

# THE ROLE OF PHONOLOGICAL, MORPHOLOGICAL AND ORTHOGRAPHIC KNOWLEDGE IN THE INTUITIVE SYLLABIFICATION OF DUTCH WORDS: A LONGITUDINAL APPROACH

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## ABSTRACT

Children of three different ages (five, eight, and ten years old) were asked to syllabify a list of auditorily presented words. The list composition was such that the effect of different knowledge sources on the children's intuitive syllabification could be assessed: the relative importance of language-universal versus language-specific phonological constraints, the effect of morphological complexity, and the effect of orthographic knowledge. The results indicate that five-year old children are already aware of language-specific constraints and are sensitive to the phonological distinction between continuant and non-continuant consonants. Literate children (eight and ten years old) are influenced in their syllabification behavior by their orthographic knowledge, i.e. once children have reached the literate stage it is difficult for them to separate phonological and orthographic knowledge in this phonological task. Finally, children in all three age groups did not syllabify singulars differently than phonologically closely matched plurals.

## 1. INTRODUCTION

This paper deals with young children's intuitive syllabification of spoken words in Dutch, their native language. More particularly, we are interested which parameters determine their choice of syllable boundaries when different knowledge sources suggest alternative segmentations.

Two types of such decision conflict will be studied: (1) a conflict between the prediction made by the distributional facts in the phonological structure of the native language and the prediction made by the distributional facts in the phonology across languages; (2) a conflict between a segmentation that is based on purely phonological considerations (e.g., /rɔ/-/nɪN/) and one that is based on morphological considerations (e.g., /rɔn/-/iN/).

The first type of conflict pertains to the distinction that is made in phonological theory between language-universal and language-specific constraints on syllable structure. If the language-universal constraints are innate (as is sometimes believed, because of their high frequency of occurrence across languages), children will take these language universals as the default option until they have assembled sufficient evidence from their native language input that their own language does not match the universal pattern on this parameter. The distribution of phonemes in the Dutch vocabulary yields an interesting syllabification conflict of

this type. In Dutch a short vowel cannot occur in end-position in a syllable (a long vowel can). In other words, when a short vowel is followed by a single intervocalic consonant, that consonant must be part of the first syllable: the segmentation /æ/-/pɛl/ (apple) does not respect the Dutch phonotaxis. However, according to several language-universal principles on syllable structure a single intervocalic consonant belongs to the second syllable: the Obligatory Onset Principle (Hooper, 1972) stipulates that the onset of a syllable must be filled whenever a consonant is available (hence: /æ/-/pɛl/ rather than /æp/-/ɛl/) and the Sonority Principle (Clements, 1990) holds that the sonority level of a syllable must decrease minimally towards the end of the syllable but increase maximally towards the syllable peak (hence: /æ/-/pɛl/ and not /æp/-/ɛl/). How will young children cope with this type of conflict?

Conflicts between language-universal and language-specific constraints may be resolved differently by children of varying age groups. If the youngest testable children have not already detected the language-specific constraint and reset the parameter in their language system accordingly, their syllabification behavior will differ from that of older children.

The second type of conflict pertains to the possibility that it may be difficult for children to keep the syllabic and morphological levels of language apart. Note that we do not doubt the linguistic validity of this distinction. The question is simply whether children segment words solely in accordance with phonological principles or attend to morphological boundaries as well. Indeed, the morphological structure of the language is a very important part of lexical knowledge and it is conceivable that children cannot ignore morphemes when doing a segmentation task.

Apart from the fact that the acquisition of language-specific constraints takes time, there is another reason for including various age groups in the study. It is interesting to make a distinction between preliterate and literate children. Once children become literate, the particular orthographic conventions of their language (in particular those pertaining to the spelling of phonemes at syllable boundaries) may be an additional knowledge source that affects their segmentation of words. Again, the Dutch language offers an ideal test case. The phonological distinction between a short and a long vowel preceding a single intervocalic consonant is not reflected in the spelling of the vowel (a single grapheme in both cases) but in the spelling of the consonant: two graphemes when the consonant follows a short vowel

(e.g., /æpêl/ is spelled as APPEL, /pæsêr/ is spelled as PASSER) and a single grapheme when it follows a long vowel (e.g., /a:pên/ is spelled as APEN, /va:zên/ as VAZEN). The realization of the intervocalic consonant as a reduplicated grapheme after a short vowel might suggest an ambisyllabic segmentation in the intuitive syllabification task, i.e. a segmentation pattern where the intervocalic consonant phoneme is copied at both sides of the syllable boundary (e.g., /æp/-/pêl/). Such a segmentation would match the segmentation of the spelling pattern of the word at the end of a sentence as prescribed by the Dutch spelling conventions. Since preliterate children do not know these conventions a comparison between preliterate and literate children can shed light on the effect of orthographic knowledge on intuitive syllabification.

