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*Benedikt Szendrői,
Bernhard Wälchli (Eds.)*

AGGREGATING DIALECTOLOGY, TYPOLOGY, AND REGISTER ANALYSIS

LINGUISTIC VARIATION IN TEXT AND SPEECH

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Aggregating Dialectology, Typology, and Register Analysis

Linguistic Variation in Text and Speech

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De Gruyter

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Convergence between dialect varieties and dialect groups in the Dutch language area*

Abstract

We aim to show that dialects are changing and becoming less differentiated. To that end, we designed an empirical study for which (in the period 2008–2011) we compiled a large corpus database of dialect recordings for 86 local dialects and of Standard Netherlandic Dutch and Standard Belgian Dutch. Two older male speakers and two younger female speakers were recorded in each of the 86 locations. Comparing dialect use of the older male speakers to that of the younger females, we measured dialect change in apparent time, focusing on lexis, morphology and sound components. We found that geographically, dialect change is a capricious process and that the lexical level has been affected the most, while the morphological level is the most stable. While dialects in the Netherlands are converging significantly towards standard Dutch, this is not the case for the Belgian dialects. Dialects have in general converged towards each other. The “natural” number of dialect groups has slightly increased at the lexical level, and decreased at the morphological level and that of the sound components.

1. Introduction

The notion of dialect usually refers to a language variety that is used in a geographically limited part of a language area in which it is “roofed” by a struc-

turally related standard variety; a dialect typically displays structural peculiarities with regard to several language components. Usually, dialects have relatively little overt prestige and are mainly used orally. Moreover, the dialects of a certain language area (including the standard variety) maintain very specific historical relationships (cf. Agard 1971: 21–24).

For centuries in the Old World, most villages and towns used to have a specific dialect of their own, which differed from that spoken in neighbouring locations in the presence or absence of specific peculiarities (“dialect features”); put differently, each local dialect was characterised by its own specific cocktail of dialect features. Nevertheless, the situation cannot be assumed to have been entirely static and homogeneous. However, since the general, society-wide spread and daily oral use of standard varieties did not begin before the end of the 19th century, and since the majority of local communities were relatively closed and stable in most social-economic respects, dialects had an established habitat, and socio-stylistic variation must therefore have been limited. Across the board, this situation came to an end with the “modernisation” of society over the course of the 20th century (Hinskens, Auer, and Kerswill 2005), albeit at different points in time and at different rates in various language areas and dialect regions, resulting in phase differences (Auer 2005).

Dialectometry is typically used to measure relationships among dialect varieties synchronically, and examples are Séguy (1973), Goebel (1982), Nerbonne, Heeringa, and Kleiweg (1999). However, a number of dialectometric studies focus on diachrony, which measures changes in the relationships among dialects or compared to a standard language. Heeringa and Nerbonne (2000) used material collected by Winkler in 1874 and Scholtmeijer in 1996 on a range of Dutch dialects, and found that 23 of the 41 varieties studied have converged towards standard Dutch at the sound component level, i.e. phonetics, phonology and morpho-phonology. Furthermore, Heeringa et al. (2000) studied eight varieties spoken in or close to the German county of Bentheim, along with nine Dutch varieties from close by, using data from the *Reeks Nederlandse Dialectatlassen* ‘Series of Dutch dialect atlases’ (Blancquaert and Pée 1925–1982) that was gathered in 1974–1975, as well as new data collected in 1999. These 17 varieties were compared to standard Dutch and standard German at the sound component level. All of the Dutch dialects were found to be converging towards standard Dutch, while all of the German dialects appeared to be converging towards standard German. Giesbers (2008), meanwhile, studied the Kleverland dialect continuum, which extends from Duisburg in Germany to Nijmegen in the Netherlands. In the early 19th century, the Dutch-German national border was drawn through this

* The authors would like to thank the editors as well as Östen Dahl, William Kretzschmar, and an anonymous reviewer for their very useful questions, comments and suggestions, which have greatly improved this contribution. In each of the 86 dialect locations surveyed in this paper, at least four informants were involved in the recordings, and three provided us with recordings of three standard languages. So, more than 347 informants have made the research that is presented in this paper possible and we would like to thank all of them. Furthermore, we are grateful to Peter Kleiweg, whose RuG/L04 package was used to create the maps presented in this work. The authors alone are responsible for any shortcomings that this paper may still have.

dialect continuum, and Giesbers selected five dialect location pairs, each of which consisted of a Dutch and a German village. Giesbers found that Dutch varieties have converged more strongly towards standard Dutch than the German ones have towards standard German, both at the lexical and the sound component levels. Particularly on the lexical level, German speakers seem to preserve more old dialect forms than their Dutch counterparts.

In this paper, we study dialect change in the Netherlands and Flanders on the basis of a larger data set that consists of recent dialect recordings for 86 villages. Our aim is to answer new questions concerning the process whereby dialects become less differentiated and fuse into larger wholes, namely *koines* or *regiolects*. This change is extensively described by Hoppenbrouwers (1990), who coined the notion of “*regiolect*”. This term represents a continuum of intermediate language forms that includes the entire structural space between dialect and standard language (Hoppenbrouwers 1990: 84; see also Hinskens 1993, Auer and Hinskens 1996; Hinskens, Auer, and Kerswill 2005). *Regiolects* are the result of increased mobility and migration on the one hand, and the influence of the standard language in education and supraregional communication on the other. Important sociolinguistic factors are the speakers’ age, sex, education and degree of urbanisation (Hoppenbrouwers 1990: 86, 172), with old, rural, and poorly educated males and young, urban, and highly educated females representing the extremes (a conservative, traditional dialect and an innovative *regiolect*, respectively). While in Hoppenbrouwers’ original conception a *regiolect* is a continuum of subtly different intermediate varieties in the structural space between traditional dialects and the standard language (cf. Bellmann 1998 on “*diaglossia*”), many analysts nowadays use the notion of *regiolect* to refer to cross-dialectal convergence or *koineisation* (hence, not to dialect-standard convergence).

