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## **INTELLIGIBILITY OF STANDARD GERMAN AND LOW GERMAN TO SPEAKERS OF DUTCH**

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### **Abstract**

This paper reports on the intelligibility of spoken Low German and Standard German for speakers of Dutch. Two aspects are considered. First, the relative potential for intelligibility of the Low German variety of Bremen and the High German variety of Modern Standard German for speakers of Dutch is tested. Second, the question is raised whether Low German is understood more easily by subjects from the Dutch-German border area than subjects from other areas of the Netherlands. This is investigated empirically. The results show that in general Dutch people are better at understanding Standard German than the Low German variety, but that subjects from the border area are better at understanding Low German than subjects from other parts of the country. A larger amount of previous experience with the German standard variety than with Low German dialects could explain the first result, while proximity on the sound level could explain the second result.

### **Keywords**

Intelligibility, German, Low German, Dutch, Levenshtein distance, language contact

## **LA INTELIGIBILIDAD DEL ESTÁNDAR ALEMÁN Y DEL BAJO ALEMÁN POR PARTE DE HABLANTES HOLANDESES**

### **Resumen**

Este artículo informa sobre el grado de inteligibilidad del bajo alemán hablado y del estándar alemán que tienen los hablantes del holandés. Se han considerado dos aspectos: en primer lugar, el

potencial relativo de inteligibilidad de la variedad del bajo alemán de Bremen y de la variedad del alto alemán correspondiente al moderno estándar por parte de hablantes del holandés; en segundo lugar, se cuestiona si los sujetos que habitan en la frontera holandesa-alemana entienden con más facilidad el bajo alemán que los habitantes de otras áreas de los Países Bajos. Esta cuestión se ha investigado empíricamente. Los resultados muestran que en general los holandeses entienden mejor el estándar alemán que el bajo alemán, pero que los hablantes de la frontera entienden mejor el bajo alemán que el resto de hablantes del holandés. El hecho que exista una mayor experiencia previa de la variedad correspondiente al alemán estándar que del bajo alemán explicaría el primer resultado mientras que la proximidad relativa al fónico explicaría el segundo resultado.

### **Palabras clave**

inteligibilidad, alemán, bajo alemán, holandés, distancia de Levenshtein, contacto de lenguas

## **1. Introduction**

Dutch and German originate from the same branch of West Germanic. In the Middle Ages these neighbouring languages constituted a common dialect continuum. Only when linguistic standardisation came about in connection with nation building did the two languages evolve into separate social units. A High German variety spread out over the German language area and constitutes what is regarded as Modern Standard German today. Varieties of Low German are still spoken in the Northern German area. Low German is considered structurally closer to Dutch than to High German varieties since the Low German dialects, including the subgroup of Low Franconian dialects from which Standard Dutch originates (cf. Willemyns 2003), are not characterized by the High German consonant shift.

The West Germanic dialect continuum has been subject to many studies in dialectology, and so has the effect that state borders may have had on this continuum. In a number of papers it has been shown that the dialects on the two sides of the Dutch-German border have grown apart due to vertical convergence towards the national standard languages (cf., e.g., Giesbers 2008; Heeringa et al. 2000; Kremer 1996; Niebaum 1990). However, most of these studies have not focussed on, or shown data about, the communicative consequences of this border, i.e. cross-border intelligibility and resulting possibilities of dialect use. With respect to intelligibility, Gooskens & Kürschner (2009) investigated whether speakers of border dialects (of Dutch and

Danish) have an advantage in understanding related dialects from the neighbouring country (cf. also Kürschner & Gooskens, accepted). Höschen (1985) conducted a study on dialect use on both sides of the Dutch-German border. Other studies of mutual intelligibility in the West-Germanic dialect continuum deal with either German dialects only (cf. Schmitt 1992) or Dutch varieties only (Impe et al. 2008; Impe 2010). Schmitt uses story telling and dialectal translations of 28 short sentences to measure the mutual intelligibility between Rhine and Moselle Franconian dialects. Impe, by contrast, bases intelligibility results on response latencies in experiments studying the identification of isolated words.

Not only the dialectal continuum, but also the relationship between the standard languages of Dutch and German has been subject to much contrastive research (cf., e.g. Van Haeringen 1956; Hüning et al. 2006). With respect to mutual intelligibility, though, studies regarding the standard languages are rare. Based on experimental studies of sentence and text understanding, Ház (2005) reports that mutual intelligibility between Standard Dutch and Standard German is possible to a certain extent. The intelligibility of Standard German among Dutch-speaking individuals was found to be higher than that of Standard Dutch among German individuals. This is attributed to the fact that German is an obligatory school subject in Dutch secondary schools, whereas most Germans do not learn any Dutch. Ház reports that a knowledge of Low German enhances the intelligibility of Dutch among German subjects.

Still, we do not know how well Low German is understood by Dutch individuals, and there have been no studies aiming to identify precisely which factors determine the degree of intelligibility in the area, i.e. whether linguistic factors such as distance on the lexical and the sound level influence the degree of intelligibility or whether non-linguistic factors such as school education and the extent of language contact could do so. In the present investigation we tested the degree of intelligibility across the Dutch-German border and tried to relate the results to some of these factors. We conducted a study of the intelligibility of Standard German and a Low German variety among native speakers of Dutch.

We decided to base our research on a word identification task, similar to the studies conducted by Impe et al. (2008) and Impe (2010). In contrast with Impe's studies, in our cross-linguistic study we did not obtain response latencies, but instead deduced the rate of intelligibility from the number of words correctly translated from

the stimulus. We assume that word recognition has a key function in language understanding, since “as long as the listener correctly recognises words, he will be able to piece the speaker’s message together” (Van Heuven 2008: 43). Understanding language, of course, means decoding linguistic signs not only on the word level, but on several levels and further research is necessary to relate our results to other levels of linguistic organization.

Research on the intelligibility of linguistic variation is relevant to linguistic theory, not only with respect to the classical dialectology and sociolinguistics of West-Germanic as presented above, but also with respect to the more fundamental question of how we deal with variation in the input, i.e. why and how we are able to understand our language in a high number of different varieties. For example, speakers in the Netherlands and Germany are often both dialect and standard speakers, meaning that they should have words stored as phonological representations in both dialectal and standard versions in their mental lexicon. Therefore, an interesting question to ask is which routes these speakers take to relate words from other varieties to their mental knowledge — the standard language, the dialect, or both representations.

