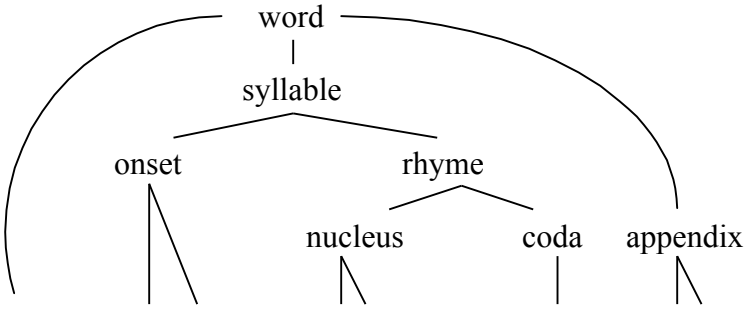
Description of the proposed research

Objectives

Introduction
Central in the study of linguistics are the questions of what constitutes knowledge of language and how it is acquired. In this project we focus on the acquisition of syllable structure in Dutch and German and its interaction with segmental constraints. Syllables are important units in phonological theory (Blevins 1995). They serve as the domain of phonological rules, such as final devoicing, vowel lengthening and shortening, etc. Although the unit of the syllable itself in generally accepted, there are a number of issues that are currently subject to debate. One issue is the exact internal structure of the syllable (Clements & Keyser 1983). Another is the question whether syllable structure is part of the phonological representation stored in the mental lexicon. We will investigate both issues in the developing systems of Dutch and German children. As Davis and MacNeilage (2002: 136) rightly point out, 'outlining the facts of acquisition is an important first step to consideration of their importance in understanding the origins of syllable production patterns".

Syllable structure in Dutch and German child language
Current descriptions of syllable structure in the target languages Dutch and German suggest that the two languages are very similar in this respect (Booij 1995, Wiese 2000). Both languages allow words to start with a sequence of three consonants, consisting of a strident coronal fricative, followed by an obstruent and a liquid: as in Dutch *spraak* 'speech' and German *sprechen* 'to speak', although word-internally only two consonants are permitted. With respect to rhyme structure the languages are also very similar: word-internal rhymes can either contain a long (or tense) vowel or a short (lax) vowel plus a consonant, strongly suggesting a binary rhyme. Word-finally, a bipositional rhyme can be followed by another consonant, as long as the resulting consonant cluster obeys the Sonority Sequencing Principle. Moreover, one or more additional coronal obstruents are permitted in the 'appendix'. This is schematized in (1a) for the Dutch words *herfst* 'autumn' and *spreekt* 'talks', and in (1b) for the corresponding words in German:

(1) Examples of Dutch/German syllables



a.		h	e r	f	s t		Dutch
	s	p r	e e	k	t		
b.		h	e r	b	s t		German
	s	p r	i	ch	t		

Upon closer inspection there are a number of differences between the languages, which may be of consequence for how the system is set up during acquisition. There are at least two important differences, which we will further investigate:

(a) The distribution of segmental features over syllables is quite different in the two languages due to a number of historical processes. The German, but not the Dutch, native vocabulary underwent the second consonant shift, which changed initial voiceless plosives and intervocalic voiceless geminates plosives into affricates (compare Dutch *appel*, *paard* vs. German *Apfel*, *Pferd*). In addition, voiceless singleton stops changed into geminate fricatives in German (compare Dutch *water* and German *Wasser*). This gave rise to many more postvocalic fricatives in German, as well as many more closed syllables (with short vowels) in comparison to Dutch.

(b) German has syllabic consonants in unstressed syllables, which standard Dutch lacks: This is particularly clear if we compare the frequent infinitival forms, which end in a syllabic nasal in German, but in a schwa in Dutch. That is, in German the schwa is often deleted, while in Dutch the nasal often deletes.

Although these differences have no immediate consequences for what a possible syllable is in the synchronic systems of the languages, it is very likely that the differences will show up in the acquisition process, through the interaction of constraints referring to syllable structure and segmental structure. A number of differences in the acquisition of syllable structure in Dutch and German have been noted, but have so far not received a satisfactory explanation. Understanding those differences will provide insight in the question of what triggers development. It will help understand to what extent acquisition is governed by universal tendencies, and to what extent language-specific properties determine the acquisition process.

