms in (15a) and (15b): they all contain medial clusters in which the consonants differ in place of articulation. Such clusters are usually not found word medially in monomorphemic words. Apparently, Eva is able to use this kind of prosodic information in the input. It therefore seems that the forms in (15a) are treated as two prosodic words each consisting of a single foot on the basis of syllable phonotactics, rather than on the basis of prosodic factors like syllable quantity.

Elke and Jarmo realize all disyllabic compounds as disyllabic monomorphemic words with initial stress, regardless of the syllable make-up of the target words, as shown in (17). However, words like \textit{olifant} /\textipa{odi\textsubscript{1}f\textsubscript{3}ant}/ ‘elephant’ are also treated like that, as is shown in (18).

(17)  
\begin{description}
\item[a. Elke’s productions of target compounds]  
schildpad ‘tortoise’ /\textipa{s\textsubscript{1}chi\textsubscript{1}l\textsubscript{1}pat}/ \quad \rightarrow \quad [\textipa{\chi\textsubscript{1}pat}] \quad (2;3.26)
\item[vliegtuig ‘airplane’ /\textipa{vli\textsubscript{i}t\textsubscript{1}l\textsubscript{1}t\textsubscript{1}eu\textsubscript{1}y\textsubscript{1}]/ \quad \rightarrow \quad [\textipa{\textsubscript{i}t\textsubscript{1}t\textsubscript{1}e\textsubscript{1}y}] \quad (2;4.15)
\item[kauwgom ‘chewing gum’ /\textipa{kau\textsubscript{1}\textsubscript{1}u\textsubscript{1}c\textsubscript{1}\textsubscript{1}m}/ \quad \rightarrow \quad [\textipa{ku\textsubscript{1}\textsubscript{1}\textsubscript{c}\textsubscript{1}m}] \quad (2;4.15)
\item[zandbak ‘sand box’ /\textipa{zam\textsubscript{1}b\textsubscript{1}k}/ \quad \rightarrow \quad [\textipa{samb\textsubscript{1}k}] \quad (2;4.29)
\end{description}

(18)  
\begin{description}
\item[a. Elke]  
olifant ‘elephant’ /\textipa{odi\textsubscript{1}f\textsubscript{3}ant}/ \quad \rightarrow \quad [\textipa{\textsubscript{o}f\textsubscript{3}ant}] \quad (2;3.26)
\item[b. Jarmo]  
olifant ‘elephant’ /\textipa{odi\textsubscript{1}f\textsubscript{3}ant}/ \quad \rightarrow \quad [\textipa{\textsubscript{f}aut}] \quad (2;1.22)
\end{description}
Apparently, these children tend to focus on the main stress in the word, rather than on just any stress. All final stressed words are realized as typical for stage 1 and/or stage 2 in § 2, but words with initial main stress and final secondary stress behave differently as soon as the child has a foot template: both stressed syllables are mapped onto a trochaic template, as in (18a). The same happens with compounds in (17).\footnote{Words of the type olifant /oli;fant/ ‘elephant’ and compounds therefore seem to behave similarly.} Since the child clearly produces only one foot it must be a monomorphemic word.\footnote{Elke and Jarmo truncated most words that contain more than one foot, and did not show the whole range of developmental stages; i.e. at the end of the recording period they still produced mostly words consisting of a single foot. It should therefore not surprise us that compounds are also still realized as one foot and one word.}

What about the children that showed a clear developmental pattern for monomorphemic larger words? Robin showed the full range of developmental stages in the period he was recorded, as shown in § 2. The data in (19) represent his developmental stages in the acquisition of compounds. As with Elke and Jarmo, the predicted first stage — the stage at which only the final foot is realized — is not attested in his data. This could be an accidental gap, but it could also reflect the strong bias to attend to main-stressed syllables. Children do seem to differ in whether a final foot with secondary stress is selected at stage 1 (cf. (5c) and (8a)), or whether the selection should at least include the main-stressed syllable (cf. 18a).