Our study will be concerned with the theoretical issues discussed above by presenting the results of intelligibility tests and their relation to conditioning factors (social and linguistic). We address the following research questions:

1. Which language variety is more intelligible to speakers of Dutch, a Low German variety or the High German variety of Modern Standard German?
2. Are Dutch speakers from the Dutch-German border area better at understanding Low German than Dutch speakers from other parts of the Netherlands?

As far as the first research question is concerned, two plausible hypotheses predict different results: a) Many Dutch speakers learn Standard German at secondary school and may be confronted with this variety in the media. For this reason they can be expected to understand this High German variety better than Low German varieties. b) Dutch is phonologically closer to Low German varieties, and this may result in a better understanding of a Low German variety than of the High German standard variety.

With respect to the second research question, we expect people from the border regions to be more able to understand Low German than people from the rest of the Netherlands. Most speakers of Dutch speak (a regionally or socially marked variety of) the standard language. Variation in the standard language is mostly phonetic in nature and does not manifest itself on a large scale. However, the local dialects spoken in the Dutch-German border area are much more deviant from each other. They entail phonological as well as phonetic differences. They also hold a strong social position, and people who live in the border area are generally familiar with their local dialect. The border dialects in the Netherlands are typologically closer to the dialects in the neighbouring parts of Germany than the Dutch standard language is, so that accordingly linguistic distances are smaller (see e.g. Giesbers 2008: 165f.). This could make intelligibility of the variety spoken on the other side of the border easier for people from the area. Furthermore, Dutch speakers from the border region are more likely to meet speakers of Low German and hear this variety than people from other parts of the country.

In order to test the hypotheses formulated above, we conducted intelligibility tests and compared the intelligibility scores with different linguistic distance measures. We tested the intelligibility of isolated words from a Low German variety and the German standard variety among Dutch high school pupils. Intelligibility was assessed by means of a test on the Internet. The subjects translated 384 Standard German or 369 Low German nouns (i.e., from the Bremen variety) into Dutch.<sup>1</sup> In order to find out the extent to which intelligibility is related to linguistic distance, we correlated the intelligibility scores with measures of linguistic distance on the lexical and the sound level between the Low German variety and Standard German on the one hand and the variety of the test subjects (Standard Dutch and/or dialectal Dutch) on the other hand.

Lexical distance was measured by counting the number of cognates. Distances on the sound level were obtained using the Levenshtein algorithm (Nerbonne & Heeringa, 2010). With this algorithm, the distance between the transcriptions of two pronunciations is calculated as the number of operations needed to transform one transcription into the other. There are three types of operations: insertions, deletions and substitutions of sound segments. The Levenshtein distance selects the least costly set of

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<sup>1</sup> The number of Low German nouns was lower than Modern Standard German words due to a technical problem with the recordings.

operations that transform one pronunciation into another (cf. Section 3.1.2). We also looked at the intelligibility results for cognates (historically related words) and non-cognates (historically non-related words) separately. Since non-cognates should be unintelligible if not learned through previous exposure, linguistic distance can play no role in the intelligibility of this subgroup. Differences in intelligibility of non-cognates between the Low German variety and Standard German (research question 1) or in border listeners and non-border listeners (research question 2) must therefore be attributed to language contact or instruction.

In Section 2, we shortly present some of the most characteristic phonological parallels and divergences between the varieties. The intelligibility data were collected in an internet-based experiment presenting isolated words in varieties of Germanic languages to pupils from secondary schools. In Section 3 we describe the specific settings of the experimental set up to give an answer to the first research question. Section 4 is concerned with the settings of the experiment set up to answer the second research question. In this setting, the intelligibility of Low German was tested in two listener groups, one group of high school pupils from the border area and one group from other parts of the Netherlands. In Section 5 we draw conclusions from our findings.

## **2. Phonological differences between Standard Dutch, Standard German, the North Saxon dialects of the Netherlands, and Low German**

We deal with four related varieties in this article: The standard varieties of Dutch and German, the so-called North Saxon variety found in the North-East of the Netherlands, and the dialectal variety of Bremen, i.e., North-Western Germany. All the varieties in this article are historically related as part of the West Germanic dialect continuum. The Low German and the North Saxon varieties are especially close, since they belong to the same, Low Saxon continuum of dialects which crosses the Dutch-German border (cf. Niebaum 1990).

Unfortunately, we will not be able to present a comprehensive overview of all parallels and divergences among the varieties under consideration. We will limit ourselves to describing two major sound changes to illustrate what the main divergences

between High German varieties (to which the German standard variety belongs) and the other varieties are, and what makes Standard Dutch different from the two Low Saxon varieties.

The so-called High German consonant shift constitutes the main difference between High German varieties on the one hand and all other (West) Germanic varieties on the other hand. Old High German is the first variety showing this shift, while, e.g., Old Low Franconian (i.e., Old Dutch) and Old Saxon (i.e., the early medieval form of Low German) did not reflect this consonantal shift. Without going into details, in the High German consonant shift voiceless stops were turned into either fricatives or affricates depending on their position, and voiced stops were turned into voiceless ones. Since the results are reflected in the High German standard variety, we can show some examples from our data contrasted with the non-shifting varieties in Table 1. Note that the Standard German variety did undergo the shift in most parts, but not completely, in contrast with the southernmost dialects of German. Table 1 shows only cases where Standard German reflects the shift consistently.

