

Vowel labelling in a pluricentric language

Flemish and Dutch labellers at work

Hanne Kloots, Evie Coussé and Steven Gillis¹

Universiteit Antwerpen — Centrum voor Nederlandse Taal en Spraak

1. Introduction²

Labelling speech sounds, i.e. classifying them into particular linguistic categories, can be influenced by several linguistic and extralinguistic factors, such as the emotional and physical condition of the speaker, the level of expertise and concentration of the labeller, and the quality and loudness of the recordings (e.g. Ohala 1989, Faber 1992, Cucchiariini 1993). Furthermore, transcribing and labelling speech of children, non-native speakers or computers is more difficult than interpreting speech of adult native speakers (e.g. van Heuven & van Houten 1985).

In addition, the regional background of the labellers influences the results of a labelling task. Most relevant research has focused on the influence of the labeller's *mother tongue*. Native speakers of a language are better at identifying vowels of their language than non-native speakers are (e.g. van Zanten & van Heuven 1984). In a vowel labelling task, the mother tongue of the labeller seems to be even more influential than the mother tongue of the speaker (Wang & van Heuven 2004). Furthermore, the responses ("labels") of native speakers are more consistent than those of non-native speakers (van Heuven et al. 1985, van Heuven & van Houten 1989). In phonological terms: the listener's mother tongue influences the location of the phoneme boundaries (Janson 1979).

Dialectologists have repeatedly drawn attention to the possible effect of the *dialectal* background of transcribers on the reliability of transcriptions (e.g. Jaberg & Jud 1927, Goossens 1965, Ringgaard 1965). In an empirical study, Fox (1974) did not find significant differences between listeners, who were all native speakers of American English, from Chicago and Oklahoma. However, Janson (1981) showed that the location of the boundary between two vowels can actually be different for labellers with a different dialectal background.

Interestingly, his informants were native speakers of Swedish originating from Stockholm and Helsinki, and hence, they did not only have a different dialectal background, but were also speakers of a different *national variety* of Swedish. Swedish is in fact a pluricentric language with (at least) two national varieties (Clyne 1992): Swedish-Swedish (the dominant variety) and Finnish-Swedish (the non-dominant variety), see Reuter (1992). This means that it is unclear whether the differences found by Janson (1981) originate from a difference in dialectal background or from the fact that the listeners have another national variety as their mother tongue.

In this study, we investigate the influence of two national varieties of Dutch, the language spoken by our informants, while keeping the dialectal background of the listeners as constant as possible. Just like Swedish, Dutch is a pluricentric language. Although, the dominant variety is spoken in the Netherlands, Dutch is also the official language of Flanders (i.e. the northern part of Belgium), Surinam, the Dutch Antilles and Aruba. For an introduction into the history, geography and linguistic structure of Dutch, see De Schutter (1994). A concise description of the Standard Dutch pronunciation in the Netherlands can be found in Gussenhoven (1999), the Belgian pronunciation of Standard Dutch is described by Verhoeven (2005). In a listening experiment, speech samples of spontaneously spoken Standard Dutch, originating from Flanders and the Netherlands, were labelled by three Flemish and three Dutch listeners. The labellers' task consisted of labelling the quality of unstressed vowels. The listeners all grew up in the same dialect area, viz. Brabant, a cross-border region consisting of the provinces Northern Brabant (the Netherlands) and Antwerp/Flemish Brabant (Belgium). In the Middle Ages, the present provinces of Antwerp and Northern Brabant belonged to the Duchy of Brabant. The dialects spoken in the former Duchy all belong to the so-called "southern central dialects" of Dutch (Weijnen 1966).³

2. Method

2.1 Informants

We studied the speech of 160 teachers of Dutch (80 from Flanders, 80 from the Netherlands). Teachers of Dutch are considered to be "prototypical" speakers of the standard language (e.g. Van de Velde & Houtermans 1999). They use the standard language on a daily basis and are expected to have excellent mastery of the standard language, although their language is expected to contain more variation than that of radio reporters (whose speech is used in earlier studies

on the pronunciation of Standard Dutch, e.g. Cassier & Van de Craen 1986, Van de Velde 1996).

