

# DIALECTAL FEATURE IMITATION IN NORWEGIAN

*Wim A. van Dommelen, Snefrid Holm & Jacques Koreman*

Department of Language and Communication Studies, NTNU, Norway

wim.van.dommelen@ntnu.no; snefrid@alumni.ntnu.no; jacques.koreman@ntnu.no

## ABSTRACT

This study investigates the ability of speakers to imitate features from another dialect of their native language. Speakers from two different Norwegian dialects spoken in Stavanger and Trondheim produced speech material using their own and each other's dialect. Acoustic analysis involved the occurrence of preaspiration in vowel – voiceless stop contexts.

Measurements revealed that preaspiration occurs in both dialects but that its duration is longer in the Stavanger dialect. In imitations speech rate was found to be reduced, suggesting increased speaking effort. In general, both speaker groups successfully adapted their preaspiration production to the norm for the imitated dialect. At the same time, gender-specific as well as idiosyncratic factors seemed to influence imitation performance.

**Keywords:** imitation, Norwegian dialects, preaspiration, articulation rate

## 1. INTRODUCTION

Imitating another speaker's voice requires changing one's own voice in two respects. First, for a successful imitation an impersonator has to mimic individual characteristics like fundamental frequency mean and range, speech rate, segmental durations, and segment qualities. In addition, in many cases imitation of specific dialectal features will be required. Previous investigations have shown that professional impersonators can be successful in mimicking  $f_0$ , formant frequencies, and global timing, e.g. [11, 12], but as shown by Eriksson and Wretling [6] timing at the segmental level seems to be harder to imitate. Non-professional speakers in Delvaux and Soquet [3] were shown to unintentionally imitate vowel length and degree of opening from another regiolect. In contrast, in a study by Kim and de Jong [9] speakers of a Korean non-lexical pitch accent dialect failed to consistently imitate a lexical pitch accent dialect of that language. To shed more light on naïve speakers' ability to mimic

dialectal features, we investigated the occurrence of preaspiration in vowel – voiceless stop sequences in two Norwegian dialects, spoken in Stavanger and Trondheim. Traditional descriptions consider preaspiration to be a typical feature of the former dialect but don't mention occurrence of such a feature in the latter [5, 10]. Therefore, preaspiration was expected to be an indicator of the present speakers' imitation skills.

## 2. METHOD

### 2.1. Recordings and subjects

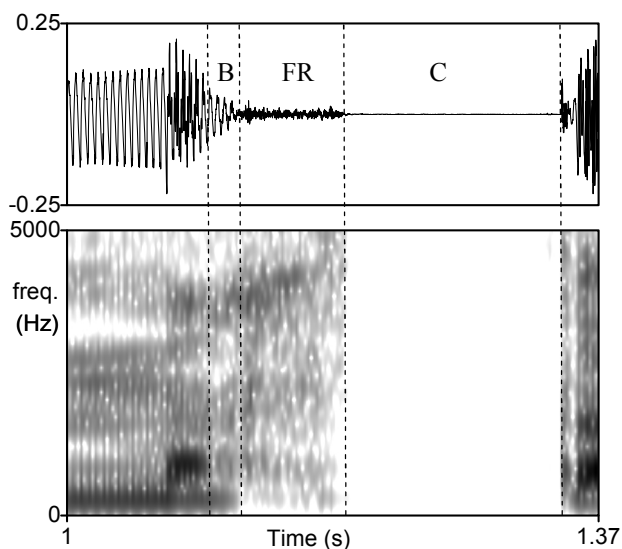
Recordings were made in sound-treated studios at the University of Science and Technology in Trondheim and the University of Stavanger with a sampling rate of 44.1 kHz and 16-bit quantization. In order to collect dialectally as authentic as possible speech material speakers were recruited who had spent most of their lives in their hometown. While in Trondheim 14 speakers (seven females, seven males) aged 19-65 years (median: 25.5 years) were recorded, the group in Stavanger comprised 13 speakers (eight females, five males) aged 20-66 (median: 28.0 years). Six Stavanger speakers had been living for a certain period in Trondheim (on average 2.3 years), but none of the Trondheim speakers had been living in Stavanger.