(19)  
Robin’s production of target compounds

a.  
\textbf{Stage 2}

- sesamstraat ‘Sesame street’ /sesam,strat/ \rightarrow \['sesa:\] (1;7.13)
- autobus ‘bus’ /oto;bus/ \rightarrow \['o:bi:s\] (1;8.10)
- vliegtuig ‘airplane’ /vli;\textit{t}oe\textit{y}\textit{x}/ \rightarrow \['tiitai\] (1;8.24)

b.  
\textbf{Stage 3}

- speeltuin ‘play ground’ /speel,\textit{toeyn}/ \rightarrow \['dyin\textsl{d}oeyn\] (1;9.3)
- vliegtuig ‘airplane’ /vli;\textit{t}oe\textit{y}\textit{x}/ \rightarrow \['fi:\textit{ts}\textsl{ha}\textit{g}\] (1;8.24)
- tankauto ‘tanker’ /\textit{teqkoito:}/ \rightarrow \['hanta\textsl{f}\textit{u}\] (1;10.7)
- zandbak ‘sand box’ /zam,bak/ \rightarrow \['suimpæt\] (1;11.7)

- brandweer ‘fire brigade’ /\textit{brant},\textit{vex}/ \rightarrow \['hanta\textsl{f}\textit{u}\] (1;10.21)

\textbf{Stage 4}

- zandbak ‘sand box’ /zam,bak/ \rightarrow \['fa:pak\] (1;11.7)
- vliegtuig ‘airplane’ /vli;\textit{t}oe\textit{y}\textit{x}/ \rightarrow \['fis,hox\] (1;11.7)

Robin’s data do however show the other three stages in development that correspond to the stages 2–4 for monomorphemic words.
What is striking about these data in comparison to the monomorphemic ones is that stage 3 with the two equally stressed feet occurs much earlier in compounds (see § 2). This brings us to the second observation that at the early stages of acquisition compound targets are rarely attempted by children, yet they nonetheless occur earlier than bipedal monomorphemic ones. If we look at when compound targets are attested more frequently in the child’s productive vocabulary, it seems that they start appearing before the child produces level stressed monomorphemic words; or, to put it differently: compounds are attempted before children start producing monomorphemic words consisting of two feet. Those compounds usually appear with level stress at first. Tirza’s data show this nicely.

If Tirza realizes both words, they are realized with level stress, as shown in (20a):

(20) **Tirza’s realizations of target compounds**

a. slaapzak ‘sleeping bag’ /slaap,zak/ → [ˈsaps ‘sak] (1;11.8)
   windzak ‘wind sack’ /vint,zak/ → [‘νιντ ‘tak] (1;11.19)
   boterham ‘slice of bread’ /ˈbɔtər,hæm/ → [ˈbɔxəl,əm] (2;0.5)
   graafmachine ‘excavator’ /ˈɡraɪfmaʃɪnə/ → [əfˈtʃi:nə] (2;0.5)
   klimrek ‘climbing frame’ /ˈklɪm.rɛk/ → [ˈpɛm ‘pek] (2;0.5)
   vliegtuig ‘airplane’ /ˈvliɡ.tjuɪɡ/ → [ˈtɪːg ‘tœɡ] (2;0.5)
   vrachtwagen ‘truck’ /ˈvraχt,əˌvæn/ → [ˈhæχ ‘təkə] (2;0.5)
   appelmoes ‘apple sauce’ /ˈæpəl,mʊs/ → [ˈæpəl,ˈmʊs] (2;0.18)

b. olifant ‘elephant’ /ˈoʊlɪˌfænt/ I → [ˈoʊfənt] (1;11.19)
   ooievaar ‘stork’ /ˈoʊɪˌvər/ II → [ˈoʊfənt] (2;2.12)
   olifant ‘elephant’ /ˈoʊlɪˌfænt/ III → [ˈoʊdəˌʃænt] (2;2.25)
   ooievaar ‘stork’ /ˈoʊɪˌvər/ IV → [ˈoʊfənt] (2;6.12)

Tirza realizes compounds differently from monomorphemic words with two stresses, which are produced much later (2–3 months), as can be seen in (20b). Although words like olifant /ˈoʊlɪˌfænt/ ‘elephant’ and ooievaar /ˈoʊɪˌvər/ ‘stork’ seem to have exactly the same stress pattern as words like appelmoes /ˈæpəl,mʊs/ ‘apple sauce’ and boterham /ˈbɔtər,hæm/ ‘slice of bread’ they are apparently treated differently. Since all monomorphemic words form still one foot, the data in (20a) should be interpreted as forming two separate words.

Thus, compounds seem in fact to have triggered the development of monomorphemic words with multiple stress. As shown above, compounds often have a syllabic structure that differs from monomorphemic words in that far more types of consonant clusters are found in the former than in the latter, and far more superheavy syllables occur word medially in compounds than in monomorphemic words. This evidence in the input probably helps the child in
deciding that compounds contain two prosodic words, when a prosodic word still maximally is a single foot.