The informants were selected according to the criteria *age*, *sex* and *region*. In Flanders as well as the Netherlands, half of the informants was born before 1955, the other half after 1960. The Belgian and the Dutch sample both contain an equal number of men and women. In each country, four regions were selected, based on linguistic, geographical and socio-economic criteria (Van Hout et al. 1999). Both for the Netherlands (henceforth: NL.) and Flanders (henceforth: FL.), the economic, cultural and linguistic centre was selected (FL.: Antwerp/Bra-bant; NL.: Randstad), and in addition an “intermediate” zone (FL.: East-Flanders; NL.: Utrecht/Gelderland) and two peripheral areas (FL.: West-Flanders, Belgian-Limburg; NL.: Groningen/Drenthe, Dutch-Limburg). The regional background of the subjects was carefully checked: only subjects who grew up and still lived in a particular region were selected. The subjects taught Dutch in schools in medium-sized cities, which were also selected on the basis of dialectological and socio-geographical criteria. A more detailed description of the sampling criteria can be found in Van Hout et al. (1999) and Kloots (2005).

2.2 Data collection

In this study the pronunciation of vowels is studied in spontaneously spoken Standard Dutch. The speech samples were collected in 1999 as part of a socio-linguistic project (van Hout et al. 1999). Part of the material which was gathered in this project consisted of spontaneous conversations between teachers and a researcher about various topics, such as literature, education, current affairs, cooking, travelling and sports. The Flemish and the Dutch recordings were made by a Flemish and a Dutch researcher respectively, in a quiet room where only the researcher and the teacher were present. The conversations were recorded on a portable DAT-recorder (Tascam DA-P1) with AKG-C420 headset condenser microphones. The speech samples were digitised and downsampled to 16 kHz (16 bits). At present, this material is also part of the *Spoken Dutch Corpus* (component “spontaneous speech”).⁴

2.3 Stimuli

In this experiment we study three words which occur frequently in spontaneously spoken Standard Dutch: *moment* (‘moment’), *manier* (‘way’) and *probeer(t)* (‘to try’, ‘tries’). By way of illustration: the *Spoken Dutch Corpus* contains 1377 occurrences of *probeer(t)*, 2814 occurrences of *manier* and 4599 occurrences of *moment*. These three words have a similar structure: they contain two syllables,

the first syllable ends in a vowel, and the second syllable is stressed. All realisations of these words were saved as separate wave-files. The spontaneous speech of the 160 teachers yielded 813 stimuli: 286 occurrences of *probeert*(t) (Fl.: 205, Nl.: 81), 236 occurrences of *manier* (Fl. 125, Nl. 111) and 291 occurrences of *moment* (Fl.: 88, Nl. 203).

2.4 Labelling task

The stimuli were labelled by means of the software package *wwstim*.⁵ The labellers were three Flemings and three Dutchmen, all native speakers of Dutch, who grew up in the provinces of Antwerp (Belgium) and Northern Brabant (the Netherlands) respectively. In this way, the dialect background of the listeners was controlled for as tightly as possible, as both provinces belong to the same (cross-border) dialect area (cf. Introduction).

All six labellers had a linguistic background and were familiar with phonetic transcriptions and labelling tasks. They labelled the stimuli individually and at their own pace. The listeners heard the stimuli one by one and in a (different) random order. If necessary, they could replay a stimulus as often as desired. Once a stimulus was labelled, it was not possible to go back and change the score anymore.