One difference concerns the development of syllable structure: whereas in Dutch child language the first syllable types appear in the order: CV > CVC (Fikkert 1994, Levelt et al 1999/2000), for German the pattern seems to be CV > VC (Moskowitz 1973, Grijzenhout & Joppen-Hellwig 2002). Grijzenhout & Joppen-Hellwig argue that children at early stages of development do not yet organise segments into syllables. However, other researchers have argued that children only have syllables at early stages, and have not yet segmented syllables into smaller units (e.g., Moskowitz 1973, MacNeilage 1998, Fikkert & Levelt *to appear*). Moreover, this explanation does not account for the attested difference between Dutch and German acquisition. Our hypothesis is the difference is due to differences in the interaction between segmental and syllabic constraints. We will investigate the structure of the targeted words (intake lexicons) in Dutch and German child language to describe the differences in detail (see 2.2).

A second difference is that Dutch children seem to acquire postvocalic sonorants relatively late (Fikkert 1994) in comparison to German children (e.g. Kehoe & Lleo 2003). Our hypothesis is that German children realise sonorants significantly earlier due to the salient nature of sonorants in German. A related question is whether sonorants have a different status in German and Dutch syllable structure. Fikkert (1994) noted that the deletion of postvocalic sonorants often resulted in compensatory lengthening (CL) of the preceding vowel, a process tightly linked with the acquisition of vowel length distinction,

which also seems to be acquired later in Dutch than in German. In a pilot study of ten German children aged 20-32 months, Altvater-Mackensen (2004) showed there is a lot of variation between the children. However, CL was only sporadically observed, as final consonants, including sonorants were seldom deleted in the data. This also raises the question how Dutch and German children acquire unstressed syllables are in the two languages, which differ significantly in the target languages.

Finally, we want to investigate how syllable final clusters are acquired in both languages, and in particular, whether the acquisition of final clusters is related to (a) the acquisition of initial /s/+obstruent clusters (e.g., Fikkert & Freitas 2004), and (b) the acquisition of morphological structure, in particular verb endings in the third person singular. The tacit assumption in much work is that morphologically simplex words are acquired before morphologically complex words. However, this need not be true; instead, morphological structure may trigger the acquisition of prosodically complex structure in morphologically simplex words (e.g., Fikkert 2001).

Syllables in the mental lexicon?

The second point is often addressed in the psycholinguistic literature. Whereas the syllable is an uncontroversial unit in linguistics, its status in psycholinguistic theory is far less obvious: the role of the syllable in perception (see for an overview Cutler 1997) and production (for an overview see Schiller 1998) is still under much debate, particularly in Germanic languages. Some have argued that syllables are units of storage in the mental lexicon (Mehler et al 1981, Dell 1986, 1988, MacNeilage 1998). In this view syllable structure is likely to be governed by the phonology of the language. Others do not assume syllables to be present as units in the mental lexicon, but rather assume that they created on the fly for the preparation of spoken language as a late process in phonological encoding (Levelt et al. 1999). In the later view, the syllabification process is governed by universal constraints and principles, such as ONSET (syllables have onsets), NOCODA (syllables do not have codas) (Prince & Smolensky 1993/2004), and the Sonority Sequencing Principle (SSP), and language-specific phonotactics.

Until recently, there was general agreement in linguistics on the fact that syllables were not part of the underlying representation, but were created by syllabification algorithms to yield syllabified output structures. After all, no language uses syllable structure contrastively, and the set of wellformedness constraints defining a language's legal phonotactic structure, can predict how syllables are built on segmental strings. Although this is still the dominant view in most phonological theories, some current phonological frameworks assume that words are stored with all (most) phonetic detail including predictable information such as syllable structure. With respect to acquisition, Carter & Gerken (2004) argued that prosodic structure is part of the stored mental representation, as children often compensate for the loss of underlying material by lengthening vowels, etc. Her research focused on the deletion of syllables, but the same should be true for the deletion of segments. For example, if children delete the final consonant in a word like *poes* 'cat', there are a number of scenarios to account for this phenomenon: children have stored /pu/ rather than /pus/, hence a CV syllable is created as in (2a). It may also be the case that children have stored /pus/, but their grammar only permits CV syllables; hence the final consonant undergoes stray erasure (2b). A third option is that children have the correct syllable template, but for some reason do not realise the final consonant (2c). In this case, the prediction following Carter & Gerken is

that words like *poes* realized as [pu] are significantly longer (due to compensatory lengthening CL) than words like *koe* realized as [ku]. This will be experimentally tested.

