

STRUCTURAL ASPECTS AND PHONETIC IMPLEMENTATION OF DUTCH STRESS RETRACTION*

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ABSTRACT

The structural conditions (in terms of focus distribution and syntax) of stress retraction in Dutch compound adjectives were investigated. Perceptual effects were determined and related to a detailed acoustical stimulus analysis.

INTRODUCTION

In Dutch, as well as in English and German, the great majority of the words have stress in one designated position, which is maintained in all contexts, e.g. 'yellow' has invariant initial stress, and 'opaque' always has final stress. However, a minority of words have variable stress. In Dutch, the most productive category is formed by compound adjectives (CA) that take primary stress on the second element, e.g. *red 'hot* as in *the poker was red 'hot* [1]. Such words have secondary stress on the first element, and can in fact be pronounced with pitch accents on both the first and the second elements. Crucially, this type of word is subject to stress retraction when followed by another metrically strong word within the same phonological phrase (ϕ), e.g. *I see a red 'hot poker* [2,3]. In the present research we aim to determine, in carefully controlled Dutch materials, the effects of (i) syntactic structure (i.e. attributive versus predicative use of CA) and of (ii) melodic structure (i.e. the absence vs. presence of pitch accents as induced by manipulation of focus distribution). When we find stress shift blocked we will assume the presence of a ϕ -boundary immediately following CA. Specifically, we want to know if stress retraction is observed when CA is attributive, and blocked when it is predicative, even though CA is immediately followed by a metrically

strong constituent. Secondly, we want to determine to what extent stress retraction is maintained when CA is not in focus, i.e. is not hit by a pitch accent. Finally, we ask whether stress retraction can occur across adjacent words that belong to separate focus domains; if not, it would mean that narrow focus domains are separated by ϕ -boundaries.

Our experimental approach will be to have screened speakers read out materials and have a group of native listeners decide whether they perceive a ws (retraction blocked) or an sw pattern (retraction applied) on the target CA's. The acoustic details of the stress patterns will then be examined.

METHOD

Two male and two female speakers of Dutch produced twelve disyllabic (compound) adjectives: four controls with fixed initial stress, four with fixed final stress, and four crucial words with retractable stress. The adjectives (A) were immediately followed by a metrically strong word with initial stress, either a noun (N) or a verb (V). In an AN sequence, A was used attributively, so that no ϕ -boundary should separate A from V. In an AV sequence, A is used predicatively, with a ϕ -boundary separating A and V. The target phrases occurred in answer sentences whose focus distributions were manipulated by immediately preceding questions, which made all constituents in the answer 'old', except one. The following table illustrates the seven focus and syntax conditions, using English examples transliterated from Dutch. In the codes, focus domains are indicated in square brackets; capitals are accented words.

- [a N] (*integrative focus*)
What has Oliver bought?
Oliver has a [well-fed calf] bought.
- [A][N] (*double focus*)
Has Oliver a lean cow bought?
Oliver has a [well-fed] [calf] bought.
- a [N] (*narrow focus on N*)
Has Oliver a well-fed cow bought?
Oliver has a well-fed [calf] bought.
- a n (*no focus, attributive A*)
Who has a well-fed calf bought?
[Oliver] has a well-fed calf bought.
- a v (*no focus, predicative A*)
Who has that cock well-fed bought?
[Oliver] has it well-fed up bought.
- [A] v (*narrow focus, predicative A*)
How has Oliver that cock bought?
Oliver has it [well-fed] up bought.
- [A] n (*narrow focus, attributive A*)
What sort of calf has Oliver bought?
Oliver has a [well-fed] calf bought.

Each speaker read the 84 question-answer pairs twice, in different random orders, yielding a total of 672 questions and answers.

The second recordings of each question-answer pair (N=336) containing a CA were presented to a group of ten native Dutch listeners who indicated for each answer its acceptability on a scale from 1 (highly unacceptable prosody) to 7 (highly acceptable prosody). Figure 1 gives the results.

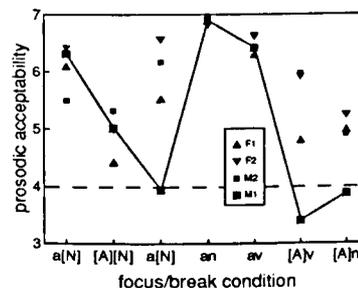


Figure 1: Acceptability (7-point scale) of answers for focus/syntax conditions and speakers.

Speaker M₂'s utterances were evaluated as insufficient (below the the midpoint of the scale, dotted line) in three focus/ ϕ conditions. For this reason M₂ was omitted from further analyses.

The second recordings (answers

only) were then presented in quasi random order to 21 native Dutch listeners, after that all the words in the utterance except the target A's had been resynthesized with formant bandwidths (B₁..B₅) set to 4.5 kHz, so that our subjects could not recognize the context words, while rhythm and melody were preserved. Subjects determined, with binary forced choice, for each target A whether they perceived initial or final stress.

RESULTS

Structural determinants of stress retraction are most convincingly observed in the stress position judgments, as indicated in figure 2.

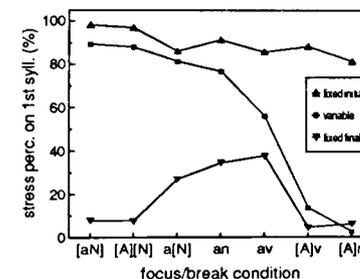


Figure 2: Percent stress perceived on first syllable broken down by focus/syntax condition and by stress type.

