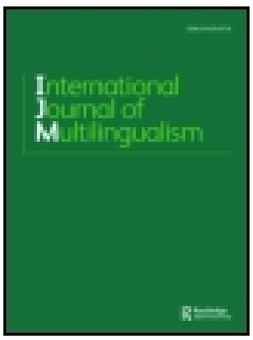

International Journal of Multilingualism

ISSN: 1479-0718 (Print) 1747-7530 (Online) Journal homepage: http://www.tandfonline.com/loi/rmjm20

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To cite this article: Charlotte Gooskens, Vincent J. van Heuven, Jelena Golubović, Anja Schüppert, Femke Swarte & Stefanie Voigt (2017): Mutual intelligibility between closely related languages in Europe, International Journal of Multilingualism, DOI: 10.1080/14790718.2017.1350185

To link to this article: http://dx.doi.org/10.1080/14790718.2017.1350185

Published online: 15 Jul 2017.

INTERNATIONAL JOURNAL OF MULTILINGUALISM, 2017
https://doi.org/10.1080/14790718.2017.1350185

Mutual intelligibility between closely related languages in Europe

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ABSTRACT

By means of a large-scale web-based investigation, we established the degree of mutual intelligibility of 16 closely related spoken languages within the Germanic, Slavic and Romance language families in Europe. We first present the results of a selection of 1833 listeners representing the mutual intelligibility between young, educated Europeans from the same 16 countries where the test languages are spoken. Next, we present the data from a sub-group of listeners who had not learned the test language and had had minimal exposure to it. This allows us to investigate how well the listeners understand the test language on the basis of structural similarities between their own language and the test languages. Finally, we compare the results of the two data sets to the traditional genealogic characterisation of the three language groups. We expect the intelligibility results from the second group of listeners who had had minimal exposure to the test language to be a better reflection of the genealogical characterisation than the results from the larger group who had sometimes been exposed to the test language or had learned it at school.

ARTICLE HISTORY
Received 13 August 2016
Accepted 28 June 2017

KEYWORDS
Intelligibility; receptive multilingualism; language trees; Germanic; Romance; Slavic

1. Introduction

Within Europe, a large number of indigenous languages are spoken of which 42 are currently being used by more than one million speakers. Only 24 are recognised as official and working languages of the European Union (Lewis, Simons, & Fennig, 2015). Respect for linguistic diversity is a core EU value. On several occasions, Leonard Orban, the European commissioner responsible for multilingualism between 2007 and 2009, has stated that multilingualism is *the* tool for creating bridges between people and that linguistic diversity will help us to develop a European identity. However, the linguistic diversity can lead to communication problems that might only be reconciled with sufficient knowledge about the language situation at hand. The High-Level Group on Multilingualism stated that new knowledge, generated by scientific research, is

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needed to bring about improvements in the acquisition of multilingual competence and the management of multilingualism. A number of research topics, among others research on 'Receptive multilingualism' as a communication strategy, were identified (European Commission, 2007).

The principle of receptive multilingualism is based on the fact that some language pairs are so closely related that the speakers are able to communicate each using their own language without prior language instruction. This strategy is widely used for communication among speakers of the three mainland Scandinavian languages, i.e. Danish, Swedish and Norwegian (Bø, 1978; Delsing & Lundin Åkesson, 2005; Maurud, 1976). For example, Danish tourists travelling to Sweden will often speak their mother tongue, Danish, to the Swedes they meet at the camping site or on the street.[1] The Swedes will often react with some hesitation at first, but will often discover that it is possible and even easier to stick to their mother tongue, Swedish, when talking to a Dane.

Communication through receptive multilingualism is also exploited to a limited degree outside of Scandinavia, e.g. in the Dutch-German border area (Beerkens, 2010; Ház, 2005), and since the Scandinavian model has proved feasible, it could easily be extended to communication between speakers of other languages in Europe (Backus et al., 2013). However, the knowledge about the degree of mutual intelligibility in Europe is rather limited and it has only been tested experimentally in a few language combinations.

