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Prosodic and Segmental Cues to the Perception of Grammatical Number in Two Limburgian Dialects of Dutch

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Abstract

This paper investigates the perception of grammatical number in two Limburgian dialects of Dutch, Roermond and Weert, as a function of focus and intonational context. In these dialects, number can be marked segmentally or prosodically. The Roermond dialect, but not the Weert dialect, appears to neutralize the prosodic distinction outside the focus constituent in IP-internal syllables. We explain this difference between the dialects on the basis of the specific prosodic marking used, duration in the Weert dialect and F0 in the Roermond dialect.

1. Introduction

Limburgian dialects spoken in the south-east of the Netherlands and the north-east of Belgium signal grammatical number segmentally (by means of schwa-suffixation or vowel change) or prosodically (by means of lexical tone or vowel quantity). In all the dialects that have them, prosodically marked number distinctions are restricted to subsets of monosyllabic nouns, of which there are typically between 10 and 20. The details of the prosodic marking vary considerably across the dialects. [2], [4] and [7] suggest that the more easterly dialects operate on a lexical tone distinction, whereas the more westerly dialects use vowel duration differences as a means of prosodic marking.

While in many tonal dialects, the tone contrast between what has recently been referred to as Accent 1 (”push tone”) and Accent 2 (”dragging tone”) is enhanced by means of duration, such that Accent 2 is longer, a production study of Roermond Dutch suggests that this dialect realizes the number distinction purely by means of a lexical tone contrast ([2]). The details of the F0 contours that realize the tone contrast vary with the intonation contour (declarative vs. interrogative intonation), the focus condition (+ vs. - focus) and the position of the target word in the intonational phrase (+ vs. - final). Figure 1 presents stylized declarative contours for Accent 1 and Accent 2 in three prosodic conditions. In a fourth condition, nonfocus nonfinal, the contrast between Accent 1 and Accent 2 was claimed to be neutralized by [2]: For both accents, the pitch remains low throughout the word.

By contrast, recent research on the dialect of Weert has indicated that the main correlate of the singular/plural distinction is vowel duration ([4],[7]). Although the vowel duration difference has been claimed to be accompanied by an alignment difference of a rising-falling pitch configuration ([8]), it would appear to be the vowel duration difference which is phonologically relevant. As a result, the prosodic marking system employed for the number distinction in Roermond is more complex than that in Weert: while Weert has a binary quantity opposition between long and short vowels, Roermond Dutch has a tone opposition whose details vary across intonational and positional contexts and moreover is subject to contextual neutralization. Native speakers of each of the two dialects, which are spoken in locations some 15 km apart, may well think that the way in which they express the number distinction in ’prosodically’ marked nouns is quite comparable across the dialects in the area, but we thought that the difference between the tonal encoding in Roermond and the quantity encoding in Weert is likely to have significant consequences for the discrimininability of the contrast across intonational conditions. Thus, while the discriminability of a quantity contrast may be expected to be largely independent of intonational context and position in the sentence, that of a tonal contrast is likely to vary from one intonational context to the next. Indeed, the discriminability of a quantity contrast is likely to approach that of a segmental contrast, which should not be expected to vary across contexts either.

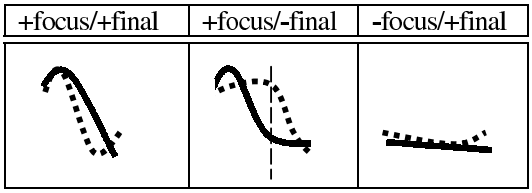

Figure 1: *Tone contrast in monosyllables, with declarative intonation. Solid lines: Accent 1, interrupted lines: Accent 2. The vertical line in the middle column indicates the end of the accented syllable.*