The goal of this research is to show that dialects are changing and are, consequently, becoming less differentiated, i.e. they are converging towards each other. Cross-dialectal convergence can of course be an effect of dialect-standard convergence. Moreover, for this reason, the influence of the overarching standard language – standard Dutch – is also systematically taken into account. Specifically, we will focus on the lexicon, and the morphology and the sound components to address the following questions:

1. Do dialects change? Do linguistic levels correlate with each other? Which level is affected the most?
2. Do dialects converge to standard Dutch? Do dialects that are less like standard Dutch converge more strongly towards it than those that are closer to it? To what extent is dialect change explained by convergence to standard Dutch?

3. Do dialects converge towards each other?
4. Do dialect groups fuse or come apart, or do their mutual relationships otherwise change?

The study we present is not concerned with socially conditioned dialect variation; it instead deals with dialect change from a horizontal (geographical) and vertical (dialect-standard interaction) perspective. Accordingly, it marries the dialectometric approach to the study of dialect convergence and divergence.¹

In Section 2, we describe the data that form the basis of this study, along with the measurement techniques that are applied to it. Then, in Section 3, the results are presented and the research questions answered. Finally, we draw our conclusions and present some proposals for future studies in Section 4.

The smallest common denominator of the papers in the present volume, be they dialectological, register-analytical, or typological in nature, is that they all draw on text or speech corpora. They also tend to use aggregational techniques to “see the wood for the trees”. Since this contribution is equally based on a relatively large corpus of (highly comparable) dialect data and aggregational techniques, it may therefore be useful to studies at other levels of typological abstraction.

2. Data source and measurement techniques

In Section 2.1, we present the database that has been assembled for this study. In Section 2.2, we discuss techniques for measuring dialect distances in the lexicon, morphology and the sound components.

2.1. Collecting the data

In the period 2008–2011, we compiled a large corpus database of dialect recordings for 86 local dialects and three standard varieties, namely Standard Netherlandic Dutch, Standard Belgian Dutch, and Afrikaans. The dialects are evenly spread over the Dutch and Frisian language areas and represent the major dialect regions (see Figure 1). The Dutch language area comprises both the Netherlands and the northern part of Belgium. Five of the record-

¹ In a similar vein, Auer, Hinskens, and Kerswill (eds, 2005) collect a number of recent studies from a range of different language areas in the Old World. Labov (2010) focuses on a number of different aspects of the ongoing processes of divergence among the dialects of American English.

ings have been made by *Stichting Ons Bildt*², and represent the varieties of Frisian spoken in Westhoek, Sint Jacobiparochie, Nij Altoene, Vrouwenparochie and Oudebildtzijl. Along with Sint Annaparochie, they are shown as a dense cluster of dots in the north-west of Frisia, close to the coast.

Dialect change in this paper is measured in apparent time. For this purpose, at least two male speakers aged 60 or older, and two or more female speakers aged between 20 and 40 were recorded in each of the 86 locations. The males represent the older phase of a particular variety and the females the newer phase. The reasoning for this is that we assume that there is a scale of conservativeness, where older males are the most conservative speakers, followed by the older females, who are in turn followed by the younger males. The younger females, meanwhile, are the least conservative speakers. In general, the speech of young speakers tends to be more innovative than that of their older counterparts. In addition, according to Romaine (1984: 113), the speech of females is usually more innovative than that of males: “women consistently produce forms which are nearer to the prestige norm more frequently than men” (see also Labov 1990: 206; Chambers 1995: 102–103). At first sight, it may look as if the dimensions of age and gender are intertwined, but they can in fact be reduced to just one: innovativeness, with older males and younger females at the extremes thereof.

Using the approach set out above, we abstract from potentially socially bound dialect-internal variations in order to broaden the study in dialect geographical respects. This enables us to gain greater insight into the present-day dynamics of the wider dialect landscape.

An episode of the Charlie Chaplin movie “The Kid” served as the basis of the recordings we made. This film focuses on a neighbourhood where many windows suddenly get broken. By accident (or so it seems), a glazier is walking around in the same area and is very keen to carry out the necessary repairs. Meanwhile, a policeman tries to find out why so many windows were broken in such a short period of time. At some point, he sees a little boy who is just about to throw a stone at a window. The policeman then realises that the child is doing this on the orders of the glazier; the policeman tries to catch both protagonists but is unable to do so.

The story was presented to our dialect speakers by way of stills from the movie as well as in narrative form. The episode can be regarded as a cross-section of plain, simple daily spoken language, and consists of 23 sentences,

Figure 1. Distribution of 86 Dutch dialect varieties. The Dutch provinces are shaded in light gray marble and the Belgian provinces are shaded in dark gray pine.

each containing an average of 7.6 words. We used a selection of 13 sentences for this study, which include a maximum of 125 words in the written standard Dutch version of the text. 90 different word types are represented.³ Both the older male and the younger female speakers operated in small groups. The number of informants per group varied between two and four, but in the overwhelming majority of cases a small group consisted of two people. When a small group was being recorded, the individuals were first asked to write down a translation of the text in their own dialect, independently of each other. Then, they compared their translations and discussed the differences between them. For each difference, they had to decide which alternative was the better version. They were then asked to write a new dia-

² See: <http://www.stichtingonsbildt.nl/>. The foundation aims to preserve the regional language and culture of Het Bildt, a small area in the northwest of the province of Frisia in the Netherlands.

³ The 13 sentences still represent the story in an understandable way. This shortened version will also be used in the perception experiment which is briefly described in Section 4.

lect translation together, which might be seen as a consensus version upon which both of them agreed. Finally, they both read this third text aloud.

Additionally, we created recordings in Standard Netherlandic Dutch (read out by Maartje van Weegen, host of the Dutch national classical radio station), Standard Belgian Dutch (by Martine Tanghe, Belgian presenter of the Flemish public broadcast station, VRT) and Standard Afrikaans (by Mariëtte Kruger, presenter at the South African television channel, SABC 2)⁴. The Dutch and Flemish standard speakers read the standard Dutch text aloud. They were all aged between 50 and 60 when they were recorded, thus being, more or less, in an intermediate position between the older male and the younger female dialect speakers.