A listener (or reader) may understand a related language for two different reasons. The first is that related languages resemble one another to a greater or lesser extent. Related languages typically share a large part of their vocabularies, since the languages branched off from a common ancestor language. To be true, the word shapes will often be different but the differences are often regular and the formal communalities between the cognate words are difficult to miss. The percentage of cognate words in the two related languages and the formal similarity between the cognates have been shown to be major determinants of cross-linguistic intelligibility (e.g. Gooskens, 2007; Tang & van Heuven, 2015). The extent to which two genealogically related languages are mutually intelligible at first confrontation is often referred to as 'inherited intelligibility' (Bahtina & ten Thije, 2013). Ideally, inherited intelligibility is assessed between interactants who have never been exposed to each other's language before. This situation is often difficult to find for adults, since it hardly ever occurs that language users have never heard or read the related language at all, but it can be approached rather closely by either using young children (who have not heard or read the other language before, e.g. Schüppert, 2011; Gooskens, van Bezooijen, & van Heuven, 2015) or by simulating the *tabula rasa* condition by computer algorithms (van Heuven, 2008). Inherited intelligibility, then, is entirely determined by linguistic factors. There is also a host of non-linguistic factors that co-determine how well someone understands a non-native language. Previous experience with the non-native language, obviously, influences the recipient's ease of understanding, and so do (either positive or negative) attitudes on the part of the recipient towards the non-native language and/or its speakers. The effect of the ensemble of non-linguistic factors is referred to as 'acquired intelligibility' by Bahtina and ten Thije (2013). The primary goal of the present research was to study the degree of cross-language intelligibility, both for written and for spoken language, between pairs of closely related languages in three European languages families, and the factors influencing the degree of intelligibility, while clearly separating between the linguistically (i.e. inherited) and extra-linguistically conditioned (i.e. acquired) components.

Previous studies have indicated that mutual intelligibility between closely related language pairs is sometimes asymmetric. Asymmetry has been observed, for example, between Spanish and Portuguese and between Czech and Slovak. The best-documented case of asymmetric intelligibility is Danish-Swedish. Danes understand Swedish better than Swedes understand Danish (e.g. Gooskens, van Heuven, van Bezooijen, & Pacilly, 2010). One of the explanations that have been put forward to explain this asymmetry is a corresponding asymmetry in attitudes towards the neighbouring languages. It has repeatedly been suggested that the asymmetric intelligibility between Swedes and Danes can be traced back to less positive attitudes among Swedes towards the Danish language, culture and people (Delsing & Lundin Åkesson, 2005; Gooskens, 2006). Also, the amount of previous exposure to the test language as well as linguistic distances between two languages can be asymmetric and this can be part of the explanation for asymmetric mutual intelligibility. An example of a lexical asymmetry is the word for 'room' which is *rum* in both Danish and Swedish but can also be *værelse* in Danish. For a Dane it will be rather unproblematic to understand the Swedish word because it is similar to the word in Danish, while for a Swede it will be difficult if the Dane uses the word *værelse*.

We established the degree of mutual intelligibility of closely related languages within the Germanic, Slavic and Romance language groups in Europe in a large-scale web-based investigation.[2] We present the results of a cloze test we developed to test the intelligibility of spoken text among educated listeners between 18 and 33 years of age. Listeners were assigned a test language from their own language family at random. We established the extent to which participants had learned the test language (or another closely related language) at school or were familiar with it through some other form of exposure, in order to be able to separate *post hoc* between inherent and acquired receptive multilingualism. We did not exclude participants with prior experience with the test language since we aimed to assess the cross-linguistic intelligibility between the related languages as it is in actual practice, i.e. including the effects of the participant's education. Our study therefore offers an overview of the cross-language intelligibility between related languages obtained for a fair cross-section of young, educated Europeans, i.e. the kind of professionals who will meet and want to communicate with one another in international, cross-border contacts. We also analysed results of a sub-group of listeners who had not learned the test language at school and had had minimal exposure to it. This allowed us to establish *intrinsic bilingualism* or *inherent receptive multilingualism*. The intelligibility results from this group of listeners should reflect the traditional genealogic affinities among the languages within each of the three language groups.