Recording sessions were organized as follows. Speakers were presented via headphones with a short recording of spontaneous speech from the dialect they had to imitate. Then, they read a total of 60 short sentences using that dialect. These sentences were written in standard Norwegian orthography (so-called Bokmål) and printed on a sheet of paper. Finally, the speakers produced the same sentences but this time using their own dialect. They were instructed to speak as if they were talking to a close acquaintance with the same dialect. It was pointed out that it was allowed to substitute written words or phrases by suited expressions from speakers' own dialect. Indeed, a number of speakers followed this suggestion for some words.

## 2.2. Analysis

Using Praat [2], the manifestation of preaspiration in 993 tokens in total were analyzed. All tokens were words with a voiceless stop in postvocalic position (e.g., *møte* [mø:tə]; ‘meeting’). Preaspiration in a stop manifests itself as a period of breathy vowel quality followed by friction produced at the glottis. Each of these periods can be very short or even absent. For the present purposes, “preaspiration” was defined as any period of breathy voicing plus following friction ([8]; cf. Fig. 1). Further, articulation rate was calculated for the sentences in which the words occurred by dividing the number of phones by sentence duration (excluding pauses).

**Figure 1:** /mat/ from <matta> (*the mat*) spoken by a female Trondheim subject speaking her own dialect. B= breathy part, FR= friction; C= closure.



## 3. RESULTS

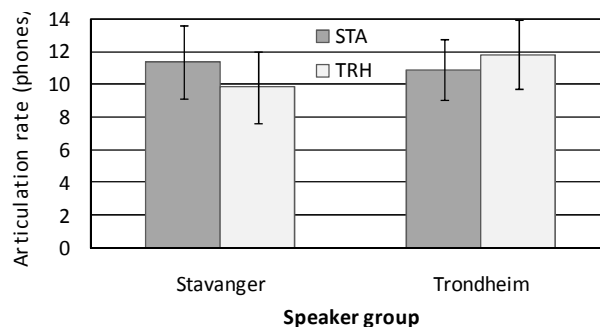
### 3.1. Articulation rate

As a first step in data analysis articulation rate was investigated. Mean articulation rates for Stavanger and Trondheim subjects speaking their own dialect and imitating other subjects’ dialect are presented in Figure 2. When speaking their own dialect, the two groups had very similar rates (Stavanger: 11.4 phones/s; Trondheim: 11.8 phones/s). In imitating, both groups showed decreased articulation rates: 9.8 phones/s for Stavanger and 10.9 phones/s for Trondheim speakers. As was shown by an analysis of variance with Group (Stavanger; Trondheim), Mode (own dialect; imitation) and Gender as factors, the generally somewhat higher articulation rate for the Trondheim speakers was statistically

significant (for Group:  $F(1, 985) = 24.1$ ;  $p < 0.001$ ). Similarly, the decrease in articulation rate in imitation mode ( $F(1, 985) = 91.8$ ;  $p < 0.001$ ) as well as the Group x Mode interaction ( $F(1, 985) = 6.51$ ;  $p = 0.011$ ) reached statistical significance. The latter result confirmed the observation that imitating slowed down Stavanger subjects more than Trondheim speakers.

On average, female speakers showed significantly faster articulation rates than males (1.2 phones/s;  $F(1, 985) = 77.9$ ;  $p < 0.001$ ). This gender effect appeared to be independent of speakers’ dialect and speaking mode as indicated by non-significant two- and three-way interactions of Gender with Group and Mode.

**Figure 2:** Articulation rate in phones/s for speakers from Stavanger and Trondheim speaking Stavanger (STA) and Trondheim (TRH) dialect. Vertical bars indicate  $\pm 1$  standard deviation.



### 3.2. Preaspiration

Preliminary to evaluating preaspiration we examined the question whether the differences in articulation rate between the groups would make normalization of preaspiration duration necessary. For each of the four combinations speaker group and own/imitated dialect linear regressions were calculated with articulation rate as predictor and preaspiration as dependent variable. In all cases preaspiration duration increased significantly with decreasing articulation rate. Using the slope values for each of the four regression lines, normalized preaspiration durations were calculated. Analyses of variance for raw and normalized preaspiration data revealed essentially the same effects for the two types of data. Therefore, the following evaluation was based on raw data only.

Let us start evaluation of the data with preaspiration duration (i.e., the total of breathy part of the vowel plus following voiceless friction; cf. Table 1). It can be seen that while in both the

**Table 1:** Breathy part of vowel (B), voiceless friction (FR) and preaspiration (PA= B+FR) duration plus standard deviation in ms for speakers from Stavanger and Trondheim speaking Stavanger and Trondheim dialect.