We subsequently created phonetic transcriptions of the recordings in order to measure dialect change, changes in the relationships among dialects, and changes in the relationship to standard Netherlandic and Belgian Dutch. Usually, two recordings of the consensus dialect version of the story were produced for both the older males and the younger females. Since phonetic transcription is time-consuming, we transcribed only one recording per group. When selecting which recording to use, we had a preference for the speaker who was the most autochthonous, had the clearest voice, and read the text most fluently. The transcriptions were made in IPA and digitised in X-SAMPA.

Although several Dutch dialect atlases are available, we decided to compile a new parallel corpus for two reasons. First, the data of the older speakers (in our case older male speakers) and the younger speakers (younger female speakers) should be comparable with each other. The same texts should have been recorded under the same circumstances. Both the recordings of the older speakers and those of the younger speakers should have been made in a relatively short time span. At first glance two usable sources for the Dutch dialect area may be the *Reeks Nederlandse Dialectatlassen* (RND) and the *Goeman-Taeldeman-van Reenen project data* (GTRP). However, the RND data was collected over an extended period of time (1922–1975) and does not consistently distinguish two generations of speakers. The GTRP material was collected over a much shorter period of time (in the 1970's and 80's), but still does not distinguish consistently between two generations. In our data, however, the data of older and younger speakers is recorded in the same way, using the same text and within a period of only three years.

Second, we need to be sure that the transcriptions are consistent. Large data sources like the RND and the GTPR are collected and transcribed by several transcribers. The consequence is that transcription differences do not always reflect dialect differences, which may disturb our measurements (Hinskens & van Oostendorp 2006; Wieling et al. 2007; Hinskens & van Oostendorp 2009). The recordings on which our dataset is based have been transcribed by one transcriber. To ensure optimal consistency per item, transcriptions have been made per sentence instead of per text. The same sentence has been played (2 times 86 is) 172 times and transcribed. Subsequently, the next sentence has been played 172 times and transcribed, etc. Between items there may exist little inconsistencies, but within the 172 transcriptions of a particular item the consistency is optimal.

2.2. Application of measurement techniques

In this section, we describe the way in which lexical, morphological and sound component distances among the dialect varieties were measured.

2.2.1. Lexical distances

The lexical distance between the two dialect varieties was measured using the method introduced by Ségué (1973): we established the percentage of items upon which the two dialects disagree lexically because of heteronymy. As an example, a comparison of Grolloo with Westkapelle shows that there is lexical variation with regard to two of the three following items: *snel* 'quickly' (*rap* vs. *gaun*); *gooien* 'to throw' (*smijten* vs. *gooien*); and *politie* 'police' (in both dialects realised as *politie* – no cross-dialectal variation in this case). Lexically, the dialects disagree on the first and second items, meaning that the lexical distance is $2/3$ times $100 = 67\%$.

Since we are faced with a maximum of 125 word transcriptions per dialect, the lexical distance between two dialects is the percentage of the maximum of 125 word pairs that disagree lexically. In the set of 125 word tokens, we found that 71 words vary lexically. This variation can be found across the 86 dialects and the two speaker groups. For example, since Grolloo has *rap* as an equivalent of *snel* 'quickly', and Westkapelle has *gaun*, there is lexical variation among the dialects. Moreover, as the older males from Grolloo use *rap* while the younger females use *snel*, there is also variation across the two speaker groups.

⁴ This latter recording has not been used in this study, but is mentioned here for the sake of completeness.

2.2.2. Morphological distances

The morphological distance between two dialect varieties was also measured using Séguy's methodology. With 125 word transcriptions per dialect, the morphological distance between two dialects is the percentage of the maximum of 125 word pairs that disagree morphologically. A morphological comparison of Grolloo to Westkapelle on the basis of three items makes plain that there is ample variation: *huiŷen* 'houses' (*huiŷen* vs. *huiŷen* – no cross-dialectal variation in this case); *wil* 'want' (3rd person singular present indicative) (*wil* vs. *wilt*); and *jongetje* 'little boy' (*jonkie* vs. *jongetje*). Given the differences in flexion and derivation, respectively, the two dialects disagree on the second and third item, so the distance is $2/3$ times $100 = 67\%$.

In the set of 125 words, we found that 52 words vary morphologically across dialects and speaker groups.

2.2.3. Distance in the sound components

Linguistic distances between dialects are measured with the aid of the Levenshtein distance metric (Levenshtein 1966). This algorithm was introduced into dialectology by Kessler in 1995. The Levenshtein distance between two strings is calculated as the "cost" of the total set of insertions, deletions and substitutions needed to transform one string into another (Kruskal 1999). In the original, simplest form of the algorithm, all operations have the same cost, e.g. 1. In this paper, however, we used graded weights that are effectively segment distances, meaning that the pair [i,v] is seen as being more different than the pair [i,i]. The segment distances are obtained on the basis of acoustic representations of a canonical set of IPA samples (see Heeringa 2004: 79–119).

A restricted set of diacritics was used in the transcriptions for this study and processed by the distance measure. We distinguished two degrees of length, namely short (all segments without additional length marks) and long (transcribed as :).⁵ Before the Levenshtein algorithm was applied to the phonetic transcriptions, long sounds were represented as two successive realisations of the corresponding "short" vowel. For example, the standard Dutch realisation of *beet* 'bite' is [be:t] and was converted to [beet].

Furthermore, we also used and processed diacritics for the palatalisation of final /n/ ([nʲ]), the velarisation of initial l ([l̠]) and nasalisation (for example [ẽ]). When a given segment was compared to a palatalised segment,

⁵ In Dutch and its dialects, phonological length contrasts only occur in vowels, in particular in phonological monophthongs.

Table 1. Calculation of the aggregate distance between Grolloo and Westkapelle on the basis of five word pairs.

		Grolloo	Westkapelle	Levenshtein distance	alignment length
<i>stil</i>	'silence'	stɪl	stɪlə	1	5
<i>huiŷen</i>	'houses'	husn	yz	3	4
<i>glas</i>	'glas'	xlas	χləs	2	4
<i>korte</i>	'short'	kœrdə	kœrtə	2	5
<i>politie</i>	'police'	plisi	pəlisi	1	6
				9	24

the segment distance was averaged by the distance between the segments in question and [j]. So, for example, the distance between [t] and [nʲ] is equal to the average of the distance between [t] and [n] and [t] and [j]. In the case of a comparison with velarised and nasalised segments, the distances were averaged by the distances to [χ] and [n], respectively.

