STRESS CLASH AVOIDANCE IN DUTCH: INVERSION OF STRESS PATTERN IN COMPLEX NOUNS?

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ABSTRACT

We tested the phonetic basis of a recent claim made by metrical phonologists that the stress pattern of di-syllabic Dutch words with initial stress is inverted to final stress in order to avoid "stress clash" when such words are embedded (as the right-hand element) in a compound noun. In one experiment speakers produced crucial words both as simplex nouns and embedded in compounds; listeners were then asked where they perceived the stress in the targets after these had been excised from their spoken context. In a second experiment we presented diphone-synthesised versions of the crucial word types with systematically varied stress patterns; listeners had to rate the acceptability of the range of patterns in various rhythmic contexts. Results indicate that listeners perceive no stress shift in naturally produced word tokens, and that they always disallow versions of such words with inverted stress patterns.

1. INTRODUCTION

Compound adjectives in Dutch and English, such as red hot, have final stress when used predicatively: the 'poker is red 'hot (a single quote preceding a syllable marks strong stress). In attributive position, however, the final stress on these words is retracted: a 'red hot 'poker. If the stress had not been retracted, the result would have been two strong stresses abutting one another, a situation called "stress clash": a red 'hot 'poker. It is generally claimed that an immediate succession of two strong stresses on the same prosodic level violates a basic rhythmic principle underlying languages such as Dutch and English. These languages have a strong preference for a so called alternating stress pattern, i.e., a regular alternation of strong (stressed) and weak (unstressed) syllables. Native speakers of Dutch and English can easily be convinced that stress retraction occurs in compound adjectives. In the older literature we find numerous claims to the same effect [2,3,4]. Moreover, laboratory experiments have shown that the inversion of stress pattern in Dutch compound adjectives is clearly audible and has robust acoustic correlates [1].

In the past few years Dutch phonologists have studied another class of rhythmic stress adjustment phenomena, viz. the behaviour of stress patterns in polysyllabic nouns embedded in compounds (cf. [6,7]). When a word like 'harnas (armour), with lexical stress on the first syllable, is embedded in a compound noun, a situation of stress clash may arise, as in 'borst'harnas (breast armour). The authors concerned [6,7] claim that stress clash is resolved in these cases by inverting the stress pattern of the embedded word, yielding 'borsthar'nas, which would have the same stress pattern as 'scheepskom'pas (ship's compass), of which the embedded noun kom'pas (compass) has lexical stress in final position. Moreover, stress

pattern inversion is claimed to be applicable only when the embedded noun has initial stress on a closed syllable (a so called non-branching rhyme). Therefore no stress adjustment is said to occur when the lexically stressed first syllable of the embedded noun is open as in, e.g., 'premie (premium) - 'jaar'premie (annual premium).

Curiously enough, the older literature contains no allusions to this type of stress adjustment at all, and ever since the claims were made, phoneticians have expressed their doubts whether these are indeed cases of stress adjustment. In the present study we tried to settle this issue in a series of experiments.

2. EXPERIMENT I: PERCEIVED STRESS IN NATURAL SPEECH

2.1. Method

The basic stimulus material consisted of three types of di-syllabic Dutch nouns, each category filled with five exemplars:

1. initial stress on an open syllable ('premie-type)
2. initial stress on a closed syllable ('harnas-type)
3. final stress (kom'pas-type)

These 15 words were used as simplex words as well as embedded word-finally in tri-syllabic compound nouns, e.g., jaarpremie, borstharnas, and scheepskompas. The resulting set of 30 words were recorded four times onto audio tape by two male speakers of Dutch, who pronounced the target words twice in a fixed carrier phrase Heb jij een [TARGET] ontdekt? (Have you a [TARGET] discovered?) with accent on the target and two more times in Heb JIJ een [target] ontdekt? (with a contrastive accent on jij).

The 120 di-syllabic target word tokens were excised from their spoken contexts using a digital wave form editor, and presented twice (in different random orders) to 18 Dutch listeners. These were asked for each stimulus word to indicate along a scale from -5 to +5 what stress pattern they perceived. In this scale "0" meant that the stress levels of the two syllables were exactly equal. "-5" was to be chosen if the subject felt that the initial syllable was much less stressed than the final syllable. "+5" had to be responded when the subject perceived much more stress on the initial syllable than on the final syllable. Intermediate values stood for less extreme differences in the distribution of stress over the two syllables.

2.2. Results and conclusions

Table I contains the results.

Table I: Mean perceived stress distribution (see text) broken down by accentedness of target, type of word (simplex vs. embedded in compound), and lexical stress type (each mean is based on 360 judgments nominally).

target	accented		unaccented	
	simpl.	emb.	simpl.	emb.
'premie	3.7	1.6	1.9	0.9
'harnas	3.7	1.7	1.5	0.5
kom'pas	-2.5	0.8	-0.5	-0.4

The perceived stress distribution clearly differs for words with initial stress ('premie-type and 'harnas-type) and those with final stress (kom'pas-type), $F(3,4194) = 957.1$ $p << .001$. The difference between initial stress and final stress is larger for simplex words than for the same words incorporated in a compound, $F(1,4195) = 55.8$, $p < .001$ (this corresponds to the difference between primary versus secondary stress on the word level). The stress patterns are perceived as more extreme in accented simplex words than elsewhere. Crucially, however, none of the differences between the 'premie-type and the 'harnas-type are ever significant, but these two types always differ significantly from the kom'pas-type (Scheffé procedure, $p < .05$).

