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THE CHANGE OF DUTCH DIALECT AREAS IN APPARENT TIME

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Abstract

We studied the apparent time change of dialect areas on the basis of data of 86 local dialects of Dutch and Frisian that we collected in the period 2008-2011. In each location, recordings were made of two older male speakers and two younger female speakers. Using the transcriptions, we calculated linguistic distances among the speakers and classified the 172 speakers in natural groups by using bootstrap clustering. We used Ward's clustering, which minimizes the total within-cluster variance. Comparing the groupings of the older male speakers with those of the younger female speakers we found that the number of groups decreased and the size of the Hollandic group increased at the lexical and morphological level. We also weighed words by their frequency of use. For the weighed data, we found a smaller number of groups and a significantly larger Hollandic area at the morphological level than for the unweighed data. This may indicate a new 'Hollandic expansion'.

Keywords

bootstrap clustering, dialect change, dialect leveling, dialectometry, frequency weighting

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EL CAMBIO DE LAS ÁREAS DIALECTALES HOLANDESAS EN TIEMPO APARENTE

Resumen

Estudiamos el cambio de tiempo aparente de las áreas dialectales a partir de los datos de 86 dialectos locales del neerlandés y del frisón que recopilamos en el período comprendido entre 2008 y 2011. En cada localidad, se hicieron grabaciones de dos hablantes masculinos de edad y dos hablantes femeninas más jóvenes. Usando las transcripciones, calculamos las distancias lingüísticas entre los hablantes y clasificamos a los 172 hablantes en grupos naturales utilizando la agrupación bootstrap. Utilizamos la agrupación de Ward, que minimiza la varianza total dentro del clúster. Al comparar las agrupaciones de los hablantes masculinos mayores con las de las hablantes femeninas más jóvenes, encontramos que el número de grupos disminuyó y el tamaño del grupo holandés aumentó en los niveles léxico y morfológico. También ponderamos las palabras por su frecuencia de uso. En los datos ponderados, encontramos un número menor de grupos y un área neerlendesa significativamente mayor a nivel morfológico que en los datos no ponderados. Esto puede indicar una nueva "expansión neerlandesa".

Palabras clave

agrupación bootstrap clustering, cambio dialectal, nivelación dialectal, dialectometría, ponderación de frecuencia

1. Introduction

Willem Grootaers was born in Heverlee, close-by Leuven in Belgium in 1911. He was a bilingual speaker of Dutch and French. In 1950 he came to Japan where he had a major influence on Japanese linguistics. In an address at the occasion of his 65th birthday, Japanese philologists compared linguistics in post-war Japan to a withered houseplant. However, once Goerotase (Grootaers in Japanese) started his dialectological work on Japanese, his influence was like the influence of rain in a dry area, they added.

Grootaers was trained in dialect geography by his father Ludovic, who founded the *Zuidnederlandse Dialectcentrale* 'southern Dutch dialect center' in 1922. As an interviewer, Grootaers junior contributed to the *Linguistic Atlas of Itoigawa* (Sibata & Grootaers 1995), thus systematically collecting and organizing linguistic data. Today we find that systematically collected data is fundamental for dialect geography and dialectometry.

In this paper we study the change of dialect areas using data of 86 local dialects of Dutch and Frisian that we collected in the period 2008-2011. Dutch is spoken in the Netherlands and the northern part of Belgium ('Flanders'). In the northwest of the Netherlands Frisian is spoken as well. In each location, recordings were made of two male speakers (60 years old or older) and two female speakers (between 20 and 40 years old).

On the basis of analyses of these data, Heeringa & Hinskens (2014) established that dialects in the Netherlands are converging significantly towards standard Dutch. However, they did not find this for the Belgian dialects, regardless whether Standard Netherlandic Dutch or Standard Belgian Dutch were taken as the reference point. They also found that dialects have in general converged towards each other both in the Netherlands and in Belgium, and between the Netherlands and Belgium.

The standard language demonstrably has a leveling effect. What is the effect of this on the dialect areas? We distinguish three dimensions:

1) Old male speakers vs. young female speakers: is the number of areas decreasing? Are there areas that have become larger? Which? Why?

2) Unweighted vs. weighted: what will change in the results if we weigh more frequent words more heavily than less frequent words?

3) Lexicon vs. morphology vs. sound components: what differences are there between these three linguistic levels with regard to dimensions 1) and 2)?

As to the second dimension we were inspired by Kloeke (1927) who devoted his PhD-dissertation about the Hollandic Expansion in the sixteenth and seventeenth centuries. Kloeke showed that the Hollandic dialects in the West of the Netherlands were leveling the other dialects in the 16th and 17th century. He focused on the words *huis* 'house' and *muis* 'mouse' which were likely pronounced as [hyːs] and [myːs] in the Hollandic dialects, and as [huːs] and [muːs] in the other dialects. Due to (trade) contacts with the prestigious Holland area, the Hollandic pronunciation of the nucleus was adopted by speakers of other and especially Low Saxon dialects as well. However, the /yː/ pronunciation spread more rapidly in the more frequently used word *huis* than in the less frequently used word *muis*. This can be seen in Figure 1. In the word *huis* the first step, the palatalization of West Germanic /uː/ into [yː], has spread more eastwards than in the less frequently used and more informal word *muis*.

Subsequently, /yː/ diphthongized into /œy/, orthographically *ui* in the Hollandic dialects and this new variant spread geographically.