Consonant change	Standard German	Standard Dutch	North Saxon	Low German	Meaning
/p/ > /f/ /p/ > /pf/	<i>Schiff</i> [ʃɪf] <i>Pfahl</i> [pfa:l]	<i>schip</i> [sxɪp] <i>paal</i> [pa:l]	[sxɪp] [pɔ:l]	<i>Schipp</i> [ʃɪp] <i>Pahl</i> [pɔ:l]	‘ship’ ‘pale’
/t/ > /s/ /t/ > /ts/	<i>Fuß</i> [fu:s] <i>Zugang</i> [tsu:gaŋ]	<i>voet</i> [vut] <i>toegang</i> [tuɣaŋ]	[vawt] [taugaŋ]	<i>Foot</i> [fɔwt] <i>Togang</i> [tɔwgaŋk]	‘foot’ ‘access’
/k/ > /x/	<i>Deich</i> [dajç]	<i>dijk</i> [dɛjk]	[dik]	<i>Diek</i> [di:k]	‘dike’
/d/ > /t/	<i>Dienstag</i> [di:nsta:k]	<i>dinsdag</i> [dinsdax]	[dinsdax]	<i>Deensdag</i> [dejnsdax]	‘tuesday’

Table 1. The High German consonant shift separating Standard German from Standard Dutch, North Saxon and Low German varieties.

Furthermore, Standard German and Standard Dutch share characteristics separating them from the Low German and North Saxon varieties. For example, long close vowels were diphthongised in the standard varieties, while monophthongs remained in Low German and North Saxon. Examples are provided in Table 2.

Standard German	Standard Dutch	North Saxon	Low German	Meaning
<i>Deich</i> [daiç]	<i>dijk</i> [dɛjk]	[di:k]	<i>Diek</i> [di:k]	'dike'
<i>Haut</i> [haut]	<i>huid</i> [hœjt]	[hu:t]	<i>Huut</i> [hu:t]	'skin'

Table 2. The High German and Dutch diphthongisation processes separating the standard languages from the North Saxon and Low German dialects.

Finally, Standard Dutch differs from all the other varieties under consideration in one characteristic respect: Secondary diphthongs were formed from old *al-/ol-* combinations in Standard Dutch, where all the other varieties keep a combination of vowel and liquid, cf. Standard Dutch *zout* [zawt] 'salt' vs. Standard German *Salz* [zalts], North Saxon [zɔ:lt], and Low German [zɔlt].

The examples of characteristic sound changes demonstrate that the Dutch varieties of North Saxon are still very close to Low German ones and cluster in a dialect continuum crossing the Dutch-German border. Informants who are acquainted with North Saxon could thus have an advantage when attempting to understand Low German compared to people who do not know a border variety. Moreover, none of the Dutch varieties considered went through the development which separated High German from all the other West Germanic varieties. Based on sound equivalences alone, we could thus expect that Low German varieties are better understood by Dutch speakers than High German varieties (such as Standard German).

### 3. Intelligibility of Standard German and Low German

#### 3.1. Method

##### 3.1.1. Intelligibility experiment

To test word intelligibility, an Internet-based experiment was conducted.<sup>2</sup> In this experiment, Dutch subjects were confronted with 384 Standard German or the

<sup>2</sup> The experiment, which also included other Germanic language pairs, may be found on the Internet at <http://www.let.rug.nl/lrs>. It is possible to participate in the test with a guest account (login: germanic, password: guest). We thank Johan van der Geest for programming the experimental interface and databases.



equivalent 369 Low German isolated singular nouns (see note 1). A data set with such a large number of words enables a detailed analysis of the kind of problems that listeners meet when listening to words in a closely related language. The nouns were randomly selected from a list of 2575 highly frequent Dutch words and translated into Standard German and the Low German variety spoken in Bremen. We assume that this random selection of words is representative for the two language varieties as far as their linguistic properties are concerned. For example, 18% of the Low German words have Dutch non-cognates, while the number of non-cognates between Standard German and Dutch is a bit higher (23%). To check whether this percentage is representative for Standard German in general, we compared the percentage of non-cognates in our selection of nouns to the percentage found among the 3000 lemmas with the highest frequencies in the Celex database (Baayen et al. 1995). The percentage was almost the same, 21%. We are not able to check the percentage for Low German since no database is available with comparable Dutch and Low German words. In a pre-test, we ensured that all the nouns were known to subjects from the test group, i.e. high school pupils aged 15-18 years.

The test words were read aloud by a male native speaker of Standard German (from Wernigerode in the district of Harz, Saxony-Anhalt) and a male native speaker of the Low German variety of Bremen (in North-Western Germany) and recorded in professional sound studios.<sup>3</sup>

144 Dutch high school pupils participated in the listening experiment. 20 of these listened to Standard German and 124 listened to Low German. The first part of the experiment consisted of a number of questions about the subjects' background. Part of the information is summarised in Table 3. We see that the mean age of the two groups of subjects is almost the same (16.5 versus 16.3). Both groups have balanced groups of boys and girls. The subjects came from places all over the Netherlands, including the border area. The subjects tested in Standard German had had 3.4 years of formal instruction in Standard German at school on average and the subjects who listened to Low German 3.7 years on average. In addition, most pupils are likely to have had informal contact with the German language through visits to Germany or through the media. It is possible to watch German television in the whole of the Dutch language

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<sup>3</sup> We thank Jörg Tiedemann and Reinhard H. Goltz for translating the test words into High and Low German respectively and for recording the test words for the experiment.

area and Dutch television mostly shows German television programs without dubbing. Such programs are usually in Standard German.

We do not have any information about the degree of exposure that the students might have had to Low German varieties. Still, it is likely that pupils from the (northern) border region with Germany have had more contact with Low German varieties than those from other parts of the Netherlands. 16 (i.e. 80%) of the subjects confronted with Standard German and 97 (i.e. 78.2%) of the subjects confronted with Low German originated from the border region. Both these sub-groups were well-mixed with respect to their age, gender, length of German instruction, and their places of origin inside or outside the border region, respectively.

	Test variety of subjects	
	Standard German	Low German
Number	20	124
Gender	F: 10, M: 10	F: 64, M: 60
Age	15-18 (mean 16.5)	15-18 (mean 16.3)
Years German	3.4	3.7

Table 3. Number of subjects, gender (F=female, M=male), age, and mean number of years of German lessons at school per group of Dutch listeners.

The subjects listened to the test words through head phones and were requested to type the Dutch translation into a text field within ten seconds. Prizes were offered to the highest-scoring participants to encourage them to complete the tasks to the best of their ability. The experiment would have been too arduous if all subjects had been given all test words. Therefore, each subject heard only one word block consisting of about one quarter of the 384 Standard German or 369 Low German words. The choice of the words and the order of presentation were randomised, so that possible fatigue effects were neutralized. Since the word blocks were automatically assigned to the subjects in random order, some word blocks were presented to more subjects than others. The lowest number of subjects that heard a word block was 3 and the highest number 38. To ensure stability of the results, we excluded the results from word blocks with only three participants in word level analyses so that a minimum of four participants listened to each word. Since we look at the mean percentages of correct translations per subject and not per word, the different numbers of subjects per word block cause no problems for the interpretation of the statistical analysis.