The listeners focused on the unstressed vowel in the first syllable of the words *moment*, *manier* en *probeert*. For every stimulus eight labels were available: “long”, “short”, “schwa”, “zero”, as well as their intermediate values “long/short”, “short/schwa”, “schwa/zero”. The labels “long” and “short” were used in their *phonological* sense and should be interpreted in terms of vowel quality (i.e. the “colour” of the vowel). In phonological descriptions of Dutch, “long” is attributed to the vowels /a/, /o/, /e/, /i/, /y/, and “short” vowels are /a/, /ɔ/, /ɛ/, /ɪ/, /ʊ/. Various labels have been proposed to designate these two categories, such as “tense” vs. “lax” vowels, “free” vs. “checked” vowels — see Kloots (2005:16) for an overview. In more recent studies, these categories are called “long” and “short” respectively (e.g. Booij 1995, Kooij & Van Oostendorp 2003). It is not clear which phonetic characteristic is exactly responsible for the difference in “quality” between both series. From a phonological point of view, both categories have a different distribution (e.g. Moulton 1962). The terms “long” and “short” should *not* be interpreted in terms of vowel *duration*, since in Standard Dutch only /a/, /o/ and /e/ are literally longer than their “short” counterparts (e.g. Nooteboom 1972). The label “schwa” refers to the central vowel of Dutch. “Zero” was used when the vowel was deleted. When the listeners could not identify the word — which is not uncommon for stimuli, taken from a corpus of spontaneous speech — they could choose the label “unintelligible”.

2.5 Aspects studied elsewhere

In this paper, the focus is on the *labellers* and the differences in *choice of labels* between both groups of judges. The degree of *agreement* between the *labellers* will not be considered here since this aspect of our experiment was already analysed in Coussé et al. (2004).⁶ The differences in the *pronunciation* of Flemish and Dutch *informants* are discussed in more detail in Kloots et al. (2003) and Kloots (2005).

3. Results

The distribution of the labels over the response categories for the three stimuli is displayed in Table 1. The last column of the table gives a general impression of the distribution: “short” is the label most frequently (40.7%) used, followed by “long” in 16.8% of the cases. The other labels were chosen in less than 11% of the cases.

Looking at the labels of the Flemish and the Dutch labellers separately, it is clear that both groups have (significantly) different preferences (Pearson $\chi^2 = 830.0$; $DF = 7$; $p < 0.01$), especially concerning the labels “long” and “short”. The Flemish labellers considered almost half of the vowels to be “short” and only 3.2% “long”, whereas the Dutch labellers used “long” in 30.3% and “short” in 32.8% of the cases. Because this difference between both groups is particularly striking, we will concentrate on the labels “long” and “short” in what follows.

The difference between the Flemish and Dutch listeners, which is apparent from Table 1, could be an unintended result of the “mixed” nature of the sample that contains speech of Flemish as well as Dutch speakers. In Table 2,

Table 1. Distribution of the labels in the judgements of the Flemish and Dutch labellers

	Flemish labellers		Dutch labellers		Total	
long	78	3.2%	740	30.3%	818	16.8%
long/short	287	11.8%	136	5.6%	423	8.7%
short	1185	48.6%	799	32.8%	1984	40.7%
short/schwa	192	7.9%	30	1.2%	222	4.6%
schwa	169	6.9%	243	10.0%	412	8.4%
schwa/zero	75	3.1%	19	0.8%	94	1.9%
zero	261	10.7%	272	11.2%	533	10.9%
unintelligible	192	7.9%	200	8.2%	392	8.0%
Total	2439	100.0%	2439	100.0%	4878	100.0%

Table 2. Flemish and Dutch stimuli, labelled by Flemish and Dutch labellers

	Flemish stimuli				Dutch stimuli			
	Flemish labellers		Dutch labellers		Flemish labellers		Dutch labellers	
long	35	2.8%	456	36.4%	43	3.6%	284	24.0%
long/short	179	14.3%	90	7.2%	108	9.1%	46	3.9%
short	876	69.9%	608	48.5%	309	26.1%	191	16.1%
other	164	13.1%	100	8.0%	725	61.2%	664	56.0%
Total	1254	100.0%	1254	100.0%	1185	100.0%	1185	100.0%

the results are further differentiated: the scores for the Flemish and the Dutch stimuli are shown separately. In Table 2, the scores for the labels “short/schwa”, “schwa”, “schwa/zero”, “zero” and “unintelligible” are summed and presented as one category: “other”.