To summarise, the following research questions will be addressed in the present paper:

(1) What is the mutual intelligibility of closely related languages within the Germanic, Slavic and Romance language groups in Europe?
(2) To what extent do acquired and inherent cross-language intelligibility differ for the language pairs at issue?
(3) How well do present-day intelligibility patterns of (inherited) cross-language intelligibility reflect genealogic taxonomies established by comparative linguistics?

2. Test languages

The intelligibility tests were carried out by means of an Internet application. To make the design manageable, we limited our investigation to the three major language families in the EU member states, i.e. Germanic (Swarte, 2016), Slavic (Golubović, 2016) and Romance (Voigt, in preparation). All 16 official national languages within these three language families were included (see Table 1). Intelligibility was only tested among speakers of languages within the same language family. So, for example, we tested mutual intelligibility between the two Romance languages Spanish and Portuguese. Similarly, we tested mutual intelligibility between the two Slavic languages Czech and Polish. But we did not test the mutual intelligibility between, for example, Spanish and Czech or between Portuguese and Polish. If a language is an official language in more than one country, we only included the variety from the country with the largest number of speakers. For example, Dutch is an official national language in both Belgium and the Netherlands, but since the larger number of speakers lives in the Netherlands, Netherlandic Dutch was included as test language and Flemish Dutch was not.

Below, we discuss the genealogic relationships between the various languages within each of the three language families. On the basis of literature on communication within each of the three language families and of our knowledge about the linguistic relationships between the languages, we formulate expectations about the mutual intelligibility within each of the three language families.

2.1. Germanic

The five Germanic languages in the investigation belong to two branches of the Germanic language family, the North Germanic branch (Danish and Swedish) and the West Germanic branch (Dutch, English and German). The West Germanic branch was originally divided into three dialect groups, Ingvaeonic, Istvaeonic and Irminonic, but due to geographical discontinuity and language interference from North Germanic and French in the case of English and mutual influence in the case of Dutch and German, the three languages no longer show a straightforward relation to this division (Harbert, 2007, p. 9; Henriksen & van der Auwera, 1994, p. 8). Nowadays, West Germanic is usually divided into two subbranches, North Sea Germanic (including English) and Continental Germanic (including Dutch and German), see, for example, Ruhlen (1987, p. 327).

Danish and Swedish are so closely related that in principle the speakers are able to communicate each using their own language without prior language instruction. This strategy is widely used for communication among the speakers (Bø, 1978; Delsing & Lundin Åkesson, 2005; Maurud, 1976). However, for many Danish and Swedish speakers, it

Table 1. Official EU languages selected for the Micrela project.

Germanic		Romance		Slavic	
Danish	Da	French	Fr	Bulgarian	Bu
Dutch	Du	Italian	It	Croatian	Cr
English	En	Portuguese	Pt	Czech	Cz
German	Ge	Romanian	Ro	Polish	Pl
Swedish	Sw	Spanish	Sp	Slovak	Sk
				Slovene	Sn

Note: Languages are listed in alphabetical order within families. Abbreviations will be used in tables and figures below.

takes some effort to understand the other language at a first confrontation, especially for Swedes coming into contact with Danish (Gooskens et al., 2010). Nordic policy-makers attach great value to the use of receptive multilingualism between the neighbouring languages Danish, Swedish and Norwegian because it can function as a means to unite the Northern countries politically, culturally and economically (*Deklaration om nordisk språkpolitik*, 2006). Still, neighbouring languages only play a marginal role in the curricula at Swedish and Danish schools (TNS Gallup, 2006).