The purpose of this paper is two-fold. First, it aims to investigate the perception of the number distinction as a function of the general phonological means by which it is encoded. We expected that the distinction would be better perceived when it is marked by segmental means (vowel change or schwa-suffixation) than by prosodic means (lexical tone or vowel duration) since the segmental opposition is phonetically more robust. Second, it seeks more specifically to establish whether perception of the number distinction depends on whether it is signalled by F0 (Roermond) or by vowel duration (Weert). Here we expected that listeners of Weert Dutch would perceive the number contrast in all prosodic contexts, including the nonfocused, nonfinal ones. By contrast, in the case of the Roermond dialect we expected the contrast to be neutralized in these contexts. Also, it may be the case that the tonal contrast is inherently less effective, in which case we should obtain lower recognition scores in the ’best’ intonational context for the tonal contrast than for the quantity contrast in the same context.

2. Method

We put the above hypotheses to the test in a perception experiment in which native speakers of the two dialects were required to label instances of naturally produced target words as either singular or plural.

2.1. Stimuli

The stimuli were based on the singular and plural forms of nine nouns in each dialect. Six nouns distinguished their singular and plural forms purely on the basis of a prosodic (i.e., tonal and/or durational) contrast, while the other three displayed segmental differences. One of these formed the plural by means of umlaut (*man - men* 'man'), and two by the suffixation of a plural ending [ə]. The singulars and plurals of each noun were used in five different sentences corresponding to five different prosodic contexts:

1. focus, final
2. focus nonfinal
3. nonfocus, final
4. nonfocus, nonfinal, before the focus
5. nonfocus, nonfinal, after the focus

Both the Roermond and the Weert dialect have gender, and premodifying elements may reveal the singular or plural status of the noun stem through their inflections. Care was taken to choose sentences that did not so reveal the number of the noun in question, which implied that the target words had to be embedded in metalinguistic carrier sentences such as *I heard "RABBIT(S)"*. A complete list of all carrier sentences and target words is given in the appendix.

The sentences were presented to native speakers of each dialect who were required to read them as naturally as possible: each sentence was read four times (in four blocks that were recorded with time intervals of some 5 to 10 minutes). For the Roermond dialect there were 3 female and 3 male native speakers, while the sentences for the Weert dialect were read by 3 female and 2 male native speakers. They were identified by an expert native speaker as authentic speakers of the dialect concerned. During the recording sessions this expert native speaker was present to assist in identifying incorrect deliveries: these were read again at the end of the recording session. The sentences were recorded on a DAT-recorder with a sampling rate of 44.1 kHz.

From the resulting sentences, 360 utterances (4 speakers, 9 words, 5 contexts, 2 numbers) were chosen on the basis of two principles: first, the best 2 male and 2 female speakers for each dialect were selected and secondly, the most fluent and representative version of each sentence was chosen. The sound level of all utterances was normalized in order to avoid major volume differences on the experimental tape.

The stimuli were grouped into two different presentation blocks. Block 1 contained the 360 stimuli in a random order and block 2 had all the stimuli in the mirrored order, such that every stimulus with a singular form corresponded to a stimulus with the plural form, and vice versa. This counterbalancing of the stimuli was done to compensate for possible effects of stimulus presentation order.

The experimental tapes were prepared electronically in such a way that the stimuli were separated by 5,000 ms of silence, enabling judges to record their judgements. There were no numerical indications of the stimuli, but after each set of 10 stimuli judges heard a short orientation signal.

2.2. Judges and procedure

In Weert, 20 judges took part, of whom 11 listened to blocks 1 and 2 and 9 listened to blocks 3 and 4. The average age of the judges was 17.6 years. In Roermond, 18 judges participated in the perception experiment: 8 judges listened to blocks 1 and 2, while 10 judges listened to blocks 3 and 4. Their average age was 17.2 years. All judges considered themselves to be authentic speakers of the respective dialects and they reported to speak dialect in most of their daily social encounters.