While Kloeke's study suggests that frequently used words are sooner affected by the influence of a prestigious variety, the study of Hinskens (2019) points into another direction. He uses data of Van Reenen & Elias (1998: 108) which comprises 18 items, including *huis* and *muis*, being words that have nucleus /œy/ in present-day standard Dutch. For each of the words Van Reenen & Elias (1998) counted the number of local dialects in which /uː/ has been changed, considering a set of 353 Dutch dialects. Additionally, for each item they provide the frequency of oral usage in two corpora of modern spoken Dutch.

As Hinskens (2019) writes, Reenen & Elias (1998) did "not take the logically following step of relating stability versus change of West Germanic /uː/ with the item's token frequencies". Hinskens (2019) does so and calculated Pearson's r between the number of dialects in which /uː/ has been changed and the frequency of usage. He found r = .294 (two-tailed p=.236) which suggests that there is no relationship between the token frequency and the number of local dialects in which /uː/ changed into something else. However, when the token frequencies are log-transformed,[1] a significant yet moderate correlation is found (r = .503, two-tailed p<.05).

This paper contributes to this discussion in that we study the influence of token frequency from an aggregate perspective. We do not focus on just one single phenomenon as in the aforementioned studies, but use random samples of data, as explained in Section 2. Moreover, we study the influence of token frequency not only for the level of the sound components, but for the lexical level and the morphological level as well.

This paper is organized as follows. In Section 2, we describe the data that form the basis of this study, along with the measurement techniques that we apply to it. In

[1] Logarithmic token frequencies were calculated as *log*(token frequency + 1). Using this formula, a token frequency of 0 remains 0.

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the same section we also extensively describe the way we applied bootstrap clustering in order to find dialect groups. Then, in Section 3, the results are presented and our research question is answered. Finally, we draw our conclusions in Section 4.

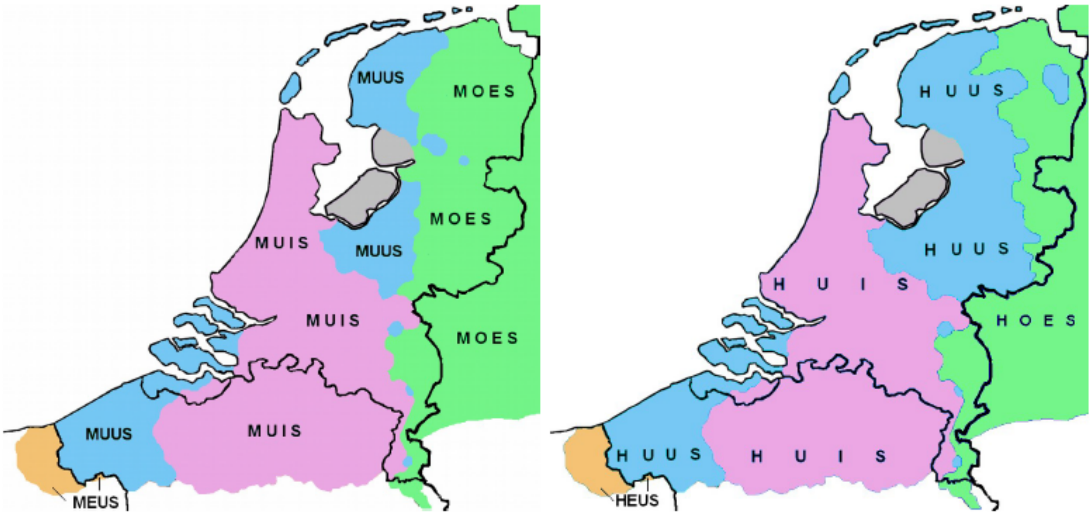

Figure 1. Variation of the word muis 'mouse' (left) and huis 'house' (right). Orthographic <oe> represents vowel [u:], orthographic <uu> represents vowels [y:] and orthographic <ui> represents diphthong [œy]. In the word *huis* the [y:] has spread more eastwards than in the word *muis*. The two maps are taken from https://nl.wikipedia.org/wiki/Lexicale_diffusie and adapted.

2. Data source and measurement techniques

2.1 Collecting the data

In this paper we present the outcomes of analyses of recordings of 86 local Dutch dialects. These recordings were compiled in the period 2008-2011 (see Heeringa & Hinskens 2014). The local dialects are evenly spread over the Dutch and Frisian language areas (see Figure 2).

In order to measure dialect change in apparent time, we recorded at least two male speakers aged 60 or older, and two or more female speakers aged between 20 and 40 in each of the 86 locations. The males represent the older phase of a particular local dialect and the females the newer phase.

A scene of the Charlie Chaplin movie “The Kid” served as the basis of the recordings that were made. This film focuses on a neighborhood 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 through a window. The policeman then realizes 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, as they run away.

The story was presented to our dialect speakers by way of stills from the movie as well as in narrative form. The scene can be regarded as a cross-section of plain, simple daily spoken language, and the narrative consists of 23 sentences, each containing an average of 7.6 words. For the present study, we used a selection of 13 sentences, which include a maximum of 125 words in the written standard Dutch version of the text.

Both the older male and the younger female speakers operated in small groups of at least 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, together they compiled a consensus version upon which all of them agreed. Finally, all of them read the consensus text aloud.

Phonetic transcriptions of the recordings were made. Usually, two recordings of the consensus dialect version of the story were produced by both the older males and the younger females. Since phonetic transcription is time-consuming, only one recording per group was transcribed, usually the recording of the most autochthonous speaker and/or the one with the clearest voice who read the text most fluently. When the speaker and the speaker’s parents were born in the location under investigation, we consider that speaker as more autochthonous than a speaker (one or both of) whose parents were born elsewhere.