It is clear from Table 2 that Flemish and Dutch labellers do not always assign the same label when classifying a particular set of vowel stimuli. In other words: when the regional background of the vowels is kept constant (the labellers listen to the same — either Flemish or Dutch — stimuli) and the regional background of the labellers is varied (we compare the results of Flemish and Dutch labellers), striking differences are found between the scores of the Flemish and the Dutch labellers. The difference between both groups of labellers is statistically significant, both for the Flemish stimuli (Pearson $\chi^2 = 525.3$; $DF = 7$; $p < 0.01$) as for the Dutch stimuli (Pearson $\chi^2 = 348.6$; $DF = 7$; $p < 0.01$).

The most apparent differences can be found for the category “long”. The Flemish labellers almost never use the label “long”, whereas the Dutch labellers use it for 36.4% of the Flemish and 24.0% of the Dutch stimuli respectively. Looking at our data set, we must assume that the category “long” is missing in the repertoire of Flemish listeners. Unlike their Flemish colleagues, the Dutch labellers differentiate between “long” and “short”. Compared to the Flemish listeners, the Dutch labellers used the label “short” less frequently, both for the Flemish data (48.5% vs. 69.9%) as for the Dutch data (16.1% vs. 26.1%).

For the category “other”, the difference between Flemish and Dutch labellers is — relatively — small, both for the Flemish as for the Dutch stimuli: 13.1% vs. 8.0% (Flemish stimuli) and 61.2% vs. 56.0% (Dutch stimuli) respectively. From a phonetic point of view, the category “other” contains (quite) strongly reduced forms (i.e. reduced to schwa or deleted, cf. 2.4). The relatively small difference between both groups of labellers indicates that Flemish and Dutch listeners seem to agree on what a “strongly reduced” vowel sounds like. The category “other” is (much) more often assigned to Dutch than to Flemish stimuli, both by the Flemish as by the Dutch labellers. From a phonetic point of view, this means that, according to the data discussed in Kloots (2005), the Dutch

speakers reduce their vowels more strongly than their Flemish colleagues, see also Kloots (2005).

4. Discussion

Flemish and Dutch labellers seem to have different categorisation strategies, especially with respect to the labels “long” and “short”. Flemish labellers use “short” much more often than their Dutch colleagues, whereas the Dutch listeners use “long” more often than the Flemish labellers. This tendency is found for the Flemish as well as for the Dutch stimuli. The discrepancy between both groups is hard to explain. The current literature hardly provides any information on the potential influence of a listener’s national variety of the standard language on vowel categorisation. More specifically, the possible differences between the categorisation strategies of Flemish and Dutch listeners are, to our knowledge, never studied.

Our results indicate that Flemish labellers — classifying unstressed vowels — hardly ever use the label “long” while this label is used much more frequently by the Dutch labellers. A possible explanation is that Flemish labellers attach relatively more value to vowel duration than Dutch labellers, while for the latter vowel quality is a decisive property. The unstressed vowels in our experiment may have a fairly short duration, and if vowel duration is indeed so important for Flemish labellers, this factor may explain the Flemish results.

To get a clear(er) understanding of the strategies used by our listeners, the acoustic properties of the stimuli should be correlated to the labels assigned by the listeners in our experiment. In other words, in order to invoke the different balance between vowel duration and quality in Flemish and Dutch listeners as the explanation of our findings, acoustic measurements of the duration and quality of our stimuli are needed. Such measurements could, for example, show if the (few) vowels labelled as “long” by the Flemish labellers have a significantly longer duration than (1) stimuli called “long” by the Dutch listeners and (2) stimuli with the label “short”. Moreover, in the present study only unstressed vowels were considered. Consequently, by studying the labelling of stressed vowels, it should be determined what role the factor stress plays in how Flemish and Dutch listeners label vowels.

With respect to the pronunciation of unstressed vowels in open syllables, Kloots (2005) showed that Flemish speakers use more “short” vowels than Dutch speakers. If differences in vowel production are accompanied by differences in classification strategy, we can assume that the Flemish labellers chose the label “short” more often than their Dutch colleagues because they

hear more “short” vowels in everyday speech. In this way, however, we run the risk of being caught in a circular argument, since the results of Kloots (2005) are based on listening experiments as well. Moreover, this argumentation does not seem to hold for every category in our experiment. Table 2 shows that the Dutch speakers used more strongly reduced forms (= category “other”) than the Flemish speakers. However, the Dutch listeners did not hear more strongly reduced forms than their Flemish colleagues. Once more, it is clear that instrumental analyses are indispensable.

