

# The Psychological Reality of Ambisyllabic Consonants in Danish

Nicolai Pharao

Department of General and Applied Linguistics, University of Copenhagen

E-mail: nicpha@cphling.dk

## ABSTRACT

The purpose of this paper is to investigate whether or to what degree Danish speakers may treat single intervocalic consonants as ambisyllabic. To this end two experiments were conducted: 1) a syllable insertion task, and 2) a pause-break task. The following factors were hypothesized to influence speaker performance: the degree of stress on the preceding vowel, the quantity of the preceding vowel, the quality of the following vowel, and spelling of the consonant. The results of the syllable insertion task show that the tendency for the consonant to be ambisyllabic increased significantly if the singleton was spelled with two letters. The results from the pause-break task confirm this finding. Interestingly, however, a dependency on the phonetic class of the consonant also emerged. The decisive factor seems to be whether the consonant is a stop or a continuant, and not, as is often assumed, its sonority.

## 1 INTRODUCTION

The problem under consideration in this paper arises from observed discrepancies between the standard phonological analysis of Danish and actual speaker performance. In Danish, allophones of the phoneme /a/ depend on its position in the syllable: [a] occurs when adjacent to an /r/, or else only in syllables closed by a labial or dorsal consonant, and is realized [a] elsewhere. Furthermore, position in the syllable determines the presence or absence of aspiration in stop consonants. Thus, /p t k/ are aspirated in syllable initial position and unaspirated in syllable final position. Therefore, we would never expect to find [a] before aspirated stops. However, it is not uncommon to hear 'papier' *paper* pronounced [p<sup>h</sup>ap<sup>h</sup>i<sup>h</sup>], that is with a vowel quality normally only found in closed syllables, immediately followed by the initial variant of the stop. To account for such observed discrepancies we must evoke the concept of ambisyllabicity, i.e. the stop should be interpreted as simultaneously constituting the coda of the preceding syllable and the onset of the following one. This description is adequate within a formal theory of phonology. However, in a description that strives towards a mental representation of speech in the minds of linguistically naïve speakers, we must establish whether the notion of ambisyllabicity is in fact psychologically real for speakers of Danish. In other words, can single consonants be shown to behave as if they belong to two syllables simultaneously? And if so, are there any further principles governing the ambisyllabic representation of consonants?

## 2 PREVIOUS FINDINGS

Data from several languages indicate that ambisyllabicity may indeed be psychologically real for speakers. Thus, [5] provides ample evidence that speakers of Dutch in certain phonological contexts treat some consonants as ambisyllabic, and [2] indicates that particularly liquids and nasals may be ambisyllabic in the minds of speakers of U.S. English. There is even a study of Danish concerning the nature of the "speaker syllable", indicating that consonants may sometimes be treated as ambisyllabic by speakers [3]. However, the concept of ambisyllabicity is not altogether uncontroversial. In [6] the concept is dismissed as theoretically undesirable, since it would constitute the only violation of the Strict Layer Hypothesis in a prosodic hierarchy. And in [4] only language specific consequences of resyllabification may be accounted for through the notion of ambisyllabicity, whereas it is regarded as irrelevant in the definition of the universal phonological syllable. In view of the conflicting analyses it was deemed necessary to conduct a full-scale investigation of the placement of syllable boundaries by Danish speakers in order to determine whether or not they actually did treat consonants as ambisyllabic in specific phonological contexts.

## 3 METHODS

Two tests were conducted to determine whether ambisyllabicity is psychologically real for speakers of Danish. The first test, a syllable insertion task, was carried out to see whether speakers will produce apparent ambisyllabic consonants at all. The second test, a replication of the pause-break task outlined in [1], was designed to examine what factors might influence the representation of a consonant as ambisyllabic.

### 3.1 THE SYLLABLE INSERTION TASK

Subjects were instructed to insert a nonse syllable (either [p<sup>h</sup>ib] or [k<sup>h</sup>uŋ]) into disyllabic Danish words. The instructions comprised a set of examples, consisting of words with medial clusters of two consonants with a syllable boundary unequivocally located between the two. Subjects were instructed to repeat each stimulus as presented to them orally and then to produce the transformed response with the nonse syllable inserted. Repetition was preferred over written prompts in order to – to the extent possible – avoid any overt influence from the

orthography.