We designed an experiment in which the intuitive syllabifications of five-year old, eight-year old and ten-year old children were explicitly studied, in order to find out whether the three knowledge sources mentioned above - language-specific phonological knowledge, morphological knowledge and orthographic knowledge - affect their segmentation process.

## 2. EXPERIMENT

### 2.1 Method

**Subjects.** Three age groups were used in the experiment: 5 year-old children (henceforth: 5YO), 8 year-old children (8YO) and ten-year old children (10YO). The 5YO children (n=40, mean age: 5;11 years) were preliterate and attended the last year of Kindergarten at the time of testing. All children in the 8YO group (n=40; mean age: 8;10 years) and 10YO group (n=40, mean age: 10;5 years) were literate (in Flemish schools in Belgium, children learn to read Dutch at the age of six). However, the knowledge sources studied in this experiment may be better developed in the 10YO group than in the 8YO group, which may result in different syllabification behavior.

**Materials.** As has been described in the introduction we wanted to confront children with two types of conflict and see how they would resolve them. In order to study the effect of language-specific phonological knowledge we presented our subjects with words in which a single intervocalic consonant follows a short vowel (n=6), i.e. words which should be syllabified in different ways according to the Dutch phonotactic system than according to the language-universal phonotactic restrictions (type /æpêl/). In the control condition we used words (n=6) in which a single intervocalic consonant follows a long vowel (type /le:pêl/). In both conditions the intervocalic consonant was a stop (the phonemes /p/, /t/, and /k/ occurred twice each). A third condition was included (n=6) in which an intervocalic fricative followed a short vowel (the phonemes /f/, /s/, and /z/ occurred twice each). This was done to study the effect of the nature of the consonant on the way the conflict between language-universal and language-specific phonological knowledge was resolved. It is possible that continuants behave differently from stops in the syllabification task. A possibility, for instance, is that subjects try to resolve the conflict between language-universal syllabification principles and Dutch syllabification principles by trying to

respect both, which they can do by making the intervocalic consonant ambisyllabic (/æp/-/pêl/). In an ambisyllabic segmentation the short vowel of the first syllable is checked by a consonant and the second syllable begins with a consonant. By their nature, continuants would seem to lend themselves more to such ambisyllabic segmentations than stops. There is a second reason why it is interesting to vary the nature of the intervocalic consonant. Any difference between these two consonant types found with preliterate children might disappear in the literate stage if literate subjects perform the syllabification task by operating on an orthographic representation of the spoken word, i.e. if they cannot ignore their orthographic knowledge. Indeed, since the Dutch spelling system requires that a single intervocalic consonant be realized as a reduplicated grapheme after a short vowel, reliance on this knowledge would yield ambisyllabic segmentations for both stops and fricatives.

The manipulation of the above mentioned phonological factors (vowel length and type of intervocalic consonant) was a replication of previous research (Gillis and De Schutter, 1996) and served at the same time as a means to have a reference point for the study of the morphological complexity factor. In order to find out whether children are able to ignore morphological boundaries when engaging in a syllabification task, a set of 18 bimorphemic words were closely matched (on a pairwise basis) to the set of critical monomorphemic words described above on the intervocalic consonant, the vowel immediately preceding that consonant and the vowel immediately following it (always a schwa). In all pairs the schwa was followed by the phoneme /n/ in the bimorphemic member of the pair and by the phoneme /l/ or /r/ in the monomorphemic member. In all items the main stress fell on the first syllable. All monomorphemic items were bisyllabic singular nouns, whereas all bimorphemic items were plurals of monosyllabic nouns. Henceforth, we will refer to the two item sets as the sets of singulars and plurals. An example of an item pair is /bo:têr/ (butter) - /po:tên/ (paws). As a result of the matching process the same two phonological factors were manipulated in the set of plurals as in the set of singulars.

All critical items were mixed with a set of 26 filler items, all bisyllabic words whose main stress fell on the second syllable. In addition we added 18 bisyllabic diminutives. Initially, these words had been added to make a contrast between inflectional morphology and derivational morphology - for that reason the diminutives were derived from the same stems as the plurals - but considering the unavoidable mismatch of word categories (singular, plural, diminutive) on the phonological environment at and around the intervocalic position (three intervocalic consonants in the case of a diminutive), such a comparison would be flawed. For that reason we will not report on the diminutives here.