Without prior instruction, the standard varieties of modern German and Dutch are mutually intelligible only to a rather limited degree (Beerkens, 2010; Gooskens et al., 2015; Ház, 2005). For many Dutch children, German is part of the school curriculum, but at the end of secondary school most students have a rather poor command of German. In general, most (young) Dutchmen prefer to speak English when communicating with Germans and even though the job perspectives are good, German is not a popular study at university. Still, receptive multilingualism is a successful way of communicating in the Dutch-German border area and is also being used as such (Beerkens, 2010). Dutch is not part of the curriculum in Germany, except at a number of schools in the border area. However, it is becoming increasingly popular for Germans to study in the Netherlands. German students in the Netherlands generally learn to understand and speak Dutch in a very short period of time.

English has developed rather independently of the continental Germanic languages Dutch and German. Lexical differences between English and other Germanic languages exist due to substantial borrowing in English of words from other languages, especially Latin and French. Without prior knowledge, the other Germanic languages are only mutually intelligible with English to a very limited degree. Native speakers of English will generally understand very little Danish, Swedish, German or Dutch. However, due to the dominant role of English as a lingua franca, the vast majority of the inhabitants of the other countries in our survey have learned English at school and by regular exposure to the language. Language surveys have shown that Europeans with Germanic language backgrounds are remarkably strong in English (EF EPI, 2016).

Disregarding English, mutual intelligibility between the languages of the two Germanic sub-branches is limited due to the linguistic distances and little exposure to the languages. However, Hedquist (1985) tested the spoken and written intelligibility of simple Swedish texts among Dutch students without prior knowledge of the language and discovered that they could translate a substantial part of the texts. He also showed that even a short course of 10 h of instructions on lexical, phonetic and orthographic differences between the languages improved the intelligibility considerably. Many Danes and Swedes learn German at school and many Low and High German words have been added to the Danish and Swedish vocabularies throughout history. For these reasons, Danes and Swedes are likely to understand Germans better than vice versa.

2.2. Romance

There is considerable disagreement about the sub-grouping of the languages in the Romance language family tree. Here, we will present the widely accepted classification by Hall (1974). He based his classification on phonological criteria. Romanian belongs to the Eastern branch, while the remaining languages in our investigation all belong to the

Italo-Western branch. Within this branch, Italian forms its own sub-branch, while Spanish, Portuguese and French belong to a different sub-branch, i.e. Western Romance. This branch is further subdivided into Ibero-Romance (Spanish and Portuguese) and Gallo-Romance (French).

Looking at the present-day situation, standard Italian is a 'central' language (i.e. it is quite close and often readily intelligible to speakers of other Romance languages), whereas French and Romanian are peripheral (they lack similarity to other Romance languages and require more effort for other Romance speakers to understand). However, the sociolinguistic position of these two peripheral languages is quite different from each other.

Through history French has had a dominant position as a lingua franca in a large part of the world and in many countries it has been a school language. Weber (1997) ranked French as being the second most influential language of the world, after English but ahead of Spanish. His criteria were the numbers of native and secondary speakers, the economic power of the countries using the language, the number of major areas in which the language is used, the number of countries using the language, and their respective populations, and the linguistic prestige associated with the mastery of the language.

The vocabulary of Romanian is based on that of Latin, but because of the geographic isolation of Romanian, loan words from non-Romance languages are frequent. Most common are Slavic words, but borrowings from Turkish, Hungarian and Albanian also occur. In modern times, Romanian vocabulary has been strongly influenced by French, Italian and other languages. Conversely, Romanian has exerted little influence on the other Romance languages in our investigation. Romanian has grammatical and lexical similarities with the other Romance languages, but is not mutually intelligible with them to any practical extent. The same is true for speakers of these languages trying to understand Romanian (Posner, 1996, p. 204). However, Romanians are often confronted with other Romance languages, for example via television, films rarely being dubbed in Romania. In the other direction, this is only the case to a much smaller degree.