The results were automatically categorized as right or wrong through a pattern match with expected answers. The answers that were categorized as wrong were subsequently checked manually. Responses that deviated from the expected responses due to a mere spelling error were counted as correct identifications. Spelling errors were objectively defined as instances where only one letter had been spelled wrongly without resulting in another existing word. So, for example the mistake in *kultuur* (correct *cultuur* ‘culture’) is considered a spelling mistake and therefore counted as correct (only one wrong letter without resulting in another existing word), while *ook* (correct *oog* ‘eye’) was not counted as correct because the spelling results in an existing word meaning ‘also’. Some words have more than one possible translation. For example, the Low German word *Laden* was sometimes translated into Dutch *winkel* and sometimes into *boetiek*, both meaning ‘shop’. Both translations were counted as correct. In the case of homonyms, both possible translations were accepted as correct. For example, Low German *översetten* can be translated correctly into Dutch *vertalen* ‘translate’ or *vertaling* ‘translation’.

After this procedure, we had obtained a score of zero (word not identified) or one (word identified) per word for each subject. We then calculated the percentage of correct translations per word. This percentage was the intelligibility score per word. We finally calculated the percentage of correct translations per subject, obtaining the intelligibility score per subject.

### 3.1.2. Linguistic distance measurements

The intelligibility results were analysed in combination with two kinds of linguistic distances: distances on the lexical level and distances on the sound level. The methods and the results of the measurements are presented in this section.

#### *Lexical distances*

We express the lexical distance between two varieties as the percentage of non-cognates between the varieties. The larger the number of non-cognate relationships between two languages, the larger the lexical distance. We used etymological dictionaries (van Veen & van der Sijs 1997; Kluge 2002) to determine whether word

pairs were cognates or not. Examples of such cognates are Modern Standard German *Weg* — Dutch *weg* ‘road’ and Low German *Stimm* — Dutch *stem* ‘voice’. In our material, most of the test words (295 = 76.8% for Modern Standard German and 302 = 81.8% for Bremen Low German) are cognates, i.e. they are historically related to their Dutch equivalents. There are 89 (23.2%) Standard German non-cognates, for example Standard German *Ausbildung* — Dutch *opleiding* ‘education’, and 67 (18.2%) Low German non-cognates, for example Low German *Bark* — Dutch *schors* ‘bark’. This means that the Dutch subjects listening to the Low German variety may have a small lexical advantage compared to the subjects listening to Standard German, since they are less often confronted with a non-cognate.

### *Levenshtein distances*

Distances on the sound level were expressed by means of Levenshtein distances. As explained in the introduction, the Levenshtein algorithm is a measure of string edit distance based on the smallest number of operations necessary to map a given string to another string. Applied in linguistics, a string of sounds (phonetic symbols) from one variety can be mapped to the corresponding string in another variety (cf. Nerbonne & Heeringa, 2010). Insertions, deletions, and substitutions are possible operations. The example in Table 4 shows the calculation of the string edit distance between Dutch *maand* and Standard German *Monat* ‘month’, pronounced as [ma:nt] in Dutch and as [mo:nat] in Standard German.

Alignment	1	2	3	4	5
Standard German	m	o:	n	a	t
Dutch	m	a:	n		t
Operations		substitution		deletion	
Cost	0	1	0	1	0

Table 4. Calculation of Levenshtein distance.

First, the two strings are aligned, with identical sounds being matched with each other (e.g. [m] and [m]). Subsequently, the minimum number of operations necessary to transform the one string into the other is calculated. Each operation is assigned a cost of one point. In our example three sounds are identical and therefore they do not add any

costs. In contrast, operations are necessary for the first vowel, which has to be substituted, and for the second vowel, which has to be deleted in order to change the Standard German pronunciation into the Dutch pronunciation. Since operations have to be performed at two slots, the Levenshtein distance is 2. To relate the distance to word length, we divide by the number of alignments, i.e. 5 in the example. The normalised distance is  $2/5 = 0.4$ , i.e. 40 per cent in our example. 100% is the maximum Levenshtein distance and 0% is the minimum distance. The distances are calculated with any kind of operation having the same cost, i.e. even if we compare two vowels of the same quality but different quantity like [a] and [a:], a substitution with a cost of one point is made and the distance is accordingly increased.

Pronunciation dictionaries provided the representations of Modern Standard German test words, and the Low German test words were transcribed by a native speaker of German (the second author). The Dutch equivalents were transcribed by a native speaker of Dutch (the third author). Levenshtein distances were calculated automatically for all pairs of cognates in both test languages. 28 Standard German and 34 Low German words had the minimum distance of 0% to Dutch, for example Dutch *blad* — Low German *Blatt* ‘leaf’, which are both pronounced as [blat]. Four Standard German and four Low German cognate words had the maximum distance of 100 per cent to Dutch, for example Dutch *oog* [o:x] — Standard German *Auge* [awgə] ‘eye’. In Levenshtein terms these cognate word pairs behave like non-cognate pairs.

The results of the measurements reveal that the Low German cognates are more similar to Dutch than the Standard German cognates are (39.4% versus 42.3%). We tested whether this difference was significantly different. Since the results were not normally distributed, we applied a Wilcoxon Signed Ranks test. The results show that the difference is significant ( $p < .05$ ,  $df = 267$ ,  $Z = -2.464$ ).

### 3.2. Results

In Table 5 the results of the word intelligibility tests are presented.<sup>4</sup> We will first discuss the overall results and next we will focus on the intelligibility of the cognates

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<sup>4</sup> Since the number of subjects differed strongly between the two groups, we conducted an analysis with a subgroup of the subjects listening to Low German. In this analysis, both groups consisted of 20 subjects.

and the non-cognates since this can give an impression of the role that linguistic distance and experience with the language play in the intelligibility.