The transcriptions were made in IPA and digitized in X-SAMPA. All recordings in our data set were transcribed by the same transcriber, viz. the first author. To ensure optimal consistency per item, transcriptions are made per sentence instead of per text.

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The same sentence was played (2 times 86 is) 172 times and transcribed. Subsequently, the next sentence was played 172 times and transcribed, etc.

For more details see Heeringa & Hinskens (2014).

Figure 2. Distribution of 86 Dutch dialect varieties. The Dutch provinces are shaded in light gray and the Belgian provinces (Flanders) are shaded in darker gray. For orientation purposes, Heverlee – the birthplace of Willem Grootaers – and Amsterdam are also shown in the map, marked by white dots.

2.2 Application of measurement techniques

2.2.1. Lexical distances

The lexical distance between the two dialect varieties was measured using the method introduced by Séguy (1973): we established the percentage of items upon which the two dialects disagree lexically because of heteronomy. 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. The other 54 words did not vary. This variation can be found across the 86 dialects and the two speaker groups. In Table 1 both types of variation are shown for the word *straat* 'street':

older male speaker	Hollum	lʊːn[2]
older male speaker	Westhoek	straːt[3]
younger female speaker	Westhoek	dik[4]

Table 1. Lexical variation of the word *straat* 'street' across local dialects and speaker groups.

When focusing on the older male speakers, we find lexical variation across the local dialects: [lʊːn] versus [dik]. When we focus on the local dialect of Westhoek, we find variation across the two speaker groups: [straːt] versus [dik].

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. In the set of 125 words, there are 37 complex words. We found that 52 words vary morphologically across dialects and speaker groups. In Table 2 both types of variation are shown for the word *huis* 'house':

[2]Cognate of English *lawn*.
[3]Cognate of English *street*.
[4]Cognate of English *dike*.

older male speaker	Venray	hyːs
older male speaker	Nijverdal	hyːzər
younger female speaker	Nijverdal	hyzə

Table 2. Morphological variation of the word *huis* ‘house’ across local dialects and speaker groups.

When focussing on the older male speakers, we find lexical variation across the local dialects: [hyːs] versus [hyːzər]. When we focus on the local dialect of Nijverdal, we find variation across the two speaker groups: [hyːzər] versus [hyzə].

2.2.3 Distance in the sound components

Distances in the sound components between dialects are measured with the aid of the Levenshtein distance metric (Levenshtein 1966). This algorithm was introduced into dialectology by Kessler (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 & Liberman 1999).

Assume the Dutch word *politie* ‘police’ is pronounced as [plitsi] in the dialect of Grolloo and as [polizi] in the dialect of Westkapelle. Changing the Grolloo realization into the Westkapelle one can be done by inserting [o], deleting [t] and substituting [s] by [z], i.e. three operations. The alignment is shown in Table 3.

	1	2	3	4	5	6	7
Grolloo	p		l	i	t	s	i
Westkapelle	p	ə	l	i		z	i
		ins.			del.	subst.	

Table 3. Alignment of the realizations of *politie* ‘police’ in the dialects of Grolloo and Westkapelle.

The aggregated distance between the two dialects is based on 125 word pairs (fewer if words were missing). We use normalized 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 4). The sum of the Levenshtein distances is 11, and the sum of the corresponding alignment lengths is 25. Therefore the aggregated distance is (11/25) * 100 = 44%.

		Grolloo	Westkapelle	Levenshtein distance	alignment length
stil	'silence'	stɪl	stɪlə	1	5
huizen	'houses'	husn	yz	3	4
glas	'glas'	xlas	χlɒs	2	4
korte	'short'	kœrdə	kɒrtə	2	5
politie	'police'	plitsi	pəlizi	3	7
				11	25

Table 4. Calculation of the aggregate distance between Grolloo and Westkapelle on the basis of five word pairs.

In the examples, we use binary operation weights: insertions, deletions and substitutions count as 1 and matches also count as 1. In our study, however, rather than using binary operation weights, we use graded operation weights throughout this paper. These weights vary between 0 and 1 and are based on comparison of spectrograms of the sounds. The spectrograms were made on the basis of recordings of the IPA sounds as pronounced by John Wells and Jill House on the cassette The Sounds of the International Phonetic Alphabet (Wells and House 1995). For each sound a spectrogram was made with PRAAT using the Bark filter, a perceptually-oriented model (Zwicker and Fastl 1990). Inserted or deleted segments were compared to silence, and silence was represented as a spectrogram in which all intensities of all frequencies are equal to 0. The [ʔ] was found closest to silence and the [a] was found most distant. This approach is described extensively in Heeringa (2004).

In perception, small differences in pronunciation may play a relatively strong role in comparison to larger differences. Therefore, logarithmic segment distances were used. The effect of using logarithmic distances is that small distances are weighted relatively more heavily than large distances, and these weights will 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.

2.2.4 Weighing of words

In the previous sections we mentioned that the aggregate distance between the two dialects was based on maximally 125 word pairs. The set of 125 words includes 82 unique words ('types'), i.e. some words appeared in the text more than once (for these words, there were >1 'tokens'). For example, the word *straat* 'street' appeared three times. Therefore, when calculating the aggregate, for *straat*, each of the corresponding word pair distances counted for one third. Similarly, other multiple occurring words were weighed by 1 divided by the number of occurrences in the set of words. This was not (always) done for the words *de* 'the', *het* 'it' and *een* 'a' due to use in different contexts and/or different variation patterns and – in the case of *het* – different uses (either as determiner or pronoun).