The data in (20a), which are typical of stage 3, thus show that the word is a central notion in acquisition. It seems therefore that the crucial question is not ‘how and when do children know that word-like units can be combined into compounds?’ but rather ‘when do children learn that words can contain more than one foot’? A stage 3 they realize two prosodic words, each consisting of one foot, rather than one prosodic word made up of two feet. That is, most forms that are analyzed as level stress forms by the children at stage 3 represent compounds or rather compound-like structures; i.e. the concatenation of two monopedal monomorphemic words. They do not have compound stress. How do we know? Crucial evidence comes from the next stage in children’s development, where initial stress is prevalent. This is typical for compound stress, since in the unmarked case stress is on the final foot in monomorphemic words.

6. Accounting for the developmental patterns: Part two

Stage 3 can be characterized as the stage in which children start combining two prosodic words, where both words have an equal amount of stress and each word contains maximally one foot. When the level stress forms of stage 3 are compared with the target forms, the child may discover that there is a difference between main stress and secondary stress in the adult forms; therefore s/he may focus on the location of main stress. Since the monomorphemic disyllabic target words with final stress are now produced correctly, we could conclude that children have learned that main stress is assigned to the rightmost foot. However, we would expect to find main stress on the rightmost syllable in longer words, too. This prediction is not borne out by the data. Rather, it looks as if the children have discovered that the first foot from the left receives main stress.

The fact that there are many more longer forms with main stress on the left than on the right if we not only consider monomorphemic words but also consider compounds and compound-like structures (like Noun Verb phrases) may provide evidence for initial stress to the child. In any event, the acquisition data clearly indicate that stress is on the left-most foot for words with more than two feet. The question is whether this is accomplished by setting the main stress parameter or the compound stress parameter. It seems to be the latter, since the notion of the word is a central one. Those forms that clearly form two separate words, based on syllable structure or semantic transparency, do receive compound stress at stage 4: the initial foot/word is stressed.
Thus, we have seen that words that are compounds or words that could have been compounds (like *olifant* /ˈoːliːfɑnt/ ‘elephant’), receive stress on the first foot. Moreover, all monomorphemic target words that have two feet in the adult target language now receive stress on the first foot, as this rule also applies to words like *krokodil* /ˈkroʊkoːdɪl/ ‘crocodile’. On the other hand, those words that cannot with certainty be analyzed as two words on the basis of their prosodic structure will be reanalyzed: *konijn* /ˈkoːˈneɪn/ ‘rabbit’, which has only one stress in the adult form (and therefore cannot be a compound) is realized as one foot with an adjoined syllable at the left. These forms therefore undergo destressing and defooting at stage 4.

Thus, children acquire the compound stress rule at stage 4, as well as destressing of degenerate feet in the disyllabic final-stressed words. It should be noticed, however, that all words are still at most one foot (although now sometimes realized loosely, since it can have adjoined syllables). The main stress parameter, however, is still not set.

The question is when does the child learn that there are also monomorphemic words with more than one foot? Clearly, when the child is comparing targets like *telefoon* /ˈteːləˈfoʊn/ ‘telephone’ with his/her own output s/he may discover that stress is different. Now, words that are incorrectly analyzed as compounds, that is, those that have final stress in the target language, have to be reanalyzed as monomorphemic words with two feet. At this point, i.e. at stage 5, the child seems to have discovered that main stress is not left, but right in monomorphemic words.

In conclusion, at stage 4 the parameters determining compound stress and destressing parameters are set and only at stage 5 is the main stress rule set.\(^{16}\) In other words, children learn compounds before they acquire longer monomorphemic words. Based on frequency in the input this is not surprising: compound and compound-like structures outnumber the bipedal monomorphemic words with final stress. Although compounds may be regarded as prosodically more complex than monomorphemic words, there is no *a priori* reason why this should be so for the child. Rather, it seems that it is precisely due to the prosodic structure of compounds being more complex than that of monomorphemic words that guides the child in analyzing the prosodic structure of target words.\(^{17}\)

**Notes**

1. There are a number of differences in comparison with Fikkert (1994, 1995), the most important one being that the obligatory branching parameter is made redundant. But the cases where this parameter was needed in Fikkert (1994, 1995) can all be accounted for by the compound stress parameter in (Id), which was therefore added to the list of parameters.
2. There is a strong relationship between the default value and the Subset Principle (Berwick 1986; Dell 1981; Wexler & Manzini 1987). The default value is the value for which positive evidence is least available to the language learner. However, sometimes other criteria are used as well. For example, the default value for the QS parameter is feet being QI; and this requires less knowledge from the learner, in the sense that the details of syllable structure need not be acquired yet. There also is a strong cue for detecting QS: the existence of two groups of words with an equal number of syllables but a different stress pattern indicates that the language must be QS. Typologically, the only QI feet are trochaic (cf. Hayes 1995). All points together suggest that children start with QI trochaic feet, which is supported by the data, as we will see. For some of the other parameters it is hard to define a default value \textit{a priori}.