The stimuli consisted of three types of words: (1) <sup>1</sup>CVCV, like [ˈbʲisʌn] *buffalo*, (2) <sup>1</sup>CVCə, like [ˈbʲilə] *beetle*, and (3) C(C)V<sup>1</sup>CVC(C), like [p<sup>h</sup>aˈlas] *palace*. Only words of type (1) and (2) were actual test items. Words of type (3) were included merely as distractors and controls, since it was assumed that the nonse syllable would always be inserted immediately before the onset to the stressed syllable. Type (1) and (2) words both contained one item each with a long vowel in the first syllable, in order to control for the influence of the quantity of the preceding vowel. Words of type (2) (i.e. disyllables with final schwa) were included in order to test whether subjects would allow schwa to appear without onset in syllable initial position despite the fact that schwa never occurs word initially in Danish. If speakers were to adhere to phonotactic constraints in their transformation of the stimuli, one would expect more responses with ambisyllabic consonants to words of type (2).

An attempt was made to control for the influence of spelling. Since the predominant orthographic cue for a short vowel is in the double spelling of the following consonant (e.g. [ˈbʲilə] ‘bille’ *beetle*) I hypothesized that knowledge of the written form would lead subjects to treat consonants represented by two letters as ambisyllabic, regardless of either quantity or quality of the surrounding vowels. In items of type (1) this was achieved by using words that were spelled with a double consonant (e.g. [ˈfaḏi] ‘fattig’ *poor*) and words spelled with a single consonant (e.g. [ˈbʲisʌn] ‘bison’ *buffalo*). The only way to control for the influence of spelling in words of type (2) was to include an item in which the intervocalic consonant is spelled with two different rather than two identical letters (e.g. [ˈfalə] ‘falde’ *to fall*).

Each subject was tested twice in the same session, first with one nonse syllable then the other. Stimuli were presented in randomized order, and the order was reversed in the second run. Half of the subjects inserted [p<sup>h</sup>iḃ] first, then [k<sup>h</sup>uḡ], and the other half inserted [k<sup>h</sup>uḡ] first, then [p<sup>h</sup>iḃ]. 10 subjects took part in the experiment. Most of them were university students but none had prior training in linguistics. Stimuli were presented orally by the author. Each session was recorded on cd and lasted about 10 minutes.

### 3.2 THE PAUSE-BREAK TASK

is a forced-choice test in which a group of subjects is asked to judge which of three different, orally presented divisions of a word is the more natural one. Division is indicated by a pause. Thus, for a stimulus like [ˈmini] *mini*, subjects were asked to indicate which of the following divisions was more natural: [mi...ni], [min...i] or [min...ni] (where ... indicates the pause).

The stimuli for the pause-break task consisted of six types of words differing in the nature of the intervocalic consonant. The intervocalic singleton was [p<sup>h</sup> b] (i), [t<sup>s</sup> ḏ] (ii), [k<sup>h</sup> ḡ] (iii), [n m] (iv), [l] (v), or [f s] (vi). All intervocalic singletons were preceded by a short vowel varying randomly in quality. In most items the vowel was stressed. However, a small portion of the stimuli consisted of words in which the consonant was placed in unstressed surroundings. Wherever possible each of the different types was represented by words in which the intervocalic singleton was spelled with a single letter and a double letter, respectively. Stimuli were presented orally by the author to a class of 25 high school students. The order of the three alternatives varied randomly for each word.

## 4 RESULTS

### 4.1 SYLLABLE INSERTION

The results from the syllable insertion task are given in table 1 below. The stimuli are grouped according to their segmental structure as described in the previous section. The stimuli are given in semi-narrow IPA transcription in the first column. The second column indicates the percentage of responses in which the consonant was treated as belonging solely to the coda of the first syllable. The third column gives the percentage of responses where it was treated exclusively as onset in the second syllable; and the fourth column gives the percentage of responses where the consonant was ambisyllabic, i.e. produced both as coda in the first syllable and onset in the second syllable after insertion of the nonse syllable.