The Levenshtein algorithm is adapted when it comes to dealing with syllabification in words, meaning that only a vowel can be matched with a vowel and a consonant with a consonant. [j] or [w] may also match with a vowel (or vice versa), and [i] or [u] with a consonant (or vice versa). A central vowel (in our research, only schwa) may be matched with a sonorant (or vice versa) or a full vowel (since schwa is the reduced vowel). In this way, unlikely matches (e.g. [p] with [a]) are precluded.

Distances are calculated between the members of a pair of variants that are lexically and morphologically identical. We used normalised distance measures, calculating the aggregated distance between two dialects as the sum of a maximum of 125 word pair distances divided by the sum of the alignment lengths that correspond to the word pairs. We illustrate this with an example in which we compare the dialect of Grolloo with that of Westkapelle on the basis of five word pairs (see Table 1).

In this example, we use binary operation weights: insertions, deletions and substitutions count as 1 and matches also count as 1. The Levenshtein distances are found in the fifth column and the corresponding alignment lengths in the sixth. The sum of the Levenshtein distances of the five word pairs is 9, and the sum of the alignment lengths is 24. The actual distance between Grolloo and Westkapelle is calculated as a percentage: 9 divided by 24, multiplied by 100 = 37.5%. Rather than using binary operation weights, we use graded operation weights throughout this paper, as mentioned above. These weights vary between 0 and 1.

The aggregated distance between the two dialects was based on 125 word pairs (fewer if words were missing). We found that all 125 words vary in terms of the sound components. Several words appeared in the text more than once; for example, the word *straat* 'street' appeared three times. So, when calculating the aggregate for *straat*, each of the corresponding word pair distances counted for one third. In this way, each word pair was weighed in the two dialect realisations of the story. The sum of the weights was 90, which is the number of the different word types.

3. Results

3.1. Do dialects change?

In this study, dialect change at the lexical and morphological levels equates with the percentage of items upon which older males and younger females disagreed lexically or morphologically, respectively. Using the Levenshtein distance (see above), the change of a particular dialect in the sound components was measured by comparing the phonetic realisation of the words by the older male informants with the realisation of the same words by the younger female participants.

The results are presented in Figure 2. Dialects are represented by dots in each of the maps. The darker a dot, the more the dialect has changed. It is difficult to recognise particular patterns in and similarities across the maps. Indeed, it seems that dialect change is a fanciful process, and that no particular regional area has changed more than others.

We correlated the levels with each other by calculating the Pearson correlation coefficients. In doing so, we discovered that the apparent time change in the sound components correlates significantly, but weakly, with the lexical ($r = 0.391$) and the morphological levels ($r = 0.380$) at the 0.01 level. We also found a significant correlation between the lexical and the morphological levels ($r = 0.217$) at the 0.05 level.

Which of the three levels was affected the most? We found that there was an average dialect change of 13.5% at the lexical level, 3.6% at the morphological level, and 13.3% in the sound components. We then compared the levels to each other by means of a paired-samples *t*-test, which is commonly used to assess whether the means of two groups are statistically different from each other. The results are shown in Table 2a. There was significantly less dialect change at the morphological level than at the lexical level and the sound component levels. We did not find significant differences between the lexical level and the level of the sound components.

Table 2a. Comparison of dialect change at three linguistic levels by means of a paired-samples *t*-test.

			<i>t</i>	<i>p</i> 1-tailed
lexis	vs.	morphology	16.092	<0.001
lexis	vs.	sound components	0.312	0.378
sound components	vs.	morphology	25.162	<0.001

Table 2b. Comparison of dialect change at three linguistic levels by means of a paired-samples *t*-test. The measurements at the three levels are normalised.

			<i>t</i>	<i>p</i> 1-tailed
lexis	vs.	morphology	12.482	<0.001
lexis	vs.	sound components	9.109	<0.001
sound components	vs.	morphology	7.717	<0.001

We also performed a second analysis, where we normalised the measurements. In our set of 125 word tokens, we found that 71 words showed variation at the lexical level across the 86 varieties and speakers (older males, younger females), while 52 words varied morphologically; but all 125 words varied at the sound component level. The number of words that may vary at a linguistic level determines the scale of the distance measurements at that particular level. For example, the distance measurements in the sound components are relatively higher than those at the morphological level. Consequently, this also affects the measurements of dialect change. A low value at the morphological level may simply be the result of the limited number of words that can vary morphologically. Accordingly, we normalised the dialect change measurements of each level by dividing them by the number of varying words at that level, instead of by the total number of words (125). We found that there was an average dialect change of 20.7% at the lexical level, 8.3% at the morphological level and 13.3% in the sound components. We then compared the levels to each other by means of a paired-samples *t*-test, which is commonly used to assess whether the means of two groups are statistically different from each other. The results are shown in Table 2b. There was significantly more dialect change at the lexical level than at both the morphological and the sound levels. Observe also that dialect change in the sound components is significantly stronger than at the morphological level. In this second analysis we find that the lexical level is affected most. In both analyses we find that the morphological level is affected least.

Figure 2. Dialect differences between older male and younger female speakers. Lexical change (left), morphological change (middle) and change in the sound components (right). Dialects are represented by dots. The darker a dot, the more the dialect has changed.

3.2. Do dialects converge to Standard Dutch?

To address this question, we measured the distances between the 86 dialects and standard Dutch at the three linguistic levels on the basis of the transcriptions describing the linguistic behaviour of older males (henceforth: “older male distances”). We also calculated distance measurements between the same dialects and standard Dutch on the basis of the transcriptions describing the linguistic behaviour of the younger females (“younger female distances”).

So, let us consider an example. In Table 3, “older male distances” and “younger female distances” from standard Dutch are presented for the dialects of Naaldwijk and Slochteren. The distances are measured at the lexical level, the morphological level, and in the sound components; at the level of the sound components, a distinction is made between Standard Netherlands Dutch (SND) and Standard Belgian Dutch (SBD). The Standard Netherlands Dutch and Standard Belgian Dutch texts do not differ lexically and morphologically, but they do differ at the level of the sound components. Changes in the relationship to standard Dutch are measured by subtracting the younger female distances from the older male distances. This gives us either positive values (representing convergence to standard Dutch) or negative values (representing divergence from standard Dutch). The peripheral dialect of Slochteren appears to have converged to standard Dutch at all linguistic levels, but the dialect of Naaldwijk in the urban agglomeration of western Holland appears to have diverged from standard Dutch at most levels, except when compared to SBD at the level of the sound components.