The judges were told that they were going to take part in a listening test on the perception of grammatical number in their dialect. They were seated in a quiet room and were given a score sheet on which they could record their judgement each stimulus in terms of the categories 'singular' and 'plural'. For every stimuli, the singular of the target word was printed on the scoring sheet in a slightly modified version of Standard Dutch orthography, after which there appeared two boxes marked 'singular" and 'plural', respectively. Before the experimental stimuli were presented, judges heard 10 practice items in order to get accustomed to the task and to have the listening volume adjusted to a comfortable level. After being presented with these trial stimuli, the tape was stopped and judges were given an opportunity to ask questions. Subsequently, judges listened to all the stimuli without interruption. Effective listening time was 40 minutes. After the experiment, none of the judges reported any difficulties.

3. Results

Analysis of variance (repeated measures) was carried out on the data pooled over the five prosodically marked words. One word had to be removed, as shown in the Appendix. There were three fixed within-subject factors: NUMBER (2 levels), CONTEXT (5 levels) and SPEAKER (4 levels). Where relevant, the Huynh-Feldt corrected p-values are reported; the significance level was set at 1%. The index for effect size is partial η^2 (ranging from 0 to 1). In Table 1, we give the significant main effects and interactions of effects, and the associated effect sizes.

Source	F	df	Sign.	η^2
N	9.978	1;17	.006	.370
C	81.202	4;68	.000	.827
S	5.479	3;51	.004	.244
N*C	15.527	as C	.000	.477
C*S	2.804	12;204	.004	.142
N*C*S	3.642	as C*S	.000	.176
N	2.564	1;19	.126	.119
C	4.266	4;76	.005	.183
S	17.251	3;57	.000	.476
N*C	5.486	as C	.002	.224
N*S	11.391	as S	.000	.375
C*S	3.686	12;228	.000	.162
N*C*S	3.660	as C*S	.000	.162

Table 1: *Prosodically marked minimal pairs: main effects and significant interactions of effects on recognition scores for Roermond (upper rows) and Weert (lower rows).*

The strongest effect in this table is CONTEXT, in Roermond Dutch. This effect is also significant in Weert, but its F and η^2 values are far inferior to those computed for Roermond. The next highest effect is found in Weert: In this dialect, SPEAKER has an F value of 17.251 and η^2=.476.

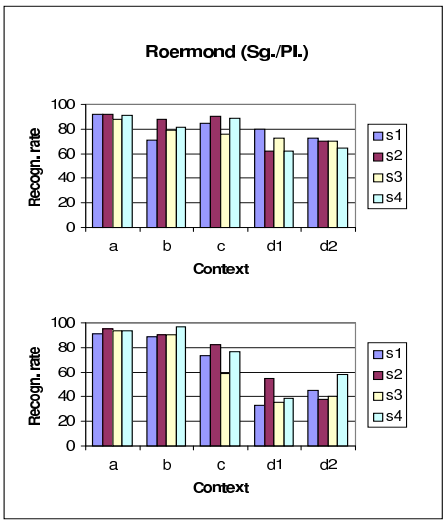

Figure 2: *Recognition scores of singular (upper panel) and plural forms (lower panel), in Roermond Dutch (prosodic cues), for four speakers, separately.*

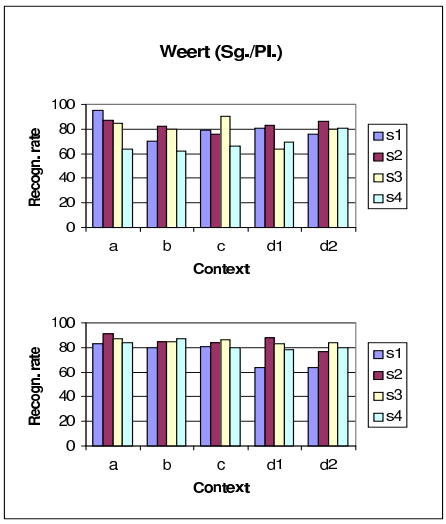

Figure 3: *Recognition scores of singular (upper panel) and plural forms (lower panel), in Weert Dutch (prosodic cues), for four speakers, separately.*