Stimuli	coda	onset	amb.
Type (1) <sup>1</sup> CVCV			
[ˈk <sup>h</sup> oːla]	5%	90%	5%
[ˈmula]	0%	42%	58%
[ˈfaḏi]	5%	42%	53%
[ˈneḏʌḃ]	63%	31%	6%
[ˈfiḡus]	10%	60%	30%
[ˈbʲisʌn]	10%	70%	20%
Type (2) <sup>1</sup> CVCə			
[ˈk <sup>h</sup> yːsə]	0%	78%	22%
[ˈmaḏə]	0%	25%	75%
[ˈseḏə]	6%	47%	47%
[ˈbasə]	5%	35%	60%
[ˈbʲilə]	0%	44%	56%
[ˈfalə]	10%	40%	50%

**Table 1:** Results of the syllable insertion task

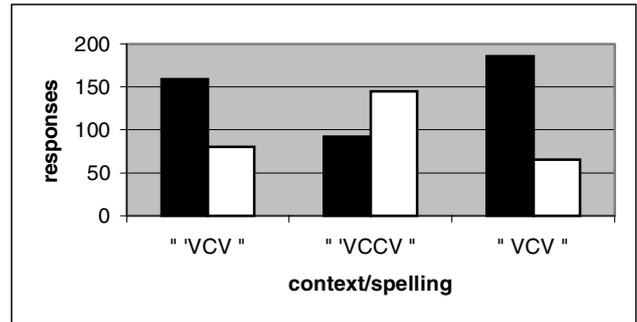
It is immediately obvious that consonants can indeed be treated as if they are ambisyllabic by linguistically naïve speakers. But it is not easy to discern any governing factors.

To deal with matters of quantity first, it is apparent from the percentages of onset-responses to [k<sup>h</sup>y:sə] ‘kyse’ *bonnet* and [k<sup>h</sup>o:la] ‘Cola’ *cola* that consonants following a long vowel tend to make up the onset of the following syllable only. Thus we may expect consonants to be ambisyllabic only if preceded by a short vowel. However, quantity alone cannot account for the distribution of responses. All type (2) words with a short vowel in the first syllable show a (modest) tendency for the consonant to be ambisyllabic, but only two of the type (1) words exhibit the same pattern. The explanation may be found in the standard spelling of the stimuli. The intervocalic singleton in the bottom two words in type (1) stimuli are spelled with a single letter in spite of the fact that the preceding vowel is short. In all other stimuli, the singleton is spelled with two letters. Furthermore, a chi-square test shows that the distribution of responses to the single-letter stimuli does not differ significantly from the distribution of responses to stimuli containing a long vowel ( $p < 0.37$ ). This indicates that the spelling of the intervocalic singleton is the strongest determinant for ambisyllabicity. The somewhat mystifying distribution of the responses to stimulus [neᵊʌᵊ] ‘netop’ *exactly* probably has an altogether different explanation. If the singleton is interpreted as forming the coda of the first syllable, each syllable in isolation would constitute a word, namely [neᵊ] ‘net’ *net* and [ʌᵊ] ‘op’ *up*.

Thus, the results from the syllable insertion task clearly show that speakers of Danish may indeed treat consonants as ambisyllabic, and they also indicate spelling to be the most important factor.

#### 4.2 PAUSE-BREAK TASK

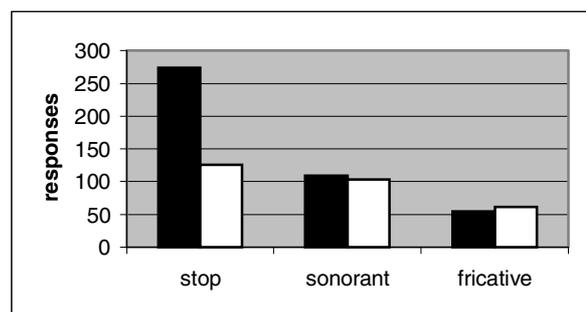
To further refine our understanding of the principles governing ambisyllabicity in Danish, we will now look at the results from the pause-break task. I choose to focus on the distribution of responses in which the intervocalic singletons were treated either as ambisyllabic or constituted the onset of the second syllable only. This is because, much like in the syllable insertion task, very few subjects ever felt the division of a word after the consonant to be the more natural one. I begin by examining the influence of spelling as opposed to degree of stress on the surrounding vowels. In Figure 1 below the leftmost pair of columns (labeled “VCV”) gives the number of responses to words where the singleton is spelled with a single letter, and the preceding vowel is stressed. The middle pair of columns (labeled “VCCV”) gives the number of responses to words also with initial stress, but where the singleton is spelled with two (identical) letters. The rightmost pair of columns (labeled “VCV”) gives the number of responses to words in which none of the vowels surrounding the singleton were stressed.