As we mentioned in Section 1, for these analyses, words are weighed by their frequency of use in spoken language. We used the frequencies obtained on the basis of a corpus of 120.000 words by de Jong (1979). This corpus includes both spoken formal and informal Dutch speech. We only considered words with a minimum frequency of 2. The frequencies were log-transformed. Before doing this, we added 1 to the frequencies, so that frequencies of 0 remain 0 (since log(1) = 0) and frequencies of 1 do not become 0.

Finally the log-transformed frequencies are multiplied with the weights described in the first paragraph of this section. When being applied in the analyses, we will refer to them as corpus frequency weights.

2.3 Finding areas

For the present study, we will basically adopt the methodology of Heeringa & Hinskens (2014) and Heeringa (2017), but use another cluster method which will reveal patterns of change that were not found in the aforementioned studies.

2.3.1 Existing procedures

Cluster analysis is ‘the process of classifying objects into subsets that have meaning in the context of a particular problem.’ (Jain & Dubes 1988: 55). The goal of clustering is to identify the main groups in complex data. Goebl (1982) introduced cluster analysis in the field of dialectometry (see also Goebl 1984 and Goebl 1993). He used this statistical technique as a means to find groups for a given a set of local dialects and their mutual linguistic distances.

On the one hand visually attractive maps are obtained by using this technique, on the other hand we have to admit its instability; small differences in the distance matrix may strongly change the results (Jain, Murty & Flynn 1999, Nerbonne et al. 2008).

In order to overcome this problem Kleiweg, Nerbonne & Bosveld (2004) introduced *composite cluster maps*, which are obtained by collecting chances that pairs of neighboring elements are part of different clusters as indicated by the darkness of the border that is drawn between those two locations. Noise is added to the clustering process, which enables the authors to estimate how fixed a border is. Given a distance matrix, a random value between 0 and a maximum is added to each distance, and subsequently the dialects are clustered. The maximum is the noise ceiling and may be one or two standard deviations of the distances in the distance matrix. This is repeated, e.g. 1,000 times, giving 1,000 clusterings, and the number of times that pairs of neighboring elements are part of different clusters in those 1,000 clusterings is counted. The results can be visualized in a map, where the darkness of the border between two locations represents the chance that the locations belong to different clusters.

Using our data set of 86 local varieties we calculated the mutual distances in the sound components as described in Section 2.2.3, and applied noise clustering. The results are shown in Figure 3.

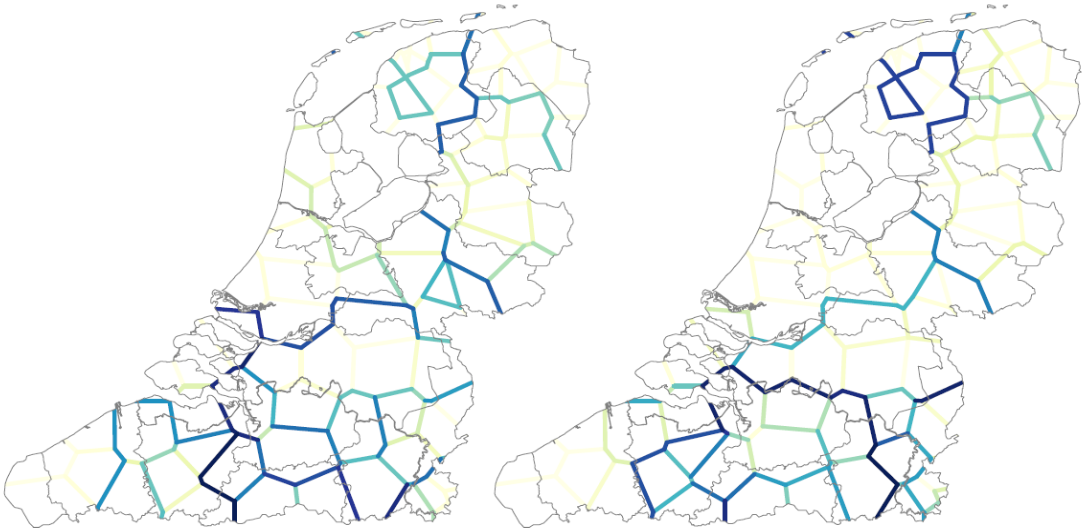

Figure 3. Composite cluster maps for the 86 local dialects. Noise clustering was applied to the mutual distances in the sound components. On the left the results using the recordings of the older male speakers, and on the right the results using the recordings of the younger female speakers. Neighboring dialects are separated by lighter or darker lines. The darker a line, the more often the two dialects are found in different clusters. The results shown here are obtained on the basis of 50 clusterings.

Related to noise clustering is bootstrap clustering that was introduced by Nerbonne et al. (2008). Given a data set with transcriptions of say 100 words for each local dialect, 100 words are randomly selected using replacement,[5] Levenshtein distances are calculated between the dialects, and the dialects are clustered on the basis of the Levenshtein distances. When this is repeated, e.g. 1,000 times, the number of times that pairs of neighboring elements are part of different clusters is counted.