Table 3. Comparison of the dialects of Naaldwijk and Slochteren to standard Dutch. Distances are measured at the lexical level, the morphological level and the sound component level (Standard Netherlands Dutch, “SND”, and Standard Belgian Dutch, “SBD”) on the basis of the transcriptions of the old males and the young females, respectively.

	lexis	morphology	sound components SND	sound components SBD
Naaldwijk				
older males	3.51	0.61	14.70	19.00
younger females	24.20	2.90	13.80	23.50
change	-20.69	-2.29	0.90	-4.50
Slochteren				
older males	14.00	13.50	29.80	32.70
younger females	3.47	1.20	26.20	28.30
change	10.53	12.30	3.60	4.40

We compared the older male distances to the younger female distances by means of a paired-samples *t*-test. In Table 4, the results are given for all 86 dialects, but also for each of the two countries separately. The results are given for all dialects (all), Netherlands dialects and Belgian dialects.

Table 4. Comparison of distance measurements between dialects and standard Dutch obtained on the basis of the transcriptions of speech by the older males and the younger females by means of a paired-samples *t*-test (SND: Standard Netherlands Dutch; SBD: Standard Belgian Dutch).

	all (<i>n</i> = 86)		Netherlands dialects (<i>n</i> = 67)		Belgian dialects (<i>n</i> = 19)	
	<i>t</i>	<i>p</i> 1-tailed	<i>t</i>	<i>p</i> 1-tailed	<i>t</i>	<i>p</i> 1-tailed
lexis	3.3	< 0.001	3.7	< 0.001	0.4	0.36
morphology	5.2	< 0.001	6.2	< 0.001	0.4	0.36
sound components SND	4.4	< 0.001	4.7	< 0.001	0.6	0.29
sound components SBD	3.6	< 0.001	3.4	< 0.001	1.3	0.11

The results obtained on the basis of the data for all dialects may suggest that dialects are converging towards standard Dutch at all levels. However, when looking at the results for each country separately, we find that dialects in the Netherlands are doing so significantly, but this is not the case for the Belgian dialects, regardless of whether Standard Netherlandic Dutch or Standard Belgian Dutch is taken as a reference point. This suggests that the situation in Belgium differs from that in the Netherlands, and that the impact of the standard language on Belgian dialects of Dutch is less strong than on Netherlandic dialects.

When we subtract the younger female distances from those of their older male counterparts for all 86 dialects, we obtain either positive (convergence) or negative values (divergence), which are represented on the map in Figure 3 (Appendix, p. 452) by red and blue dots, respectively. The intensity of the red tones represents the extent to which a local dialect has converged towards standard Dutch, while the intensity of the blue tones corresponds to the extent to which a dialect has diverged from standard Dutch.

Just as for Figure 2, we do not recognise particular patterns in Figure 3. Note, however, that at all levels the majority of the dialects have red dots, i.e. most dialects are converging to standard Dutch. When we look at the Belgian part of the maps, though, we find a relatively large number of blue dots, which illustrates our finding that the Belgian dialects are not significantly converging to standard Dutch. In the Netherlands, Frisian is officially recognised as a second national language. Therefore, the question may arise whether varieties of Frisian are less influenced by standard Dutch. In our set of locations, Frisian is spoken in Sexbierum, Veenwouden, Grouw, Workum, Jubbega and Lemmer (see Figure 1). When looking at the maps in Figure 3, we find that most rural varieties of Frisian have blue dots at both the lexical level and the level of the sound components, so it looks as though they are less influenced by standard Netherlandic Dutch and do not follow the general pattern in the Netherlands. However, at the morphological level, most Frisian dialects have converged to standard Dutch and follow the general pattern in the Netherlands. As well as the rural varieties of Frisian, in Sneek, Westhoek (and other locations close by, which are together called Het Bildt), Dokkum and Hollum (on Ameland island), dialects are spoken that result from the historical mixing of Frisian and Dutch. At all three levels, about half of them appear to be converging to standard Dutch. The clearest result is that the Ameland dialect of Hollum is converging to standard Dutch at each of the three levels; this outcome is in line with Jansen's (2010) findings. In summer, the island is visited by large numbers of tourists from the mainland, which may influence the dialect.

Table 5. Correlations between convergence measurements to Standard Dutch and the distance to Standard Dutch obtained on the basis of the transcriptions produced by the older males and the younger females. In the sound components, a distinction is made between Standard Netherlandic Dutch (SND) and Standard Belgian Dutch (SBD). Correlations marked with ** are significant at the 0.01 level.

	all (<i>n</i> =86)		Netherlandic dialects (<i>n</i> = 67)		Belgian dialects (<i>n</i> = 19)	
	<i>r</i>	<i>n</i>	<i>r</i>	<i>n</i>	<i>r</i>	<i>n</i>
lexis	0.581**	56	0.632**	47	0.936**	9
morphology	0.462**	60	0.515**	50	0.085	10
sound components SND	-0.194	59	-0.233	49	0.318	10
sound components SBD	-0.091	53	-0.178	42	0.335	11

We take a closer look at the convergence measurements, i.e. the positive values that are obtained when the distances of the younger female speakers' varieties to the standard language are subtracted from those of their older male counterparts. In this way, we can attempt to answer the question of whether dialects that are somewhat distant from standard Dutch are converging more strongly towards it than those dialects that are closer to it. In order to address this issue, we correlated the convergence measurements with distances to standard Netherlandic and Belgian Dutch. The results are shown in Table 5, which reports results for the Netherlands and Belgium separately.