Interestingly, historical linguistics offers an alternative perspective. According to descriptions of the pronunciation of Middle Dutch (e.g. van Haeringen 1953, van Loey 1970, van Bree 1977), in medieval times, the difference in vowel quality between “long” and “short” vowels was smaller than in contemporary Standard Dutch, whereas the durational aspect was much more important for identifying both series of vowels. The difference in vowel duration between “long” and “short” vowels has decreased and vowel quality became more important for the classification of vowels. Maybe this historical approach could also explain why *contemporary* Flemish listeners attach (relatively) more value to vowel duration than their Dutch colleagues (see above). Looking at our data, we get the impression that for Flemish listeners vowel duration has remained more important than for Dutch listeners.

At any rate, it is not strange that Flemish and Dutch labellers may have different classification strategies, since both groups are used to a different national variety of Standard Dutch. Sociolinguistic apparent-time studies have shown that the pronunciation of Standard Dutch in Flanders and the Netherlands is systematically growing apart since the 1930’s (Cassier & Van de Craen 1986, Van de Velde 1996). There is also fairly little contact between both parts of the language area (e.g. Kloots 2001). Moreover, it is not uncommon for national varieties to attach a different value to the feature [duration] (see, for instance, Reuter (1992) for a comparison between the Swedish and the Finnish variety of Swedish).

5. Conclusion

Our experiment has shown that the “national” background of the listeners can result in different categorisation strategies. Trying to rule out this factor is not very realistic. Nevertheless, we should pay attention to this variable. Linguists should be (more) aware of the fact that results of categorisation tasks cannot always be directly generalised to all (national) varieties of the same language. Therefore, in reports of labelling experiments, the “national” background of the listeners should always be mentioned explicitly. For a better understanding

of the labelling differences between Flemish and Dutch listeners, instrumental analysis of the stimuli is needed. In that analysis vowel quality and duration should be systematically measured, both for stressed and unstressed vowels.

Notes

1. Hanne Kloots and Evie Coussé are Postdoctoral Fellow and Research Assistant of the Research Foundation — Flanders (FWO — Vlaanderen), respectively.
2. The authors thank the two anonymous reviewers and the audience attending the presentation of this paper at the *TIN-dag 2006*, for their useful comments.
3. Of course, this does not mean that Belgian and Dutch speakers of “Brabant” dialects sound *identical*. The political border between Belgium and the Netherlands is turning more and more into a linguistic border (Taeldeman 1990, De Schutter 1994, Hoppenbrouwers & Hoppenbrouwers 2001). The dialectal basis of both groups of “Brabanters” is still the same, but their speech is more or less “coloured” by a different national variety.
4. Information about the *Spoken Dutch Corpus* can be found at the following websites: <http://lands.let.kun.nl/cgn/home.htm> and <http://www.tst.inl.nl>
5. The software *wwstim* was developed by Theo Veenker (University of Utrecht). See <http://www.let.uu.nl/users/~Theo.Veenker/personal/projects/wwstim/doc/nl>
6. In Coussé e.a. (2004) the agreement between the labellers was expressed by relative frequencies (“percentage agreement”). Since one specific category (namely “short”) was chosen much more frequently than the others (see Table 1) the use of kappa scores would not have given an accurate picture of the agreement between the labellers (e.g. Rietveld & van Hout 1993).

References

- Booij, Geert. 1995. *The Phonology of Dutch*. Oxford: Clarendon Press.
- Bree, Cor van. 1977. *Leerboek voor de historische grammatica van het Nederlands. Klank- en vormleer met een beknopte grammatica van het Gotisch*. Groningen: Wolters-Noordhoff.
- Cassier, Luc & Piet Van de Craen. 1986. “Vijftig jaar evolutie van het Nederlands”. *Werk-in-uitvoering. Momentopnamen van de sociolinguïstiek in België en Nederland* ed. by Jos Creten, Guido Geerts & Koen Jaspaert, 59–73. Leuven & Amersfoort: Acco.
- Clyne, Michael, ed. 1992. *Pluricentric Languages. Differing Norms in Different Nations*. Berlin & New Nork: Mouton de Gruyter.
- Coussé, Evie, Steven Gillis, Hanne Kloots & Marc Swerts. 2004. “The Influence of the Labeller’s Regional Background on Phonetic Transcriptions: Implications for the Evaluation of Spoken Language Resources”. *Proceedings of the 4th International Conference on Language Resources and Evaluation*, IV, ed. by M. Lino et al., 1447–1450. Paris: ELRA.