The experimental items were divided between two lists. List 1 contained 9 singulars, 9 plurals that were phonologically matched to the singulars on the phonemes at and around the intervocalic position (as described above) and 9 diminutives which did not share a stem that already occurred in the plurals. List 2 contained the remaining critical items. The filler items were added to both lists and a fixed random order was determined for each list. In both lists each word type was represented by 3 items where a long vowel was followed by a stop, 3 items where a short vowel was followed by a stop,

and 3 items where a short vowel was followed by a fricative. Combining the data from the two lists yielded 6 items for each combination of morphological type and phonological condition.

The two lists were recorded and copied on a minidisk for auditory presentation.

**Procedure.** Children were tested individually in a silent room of their school. They had been introduced to the experimenter in their classroom and told what task they would have to perform. When they presented themselves for the experiment the task was explained to them once more. It was explained in as natural a way as possible for each age group. The instructions emphasized that the child had to repeat the auditorily presented words very slowly. Examples were provided. The child was sitting in front of a small microphone and syllabified each word. The experimenter initiated the onset of each new trial upon scoring the subject's response on a scoring sheet.

## 2.2. Results

The total frequencies of the various syllabification types occurring in the data were summed across all items belonging to the same category and across subjects. Three syllabification types were distinguished: (i) segmentations in which the syllable boundary was between the intervocalic consonant and the preceding vowel (e.g., /æ/-/pêl/), (ii) ambisyllabic segmentations, i.e. where the intervocalic consonant occurred both at the end of the first syllable and at the beginning of the second one (e.g., /æp/-/pêl/), and (iii) segmentations in which the syllable boundary immediately followed the intervocalic consonant (e.g., /æp/-/êl/). For purposes of analysis the latter type could be ignored as the proportion of responses falling in this category was very small in all three age groups (5YO: 2.9 %, 8YO: 2.3 %, 10YO: 3.6 %). Given the complementary nature of the other two syllabification types, only the data for the first type were analysed. All frequencies observed for this type are shown in Table 1 as a function of the phonological, morphological and age factors.

Statistical comparisons were made by means of chi-square tests. We will consider the strictly phonological issues (interaction between language-universal and language-specific phonological knowledge) separately from the interaction between phonological knowledge and morphological knowledge. Since the effect of orthographic knowledge can only be assessed by comparing the phonological and morphological effects across age groups, we will report on the three age groups separately.

	5YO		8YO		10YO	
	Sing.	Plural	Sing.	Plural	Sing.	Plural
VV+stop	113	117	117	117	118	114
V+stop	114	113	59	65	55	56
V+fric.	85	70	40	35	32	24

**Table 1:** Frequencies of syllabifications in between the intervocalic consonant and the preceding vowel. The abbreviations VV and V stand for a long and a short vowel respectively.

**Five-year old children.** A chi-square analysis was performed on the frequencies for the three types of phonological environment in the category of singulars. The outcome was marginally significant:  $X^2 = 5.21$ ,  $p = .07$ . Whereas the effect of vowel length in the environment of an intervocalic stop was non-significant ( $X^2 < 1$ ), the effect of the nature of the intervocalic consonant was significant ( $X^2 = 4.23$ ,  $p < .05$ ), there being many more ambisyllabic segmentations in the context of a fricative than in the context of a stop. The effect of morphological complexity (singulars versus plurals) was non-significant ( $X^2 = 1.29$ ,  $p = .52$ ).

**Eight-year old children.** The frequencies observed for the singulars in the 8YO group differed significantly from those observed in the 5YO group ( $X^2 = 16.86$ ,  $p = .0002$ ). Whereas the effect of vowel type differed significantly between the two age groups ( $X^2 = 11.28$ ,  $p = .0008$ ), there being many more ambisyllabic segmentations in the short vowel condition in the 8YO group than in the 5YO group, the effect of the nature of the intervocalic consonant was constant across groups ( $X^2 = .15$ ,  $p = .70$ ). For the category of plurals the same pattern of findings was observed: an overall difference between the two age groups ( $X^2 = 11.58$ ,  $p = .003$ ), which was due to the different effect of vowel length ( $X^2 = 7.45$ ,  $p = .006$ ) - more ambisyllabic responses in the short vowel condition in the 8YO group - in the presence of a constant effect of the nature of the intervocalic consonant ( $X^2 = .29$ ,  $p = .59$ ). The effect of morphological complexity in the 8YO group was non-significant ( $X^2 = .62$ ,  $p = .73$ ), i.e. the two phonological variables (nature of intervocalic consonant and vowel length) had the same effects in the categories of singulars and plurals.