Words	N words Standard German	Intelligibility Standard German	N words Low German	Intelligibility Low German	Sign. ( <i>df</i> = 142)
Cognates	295	71.4%	302	65.5%	$p < .01$ (U = 774.0)
Non-cogn.	89	26.6%	67	10.3%	$p < .001$ (U = 242.0)
Total	384	60.2%	369	55.7%	$p < .05$ (U = 889.0)

Table 5. The results of the Standard German and Low German intelligibility tests, for cognates, non-cognates and totals as well as the results of a Mann-Whitney-Test. Subjects were native Dutch speakers. The rightmost column shows the result of comparing the intelligibility scores (percentages).

### 3.2.1. Overall intelligibility

The results in Table 5 show that the subjects listening to the Standard German words were able to translate more words correctly (mean 60.2%) than the subjects listening to the Low German variety (mean 55.7%). The results of a Mann-Whitney Test show that the distributions differ significantly ( $p < .05$ ). Note that when applied in the subset as explained in footnote 4, the test does not report significantly different distributions.

We correlated the binary variable coding the cognate/non-cognate distinction with the intelligibility scores per word in both groups. The correlation between the Dutch-Low German lexical distance and the intelligibility of the Low German variety is significant ( $r = -.55$ ,  $p < .001$ ) and so is the correlation between the Dutch-Standard German lexical distance and the intelligibility of Standard German ( $r = -.49$ ,  $p < .001$ ). The correlations between the Levenshtein distances and the intelligibility results are also significant for both test languages ( $r = -.52$ ,  $p < .001$  for Standard German and  $r = -.61$ ,  $p < .001$  for Low German). This shows that lexical distances and distances on the sound level play a role in the intelligibility. We will have a closer look at this in Section 3.2.2.

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The subgroup resembled the group of subjects listening to Standard German with respect to mean and range of age and the number of years of German classes. Otherwise it was randomly sampled. In this analysis the result was for cognates Standard German 71.4 vs. Low German 65.6 ( $p < .05$ , U = 124.0), for non-cognates 26.6 vs. 9.4 ( $p < .001$ , U = 36.0), and total 60.2 vs. 56.1 (not significant, U = 150.0).

### 3.2.2. Cognates

When looking at the cognates separately, we see the same trend as for the overall results: the Dutch subjects translate more Standard German than Low German words correctly (71.4% versus 65.6%). This difference is significant at the one percent level. Again this points to prior experience with the test language as a more important factor than linguistic distances. However, this does not mean that linguistic distances do not play a role. The difference may have been even larger if the subjects listening to Low German had not had an advantage at the sound level.

In Section 3.1.2 we already saw that there is a significant inverse correlation between Levenshtein distance and intelligibility. In order to confirm that smaller Levenshtein distances do indeed lead to a higher percentage of correctly translated words, we split up the results into three groups applying the following procedure. We first subtracted the Levenshtein distances to Low German from the distances to Standard German per word. 92 words turned out to have a smaller distance to Low German than to Standard German (group 1, see examples in Table 6). For 86 words it was the other way round, in this group the distance to Low German was larger than to Standard German (group 2, see examples in Table 7). Finally, 101 words showed no difference in distance (group 3, see Table 8).

Dutch	Low German	Standard German	meaning
[stɔrm]	[stœm]	[ʃtœm]	‘storm’
[as]	[a]	[aʃə]	‘ashes’
[vlax]	[flax]	[flagə]	‘flag’

Table 6. Examples of Dutch words that have a smaller Levenshtein distance to Low German than to Standard German (group 1).

Dutch	Low German	Standard German	meaning
[hɑ:vən]	[hɔ:bm]	[hɑ:fn]	‘harbor’
[blut]	[blɔwt]	[blu:t]	‘blood’
[za:l]	[zɔ:l]	[za:l]	‘saloon’

Table 7. Examples of Dutch words that have a smaller Levenshtein distance to Standard German than to Low German (group 2).

Dutch	Low German	Standard German	meaning
[bløk]	[bløk]	[bløk]	‘block’
[kynst]	[künst]	[künst]	‘art’
[plats]	[plats]	[plats]	‘place’

Table 8. Examples of Dutch words that have the same Levenshtein distance to Standard German and to Low German (group 3).

If distance on the sound level does indeed play a role, the subjects can be expected to have an advantage when listening to the Low German words with a smaller distance to Dutch than the Standard German words and they also can be expected to have an advantage on the sound level when listening to the Standard German words that are more similar to Dutch than the Low German words. However, it is an additional advantage for this latter selection of words that the subjects have experience with Standard German. For the words with the same Levenshtein distance to Low and Standard German there is no advantage on the sound level for either of the two varieties, and only an advantage of experience for the Standard German words. The advantages for the three selections of words are summarized in Table 9 together with the intelligibility results.

Levenshtein distance	Group 1: Low German < Standard German		Group 2: Standard German < Low German		Group 3: Standard German = Low German	
	Low German	Standard German	Low German	Standard German	Low German	Standard German
Test variety	Low German	Standard German	Low German	Standard German	Low German	Standard German
Similarity on sound level	+	-	-	+	-	-
Experience	-	+	-	+	-	+
% correct	71.7	68.7	51.2	74.4 ***	71.0	71.7

Table 9. Advantages due to sound similarity and/or experience and intelligibility results for three subgroups of words, 1 (Dutch words with a smaller Levenshtein distance to Low German than to Standard German), 2 (Dutch words with a smaller Levenshtein distance to Standard German than to Low German), and 3 (Dutch words with the same distance to Standard German and Low German). \*\*\* indicates that the result for the test language is significantly higher than for the other test language at the .001 level.

Table 9 shows that Low German words that have a smaller distance to Dutch than their Standard German equivalents (group 1) are not significantly better understood (Low German 71.7% correct translations versus 68.7% for Standard German,  $p > .05$ , Z



=  $-0.599$ , Wilcoxon Signed Ranks Test). Apparently, the advantage of the greater similarity with Low German is counterbalanced by the advantage of the greater experience with Standard German.