Nerbonne et al. (2008) show that noise clustering and bootstrap clustering produce similar results, but bootstrap clustering has the advantage of having one parameter less, i.e. no noise ceiling needs to be specified. Both the work of Kleiweg,

[5]Sampling with replacement means that the probability of a word to be chosen remains the same, regardless whether that word was chosen before. It is therefore possible that the same word is chosen multiple times in one run, while other words are not chosen at all.

Nerbonne & Bosveld (2004) and Nerbonne et al. (2008) focus on boundaries which may be weaker or stronger, i.e., they are gradual. These maps require more interpretation than the traditional dialect maps where the color distinctions give a visual representation of the borders between different dialect areas, for example, the map by Te Winkel (1901) and the map by Daan & Blok (1969).

In our study we will use the kind of bootstrap clustering as introduced by Heeringa & Hinskens (2014) and described in more detail by Heeringa (2017) which generates areas, similar to classical dialect maps. When using this procedure it is taken into account that not every local dialect can be classified with statistical confidence and therefore be assigned to a particular dialect area.

2.3.2 Generating areas with bootstrap clustering

The procedure for finding dialect areas by means of bootstrap clustering consists of five steps.

1. Resampling

Select 1000 times randomly 125 items from 125 items with replacement. For each resampled set of items calculate the aggregated linguistic distances among the 172 speakers.

2. Ward's clustering

For each of the 1000 distance matrices perform cluster analysis. We used the Ward's method which minimizes the total within-cluster variance.

3. Find the number of natural groups

For each of the 1000 clusterings determine the number of natural groups. For each clustering we get a dendrogram. 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 172 (2 recordings for each dialect, the one for the older men and the one for the younger women, hence 2x86), with each grouping containing a single variety. We thus have 171 levels, the first suggesting a division into two groups and the 171th suggesting a division into 172. For each division in i groups ($2 \leq i \leq 171$), we compute the variance in the original distances, as explained by the cophenetic distances of the part of the tree that gives a division in i groups. Cophenetic distances are distances between the dialects as reflected by the dendrogram. The cophenetic distance between two local dialects is the height of the dendrogram where the two branches that include the two objects merge into a single branch1 (Sokal & Rohlf 1962).

When plotting the variances against the number of groups ($2 \leq i \leq 171$), we will likely find that 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 & Blashfield 1984). After the angle, the amount of explained variance in the distances increases much more slowly than before.

In order to find the angle in an automatized way, we performed a linear regression analysis where the logarithmic number of clusters is the predictor and the explained variance the dependent variable. The elbow is found where the difference between the variance predicted by the logarithmic number of cluster and the 'real' variance is largest.

4. Count number of times that two dialects share the same group

For each pair of dialects count the number of times that both dialects are found in the same natural group across the 1000 clusterings.

5. Create networks

When two dialects belong to the same group in more than 950 cases (95%), mark them as `connected.' In this way we obtain networks. Each network is a group.

Note that this analysis is applied to all 172 speakers at once. Heeringa & Hinskens (2014) and Heeringa (2017) applied the procedure separately for the 86 older male speakers and the 86 younger female speakers. Subsequently they manually matched the groupings found among the older male speakers with the groupings among the younger female speakers. This matching is not always unambiguous. However, by applying the procedure to *all* speakers at once, this matching is no longer necessary.

Furthermore, in step 2 we use Ward's clustering, while Heeringa & Hinskens (2014) and Heeringa (2017) used single-linkage clustering, where at each step the two clusters separated by the shortest distance are combined. This choice was inspired by the little arrow method which the map of Daan & Blok (1969) is based on. Using the little arrow method, locations which have similar dialects according to the speakers are connected by arrows in the map. Although this method resembles the arrow method somehow, the difference is that when using the little arrow method, only neighboring local dialects are compared to each other and – if judged to be similar by their speakers - 'connected', while single-linkage clustering may 'connect' any pair of local dialects, regardless whether they are geographically close or not.

In this paper we follow Goebl (1982, 1983, 1993) who used Ward's method. This method minimizes the total within-cluster variance. At each step the procedure finds the pair of clusters that leads to a minimum increase in total within-cluster variance after merging. This method tends to create clusters of the same size (Legendre & Legendre 1998). If the variance of the mutual linguistic distances among the local dialects within a group is small, then there are no (clear) boundaries within that group. It also means that an arbitrary speaker of a group will understand all local varieties within that group (about) equally well. As such, it seems to us justified to explore the dialect landscape by using Ward's method, but we do not reject other techniques that – when applied to linguistic distances among local dialects – consider the dialect landscape from a (slightly) different angle. Using Ward's method, patterns in the dialect landscape are revealed that would not have been made visible by other cluster methods such as single-linkage clustering.

3. Results

The results are shown in Figure 4. It is striking that at the lexical level a large number of local dialects was not classified. The exact counts for all three levels are given in Table 5.

	lexical	morphological	sound components
older male speakers	62	32	10
younger female speakers	53	25	11

Table 5. Number of unclassified local dialects per linguistic level.

For both the results on the basis of the recordings of the older male speakers and the results of the recordings of the younger female speakers we find that the number of classified local dialects is larger at the morphological level than at the lexical level (62/86 vs. 32/86, $p<.001$, 53/86 vs. 25/86, $p<.001$) and larger at the level at the sound components than at the morphological level (32/86 vs. 10/86, $p<.001$, 25/86 vs. 11/86, $p<.01$).

Furthermore, the number of groups changed at each level in apparent time (older men compared to younger women) as can be seen in Table 6.

	lexical	morphological	sound components
older male speakers	8	18	15
younger female speakers	6	11	16

Table 6. Number of groups per speaker group and linguistic level.