- Cucchiari, Catia 1993. *Phonetic transcription: a methodological and empirical study*. PhD diss., Katholieke Universiteit Nijmegen.
- De Schutter, Georges. 1994. "Dutch". *The Germanic Languages* ed. by Ekkehard König & Johan van der Auwera, 439–477. London & New York: Routledge.
- Faber, Alice. 1992. "Articulatory variability, categorical perception, and the inevitability of sound change". *Explanation in Historical Linguistics* ed. by Garry W. Davis & Gregory K. Iverson, 59–75. Amsterdam & Philadelphia: John Benjamins.
- Fox, Robert A. 1974. "An experiment in Cross-Dialect Vowel Perception". *Papers from the Tenth Regional Meeting — Chicago Linguistic Society* ed. by Michael W. La Galy, Robert A. Fox & Anthony Bruck, 178–185. Chicago: Chicago Linguistic Society, Goodspeed Hall.
- Goossens, Jan. 1965. *Die niederländische Strukturgeographie und die "Reeks Nederlandse dialectatlassen"*. Amsterdam: Noord-Hollandsche Uitgevers Maatschappij.
- Gussenhoven, Carlos. 1999. "Dutch". In *Handbook of the International Phonetic Association*, 74–77. Cambridge et al.: Cambridge University Press, repr.
- Haering, Coenraad B. van. 1953. "Onze „uitspraak" van het Middelnederlands". *De Nieuwe Taalgids* 46.9–18.
- Heuven, Vincent J. van & Els van Houten. 1985. "De klinkers in het Nederlands van Turken". *Forum der Letteren* 26.201–213.
- Heuven, Vincent J. van & Els van Houten. 1989. "Vowel labelling consistency as a measure of familiarity with the phonetic code of a language or dialect". *New Methods in Dialectology. Proceedings of a workshop held at the Free University, Amsterdam (1987)* ed. by Marten E.H. Schouten & Piet T. van Reenen, 79–86. Dordrecht & Providence RI: Foris Publications.
- Heuven, Vincent J., van, Houten, Els van & Jan W. de Vries. 1985. "De perceptie van Nederlandse klinkers door Turken". *Spektator* 15.225–238.
- Hout, Roeland van, Georges De Schutter, Erika De Crom, Wendy Huynck, Hanne Kloots & Hans Van de Velde. 1999. "De uitspraak van het Standaard-Nederlands: variatie en varianten in Vlaanderen en Nederland". *Artikelen van de Derde Sociolinguïstische Conferentie* ed. by Erica Huls & Bert Weltens, 183–196. Delft: Eburon.
- Hoppenbrouwers, Cor & Geer Hoppenbrouwers. 2001. *De indeling van de Nederlandse streektaalen*. Assen: Van Gorcum.
- Jaberg, Karl & Jakob Jud. 1927. "Transkriptionsverfahren, Aussprache- und Gehörschwankungen. Prolegomena zum 'Sprach- und Sachatlas Italiens und der Südschweiz'". *Zeitschrift für romanische Philologie* 47.171–218.
- Janson, Tore. 1979. "Vowel duration, vowel quality, and perceptual compensation". *Journal of Phonetics* 7.93–103.
- Janson, Tore. 1981. "Identical Sounds and Variable Perception". *Phonologica 1980. Akten der Vierten Internationalen Phonologie-Tagung* ed. by Wolfgang U. Dressler, Oskar E. Pfeiffer & John R. Rennison, 215–221. Innsbruck: Institut für Sprachwissenschaft der Universität Innsbruck.
- Kloots, Hanne. 2001. "Leerkrachten Nederlands en het andere deel van het taalgebied". *Taal & Tongval* 53.175–196.
- Kloots, Hanne. 2005. *Vocaalreductie in het Standaardnederlands in Vlaanderen en Nederland*. PhD diss., Universiteit Antwerpen.
- Kloots, Hanne, Georges De Schutter, Steven Gillis & Marc Swerts. 2003. "Verdoffende vocalen en klinkers die verdwijnen: een casestudy". *Nederlandse Taalkunde* 8.231–254.