All of the significant correlations are positive, meaning that lexical convergence appears to correlate significantly with lexical distance to standard Dutch for the entire Dutch dialect area and for each of the two countries separately. Morphological convergence, meanwhile, correlates significantly with morphological distance to standard Dutch for the entire Dutch dialect area, as well as for the Netherlandic part. We did not find any significant correlations in respect of the sound components. Given these results, we are able to recognise some sense of order: lexical convergence is most clearly determined by the original lexical distances to standard Dutch, but in terms of the sound components, there is no significant relationship. The morphological level is somewhere in between: a significant correlation is found in Netherlandic dialects, but not in Belgian dialects. The latter result in particular shows that the situation in Belgium regarding the influence of standard Dutch differs from the situation in the Netherlands.

Table 6. Correlations between convergence to Standard Dutch and dialect change. For the sound components a distinction is made between Standard Netherlandic Dutch (SND) and Standard Belgian Dutch (SBD). Correlations marked with ** are significant at the 0.01 level; correlations marked with * are significant at the 0.05 level.

	all (<i>n</i> = 86)		Netherlandic dialects (<i>n</i> = 67)		Belgian dialects (<i>n</i> = 19)	
	<i>r</i>	<i>n</i>	<i>r</i>	<i>n</i>	<i>r</i>	<i>n</i>
lexis	0.596**	56	0.605**	47	0.726*	9
morphology	0.620**	60	0.697**	50	0.144	10
sound components SND	0.383**	59	0.563**	49	0.275	10
sound components SBD	0.375**	53	0.340*	42	0.639*	11

In Section 3.1., we measured dialect change. To what extent can dialect change be explained by convergence to standard Dutch? In order to tackle this question, we correlated the convergence measurements with the dialect change measurements discussed in Section 3.1. The results are shown in Table 6.

Again, all significant correlations are positive. The fact that most correlations are significant suggests that convergence to standard Dutch is a strong explanatory factor for dialect change. However, for Belgium, we did not find any significant correlations for the morphological level generally, nor did we find any significant correlations for the sound components with Standard Netherlandic Dutch as a reference point. The latter outcome does not come as a surprise, since Belgian dialects are instead converging towards standard Belgian Dutch. However, we cannot explain why we have not found a significant correlation at the morphological level for the Belgian dialect varieties.

3.3. Do dialects converge towards each other?

To elucidate this issue, we first measured the distances among the 86 dialects at the three linguistic levels under consideration on the basis of the transcriptions describing the older male speakers. We then compared these to the distance measurements among the same dialects on the basis of the transcriptions describing the younger female speakers. The older male distances are compared to the younger female distances by way of a paired-samples *t*-test. The results are shown in Table 7. In the table, the results are given for (i) all dialect pairs that can be formed out of the 86 dialect varieties ($86 \times 85 / 2 =$

Table 7. Comparison of distance measurements among dialects obtained on the basis of the transcriptions describing the older males and the younger females by means of a paired-samples *t*-test.

	all pairs (<i>n</i> = 3,655)		Netherlands- only pairs (<i>n</i> = 2,211)		Belgium- only pairs (<i>n</i> = 171)		mixed pairs (<i>n</i> = 1,273)	
	<i>t</i>	<i>p</i> 1-tailed	<i>t</i>	<i>p</i> 1-tailed	<i>t</i>	<i>p</i> 1-tailed	<i>t</i>	<i>p</i> 1-tailed
lexis	18.4	< 0.001	15.0	< 0.001	4.0	< 0.001	10.2	< 0.001
morphology	25.1	< 0.001	26.7	< 0.001	4.2	< 0.001	8.5	< 0.001
sound components	22.0	< 0.001	24.4	< 0.001	4.8	< 0.001	5.6	< 0.001

3655), (ii) the dialect pairs spoken in the Netherlands; (iii) the dialect pairs spoken in Belgium, and (iv) all of the “mixed” pairs, with one dialect being Netherlandic and the other being Belgian.

All *t*-values are both significant and positive; the latter fact indicates that the distances among the dialect varieties spoken by the older males are greater than those spoken by the younger females. This, in turn, shows clearly that dialect distances have decreased, i.e. that dialects have converged towards each other in the Dutch dialect area in the Netherlands and in Belgium, while the Netherlandic and Belgium dialects have also converged towards each other.

When we then subtract the younger female distances from the older male distances for all dialect pairs, we obtain either positive (convergence) or negative values (divergence). On the maps in Figure 4 (Appendix, p. 452), individual local dialects are connected to each other by red and blue lines. The intensity of the redness represents the extent to which the dialects have converged towards each other, while the intensity of the colour blue depicts the extent to which the dialects have diverged away from each other. It is not easy to find regularities in the fanciful patterns of the lines, but there does seem to be more blue (divergent) lines between dialects on either side of the Netherlandic/Belgian state border. This suggests that the state border makes Netherlandic and Belgian dialects diverge away from each other.

When comparing the maps in Figure 4 with the corresponding maps in Figure 3 (Appendix, p. 452), a cursory glance reveals that dialects which converge to standard Dutch relatively strongly also converge to their surrounding dialects. In future work we will address the extent to which convergence among dialects is explained by convergence to standard Dutch.

In addition to this we compared the overall variance of the “old” distances with the overall variance of the “new” distances by means of a Le-

Table 8. Comparison of variances of measurements obtained on the basis of recordings of older males and younger females at three linguistic levels by means of a Levene paired test for scale comparison.

	older males	younger females	<i>t</i>	<i>p</i> 1-tailed
lexis	75.74083	73.61294	2.5412	<0.01
morphology	21.89064	17.19663	10.0295	<0.001
sound components	41.47941	44.74342	-3.1005	<0.001

vene's test at each level. The results are shown in Table 8.⁶ For both the lexical level and the morphological level we found that the overall variance has significantly increased. However, for the level of the sound components we found the opposite: the overall variance has significantly decreased.

3.4. Do dialect groups change?

3.4.1. Cluster analysis

Do dialect groups fuse or come apart, or do their mutual relationships change in another way? To shed light on this matter, we classified our set of 86 dialects on the basis of their mutual linguistic distances by means of bootstrap clustering. We do this on the basis of both "old" distances and "new" distances. "Old" distances are obtained on the basis of the transcriptions of the older male speakers, and "new" distances on the basis of the transcriptions of the younger female speakers. In order to find the groups on the basis of distances measured for a linguistic level (lexis, morphology or sound components) and an age group (older males, younger females), we performed a procedure consisting of seven steps.