3. Notice that the input contains many forms that show a different (exceptional) stress pattern than expected based on the parameter values for Dutch given in (1). However, since the child has to make his/her hypotheses on the basis of the input data, these forms will (have to) be considered. In Fikkert (1994) I argue that, contrary to the standard analyses, the regular stress pattern for words ending in a — VC rhyme is final and that words like \textit{robot} /\textit{Roibot}/ 'robot' are the exception. Crucial evidence comes from acquisition data (Fikkert 1994:287 ff.).

4. \textit{Krokodil} /\textit{kRo:ko:'dil}/ 'crocodile' and \textit{olifant} /\textit{o:li:,fant}/ 'elephant' are exceptional according to the normal stress rules given in (1). In \textit{krokodil} the final heavy syllable bears main stress, but it should have been extrametrical and therefore not bear main stress. In \textit{olifant} main stress is initial, but should have been on the superheavy final syllable. The final syllable only has secondary stress, as if the form had compound stress. See also note 6.

5. It is common knowledge that children's perception is ahead of their production. Moreover, it has usually been assumed in the linguistic literature that perception is adult-like, and therefore children store an accurate representation of the input form. However, there is also ample evidence (see Waterson 1971, 1987, and the discussion in Macken 1980 and Smith 1989) that this assumption is far too strong. Although perception is ahead of production, it is not yet perfect. One has to bear in mind that the 'fish'-phenomenon (Smith 1973), where the child is aware of his incapability of producing the correct form, typically occurs with older children, and usually involves 'difficult' sounds. Moreover, although research into perception shows that even very small babies are already able to distinguish many phonetic details (cf. Jusczyk 1997), one has to separate acoustic phonetic discrimination from linguistic identification. The child may well hear many distinctions, but s/he still has to learn which of these distinctions are linguistically relevant, and how to represent the relevant linguistic distinctions in the lexicon. This issue has so far hardly received any attention in the literature on acquisition (but see Lahiri & Marslen-Wilson (1991) for psycholinguistic arguments for a similar distinction in adult language). A second point that bears on this issue is the exact form of a lexical representation. I assume that the mental representation of lexical items is underspecified as much as possible. This is true not only for children, but also for adults. In comparing input and output, only linguistic mismatches lead to learning. 'No mismatch' (i.e. no match and no mismatch) and 'perfect match' do not lead to revision of either the lexical representation, or the lexical phonology.

6. Most children do not distinguish between main and secondary stress and therefore take the final secondary-stressed syllable of the target \textit{olifant} 'elephant' /\textit{o:li:,fant}/, as shown in (5c) and (8a).

7. In an OT account, the one foot stage would be accounted for by a high ranking of Alignment constraints (cf. Prince & Smolensky 1993; McCarthy & Prince 1993; Demuth 1996b).

8. Also, stress in the child's output forms does not always conform to that in the adult's target form, indicating a different prosodic structure for target (input) and output forms (i.e. stages 2 and 3).
9. Thus, words are not stored in the child’s lexicon with prosodic information. Only unpredictable segmental (or prosodic) content is stored (cf. for similar conclusions Lahiri & Marslen-Wilson 1991; Wheeldon & Lahiri 1997, among others.)

10. The word *zandbak* ‘sand box’ /'zam,bak/ is usually produced with an initial CVC syllable, since the final coronal stop is seldom realized.

11. The same is reported for English children (Kehoe & Stoel-Gammon 1997), although English and Dutch differ significantly in their prosodic system in that final secondary stress is less common in English nouns due to final syllable extrametricality.

12. It should be noted that Jarmo and Elke have been followed from a stage earlier than, for instance, Tirza and Eva, and have not been followed through all stages. So it might very well be the case that Jarmo and Elke, too, would have shown the same pattern as the latter two in the later stages, if only we had followed them long enough.

13. Of the disyllabic target words with final stress, Elke truncated 94% and Jarmo 92%. They invariably realized the final foot.