So far, these results do not support the claims made by metric-

al phonologists, who predicted that the stress pattern of harnas would resemble that of 'premie in simplex words but that of kom'pas in compounds. One may argue somewhat perversely, however, that our spreakers may have behaved a-typically, and that an (even) more proficient speaker would have displayed the predicted stress shift after all. In order to resolve this possibility we ran a control experiment with an ideal (synthetic) speaker who produced the desired stress shifts exactly the way we wanted.

3. EXERIMENT II: PREFERRED STRESS PATTERN IN SYNTHETIC SPEECH

3.1. Method

The lexical material underlying the stimuli were three word pairs:

(jaar)premie:	initial stress, 1st syll. open
(borst)harnas:	initial stress, 1st syll. closed
(scheeps)kompas:	final stress

These words were embedded in final position in compounds; the resulting set of eight words were then synthesized from diphones (using the PB30 diphone set; for details cf. van Rijnsoever, 1988) in the same two carrier phrases (i.e., once with and once without accent on the target) that were used in experiment I. Each utterance was given the same pitch pattern with a standard declination and a with a 6 semitone rise-fall on the accented syllable. The duration of final two syllables in the targets was systematically varied in five steps, so as to create a continuum from stress on the penult syllable, via level stress, to stress on the final syllable (note that 80% of the original recording speed is the standard synthesis output rate):

	penult	final
rising	48%	112%
	64%	96%
level	80%	80%
	96%	64%
falling	112%	48%

The resulting set of 3 (lexical words) * 2 (simplex/embedded) * 2 (yes/no accent on target) * 5 (temporal stress patterns) = 60 stimulus types were presented to 19 native Dutch listeners in two different random orders, who had to indicate the acceptability of each item along a scale from 0 (unnacceptable stress pattern) to 7 (completely acceptable stress pattern).

3.2. Results

From the acceptability scores of the five temporally different versions of a stimulus type we derived its preferred stress pattern for each individual listener. To this efect we devised an index such that negative values indicate stronger preference for initial stress (i.e., a relatively long first syllable), and positive values stronger preference for final stress (i.e., a relatively long second syllable); an index of 0 would indicate that perfectly even stress is preferred. Table II summarizes the results.

Table II: Mean preferred stress pattern broken down by accent type (yes/no accent on target), word type (simplex vs. embedded in compound), and lexical stress type.

target	accented		unaccented	
	simpl.	emb.	simpl.	emb.
'premie	-.22	-.08	-.52	.03
'harnas	-.19	.02	-.24	-.02
kom'pas	.03	.29	.36	.40

We notice that the effects are stronger for unaccented than for accented targets. Words with initial lexical stress are always towards the negative end of the scale, while words with final stress appear at the positive end of the scale. When the simplex words are embedded into compounds, there is a general preference for a stronger (more stressed, longer) final syllable. This effect is especially clear when the targets are accented, and somewhat instable for unaccented targets. Crucially, however, there is not the slightest preference for stronger

final stress when 'harnas is embedded, even though rhythmic inversion was predicted there. Moreover, counter to the linguists' prediction, there is no systematic difference between 'premie and 'harnas.

4. CONCLUSION AND DISCUSSION

Our experiments have failed to support the predictions of metrical phonologists to the effect that embedding an initially stressed word in a compound noun would lead to an inversion of stress pattern. The stress pattern, and the temporal organisation associated with it, of an embedded noun with initial stress remains completely distinct from the stress pattern of an embedded word with final stress. We therefore take the view that these phonological predictions are wrong, and suggest that the principle of stress clash avoidance be restricted to the class of compound adjectives (the "stress retraction"-cases in §1). Notice that compound adjectives receive their stress pattern through the phrasal stress rule, i.e., by a process that is intrinsically above the level of the word. Apparently, there is no stress clash when two lexical stresses become adjacent in a compound noun, i.e., no stress clash is felt at the word level.

The duration of the first syllable in any di-syllabic word gets relatively shorter if this word is the final element of a compound (cf. table II). Three general (non-language-specific) low-level duration rules account for this phenomenon: (i) A syllable with main stress is longer than other syllables. When a word is embedded in a compound, it loses its main stress, i.e., the lexically stressed syllable loses its pitch movement, and gets shortened. (ii) Longer words are spoken faster than shorter words, therefore the syllables of the di-syllabic words will generally be shortened when they are embedded in a longer compound. (iii) A word-final syllable is lengthened so as to mark off the word (final lengthening).

Since the result, a shortened syllable at the onset of the embedded word, is compatible with the desired stress pattern of kom'pas, the shortening is not picked up for this type of word. When a long, open initial syllable is shortened (as in 'premie), the decrement in duration will be too small to reach the listener's awareness. But if a short, closed syllable gets shortened by the same amount, the effect may be above threshold and the linguist will be tempted to interpret this as a shift in stress.

We take the view, of course, that the effects of such low-level duration rules should not be mistaken for stress effects; or else we would have to interprete the same effect as a stress shift in one case ('harnas) and as a subliminal duration shift in others ('premie, kom'pas).

NOTE

Experiments 1 and 2 were run by my students Ellen L. Bish and Ruben van de Vijver, respectively.

5. REFERENCES

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