Spanish and Portuguese are mutually intelligible to a large extent. The relationship is reportedly asymmetric, Spanish being more easily understood by speakers of Portuguese than the other way round. Jensen (1989) tested mutual intelligibility between Portuguese and Spanish speakers from Latin America. The Portuguese speakers were more successful than the Spanish speakers at interpreting what they heard. A similar asymmetry has been observed informally for European Spanish and Portuguese but was never tested experimentally. A possible explanation for the asymmetry is that Portuguese has a rather complicated vowel system with nasalised vowels and a high prevalence of assimilations (Mateus & d'Andrade, 2000), while the Spanish vowel system only has five vowels (Cressey, 1978). Moreover, Voigt and Schüppert (2013) showed that Portuguese speakers reduce more syllables in spontaneous speech and produce fewer but more complex syllables than Spanish speakers do. This is likely to make it difficult for Spanish listeners to demarcate and recognise words in running speech.

2.3. Slavic

Scholars traditionally divide Slavic languages into three main branches on the basis of geographical and genealogical principles (Sussex & Cubberley, 2006, p. 42). The six Slavic

languages included in our investigation belong to either the West Slavic branch (Czech, Slovak and Polish) or the South Slavic branch (Croatian, Slovene and Bulgarian).

Although the Slavic languages diverged from a common proto-language later than other Indo-European language families, enough differences exist between the various Slavic dialects and languages to make cross-language communication cumbersome or impossible. However, very little research has been carried out on mutual intelligibility in the Slavic language area and discussions on various fora on the Internet reveal considerable disagreement as to the extent to which speakers of the various Slavic languages can understand each other.

It can be hypothesised that mutual intelligibility is higher within each of the branches than between languages across branches due to a greater linguistic similarity. Czech and Slovak are linguistically very similar and belong to the same sub-branch (Southern West Slavic), and there is a large amount of contact between the speakers of these two languages. Good to excellent mutual intelligibility has been reported, with an asymmetrical pattern such that speakers of Slovak understand Czech better than vice versa, probably due to the fact that Czech is used commonly both in Slovak mass media and in daily communication with Czech natives in Slovakia (Budovičová, 1978; Nábělková, 2007). The third language in the sub-branch, Polish, belongs to a separate sub-branch (Northern West Slavic) which leads us to expect a lower degree of cross-language intelligibility.

Croatian and Slovene belong to the same South Slavic sub-branch (Western South Slavic) and also the two countries share a geographic border. For this reason, some mutual intelligibility is expected. Many Slovenians were bilinguals, with Serbian/Croatian as their second language since Slovenia was a part of Yugoslavia and Serbian/Croatian is a major source of loan words in Slovenian. Serbian/Croatian continues to wield influence on the Slovenian language while the influence of Slovenian on Serbian/Croatian has been less strong. We therefore expect cross-language intelligibility between Slovene and Croatian to be asymmetric and in favour of Serbian/Croatian.

Bulgarian belongs to the Eastern South Slavic branch and has several characteristics that set it apart from all other Slavic languages, such as an almost complete loss of case declension in the noun and the unique borrowing of certain grammatical features from other non-Slavic Balkan languages. For example, the definite article is placed after the noun or adjective (e.g. *masa* 'table', *masata* 'the table'), as in Albanian and Romanian, and the infinitive form of the verb is replaced by a clause, as in modern Greek, Albanian and Romanian. Finally, Bulgarian shares no border with the other Slavic languages in our investigation. For this reason, we expect the mutual intelligibility with Bulgarian to be low.