- Kooij, Jan & Marc van Oostendorp. 2003. *Fonologie. Uitnodiging tot de klankleer van het Nederlands*. Amsterdam: Amsterdam University Press.
- Loey, Adolphe C.H. van. 1970. *Schönfelds historische grammatica van het Nederlands. Klankleer, vormleer, woordvorming*. Zutphen: W.J. Thieme & Cie, 8th ed.
- Moulton, William G.. 1962. "The vowels of Dutch: phonetic and distributional classes". *Lingua* 11.294–312.
- Nooteboom, Sieb G. 1972. *Production and Perception of Vowel Duration. A Study of durational Properties of Vowels in Dutch*. PhD diss., Rijksuniversiteit Utrecht.
- Ohala, John J. 1989. "Sound change is drawn from a pool of synchronic variation". *Language Change. Contributions to the Study of Its Causes* ed. by Leiv E. Breivik & Ernst H. Jahr, 173–198. Berlin & New York: Mouton de Gruyter.
- Reuter, Mikael. 1992. "Swedish as a pluricentric language". *Pluricentric Languages. Differing Norms in Different Nations* ed. by Michael Clyne, 101–116. Berlin & New York: Mouton de Gruyter.
- Rietveld, Toni & Roeland van Hout. 1993. *Statistical Techniques for the Study of Language and Language Behaviour*. Berlin & New York: Mouton de Gruyter.
- Ringgaard, Kristian. 1965. "The Phonemes of a Dialectal Area, Perceived by Phoneticians and by the Speakers Themselves". *Proceedings of the Fifth International Congress of Phonetic Sciences* ed. by Eberhard Zwirner & Wolfgang Bethge, 495–501. Basel & New York: S. Karger.
- Taeldeman, Johan. 1990. "Ist die belgisch-niederländische Staatsgrenze auch eine Dialektgrenze?". *Grenzdialekte: Studien zur Entwicklung kontinentalwestgermanischer Dialektkontinua* ed. by Ludger Kremer & Hermann Niebaum, 275–314. Hildesheim: Olms.
- Van de Velde, Hans. 1996. *Variatie en verandering in het gesproken Standaard-Nederlands (1935–1993)*. PhD diss., Katholieke Universiteit Nijmegen.
- Van de Velde, Hans & Muriël Houtermans. 1999. "Vlamingen en Nederlanders over de uitspraak van nieuwslezers". *Artikelen van de Derde Sociolinguïstische Conferentie* ed. by Erica Huls & Bert Weltens, 451–462. Delft: Eburon.
- Verhoeven, Jo. 2005. Illustrations of the IPA — "Belgian Standard Dutch". *Journal of the International Phonetic Association* 35.243–247.
- Wang, Hongyan & Vincent J. van Heuven. 2004. "Cross-linguistic confusion of vowels produced and perceived by Chinese, Dutch and American speakers of English". *Linguistics in the Netherlands 2004* ed. by Leonie Cornips & Jenny Doetjes, 205–216. Amsterdam & Philadelphia: John Benjamins.
- Weijnen, Antonius A. 1966. *Nederlandse dialectkunde*. Assen: Van Gorcum, H. Prakke & H. Prakke.
- Zanten, Ellen van & Vincent J. van Heuven. 1984. "A Cross-Dialect Study of Vowel Perception in Standard Indonesian". *Proceedings of the Tenth International Congress of Phonetic Sciences* ed. by Marcel P.R. Van den Broecke & Antonie Cohen, 634–640. Dordrecht & Cinnaminson: Foris Publications.