1. We select 1,000 times randomly a subset from the 125 items, where each item has a chance of 50% to be chosen. On average a subset will consist of 62.5 words.
2. For each subset we calculate the aggregated distances.
3. On the basis of the distances we perform agglomerative hierarchical cluster analysis: each observation starts in its own cluster. The clusters are

⁶ We used the implementation in the *PairedData* package in *R* which is described as a "robust test of scale for paired samples based on absolute deviations from the trimmed means (or medians), called extended Brown-Forsythe test in Wilcox (1989)." We experimented with both the trimmed mean (0.1%) and the median as location parameter of centering, but obtained similar results.

then sequentially combined into larger clusters, until all elements end up being in the same cluster. We used single-linkage or nearest neighbour clustering, which means that at each step, the two clusters separated by the shortest distance are combined. The result is a binary hierarchical tree structure in which the dialect varieties are the leaves, and the branches represent the distances among (clusters or groups of) dialect varieties (Jain and Dubes 1988). We chose nearest neighbour clustering since this method reflects the idea of dialect areas being continua, where the distance between geographically neighbouring dialects is small, and the difference between geographically distant points may be large.

4. On the basis of the tree we determine the number of natural groups. Dendrograms are binarily branching trees. Within a dendrogram different levels of detail can be distinguished. Starting at the root, a division into two groups is found. Then, if we delve a little deeper we find that one of the two groups is divided into two further groups. At the bottom of the tree are the leaves, and here we find a classification into the maximum number of groups, in our case 86, with each grouping containing a single variety. We thus have 85 levels, the first suggesting a division into two groups and the 85th suggesting a division into 86. For each level i ($1 \leq i \leq 85$), we computed the variance in the original distances, as explained by the cophenetic distances of the part of the tree that gives a division in $i+1$ groups. In a graph, the variances are plotted against the number of groups as distinguished by each of the levels. The initial clusters usually explain a great deal of the variance. However, at a certain point the marginal gain will drop, yielding an angle in the graph. This angle provides the number of natural clusters and is known as the "elbow" (Aldenderfer and Blashfield, 1984). After the angle, the amount of explained variance in the distances increases much more slowly than before.
5. For each pair of dialects we count the number of times that both dialects are found in the same natural group. The number will vary between 0 (never) and 1,000 (always).
6. When two dialects belong to the same group in more than 950 of the cases (95%), we mark them as being "connected".
7. In this way we will obtain networks. For example, when dialects *A* and *B* are connected, and dialects *C* and *D* are connected, but dialects *A* and *B* are not connected with dialects *C* and *D*, we obtain two separated networks, each of which consists of two dialects. We consider each network a group. Dialects which are not connected to any other dialect remain unclassified.

3.4.2. Change of dialect groupings

The results are shown in Figure 5 (Appendix, p. 453). At the lexical level we do not find any grouping on the basis of the “old” distances; the map shows one large dialect continuum which covers the Netherlands and part of Belgium. In the map on the basis of the “new” distances we find that this continuum has receded to the Netherlands only. However, three Frisian varieties (blue) and five dialects of Het Bildt (orange) are found as separate groups.

At the morphological level the yellow group in the “old” map includes Belgian dialects. In the “new” map the group contains Netherlandic dialects only, except for Oostende in the Southwest. The two Frisian varieties (blue dots in the Northwest) and the purple group have been absorbed by the yellow group, but three small groups each containing two dialects are found in the “new” map (pink, turquoise and darker blue groups).

At the level of the sound components the mixed Frisian group (orange in the “old” map) has been absorbed by the group of Holland dialects (yellow), and the petrol blue group has expanded and absorbed the dialects of Kampen and IJsselmuiden (lighter green in the “old” map). The group of two Zeeland varieties (green/brown) has disappeared and the pink group has split in two smaller groups. The northern Limburg group (red/brown) has disappeared, and the group in the Southeast (red dots in the “old” map) has split into two groups. In the “new” map the red/brown dots represent transitional Limburg dialects, and the red dots Ripuarian dialects.

3.4.3. How well do the groupings represent the mutual distances between the dialects?

In order to answer this question we performed a logistic regression analysis where the linguistic distance measurements are the independent variable, and the values found at the 6th step of the algorithm in Section 3.4.1 are the dependent values. In this way we get a model in which for each pair of dialects the mutual distance predicts the probability that the dialects belong to the same group.

In order to measure goodness of fit, we dichotomised the probabilities predicted by the model. Probabilities larger than 0.5 are coded as 1 (dialects belong to the same group), and those which are equal to or smaller than 0.5 are coded as 0 (dialects do not belong to the same group). We then counted the number of times that the dichotomised predicted probabilities agree with the dependent variable and divided this by the total number of dialect pairs. Since we have 86 dialects, the total number of dialect pairs

Table 9. Goodness of fit values for the groupings shown in Figure 5. The column “number of pairs” shows the number of pairs which the dependent variable (which tells us whether the two dialects share the same group) and the predicted variable (sharing of group membership predicted on the basis of the linguistic distances) agree about. Percentages are calculated by dividing the number of agreements by the total number of pairs (3655) and multiplying this proportion by 100.

	older males		younger females		difference	
	number of pairs	percentage	number of pairs	percentage	number of pairs	percentage
lexis	3187	85.8 %	3395	92.9 %	208	5.7 %
morphology	3024	82.7 %	3121	85.4 %	97	2.7 %
sound components	3597	98.4 %	3476	70.8 %	-121	-3.3 %

equals $((86 \times 86) - 86) / 2 = 3655$. The number of agreements varies between 0 and 3655. The results are shown in Table 9.

We also tested whether the proportion of agreements differed between the model on the basis of the data of older males and the model on the basis of the data of younger females. We compared the proportions using the test of equal or given proportions. For all of the levels we found that the proportions differ significantly. At the lexical level and the morphological level the proportion of agreements has significantly increased ($p < 0.0001$ and $p < 0.01$ respectively), and at the level of the sound components the proportion of agreements has significantly decreased ($p < 0.001$). This agrees with the results discussed in Section 3.3 where we found that the overall variance in the mutual linguistic distances has increased at the lexical and morphological level, and decreased at the level of the sound components.