Looking at the words that have a smaller distance to Standard German than to Low German (group 2) we see a large difference in the intelligibility scores of Low German (51.2% correct) and Standard German (74.4% correct). The difference is significant at the .001 level ( $Z = -4.380$ , Wilcoxon Signed Ranks Test). This large difference must be due to the fact that both experience and linguistic distance favour the intelligibility of Standard German while experience only plays a minor role for the comprehension of Low German. It is furthermore noticeable that there is a large difference between the intelligibility scores of Low German in group 1 and 2 (71.7% vs. 58.4%), while this difference is small for Standard German (68.7% vs. 75.6%). This points to an important role of similarity on the sound level for the intelligibility of Low German and a smaller role for the intelligibility of Standard German.

Finally, when there is no difference in the Levenshtein distance to the two test languages, there is also no significant difference in intelligibility rates (71.0% for Low German and 71.7% for Standard German,  $p > .05$ ,  $Z = -0.209$ , Wilcoxon Signed Ranks Test). This is remarkable. Because of prior experience one would expect Standard German to be easier to understand. On the other hand, it could well be that the Low German and Standard German words in this group are very similar to each other so that the knowledge of Standard German automatically leads to an understanding of Low German.

### 3.2.3. Non-cognates

Finally we look at the intelligibility of the non-cognates. We see a large difference in intelligibility: 26.6% for Standard German and 10.3% for Low German. The distributions differ significantly at the .001 level (Mann Whitney-Test). For both varieties the Levenshtein distances are maximal for this subset of words, differences on the sound level can therefore not play a role in explaining the results. Thus, on the basis of the intelligibility of non-cognates we conclude that experience does play an important role in explaining the difference in intelligibility of High and Low German. Non-cognates can only be understood through previous exposure. Some of the Low German

non-cognates were probably correctly translated because they are similar to or identical with the corresponding Standard German non-cognates and had therefore been learnt during formal education.

#### **4. Intelligibility of Low German**

Results presented in the previous section show that speakers of Dutch have fewer problems understanding Standard German than Low German words. This must be due to previous exposure to Standard German through lessons at school and through the media. In the Netherlands, television programs in which a foreign language is spoken are almost never dubbed and are instead subtitled. This means that Dutch people are regularly confronted with foreign speech on an auditory basis. They are often confronted with Standard (i.e., High) German, but Low German programs are rare in the Dutch television. We hypothesized that a smaller linguistic distance to Low German may give Low German a head start, but previous exposure to Standard German will counterbalance this effect.

In the following sections we will have a closer look at the intelligibility of Low German in the Netherlands. We compare the intelligibility scores of Dutch subjects from the north-eastern regions close to the border with Germany to the performance of subjects from non-bordering regions. Traditionally, the dialects close to the border in the North-East of the Netherlands (the so-called North Saxon dialects) were linguistically transitional between Low German and the dialects of Dutch that are spoken more to the west (cf. Hinskens 1993). Just as the Low German varieties in North-Western Germany (i.e., also in Bremen), they belong to the group of the Low Saxon dialects. Although nation building and standardization has had a large impact on these varieties (cf. de Vriend et al. 2008; Giesbers 2008; Kremer 1990, 1996; Niebaum 1990), they are still closer to Low German than the non-Saxon language varieties of the Netherlands to which Standard Dutch belongs (cf. Reker 1996), cf. Section 2. We therefore expected subjects from the border area in the North-Eastern part of the Netherlands to be better at understanding Low German words than subjects from non-bordering regions.

#### 4.1. Method

##### 4.1.1. Intelligibility experiment

The Low German test was identical to the test that was described in Section 3.1.1., i.e. 369 highly frequent Low German nouns were presented to Dutch high school pupils by means of an Internet experiment. In total 124 subjects were tested. Since we wanted to compare the intelligibility among subjects living close to the German border to the intelligibility of subjects living in other parts of the country, the subjects were divided into two groups, referred to as the ‘border group’ and the ‘non-border group’ respectively. To determine if the subjects living close to the border could have an advantage from their knowledge of the North-Eastern Dutch dialects, we asked them if they knew the local dialect. 65 of the 97 subjects from the border region answered positively to this question. We excluded the remaining 32 subjects from further analysis. There were now 65 subjects in the border group and 27 in the non-border group, adding up to 92 subjects. The 65 subjects from the border group all came from the provinces of Groningen and Drenthe in the Northern part of the Low Saxon area. The dialects spoken in the places where the speakers come from are part of a coherent dialect group. They all belong to the dialect group that Hoppenbrouwers & Hoppenbrouwers (2001: 65) refer to as the ‘Low Saxon central group’. The 27 subjects in the non-border group came from the provinces of Zeeland (city of Hulst) and Flevoland (city of Almere), which are not adjacent to the German border. Information about the subjects is summarized in Table 10. We see that the border subjects are slightly older than the non-border subjects ( $t = -1.918$ ,  $df = 90$ ,  $p = .058$ ) and that they have had German at school for a longer period ( $t = -2.889$ ,  $df = 90$ ,  $p < .01$ ). In the border group more male than female subjects participated (37 males versus 28 females) and in the non-border group this was the other way round (17 females and 10 males).

	Subjects	
	Border	Non-border
Number	65	27
Gender	F 28, M 37	F17, M10
Age	15-19 (mean 16.5)	15-19 (mean 16.1)
Years German	4.1	3.3

Table 10: Number of subjects, gender (F=female, M=male), age, number of years of German lessons at school per group of listeners.

#### 4.1.2. Linguistic distance measurements

In Section 3.1.2, we explained how we measured the linguistic distances between Standard Dutch and Low German. In order to be able to compare the linguistic basis that the border group had for understanding the Low German words to the linguistic basis of the non-border group, we also needed to measure the distance between the respective Dutch dialects and Low German. To this end we had a speaker of the Dutch North Saxon variety translate the Low German words into his variety and read them aloud. The border group of subjects came from different places in the border area. In order to achieve transcriptions that would represent the whole area, we made recordings of a speaker who is born and raised in Uithuizen and now lives in Bedum. These places are in the middle of the area where the subjects came from.<sup>5</sup> On the basis of the recordings, phonetic transcriptions were made by a German linguist (the second author).