Dialect	Speaker group					
	Stavanger			Trondheim		
	B	FR	PA	B	FR	PA
Stavanger	27 (25)	38 (32)	65 (27)	32 (22)	28 (26)	60 (25)
Trondheim	23 (24)	29 (32)	52 (29)	28 (19)	22 (22)	50 (20)

Stavanger and the Trondheim dialect preaspiration was produced, its duration was longer in the first case (averages of 65 ms and 50 ms, respectively;  $t(441)= 6.91$ ;  $p < 0.0001$ ). Further, both speaker groups adapted their articulation in the imitation mode. Whereas Stavanger subjects reduced preaspiration duration by 13 ms to 52 ms, Trondheim people increased its duration by 10 ms to 60 ms. An ANOVA with factors Group, Dialect and Gender revealed that both speaker groups did successful imitations (both for Group and Group x Dialect interaction  $F < 1$ ). The factor Gender will be dealt with in section 3.3.

Inspection of the constituting parts of preaspiration, i.e. breathy vowel and friction, revealed that the observed preaspiration differences in the own dialect mode were due to dialect-specific friction production. Both speaker groups produced similar breathy vowel parts (27 ms and 28 ms for Stavanger and Trondheim subjects, respectively). In imitating, Stavanger speakers reduced and Trondheim speakers increased its duration to 23 ms and 32 ms, respectively. According to an ANOVA, both the effect of dialect and speaker group was significant ( $F(1, 985)= 5.53$ ;  $p= 0.019$ ;  $F(1, 985)= 18.6$ ;  $p < 0.001$ ), with no significant interaction ( $F < 1$ ). Of most importance for preaspiration differences is the part with voiceless friction. The difference between own dialect productions was relatively large: 38 ms for Stavanger vs. 22 ms for Trondheim speakers. In imitation, these durations were changed towards the values of the respective dialects (to 29 ms by the Stavanger and 28 ms by the Trondheim group). An ANOVA revealed significant main effects for both dialect ( $F(1, 985)= 22.0$ ;  $p < 0.001$ ) and speaker group ( $F(1, 985)= 18.3$ ;  $p < 0.001$ ) with no significant interaction ( $F(1, 985)= 1.14$ ;  $p= 0.287$ ).

### 3.3. Effect of gender

In section 3.1 we have seen that the female speakers in both dialect groups had faster articulation rates than the males. Here, we will investigate whether there also is a general gender

effect for preaspiration. In addition, we will look into the question whether there exists a gender-specific difference in imitation performance. For reasons of space we will discuss preaspiration duration only.

Pooled across dialects and speaking modes, the data revealed generally longer preaspiration durations for females (63 ms) compared with males (49 ms). According to the ANOVA referred to above (section 3.2), this effect was highly significant ( $F(1, 985)= 77.2$ ;  $p < 0.001$ ). As can be seen from Table 2, longer female durations were found in both speaker groups and speaking modes. In the own dialect mode, the effect was larger for Stavanger (71 ms vs 55 ms) than Trondheim speakers (52 ms vs 48 ms). Imitating Trondheim dialect, Stavanger females showed less reduction (71-59= 12 ms) than males (55-40= 15 ms). Similarly, female Trondheim speakers increased preaspiration duration in their Stavanger imitations substantially more than males (68-52= 16 ms vs. 52-48= 4 ms). These tendencies are all confirmed by significant interactions for Group x Gender ( $F(1, 985)= 6.27$ ;  $p= 0.012$ ) and Group x Dialect x Gender ( $F(1, 985)= 4.82$ ;  $p= 0.028$ ).

**Table 2:** Preaspiration duration and standard deviation in ms for female (F) and male (M) speakers from Stavanger and Trondheim speaking Stavanger and Trondheim dialect.

Dialect	Speaker group			
	Stavanger		Trondheim	
	F	M	F	M
Stavanger	71 (26)	55 (25)	68 (26)	52 (20)
Trondheim	59 (29)	40 (25)	52 (21)	48 (19)

### 3.4. Individual behavior

The results presented in the previous section seem to suggest that speaker gender is a very influential factor in imitation performance, possibly more important than idiosyncratic factors. To shed more light on this issue, data were analyzed at the level of individual speakers. For both speaker groups and both genders, correlation analyses were carried out investigating the relationship between preaspiration duration in the own dialect vs.

imitating mode. For each individual speaker, cases were selected where the same word in the same utterance occurred in both speaking modes.