At the lexical level and at the morphological level, the number of groups decreased. However, at the level of the sound components the number of groups increased.

At the lexical level, West-Flemish (represented by the green dots in the utmost southwest) and Frisian (the blue dots in the northwest) are relatively stable. The group represented by the yellow dots has dramatically expanded from 3 dots to 15 dots. Comparing the proportions 3/86 versus 15/86 with Fisher's exact test we found that this increase is significant ($p<.01$).

At the morphological level we find many groups that are geographically less clearly divided. Most local dialects have even changed groups. When focusing on the yellow group, we find again that the group has expanded. This expansion is significant as well (4/86 versus 13/86, $p<.05$).

At the level of the sound components we find geographically clearly delimited groups. None of the groups has (strongly) increased or decreased. However, a group in the southwest (blue-green dots) has disappeared, and the groups represented by darker blue dots (about in the center, north of the Netherlandic/Belgian state boundary) has split in two smaller groups (red-brown and lighter purple dots). The group represented by the yellow dots has not significantly increased (11/86 versus 12/86).

In the maps the dialect group represented by the yellow dots constitute what we may call the main birth ground of standard Dutch, be it that standard Dutch also absorbed properties from other dialects. As such the expansion of the groups represented by the yellow dots rather represents the influence of standard Dutch on the local dialects, as was also established by Heeringa & Hinskens (2014).

As we saw earlier in Section 1, Kloeke pointed out that the influence of a dominant and prestigious dialect influences in particular frequently used words. This may cause dialect leveling, the process of an overall reduction in the variation or diversity of features in one or more dialects, which in turn, may cause a decrease in the number of distinguished dialect areas. While Kloeke's example of lexical frequency effects concerns individual linguistic phenomena, we will test for this by considering the aggregate of the data for the variables at all three levels. In Section 2.2.4 we explained how words were weighted by their use in spoken Dutch. When weighing words by their token frequencies, at each of the three linguistic levels we obtain the number of groups that are shown in Table 7.

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	lexical	morphological	sound components
older male speakers	12	12	15
younger female speakers	11	9	18

Table 7. Number of groups per speaker group and linguistic level.

At the lexical level and at the level of the sound components we find a larger (or equal) number of groups compared to the unweighted results (see Table 6). At the morphological level, however, we find a smaller number of groups, both for the older male speakers and the younger female speakers.

Kloeke found a Hollandic expansion, i.e. dialects in the west of the Netherlands – Holland – influenced the other dialects, making the area with pronunciation /yː/ in the words *huis* and *muis* larger. In our case, we especially focus on the group which is represented by the yellow dots (in Figures 4 and 5), and which we will refer to as the 'Hollandic' group in the remainder of this paper.

The results for the Hollandic area are shown in Figure 5 (right column) and aligned to the results obtained on the basis of the non-weighed analyses (left column, same as the right column in Figure 4). These results enable us to check whether frequently used words are affected more strongly by standard Dutch than less frequently used words. If that is the case, we expect that the maps in the right area show areas that include a larger number of yellow dots then the respective corresponding maps in the left column. We checked this for all levels for the results obtained for each of the two groups (older male speakers and younger female speakers). The counts that we obtained are given in Table 8.

	older male speakers				younger female speakers			
	non-weighed		weighed	sig.	non-weighed		weighed	sig.
lexical	3	vs.	6	n.s.	17	vs.	17	n.s.
morphological	4	vs.	35	p <.001	15	vs.	43	p < .001
sound components	11	vs.	4	n.s.	12	vs.	6	n.s.

Table 8. Number of local dialects in the 'Hollandic' group, broken down by speaker group, weighing and linguistic level. *P*-values are given for the non-weighed/weighed comparisons.

Only at the morphological level we find for both the older male speakers and the younger female speakers that the Hollandic group is significantly larger in the map obtained on the basis of the weighed analyses than in the map obtained on the basis of the non-weighed analysis (p<.001). This means that Netherlandic dialects and Frisian varieties are morphologically less distinguished from the Hollandic group in the frequently used words than in less frequently used words, which indicates lexical diffusion at the morphological level.