The same kind of ANOVA was performed on the segmentally distinguished minimal pairs, which served as a baseline for number recognition under phonologically favourable circumstances. No significant effects were found for Roermond: the lowest p-value is .011, for the effect NUMBER, with $F(1,17)=8.053$ and $\eta^2=.321$. In Weert, we found two significant effects : CONTEXT, with $F(4,76)=6.610$, $p=.001$ and $\eta^2=.258$, and SPEAKER, with $F(3,57)=7.356$, $p=.000$ and $\eta^2=.279$. As we can see, there is more variation due to the speaker in Weert than in Roermond Dutch. However, since this variation is not systematic, we will not discuss this effect any further.

Fig. 2 to 4 show recognition scores as a function of prosodic context, first for the prosodically marked forms (Fig. 2 and 3), and then for the segmentally marked forms (Fig. 4). The contexts are abbreviated as follows: a = focus/final, b = focus/nonfinal, c = nonfocus/final, d1 = nonfocus/nonfinal (prenuclear), d2 = nonfocus/nonfinal (post-nuclear).

4. Discussion and Conclusion

In our experiments on the recognition of singular and plural forms in the dialects of Roermond and Weert, we obtained the following results:

1. Recognition scores of singulars and plurals of nouns with segmentally marked number, either by means of umlaut or by means of a schwa-suffix, are higher than of those of nouns with prosodically marked number. This holds for all contexts in both dialects.
2. In Roermond Dutch, but not in Weert Dutch, there is a clear difference between recognition scores in the -focus/-final contexts and the +focus and/or +final ones. Even though this difference is less salient in singular than in plural forms (which is also shown by the rather strong combined effect of number and context in the ANOVA), we conclude from our results that in Roermond Dutch, prosodically marked number distinction appears to be obliterated outside the focus constituent in IP-internal syllables.

It is not surprising that segmentally marked number is better recognized than prosodically marked number, in view of the greater salience of vowel quality differences and additional syllables than of tonal and durational differences. What is surprising is that recognition rates of prosodically marked number is so high. It is generally believed that the Limburgian tone contrast is very subtle and difficult to hear, but our results show that this is not the case for native speakers: In the cases where a contrast is expected, the recognition scores in Roermond are in average even higher than the ones in Weert. With these results, we do not postulate a general dominance of F0 on duration, but we can at least reject the hypothesis that durational contrasts are intrinsically easier to perceive than tonal ones.

The fact that in Roermond Dutch, singular forms are better recognized than plural forms in the -focus/-final contexts, can be explained by a bias towards Accent 2, due to the rather flat pitch contour that also characterizes Accent 2 in a +focus/-final position. The fact that the prosodic number distinction is not perceived in IP-internal syllables outside the focus constituent in Roermond Dutch confirms results for productive data ([2]). What is new, however, is that this neutralization occurs before the focus as well as after it.

Our results demonstrate the importance of studying lexical tone contrasts in the wider context of sentence prosody and information structure.

5. References

[1] Cajot, J., 2001. Een toonloze enclave in polytoon gewaand gebied. Een les in structurele fonologie? *Jaarboek 3 van de Vereniging voor Limburgse Dialect- en Naamkunde.* Hasselt.

[2] Gussenhoven, C., 2000. The lexical tone contrast of Roermond Dutch in Optimality Theory. In *Prosody: Theory and Experiment. Studies presented to Gösta Bruce*, Horne (ed.). Dordrecht: Kluwer Academic Publishers, 129-167.