14. This has interesting consequences for the acquisition of syntactic structures. One could hypothesize that only at stage 3 are children able to acquire more complex syntactic phrases, consisting of a head and a complement (or vice versa), since only now are they able to realize these structures prosodically.

The input to the child contains not only many compounds where the phonological head is morphologically the complement, and the phonological non-head is the morphological head (the right-hand head rule). Many syntactic phrases have the same structure: the syntactic complement in a noun-verb phrase is the phonological head of the phrase, i.e. *boekje* in *boekje lezen* (‘read a book’ *dim.*) and *koekje* in *koekje eten* (‘eat a biscuit’ *dim.*) and bears more stress than the verb, which is the syntactic head. If not only nominal compounds, but also these syntactic constituents are regarded as compounds (see Penner, Wymann & Weissenborn, this volume, for an analysis along these lines), the number of compounds is so overwhelming that it is bound to trigger an early setting of the compound stress parameter.

15. Alternatively, stress is on the first foot because of the default value [main stress is initial] of the main stress parameter. However, the child’s input does contain words where stress is not initial. These words could have triggered the setting of the parameter to the marked value.

16. Demuth & Fee (1995) and Demuth (this volume) have a somewhat different analysis in terms of stages. They call the first stage in acquisition the ‘CV stage’. This does not correspond exactly with my monosyllabic stage, which also contains CVC words. The stage in which CVC syllables occur is preceded by a stage in which no closed syllables occur: the core syllable stage (Fikkert 1994, Chapter 4). In this sense, there is no disagreement as to the existence of such a stage. However, according to Demuth & Fee the next stage is the minimal word stage and is characterized by CVC, CVV and CVCV words, which form exactly one moraic (i.e. QS) trochee. This stage does not correspond to any stage in my description; and, although Demuth uses my data to confirm this stage, I could not find any evidence for it. I also think that the name of this stage is misleading. Although in a sense the child has a minimal word (at *my* stage 1/one foot stage) which equals a disyllabic foot, the foot is not a moraic trochee, as in the target languages, but a syllabic trochee. In other words, in the child’s system a CVC word would be a degenerate foot, since it only consists of one syllable, whereas a foot would have two syllables. That is not to say that they are not allowed; we have seen that they occur abundantly. At my stage 1, CVCV and CVC both are one single foot, but at stage 2 a weak member of a foot can consist of a (super)heavy syllable, clearly indicating that weight or mora counting is simply irrelevant at this stage and that the child-forms exceed the minimal foot template of the adult.
After a minimal word stage, children enter — according to Demuth & Fee — a stress foot stage. This stage roughly coincides with my stage 1 and stage 2. My stage 3 and 4 roughly correspond to Demuth & Fee’s ‘2 Stress Feet’ stage. I would like to maintain that children go from a monosyllabic stage to a stage characterized by the fact that all forms consist of exactly one foot (my stage 1 and stage 2). It is true that at stage 3 more than one feet are allowed, but this is mostly a consequence of the changing of the foot type from QI to QS. Thus, whereas I explain transitions as the setting of the QS parameter, which results in a change from QI to QS feet, Demuth characterizes the same change (transition from stage 1, 2 to 3, 4) as one from one foot to two feet, without explaining what triggers this, and why children did not have words consisting of two feet before.

A further point which is not considered in depth and is very much oversimplified in Demuth’s analysis is the fact that she considers CVV and CVC both as bimoraic. Though true for English, it is not true for Dutch, where open syllables with long vowels invariably behave as light for purposes of stress. But Dutch does have words made up of exactly one CVV syllable (for example koe /ku/ ‘cow’, zee /ze:/ ‘sea’, sla /slaV ‘salade’, etc.). Apparently Dutch allows subminimal words, but that is not to say that CVV is a heavy syllable: normally CVV would never make a foot on its own.

17. A similar conclusion is reached in Fikkert & Freitas (1997). There, the acquisition of syllable structure constraints in Dutch and Portuguese is compared. Although Dutch has a far more complex rhyme structure than Portuguese, Dutch children acquire the intricate details of the Dutch system much quicker than the Portuguese children. We argue that this is due to the evidence for the Dutch language learner being far more salient than that for the Portuguese language learner. Stated differently: As long as the evidence is not entirely clear, children hold on to unmarked structures. It is only after receiving enough transparent evidence that they will set parameter values to marked settings. The complexity of the structures to be acquired is not at issue; it is the evidence for those structures that counts for ‘ease’ of learnability that is at issue.

References


Demuth, K. This volume. “Prosodic Constraints and Morphological Development.”