A's with fixed initial stress receive at least 80% stress judgments on the first syllable. A's with fixed final stress receive never more than 40% initial stress judgments, and even less than 10% when they are in focus (stress position is marked less effectively when A does not bear a pitch accent). The crucial (i.e. variable) type of A is perceived with retracted stress (i.e. at least 75% stress perceived initial stress) in four out of seven focus/syntax conditions; in all of these, A is used attributively. Stress retraction is blocked when A is in narrow focus, whether used attributively or predicatively. Also, there is a trend to block stress retraction when a non-focused A is used predicatively. Summarizing: stress retraction applies unless A (i) is used predicatively or (ii) constitutes a single narrow focus domain.

Let us now turn to the phonetic implementation of Dutch stress retraction. F_0 contours were parametrised and measured in terms of excursion size (semitones, st), duration (ms), slope (st/s) and temporal alignment (ms re. vowel onset) of the rise and fall portions of the pitch configurations on the target adjectives; also duration (ms) as well as peak intensity (dB) of both syllables in the adjectives were determined. We will present results only for the crucial A's with retractable stress.

F_0 . All accents on targets were rise-fall contours, and there was never more than one accent-lending pitch configuration on our target A's: double accents did not occur. Figure 3 presents the seven focus/syntax conditions as centroids in a plane defined by F_0 excursion size and relative F_0 peak position (in % of target A's length).

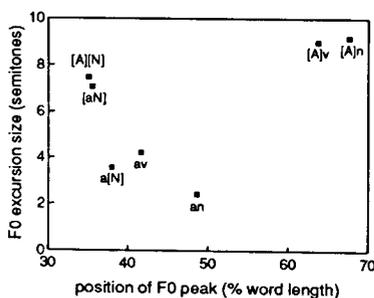


Figure 3: F_0 excursion size (st) and relative position of F_0 peak for seven focus/syntax conditions.

There are large pitch movements late in the targets in [A]v and [A]n, indicating blocking of stress retraction when there is a single narrow focus accent on A. When A is in integrative focus or part of a double focus, we observe large pitch accents early in the targets, indicating stress retraction. Notice that there is no difference in F_0 contour on A's in integrative and in double focus: even though speakers have the option to omit the accent on A in integrative focus, they choose not to; moreover, listeners do not object to this kind of accentuation (cf. figure 1). Finally, no systematic F_0 movements are found

when the target A's are outside focus. Unaccented words are not associated with F_0 movements in Dutch; the small excursions that appear in the figure are the leading or trailing flanks of pitch accents associated with earlier or later words in the utterances (or merely the reflection of declination).

Intensity. Figure 4 presents the centroids of the seven focus conditions in a plane defined by the peak intensities (in dB) of the vowels in the first and second syllable of the target A's.

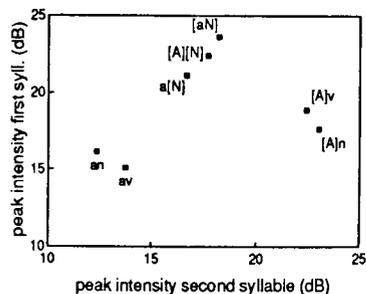


Figure 4: Vowel peak intensity (dB) of first and second syllables for seven focus/syntax conditions.

The vowels in the second syllable have greater intensity than those in the first when stress retraction is blocked due to a single narrow focus accent on A. The situation is reversed when stress retraction is applied in integrative or double focus. A similar exchange of a quantum of intensity is observed, but on a smaller scale, when the crucial word pair is outside focus. This indicates that stress shift also applies when there is no pitch accent (as was reported earlier [1,5]). Finally, stress shift is noticeable in unaccented, unfocused A's followed by a focal accent (see also figure 2). Therefore the presence of an accent on a later word may trigger stress shift on a non-accented earlier word, but the converse does not hold.

Duration. The effects of the seven focus/syntax conditions on the durations (ms) of the first and second syllables of our target A's are presented in figure 5.

The effects are qualitatively the same as for intensity differences. When stress

retraction is blocked in [A]n and [A]v, second syllables are relatively long and first syllables short; when stress retraction applies in integrative or double focus, the second syllable loses some 15% of its duration, while the first syllable is lengthened by a similar amount. The same transfer of a quantum of duration can be observed when the crucial word pair is outside focus (and therefore unaccented)

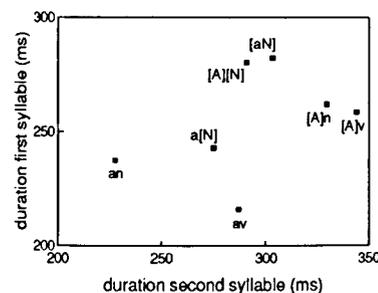


Figure 5: Duration of first and second syllable (ms) for seven focus/syntax conditions.

CONCLUSION AND DISCUSSION

The environment for stress retraction in Dutch (and related languages) can now be formulated as follows: stress retraction applies unless a compound adjective, or metrically similar constituent, (i) is used predicatively or (ii) constitutes a single narrow focus domain. Assuming that the blocking of stress retraction implies a ϕ -boundary immediately following A, we infer from these results that:

- there is a ϕ -boundary after a single narrow focus domain;
- there is a ϕ -boundary after a predicative adjective;
- there is no ϕ -boundary between two adjacent narrow focus domains (double focus).

Phonetically, when the target word is accented (due to focus) the retraction is implemented as a shift of the F_0 peak from the final to the initial syllable, with a concomitant transfer of a quantum of duration and intensity. The retracted accents tend to be marginally (but significantly) smaller (by about 2

st), which is compatible with a deletion rather than a movement analysis of stress retraction [4,5]. Alternatively, the effect may be due to a difference in number of accents: in both [A]n and [A]v there is only one accent, whilst two accents are involved in the retraction conditions. What remains of stress retraction on unaccented (unfocused) targets is an (audible) transfer of a quantum of duration and intensity from the final to the initial syllable.

NOTE

*This paper is based on the second author's Master's thesis [6] written under the supervision of the first author.

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