[3] Gussenhoven, C., Van der Vliet, P., 2001. The phonology

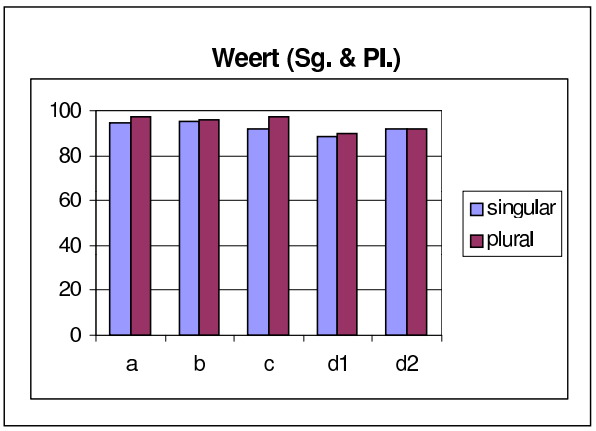

Figure 4: *Recognition of singular and plural, pooled over four speakers, in Weert Dutch. The data for Roermond are very similar to these, except that all scores are above 96%.*

of tone and intonation in the Dutch dialect of Venlo. *Journal of Linguistics*, 35, 99-135.

[4] Heijmans, L., 2003. The relationship between tone and vowel length in two neighboring Dutch Limburgian dialects. In *Development in Prosodic Systems*, Fikkert & Jacobs (eds). New York: Mouton de Gruyter.

[5] Schouten, B., Peeters, W., 1996. The Middle High German vowel shift, measured acoustically in Dutch and Belgian Limburg: diphthongization of short vowels. *Zeitschrift für Dialektologie und Linguistik*,63, 30-48.

[6] Verhoeven, J., 2002. The Phonetics of Tonal Contrasts in Weert Revisited. In *Phonetic Work in Progress. Antwerp Papers in Linguistics, 100*, Verhoeven (ed.), 191-197.

[7] Verhoeven, J., 2003. *Production and Perception of Lexical Tone in Weert.* Ms.

[8] Verhoeven, J., Connell, B., 1992. Tonal accents in a Limburg dialect: an acoustic-phonetic investigation. *Progress Report from Oxford Phonetics (PROPH)*, 5, 60-72.

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7. Appendix: Stimuli

The recorded stimuli are highly similar in Weert and Roermond Dutch. We here give the five carrier sentences for the word knien (’rabbit(s)’), plus all the target words as they appear in the dialect of Roermond. The word pin, which we had used as a prosodically marked noun, had to be excluded, as our Roermond subjects appeared to be unfamiliar with the plural form in question, for which they would rather use a suffixed form.

1. +focus, +final :
   In ’t Remunjs zaes-se geweun ”KNIEN”.
   In Roermond Dutch, you just say ”RABBIT(S)”
2. +focus, -final :
   [Wat höbs-se geheurd?] Ich höb ”KNIEN” geheurd.
   [What did you hear?] I heard ”RABBIT(S)”.
3. -focus, +final :
   [Eers ZAG hae ”knien”,] toen SJREEFDE hae ”knien”.
   [First he SAID ”rabbit(s)”,] then he WROTE ”rabbit(s)”.
4. -focus, -final, pre-nuclear :
   [Höbs-se ”knien” GEZAG?] Nae, ich höb ”knien” GEZÓNGE.
   [Did you SAY ”rabbit(s)”?] No, I SUNG ”rabbit(s)”.
5. -focus, -final, post-nuclear :
   [Heurt allein WILSKE ”knien” good?] Nae, ouch MIEKE heurt ”knien” good.
   [Does only WILSKE hear ”rabbit(s)” well?] No, also MIEKE hears ”rabbit(s)” well.

Target words (prosodic/segmental):

bein (’leg(s)’)	knien (’rabbit(s)’)
derm (’intestine(s)’)	pin (’wooden nail(s)’)
erm (’arm(s)’)	sjtein (’stone(s)’)
kleur/-e (’colour(s)’)	teen/tene (’toe(s)’)
man/men (’man/men’)	