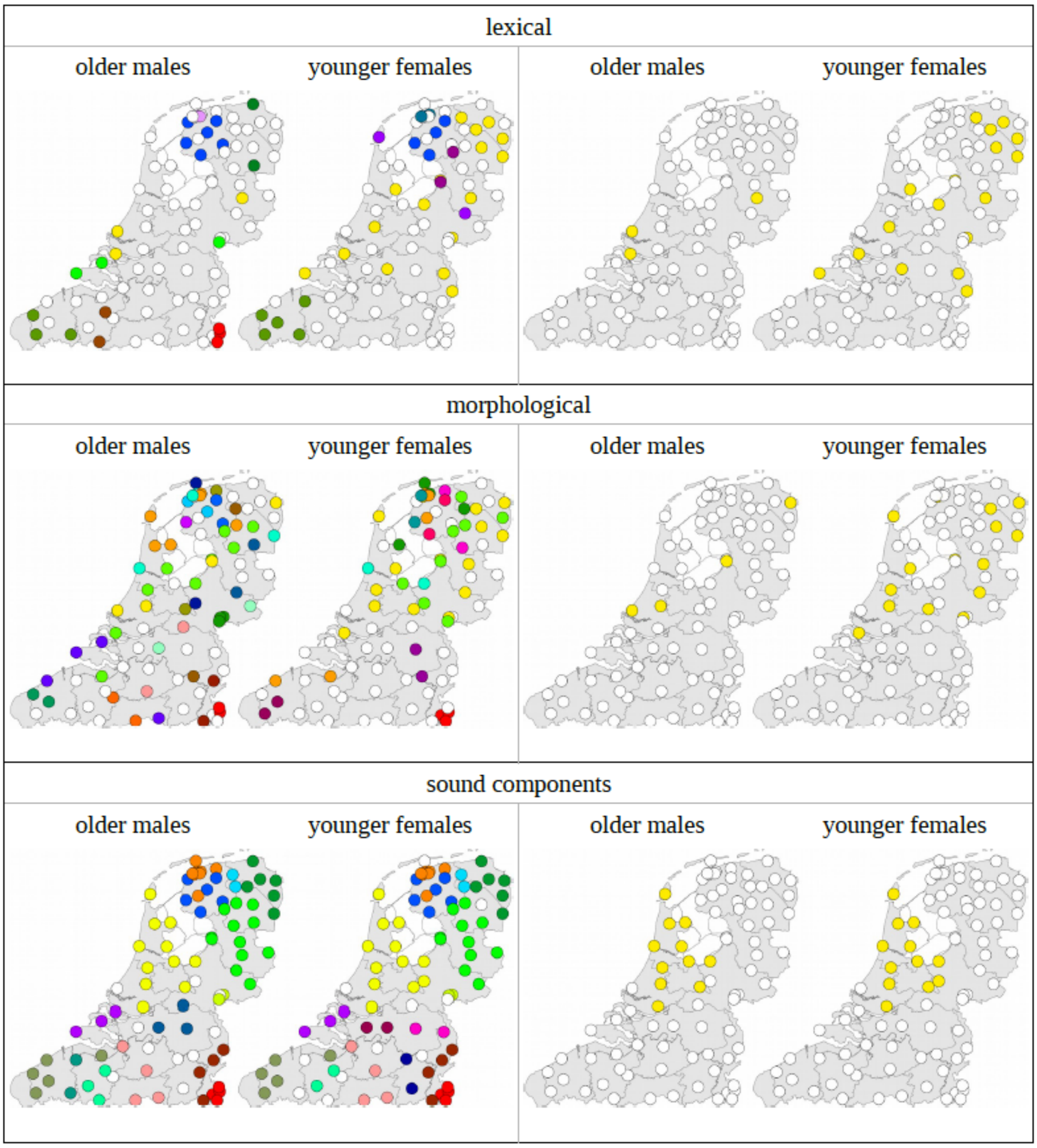

Figure 4. Change of dialect groups at the lexical level (top), the morphological level (middle) and sound component level (bottom). For each pair of maps the left one is obtained on the basis of variation measured among the transcriptions of the older males, and the right one is obtained on the basis of variation measured among the transcriptions of the younger females. The maps in the left column show all groups, and the maps in the right column show only the group close to standard Dutch.