3. Method

3.1. Cloze test

To establish how well inhabitants of the 16 European languages in our investigation understand closely related languages, we needed to test the intelligibility among a large number of listeners. To make this undertaking feasible, we decided to develop a test that could be carried out online via the Internet and could be scored automatically using software. We opted for a variant of the so-called cloze test.[3] The cloze test was

developed in 1953 in the United States by William Taylor and has since then been used extensively for measuring text comprehension in the classroom (Abraham & Chapelle, 1992; Keshavarz & Salimi, 2007) but also for research purposes (e.g. van Bezooijen & Gooskens, 2005). In a cloze test, selected words are removed from the text and replaced by gaps, i.e. lines or empty spaces of uniform length (in the case of written language) or by beeps (in the case of spoken language). The cloze tests require the ability to recognise words and to understand context in order to identify the correct words or type of words that belong in the gaps. It is therefore an easy and useful way to test overall text intelligibility. Sometimes the removed words are placed above the text and it is the task of the subjects to put the words back in the correct position. Alternatively, it may be left to the subjects to think of suitable words. The scoring of the second version is more difficult because the researcher has to decide whether the words offered by the subject are correct or not. The first version can be scored automatically and is therefore an efficient and objective way of testing text comprehension. This is important since we wanted to test a large number of listeners. We therefore opted for this version for our investigation. We presented spoken stimuli to the listeners with beeps where words had been removed. The listeners had to select the missing word from an array of words on the computer screen by clicking on the word with a mouse pointer. The number of correctly selected words is our measure of intelligibility. We will describe the experiment in more detail below.

3.2. Texts

As the basis for the cloze test, we used four English texts from a set of exercises used to prepare students for the Preliminary English Test (PET) at the University of Cambridge.[4] The texts all have an intermediate level (B1 level as formulated by the Common European Framework of Reference for Languages, see Council of Europe, 2001) and their contents are culturally neutral. At this level, people can understand the main points of clear 'standard' speech on familiar matters connected with work, school, leisure, etc. In TV and radio current affairs programmes or programmes of personal or professional interest, they can understand the main points provided the speech is relatively slow and clear (Council of Europe, 2001, p. 237). We adapted the texts slightly so as to obtain texts that were uniform in terms of total length (about 200 words) and number of sentences (either 16 or 17).

The four texts were translated from English to all the test languages (see Table 1) by native speakers of the target languages who were experienced translators with excellent understanding of English. All texts were translated by at least three translators and combined into a consensus translation in an interactive session. The translators were instructed to stick to the original English texts as much as possible but to avoid ungrammatical or unnatural constructions. In this way, we hoped to obtain texts that were as comparable as possible across languages in terms of content and level of difficulty. In the appendix, the written form of the four texts is presented.

3.3. Speakers and recordings

We recorded 6 female native speakers of each of the 16 languages in our investigation. They were all between 20 and 40 years old and could be considered standard speakers of the languages.

The speakers were instructed to read the texts out clearly and at normal speed. We created 16 online surveys, each with sample recordings from one language, where native listeners of the respective languages were instructed to rate each of the six speakers. They rated the speakers by answering the question 'How suitable is this speaker for presenting the news on national television?' on a 5-point scale ranging from 'not at all suitable' to 'very suitable'. The voices of the four best-rated speakers per language were used in the experiment. From each speaker, the recording of one randomly chosen text was used. By using four different speakers, we hoped to neutralise the potential influence of voice quality on the results.

3.4. Task

Each text was divided into 12 sound fragments, corresponding to sentences or clauses. In each fragment, one word was replaced by a beep of 1 s with 30 ms of silence before and after the beep. Listeners heard each fragment twice and then had 30 s to click on the word they thought had been removed from the place in the fragment where they heard the beep. Once a word had been selected, it was greyed out, but the word could still be reused if later on the listeners realised that the word fitted better in another gap. When moving the mouse over a word in the array on the screen a translation into the listener's native language appeared. This was done in order to avoid the situation that participants understood the entire context but might not show their understanding if they did not know the target word.

In the appendix, the words that were replaced by a beep are indicated in bold.