#### *Lexical distances*

The lexical distances to Low German are very similar for Standard Dutch and the Dutch border dialect. Of the 369 Low German test words, 302 (81.8%) were Standard Dutch cognates and 300 (81.3%) were border dialect cognates. Examples are Low German [poli'tsaj] — Dutch border dialect and Standard Dutch [po'litsi] 'police' and Low German [hɔnt] — Dutch border dialect [hɔ:nt] — Standard Dutch [hɔnt] 'dog'. There were 67 (18.2%) Standard Dutch and 69 (18.7%) border dialect non-cognates, for example Low German [deɐn] — Dutch border dialect [vɪxjə] — Standard Dutch [mɛjʃə] 'girl'.

<sup>5</sup> We thank Siemon Reker for translating and recording the test words.

### *Levenshtein distances*

The results of the distance measurements on the sound level show that the Low German cognates are only slightly closer to the border dialect (39.2%) than to Standard Dutch (40.6%). This difference is not significant ( $p = .121$ ,  $Z = -1.552$ ,  $df = 286$ , Wilcoxon Signed Ranks Test).<sup>6</sup> However, it should be kept in mind that the border group is bilingual and is able to use sound information from both the border dialect and Standard Dutch. Therefore we calculated a new Levenshtein distance, selecting the smallest distance to Low German per word pair. Forty-nine of the border dialect words had a smaller distance to Low German than their Standard Dutch equivalent and for 38 words the situation was reverse, the Standard Dutch words having a smaller distance to Low German than the border dialect equivalents. For 130 words the distance was the same for both varieties. The new Levenshtein distance calculated on the basis of the smallest distance to the border dialect per word pair was 35.4, and the distribution differs significantly from that of the distances between the border dialect and Low German (39.2%;  $p < .001$ ,  $Z = -6.514$ , Wilcoxon Signed Ranks Test). So it is likely that the border group subjects have an advantage on the sound level above the Standard Dutch group when confronted with Low German.

### *4.2. Results*

In Table 11 the results of the word intelligibility tests are shown.<sup>7</sup> Like in the previous section we will first discuss the overall results, and next we will focus on the intelligibility of the cognates and the non-cognates separately.

The correlation between the lexical distance between Low German and the Dutch border dialect and the intelligibility scores of the border group was higher ( $r = .54$ ,  $p < .01$ ) than the correlation between the lexical distance between Low German

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<sup>6</sup> A few cognates had to be left out of the analysis because the transcriptions were missing in the database. Therefore the  $df$  is smaller than the number of cognates –1.

<sup>7</sup> The test groups differed strongly with respect to the number of years of German instruction. To ensure that this difference alone was not the reason for the different degrees of intelligibility, we also conducted a second analysis with two subgroups in which the subjects in both groups had learnt 3.7 years of German (border group:  $n = 50$ , mean age 16.3; non-border group:  $n = 21$ , mean age 16.5). For cognates, the intelligibility results were border group 66.6 vs. non-border group 62.7 ( $p < .05$ ,  $U = 354.0$ ). For non-cognates border group 9.7 vs. non-border group 9.7 (not significant,  $U = 512.0$ ), and total border group 57.0 vs. non-border group 52.6 ( $p < .05$ ,  $U = 344.5$ ).

and Standard Dutch and the intelligibility of the non-border group ( $r = -.50, p < .01$ ). However, the correlation is even higher when the intelligibility scores of the border group are correlated with the lexical distance between Low German and Standard Dutch ( $r = -.55, p < .01$ ). This might suggest that the border group relates the Low German words to Standard Dutch words in the first place. The difference between the correlations is insignificant ( $t = 12.79, p > .05$ ).

The correlation between the Levenshtein distance from the subjects' own variety (border dialect or Standard Dutch) to Low German and intelligibility is significant at the .01 level for both groups ( $r = -.47$  for the border group and  $r = -.59$  for the non-border group). For the border group the correlation becomes larger when intelligibility is correlated with the distance between Low German and Standard Dutch rather than the distance between Low German and their own dialect ( $r = -.60$ ). The difference between these correlations is non-significant ( $t = -5.1, p > .05$ ). Also when correlating with the new distances calculated on the basis of the smallest distance to Low German (see above), the correlation is higher ( $r = -.52$ ), but the difference to the correlation with the border dialect only is not significant ( $t = 3.14, p > .05$ ). The correlation coefficients might thus again suggest that the border group uses Standard Dutch when understanding Low German, and even that the route via Standard Dutch is preferred, but there is no proof for this since the correlations do not differ significantly.

Words	N	Intelligibility	Intelligibility	Sign.
	words	border group	non-border group	( $df = 90$ )
Cognates	302	67.0	61.9	$p < .01$ (U = 507.0)
Non-cogn.	67	11.6	8.1	$p = .07$ (U = 671.0)
Total	369	57.1	51.9	$p < .01$ (U = 515.5)

Table 11. The results of the Low German intelligibility test for the border group and the non-border group, for cognates, non-cognates and totals as well as the results of a Mann-Whitney-Test.

#### 4.2.1. Overall intelligibility

The border group understands Low German significantly better (57.9% correct answers) than the non-border group (51.9% correct). This result can be due to a linguistic advantage or more experience in the group of the border subjects. In the following two sections we will try to get an impression of the role that these two factors play in the intelligibility of Low German in the two groups of subjects.

#### 4.2.2. Cognates

When only looking at the intelligibility of the cognates, we find that the border group translates significantly more words correctly (67.0%) than the non-border group (61.9%). As explained in Section 4.1.2, the fact that no significant differences are found among the linguistic distances to Low German does not mean that linguistic distances are not part of the explanation for the difference in intelligibility. It is possible that the border group has a linguistic advantage because they can get help from both their dialect and Standard Dutch. On the other hand the border group is also likely to have had more contact with Low German than the non-border group. We will now have a look at two subgroups of cognates, namely 49 word pairs where Levenshtein distances between the border dialect and Low German are smaller than between Standard Dutch and Low German (group 1, see examples in Table 12) and 167 word pairs where Levenshtein distances between Standard Dutch and Low German are smaller than between the border dialect and Low German or where they are just the same (group 2, see Tables 13 and 14).

Low German	Dutch border dialect	Standard Dutch	meaning
[kne:j]	[kne:j]	[kni]	‘knee’
[bu:ʦlant]	[butənlant]	[bœjʦlant]	‘abroad’
[vi:n]	[vi:n]	[vɛjn]	‘wine’

Tab 12: Examples of Low German words that have a smaller Levenshtein distance to the border dialect than to Standard Dutch.