The analyses revealed positive correlations for all four subgroups, reaching statistical significance in three cases: Stavanger females ( $r=0.386$ ;  $n=117$ ;  $p<0.001$ ), Trondheim females ( $r=0.292$ ;  $n=106$ ;  $p=0.002$ ) and males ( $r=0.429$ ;  $n=107$ ;  $p<0.001$ ). The exception was the male Stavanger subgroup ( $r=0.180$ ;  $n=87$ ;  $p=0.094$ ). These results thus indicate that there is a certain carry-over effect of own dialect behavior to imitation. It should be noted, however, that the correlations are weak. The impact of idiosyncratic behavior seems therefore to be relatively small.

#### 4. DISCUSSION

The similar articulation rates for own dialect production by speakers from Stavanger and Trondheim is in congruence with the lack of rate differences found for speakers from Southern, Western and Northern Norway in [1]. The lower articulation rates observed for both speaker groups in imitating can be taken as an indication of increased effort in speech production.

The effects of speaker group (Stavanger, Trondheim) and speech mode (own dialect, imitation) on preaspiration appeared to be robust and basically independent of articulation rate. Traditionally, preaspiration is regarded as one of the typical features of the Stavanger dialect. Although this is not true for the Trondheim dialect, also here preaspiration was observed in the present investigation, confirming previous findings [4]. Based on these studies it seems safe to state that a typical Norwegian “preaspiration” dialect like that from Stavanger just has a stronger amount of preaspiration than the Trondheim dialect and that the main difference lies in the part with voiceless friction.

From a forensic point of view it is interesting to observe imitation performance of the present subjects. In spite of the moderate size of the preaspiration difference between the two dialects under scrutiny, speakers seem not only to have (at least) implicit knowledge of this feature but also to be able to adjust their productions and achieve rather successful imitations. On average, imitations of the preaspiration feature were not fully perfect. We have seen that one of the factors constraining imitation is speaker gender. Presumably due to physiological gender differences, females usually

show stronger preaspiration than males [7, 8]. This could explain why the present Stavanger female speakers reduced their preaspiration duration not quite sufficiently in imitating Trondheim dialect. On the other hand, physiological predispositions might have helped the female Trondheim speakers to produce Stavanger-like preaspiration. Finally, the significant correlations between preaspiration in own dialect and imitation for three out of four cases suggested that imitation behavior partly is determined by idiosyncratic factors.

#### 5. REFERENCES

- [1] Almqvist, J. 2000. Kor fort snakker vi egentleg? *Nordlyd. Tromsø University Working Papers on Language & Linguistics* 28, 60-73.
- [2] Boersma, P., Weenink, D. 2010. Praat: doing phonetics by computer (Version 5.1.00) [Computer program]. <http://www.praat.org/>
- [3] Delvaux, V., Soquet, A. 2007. The influence of ambient speech on adult speech productions through unintentional imitation. *Phonetica* 64, 145-173.
- [4] van Dommelen, W.A. 1999. Preaspiration in intervocalic /k/ vs. /g/ in Norwegian. *Proc. 14th ICPhS San Francisco*, 2037-2040.
- [5] Endresen, R.T. 1991. *Fonetikk og fonologi. Ei elementær innføring*. Oslo: Universitetsforlaget.
- [6] Eriksson, A., Wretling, P. 1997. How flexible is the human voice? A case study of mimicry. *Proc. EuroSpeech '97 Rhodes*, Vol. 2, 1043-1046.
- [7] Fant, G., Kruckenberg, A., Nord, L. 1991. Prosodic and segmental speaker variations. *Speech Communication* 10, 521-531.
- [8] Helgason, P., Ringen, C. 2008. Voicing and aspiration in Swedish stops. *Journal of Phonetics* 36, 607-628.
- [9] Kim, J., de Jong, K. 2007. Perception and production in pitch accent system of Korean. *Proc. 16th ICPhS Saarbrücken*, 1273-1276.
- [10] Wolter, H. 1964. On preaspirated stops in a Norwegian dialect. *Proc. 5th ICPhS Münster*, 594-597.
- [11] Zetterholm, E. 2002. A case study of successful voice imitation. *Logopedics Phoniatrics Vocology* 27, 80-83.
- [12] Zetterholm, E. 2003. The same but different – three impersonators imitate the same target voices. *Proc. 15th ICPhS Barcelona*, 2205-2208.