**Figure 1: Distribution by category** – black columns indicate the total number of responses where the singleton was treated as onset in the following syllable and white columns give the total number of responses where it was treated as ambisyllabic.

It is readily apparent from the diagram that the category “VCCV” is very different from the two other categories.

Indeed the distribution of responses to words of this category is shown by chi-square tests to be significantly different from either of the other two categories (in both cases  $p < 0.001$ ). Although there is some difference in the distribution of responses to categories “VCV” and “VCV”, the difference is not significant ( $p < 0.1$ ). Thus, I conclude that spelling, again, is the most important factor, since responses to “VCCV” words had more ambisyllabic responses than onset responses, whereas the opposite is true of words in the categories “VCV” and “VCV”. However, it is interesting to note that all consonants, regardless of their spelling, may be treated as ambisyllabic by the subjects. Traditionally, the tendency for consonants to be ambisyllabic has been related to their position in the sonority hierarchy. The distribution of onset and ambisyllabic responses for words containing intervocalic stops, sonorants and fricatives is given in Figure 2 below.



**Figure 2 : Distribution by sound type** - black columns indicate the total number of responses where the singleton was treated as onset in the following syllable and white columns give the total number of responses where it was treated as ambisyllabic.

The diagram shows a striking difference in the distribution of responses to words in which the singleton is a stop as opposed to words where the singleton is either a sonorant or a fricative. And the difference is statistically significant (in both cases  $p < 0.001$ ), whereas there is no significant

difference between the distribution of responses to words where the singleton is a sonorant or a fricative. This is surprising. If the sonority of the consonant were to exert any influence upon its tendency to be treated as ambisyllabic, one would expect stops and fricatives to group together, not fricatives and sonorants, since unvoiced stops and fricatives resemble each other more with respect to sonority, than do unvoiced fricatives and sonorants. However, there *is* a feature which is shared by fricatives and sonorants, namely that of continuous airflow through the vocal tract. That is, the sounds which are most likely to be ambisyllabic, at least for Danish speakers, are all continuants, if we allow nasals to be classified as such in accordance with their nasal flow, and in spite of their oral closure. Thus, with respect to ambisyllabicity, continuants appear to constitute a psychologically real class of sounds to speakers of Danish.

## 5 CONCLUSIONS

The data presented here give a clear answer to the question whether ambisyllabic consonants may be psychologically real to speakers of Danish. They may. What is also interesting are the factors governing the behavior of a consonant as ambisyllabic. Primarily, there is the consonant's representation in the orthography, since singletons spelled with two identical letters are most likely to behave as ambisyllabic. However, a second deciding factor is whether or not the consonant is a continuant or a stop. If it is a continuant it is likely if not mandatory, that the consonant be treated as ambisyllabic. Accordingly, the concept of ambisyllabicity is relevant in a theory that desires to achieve a certain degree of psychological adequacy, and, for Danish at least, consonants with a continuous airflow (whether oral or nasal) are more likely to be ambisyllabic than stop consonants.

## REFERENCES

- [1] B. L. Derwing, "A 'Pause-Break' Task for Eliciting Syllable Boundary Judgements from Literate and Illiterate Speakers: Preliminary Results from Five Diverse Languages", *Language and Speech*, vol. 35, pp. 219-235, 1992.
- [2] D. Fallows, "Experimental evidence for English syllabification and syllable structure", *Journal of Linguistics*, vol. 17, pp. 309-319, 1981.
- [3] N. Grønnum, "Syllables at multiple levels of representation in Danish", in *Journées d'Etudes Linguistiques Nantes*, pp. 24-29, 1999.
- [4] J.B. Hooper, "The syllable in phonological theory", *Language*, vol. 48, pp. 525-540, 1972.
- [5] N. O. Schiller, A. S. Meyer & W. Levelt, "The Syllabic Structure of Spoken Words: Evidence from the Syllabification of Intervocalic Consonants", *Language and Speech*, vol. 40, pp. 103-140, 1997.
- [6] E. Selkirk, "The Syllable", in *The structure of phonological representations (Part II)*, H. van der Hulst & N. Smith, Eds., pp. 337-384, Cinnaminson NJ: Foris Publications, 1982.