3.4.4. Have dialect groups changed more at one level than at another one?

In the previous section we calculated the number of agreements between the dichotomised predicted probabilities of a pair of dialects sharing the same group and the corresponding values of the dependent variable. We counted the number of agreements per age group (older males, younger females) and calculated the difference counts and percentages (sixth and seventh column respectively in Table 9) for each linguistic level. In this section we will compare the difference proportions with each other (difference counts divided by the total number of dialect pairs, 3655) using the test of equal or given proportions. The results are presented in Table 10. The table shows that the lexical groupings have changed significantly more than groupings obtained

Table 10. Comparison of the goodness of fit values of the three linguistic levels by means of a test of equal or given proportions.

			difference		<i>p</i> 1-tailed
			number of pairs	percentage	
lexis	vs.	morphology	111	3.0%	<0.0001
lexis	vs.	sound components	87	2.4%	<0.0001
sound components	vs.	morphology	24	0.7%	0.0569

on the basis of morphological distances and distances at the sound components. This agrees with the findings in Section 3.1. Specifically, the results in Table 2b suggest that dialect distances at the lexical level have changed more than those at the other two levels. In this section we find the same for dialect groups.

4. Conclusions and future prospects

In this paper we examined (1) dialect change, i.e. the apparent time change of individual dialects, (2) convergence to and divergence from standard Dutch, (3) convergence and divergence among dialects, and (4) change of dialect groups. In this endeavour, we considered variation in the lexicon, morphology, and the sound components. Our findings can be summarized as follows:

1. Geographically, dialect change is a capricious – that is, partially unpredictable – process, such that no particular regional areas can be demonstrated to have changed more than others. The morphological level has been affected the least, and therefore is the most stable level. Also, the three levels – lexis, morphology and sound components – correlate significantly with each other.
2. Dialects in the Netherlands are converging significantly towards standard Dutch, but this is not the case for the Belgian dialects, regardless of whether Standard Netherlandic Dutch or Standard Belgian Dutch is taken as the reference point. The impact of the standard language in Belgium is probably less strong than in the Netherlands. Moreover, dialects that are relatively distant to standard Dutch are converging more strongly to standard Dutch at the lexical and morphological levels than those that are close to standard Dutch. We did not observe a similar correlation at the level of the sound components. In all, convergence towards standard Dutch is a powerful explanatory factor of dialect change.

3. Dialects have in general converged towards each other in the Netherlands and Belgium, and between the Netherlands and Belgium. The overall variance of the linguistic distances between the dialects has increased at the lexical and morphological level, and decreased at the level of the sound components.
4. Dialect groups have changed at each of the three linguistic levels. The change of dialect groups at the lexical level is significantly stronger than at the other two levels.

In closing, we would like to present some of our proposals in respect of future research. First, we intend to determine to what extent dialect change as measured in Section 3.1 is a matter of convergence to standard Dutch. Accordingly, we will split the measurement of change into two parts: changes that cause the dialects to converge to standard Dutch, and changes that cause the dialects to diverge from standard Dutch. Secondly, and in relation to our measurement of convergence and divergence among dialects (as set out in Section 3.3), we would like to investigate to what extent the convergence of dialect A towards dialect B is the result of either the convergence of dialect A to standard Dutch, or of the convergence of dialect B to standard Dutch, or both (cf. Sobrero's 1996 notion of "passive koineisation"). The complementary question is: which part of the convergence measurement of dialect A towards dialect B cannot be explained by the convergence of dialect A and/or B to standard Dutch? Which mechanisms are behind the latter type of convergence? Thirdly, we focused in this study on the lexical, morphological and sound component levels. In future work, however, we aim to take a closer look at the latter, establishing the effects of the pre-lexical, the lexical, the post-lexical and the phonetic components.⁷ Finally, we hope to conduct a web-based perception experiment based on the newly collected recordings. In this experiment, subjects will assess distances between their own dialect versions and a range of other varieties of Dutch (cf. Gooskens and Heeringa 2004). The perceptual distances obtained in this way will enable us to ascer-

⁷ The pre-lexical level pertains to the segment inventories, the (largely historically grown) distribution of segments over "lexical sets", phonotaxis and the like. The lexical level relates to the interaction of phonology with morphology and to the phonology of grammatically complex words, including stress. The post-lexical level, meanwhile, pertains to the interaction of phonology with syntax (e.g. sandhi phenomena) and the prosodic organisation of speech. Finally, the phonetic component relates to such things as the dialect-specific realisations of particular segments, which is one of the main ingredients of what is usually subsumed under "accent".

tain whether, in the view of speakers, dialect borders have disappeared, and whether dialect groups have been fused.

The study presented in this paper shows that dialectometry is useful when it comes to revealing changes of individual dialects, changes in the relationships among dialects, and changes between dialects and the overarching standard language. The methodology may also be useful to historical linguists who wish to study the changes in the relationships between specific dialects and/or languages and a proto-language. In this paper, we used parallel corpora, with one corpus containing the speech of older male speakers and another containing that of their younger female counterparts. The corpora are closely comparable, as translations of the same items and sentences are found in both. However, our methodology can still be used for studying dialect and/or language change on the basis of larger corpora that are not entirely identical and are thus less directly comparable. Instead of Levenshtein distances, frequency-based approaches could be utilised, such as the one developed by Hoppenbrouwers and Hoppenbrouwers (2001) or Szmrecsanyi (this volume).

The methodology applied in this study might also be relevant to researchers interested in cross-linguistic variation; after all, our research looks at dialect change at a level of abstraction that is common in the literature on cross-linguistic typology. It may be possible to extend the method to language families, which is the next highest level of typological abstraction, perhaps enabling national language systems to be compared to family systems.

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Appendix to the contribution by Wilbert Heeringa and Frans Hinskens

Figure 3. Convergence towards and divergence from standard Dutch. Red dots indicate convergence, blue dots indicate divergence.

Figure 4. Convergence among dialects. Red lines indicate convergence and blue lines indicate divergence.

Figure 5. Change of dialect groups at the lexical level (left), the morphological level (middle) and sound component level (right). The groups on the maps in the top row are obtained on the basis of variation measured among the transcriptions of the older males, while the groups in the maps in the bottom row are obtained on the basis of variation measured among the transcriptions of the younger females.