(2)

a. Incomplete segmental representation	b. CV syllables	c. CVC syllable causing CL
p u	p u s	p u (s)
| |	| |	| ⌈\
C V	C V	C V C

In this project, we will investigate compensatory processes in child language, and compare deletions in onsets or onset clusters with deletions in the rhyme. In other words, if children delete segmental material in comparison to the target word, do they reserve 'slots' in the representation of their words, as schematized in (2c).

Summary

The following summarizes the objectives of this proposal:

• The investigation of the emergence of syllable complexity in Dutch and German, and in particular, the comparison of the process in the two closely related Germanic languages. We will test the following hypotheses:

- German children regard postvocalic sonorants as part of the nucleus, due to the syllabic nature of sonorants in unstressed position, whereas Dutch children vary in their analysis of sonorants; particularly, nasals will often be treated on a par with obstruents.
- German children produce more onsetless syllables (or syllables starting with a glottal stop) than Dutch children due to the more marked nature of word-initial obstruents in German compared to Dutch.
- Investigate the relationship between final clusters and initial /s/-obstruent clusters
- Investigate the relationship between final clusters and morphologically complex words

• In this project we are going to investigate the following questions:

- Is there evidence for syllable templates in the mental lexicon? We will investigate whether deleted segments are compensated for in the word for instance by lengthening the preceding vowel (Cf. Carter & Gerken 2004).

Methods

Production data

(a) *Intake/Input*. We will use the existing electronic databases for Dutch (CLPF) and German (Elsen) to investigate the interaction between syllable structure and segmental structure. We will

- analyse the target lexicons of Dutch and German children (i.e., the structure of the attempted words), and describe the differences
- analyse the production lexicon of Dutch and German child language and describe the differences.
- We will also use Dutch and German CDI-lists to compare the structure of early words in both languages.

• *Child language production data*. Although there exists an extensive database for Dutch, and a smaller one for German, systematic comparison of child language forms in both

languages is often impossible due to lack of relevant data at various stages in development. In this research we will therefore compare results from the databases with systematically acquired data from production experiments, in particular picture naming and elicitation experiments. In those experiments we control various factors, such as vowel length, complexity of coda, segment type in coda, type of unstressed syllable, etc., to make a direct comparison between Dutch and German possible. We will carry out these experiments in the age groups 18-20, 24-26, 30-32. We will carry out the production experiments both in the Child Language Lab in Nijmegen, and in Konstanz, in collaboration with Lahiri and Grijzenhout (University of Konstanz). This research will be part of the SFB 471. The production data will allow us to investigate both the emerging complexity of syllables in both languages, as well as form the basis for the acoustic analysis of data to investigate compensatory strategies.

• *Perception data*. In addition to the production experiments, we will also investigate perception, focusing on whether children can perceive the difference in vowel length, the difference between VC and V:, where the vowel has undergone compensatory lengthening, using the *switch paradigm* with newly taught words, and the *preferential looking paradigm* with known words, using correct pronunciations and mis-pronunciations, such as for instance sch[ɛ]p, sch[ɛl]p, and sch[ɛː]p. Both types of perception experiments have been successfully tested in the Baby Research Center in Nijmegen in other studies (Fikkert et al., *in prep.*, van der Feest, *in prep.*, Dietrich, *in prep*.). The German children will be tested with the same procedures in Konstanz.

Resources

The research will use longitudinal databases. The Dutch CLPF database (Fikkert 1994, Levelt 1994) has been transformed into the new *Phon*-format, which will make the analysis of a large body of data much easier than before. The database currently contains data from 14 children who are between the age of ten months and 1;10 at the beginning of a one year period of data collection. As this database is the first one to become available in *Phon*-format in *Childes* (Rose 2003, Rose & MacWhinney 2004) (see http://childes.psy.cmu.edu/phon/), we will receive support from Yvan Rose and his team with defining search routines. A set of transcribed German data will be made available in the *Phon*-format and is already available in electronic format.

For the production experiment pilots have been done in both Dutch and German. However, to make a direct comparison possible, both tests may need some adjustment. We have also run a pilot study eliciting third person singular forms in the child language lab, which are appropriate for the last two age groups. However, younger children hardly produce these forms and it has proven difficult to elicit such forms.