**Ten-year old children.** The responses in the 10YO group did not differ from those observed in the 8YO group, neither for the singulars ( $X^2 = .75$ ,  $p = .69$ ) nor for the plurals ( $X^2 = 1.48$ ,  $p = .48$ ), which indicates that the effect of the two phonological variables was the same in both age groups. The effect of morphological complexity was non-significant ( $X^2 = .92$ ,  $p = .63$ ).

## 2.3 Discussion

The experiment had been designed to study the effect of phonological, morphological, and orthographic knowledge on Dutch-speaking children's intuitive syllabification of spoken words in their native language. We will discuss the role of the phonological and morphological factors consecutively and in each case consider the effect of age, hence orthographic knowledge.

The effect of vowel length was non-significant in the 5YO group, whereas it was in the two literate groups. In contrast, the effect of the nature of the intervocalic consonant (stop versus fricative) did not differ between age groups. In all cases children made more ambisyllabic responses in the context of a fricative than in the context of a stop. The evolution of the effect of vowel length might suggest that preliterate children are not yet aware of the language-specific phonological fact that short vowels cannot occur in syllable-final position, whereas the literate children are. However, the effect of the intervocalic consonant indicates that preliterate children are much more reluctant to violate the language-

specific phonological constraint in the context of a fricative than in the context of a stop, which means that they have access to this constraint. In other words, there appears to be an interaction between children's implicit awareness of the constraint and the nature of the intervocalic consonant. Arguably, the phonological distinction between phonemes belonging to the class of continuants (like fricatives) and non-continuant phonemes (like stops) determines children's readiness to make an ambisyllabic response.

The finding that the effect of vowel length changes between the preliterate and literate groups indicates that orthographic knowledge may play a role in intuitive syllabification. Whereas preliterate children avoid ambisyllabic responses, which can resolve the conflict between language-universal and language-specific knowledge, in the context of a stop following a short vowel, literate children make these responses much more readily. Why do non-continuant lend themselves so much easier to ambisyllabic responses in the literate groups? The answer that we suggest is that knowledge of the orthographic conventions of the language comes in here. In Dutch a single intervocalic consonant is doubled in spelling after a short vowel, irrespective of the nature of the consonant (e.g., /æpêl/ is spelled as APPEL, /mœsêl/ as MOSSEL). If the spelling of the word affects subjects' syllabification process, intervocalic stops will occur in ambisyllabic responses too, which is what we observed. The fact that a difference is still obtained between stops and fricatives in the 8YO and 10YO groups indicates that the distinction between continuant and non-continuant consonants is not totally overruled by subjects' orthographic knowledge, i.e. that children apparently consider both orthographic and phonological factors. Yet in an earlier experiment (Gillis and De Schutter, 1996) another group of 8YO children did not distinguish between words with an intervocalic stop and words with an intervocalic fricative. At this stage we cannot account for the discrepancy between these two experiments.

In all three age groups the effect of morphological complexity was non-existent, i.e. the effect of the two phonological factors was the same for the singulars as for the plurals. This finding shows that these children could well keep the phonological and morphological levels apart in the syllabification task. We should be careful not to overgeneralize this finding. In this experiment we reported data on one particular instance of polymorphemic word only: plurals. These words were selected because they could be matched phonologically to the monomorphemic words in the materials. Possibly plurals behave differently from other types of polymorphemic words. They represent inflectional morphology and it is possible that words belonging to the domain of lexical morphology (e.g., derivations) behave differently.

### 3. CONCLUSIONS

Language-specific phonological knowledge determines children's intuitive syllabifications. More particularly, 5YO children are already sensitive to the language-specific phonological constraint on Dutch syllables that a short vowel cannot occur in syllable-final position. They are also aware of the distinction between continuants and non-continuant. Older children, who have already learnt to read and write, apparently cannot separate their orthographic

knowledge from their phonological knowledge, even though phonological factors still play a role (the distinction between continuant and non-continuant consonants). This confounding between knowledge sources does not occur between the phonological and morphological domains, at least not for plurals.

### 4. BIBLIOGRAPHY

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