Low German	Dutch border dialect	Standard Dutch	meaning
[bet]	[bɛ:t]	[bɛt]	‘bed’
[bibliote:k]	[bibəltajk]	[bibliote:k]	‘library’

Table 13. Examples of Low German words that have a smaller Levenshtein distance to Standard Dutch than to the border dialect.

Low German	Dutch border dialect	Standard Dutch	meaning
[bilt]	[be:lt]	[be:lt]	‘picture’
[modɛl]	[modɛl]	[modɛl]	‘model’

Table 14. Examples of Low German words that have the same Levenshtein distance to Standard Dutch and to the border dialect.

In Table 15 we summarize the advantages of proximity on the sound level and experience for the two subgroups of cognates as well as the intelligibility results for the two groups of subjects. In the group 1 words, the border group subjects have an advantage on the sound level as well as an advantage from the fact that they probably have had more contact with Low German and we therefore expect a higher percentage of correct answers for the border group. This is indeed the case. The border group translated 48.4% of the words correctly and the non-border group only 36.8%. The distributions differ significantly at the .01 level ( $Z = -3.334$ , Wilcoxon Signed Ranks Test).

In group 2, both groups are likely to have the same advantage on the sound level, since they both know Standard Dutch. The border group has an additional advantage from experience. The border group translated 72.5% of the words correctly, and the non-border group translated only 68.6% of the words correctly. Since the difference in the percentages of correct translations in the two groups of subjects is significant ( $p < .01$ ,  $Z = -2.736$ , Wilcoxon Signed Ranks Test), it can be concluded that contact does play a role in the intelligibility of the border group. Furthermore, we can see that both subject groups perform better when Standard Dutch words are equally similar or more similar to Low German (group 2 words) than when the border dialect words are more similar (group 1 words),  $p < .001$ ,  $df = 214$  in both cases (border group  $U = 2367.0$  and non-border group  $U = 2170.5$ , Mann-Whitney test). This points to both groups having a larger advantage of sound proximity to Standard Dutch than to the border dialect. Also for the border group, the route via Standard Dutch seems to be the most favoured one.

Based on these results we conclude that contact plays a role while advantage on the sound level is probably more important for intelligibility. Unfortunately a subgroup of words where contact plays no role does not exist. This makes it difficult to draw stronger conclusions about the role of similarity on the sound level compared to experience.



Levenshtein distance	Word group 1: border < non-border		Word group 2: border ≥ non-border	
	border	non-border	border	non-border
Similarity on the sound level	+	-	-	-
Experience	+	-	+	-
% correct	48.4 **	36.8	72.5 **	68.6

Table 15. Advantages due to sound similarity and/or experience and intelligibility results for the two subgroups of words, 1 (Low German words with a smaller Levenshtein distance to border dialect than to Standard Dutch) and 2 (Low German words with a smaller Levenshtein distance to Standard Dutch than to border dialect or same distance). \*\* indicates that the result for the test group is significantly higher than for the other test group at the .01 level.

#### 4.2.3. Non-cognates

When it comes to understanding non-cognates, distances on the sound level can play no role. Non-cognates are in principle unintelligible unless the subjects know them from previous experience with the language. If the border group subjects are able to translate more non-cognates correctly than the non-border group subjects, it can be concluded that subjects living at the Dutch side of the border indeed come into contact with the German dialects spoken at the other side of the border. From Table 11 it becomes clear that the border group translated slightly more non-cognates correctly (11.6%) than the non-border group (8.1%). However, this difference is not significant at the .05 level. This corroborates that previous experience does not seem to play a role.

### 5. Conclusions

We presented two experiments dealing with questions of how well varieties of German are understood by Dutch listeners. The resulting intelligibility scores were interpreted against the background of a division in the lexicon (cognates vs. non-cognates) and Levenshtein distances measuring distances on the sound level between words from different varieties. In this way, we were able to draw conclusions about the influence of previous exposure (i.e., language contact) to the stimulus varieties, and the

influence of proximity on the sound level (based on Levenshtein distances) between the varieties of the speakers and the stimulus varieties.

The Dutch language is more closely related to Low German than to High German (linguistically speaking). We therefore compared the intelligibility of a Low German variety (from Bremen) and a High German variety (the German standard variety). The results of this first experiment show that speakers of Dutch understand more Standard German than Low German words. This must be attributed to the more intensive contact with the High German standard variety, which Dutch speakers experience through German classes at school and through exposure to spoken Standard German in the media.

In the second group of experiments we tested whether the knowledge of a structurally close border dialect had an influence on understanding Low German words, by comparing a group of border subjects to a group of non-border subjects. The results show that Dutch speakers from the Dutch-German border area understand more Low German words than Dutch speakers from other part of the Netherlands. In this case contact seems to play a less important role and the difference in intelligibility should probably be attributed to the Levenshtein distances to Low German, which are smaller for the border dialect than for Standard Dutch. However, the results also suggest that even though listeners from the border area have an advantage on the sound level from their local dialect when listening to Low German, Standard Dutch plays a dominant role for this group as well in the decoding of Low German words.

The results from both sets of investigations are relevant to sociolinguistic theory as well as theories of the cognitive processes involved in understanding closely related language varieties. From a sociolinguistic point of view, the first experiment shows that the higher exposure with the neighbouring standard language in school instruction and the media is more important to the intelligibility of German than the higher proximity on the sound level which the Dutch subjects have towards neighbouring Low German dialects. Therefore, although the standard variety of German belongs to the High German group, and Dutch is much more closely related to Low German, Standard German is better understood than the Low German variety tested.

The findings of the second group of experiments add to our understanding of the language processing of bidialectal listeners and show that listeners have an advantage of knowing more than one variety of a language when confronted with a third closely

related variety. They seem to be able to activate more phonological representations in their mental lexicon and search for the most similar pronunciation when trying to identify a word with a deviant pronunciation. The results also suggest that the route taken to compare a foreign sound string to strings in the mental lexicon probably goes through the Dutch standard variety first, and that use of the dialectal representations is secondary. This impression stimulates further research based on experiments with a more specific design identifying the “mental routes” taken to deal with input from closely related varieties.

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