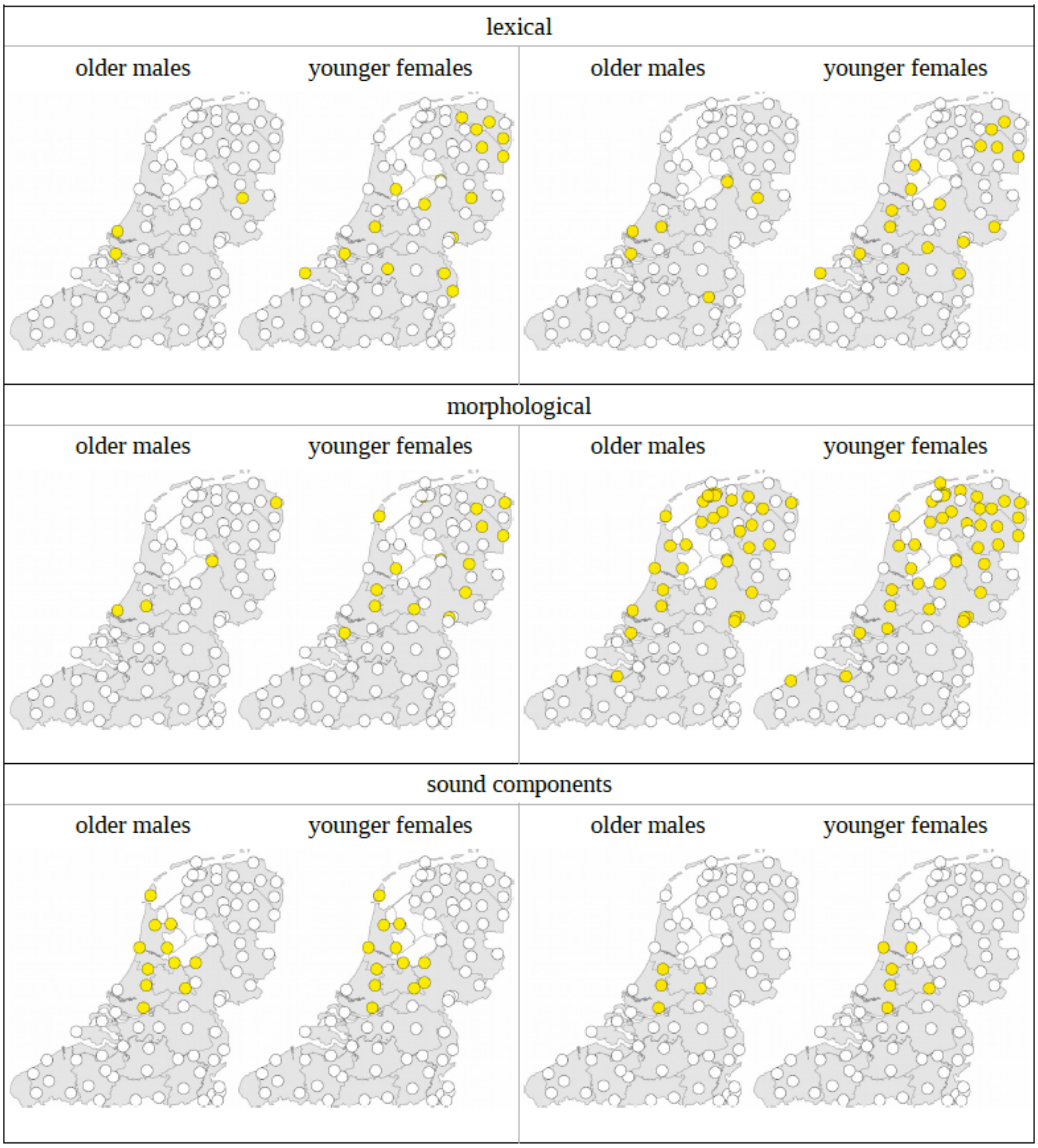

Figure 5. Change of the 'Hollandic' dialect group at the lexical level (top), the morphological level (middle) and sound component level (bottom). For each pair of maps the left one is obtained on the basis of variation measured among the transcriptions of the older males, and the right one is obtained on the basis of variation measured among the transcriptions of the younger females. The maps in the right column result from the analysis where words are weighted by their frequencies in spoken Dutch.

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4. Conclusions

When we compare the results on the basis of the recordings of the older male speakers with the results on the basis of the younger female speakers (for both unweighted and weighed data), the results for the lexical level and the morphological level agree with our expectation: the number of groups decreased, and the we found a remarkable geographical increase in the Hollandic dialect group.

Furthermore, when weighing the words by their frequency of use, at the morphological level we found a smaller number of groups and a significantly larger Hollandic area compared to the unweighted results. This may indicate a new Hollandic expansion.

These findings leave us with two questions. First, why did we find an increase of groups at the level of the sound components when comparing results on the basis of the recordings of the older male speakers and the younger female speakers? Second, when weighing words by their frequency of use, why do we find only at the morphological level a decrease of groups and a increase of the Hollandic area (as the comparison of Tables 3 and 4 reveals)? After all, the studies of Kloeke (1927) and Hinskens (2019) concern the level of the sound components, but for this level (and also for the lexical level) we did not find these effects.

As to the first question, today's influence of standard Dutch is not geographically determined as it was in the 16th and 17th century, where dialects close to Holland were sooner influenced than the more remote ones. Today, standard Dutch influences speakers of dialects via media such as television, radio and the newspapers. Therefore, the influence may differ from village to village, and within a village even from speaker to speaker. Heeringa & Hinskens (2014) showed that both dialect change and convergence to standard Dutch is a capricious process, so that no particular regional areas can be demonstrated to have changed more than others. Heeringa & Hinskens (2014) found that the dialects have in general converged towards each other. But at a more local level some local dialects may have converged to standard Dutch while other did not, making them more different to each other, and decreasing the cohesion of the dialect group to which they belong, maybe even so that a dialect group falls apart in several parts. The idea of decreased cohesion within dialect areas may agree with Heeringa & Hinskens (2014) who found that the overall variance of the linguistic distances among the dialects increased at the lexical and morphological level, but decreased at the level of the sound components. When the variance at the level of the sound components decreases, this means that the deviations of the distances to the mean distance have decreased, i.e. distances become closer to their mean on average. A decrease of the variance may occur when larger distances (i.e. distances among linguistically more remote local dialects) decrease and/or smaller distances (i.e. distances among linguistically more close local dialects, for example within a dialect group) increase. When closely-related local dialects within a group become more different to each other, that dialect group is losing its cohesion.

As to the second question, Heeringa & Hinskens (2014) found the morphological level to be the most stable level, it changed significantly less than both the lexical level and the level of the sound components. Therefore, we hypothesize that change at the two latter levels is more like a regular, all-at-once change which is not sensitive to frequency of usage, while change at the more stable morphological level is more gradual, i.e. first frequently used words change, and later on less frequently used words as well. In order to test this, useful future research would be to look at the individual phenomena at the three levels.

It should also be stressed that our results are obtained on the basis of an aggregate analyses. Although our aggregate analyses showed lexical frequency effects only at the morphological level, this does not exclude the possibility that lexical frequency effects can still be found for individual phenomena at the two other levels, such as was found by Kloeke and in the study of Hinskens (2019) when using log-transformed token frequencies. However, when the number of phenomena that are sensitive to lexical frequency is small and the correlation between linguistic change and token frequency is weak (although significant), this might not appear in an aggregate analysis, which is another reason to look at the individual phenomena as well.

In sum, we find that collected data that has been systematically collected along the lines of Willem Grootaers enables us to study dialect change and change of dialect groups.

The Flemish Dutch methodology of Willem Grootaers was fruitfully applied to Japanese. The methodology demonstrated in this paper, too, can be used for any dialect landscape in order to investigate the influence of a standard language or another prestigious regional or supra-regional dialect.

Acknowledgments

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.

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