3.5. Procedure

The listeners were tested via an online application (see http://www.micrela.nl/app). They were first asked to complete a questionnaire about their native language, age, sex and level of education. They were also asked how much exposure they had had to the test language on six 5-point scales representing different written and spoken situations and for how many years they had learned the language. The answers to the questions were used to select listeners with similar background in order to be able to compare the results of the various listeners groups.

After the listeners had finished the questionnaire, the intelligibility test started. The test language was one of the related languages from the language family of the listener (Germanic, Romance or Slavic). In total, there were 64 different tests (4 texts and 16 languages). A listener was tested in a randomly selected text and language (never his or her own native language). The entire online session lasted approximately 15 min (questionnaire and test together).

3.6. Listeners

Since the listeners were tested online, no restrictions concerning their background were set beforehand. We selected listeners for further analysis afterwards by matching the groups according to certain criteria. We focused on young adults and excluded listeners younger than 18 years and older than 33 years. The selected listeners all came from the

same countries where the speakers came from (see Table 1). They had all grown up and lived most of their lives in the relevant country and spoke the language of the country as their native language at home. All listeners followed or had followed a university education. Some of the test languages are also school languages. We excluded listeners who had learned the test language for longer than the maximum period offered during secondary education.

The criteria described above resulted in a selection of 1833 listeners (426 from the Germanic, 581 from the Romance and 826 from the Slavic language area). Sixty-two percent of the Germanic, 51% of the Romance and 43% of the Slavic listeners were male. The mean number of listeners per combination of speaker and listener group was 26.2 (ranging between 14 and 58).

We looked at two data sets, one involving intelligibility results from all included listeners and one with a further selection of data from listeners who had received minimal exposure to or instruction in the test language. The results from the former groups represent the intelligibility structure as found among younger, educated people in Europe. With the latter selection of listeners, we are able to zoom in on inherent receptive bilingualism. In the ideal case, we would need listeners without any prior exposure to the target language whatsoever. These listeners should also have no knowledge of other languages that might help to understand the test language. However, in order to get a sufficient number of listeners we had to be less strict when making this selection. We selected a subset of listeners who had indicated that their mean exposure to the test language on six 5-point scales was below 2.0 (with '1' indicating no exposure) and who had not learned the target language at school. This reduced the number of listeners to 1307 and the number of language combinations represented by more than 7 listeners, which we regarded a minimum for a stable analysis. For instance, there are no Dutch listeners between 18 and 33 years who have not learnt English in school. Nine out of the original 70 language combinations are no longer represented, six of which are in the Germanic group (see Section 4.1).

4. Results

Per language combination we calculated the percentage of words that were correctly selected in the cloze test. A language combination is an ordered pair of languages AB, where A is the native language of the listener and B the test language. Symmetry and asymmetry in cross-language intelligibility can readily be observed by comparing the scores obtained for the language combination AB with its counterpart pair BA, in which the listener language is B and the test language is A. The Germanic and Romance language families are represented in our data set by 20 ordered pairs. The Slavic group comprises 6 languages and accordingly contributes 30 ordered pairs.

In Section 4.1, we first consider the intelligibility per language family to get an impression of which language families and language combinations are most successful when it comes to understanding closely related languages and which are less successful. We look at the means for all listeners as well as for the subgroups of listeners with a minimal exposure. We will end the presentation of the intelligibility in each language family by focusing on the language combinations that show asymmetric intelligibility. In Section 4.2, we will establish to which degree the present-day intelligibility structure in Europe reflects the genealogic relationships within each of the three language families.

4.1. What is the mutual intelligibility of closely related languages within the Germanic, Slavic and Romance language groups in Europe?

4.1.1. Germanic

Figure 1 presents the intelligibility results of the Germanic listeners. The black bars show the results including all listeners, whereas the grey bars represent the listener groups with minimal exposure and no history of language learning in an educational setting. In Table 2, the numerical results per language combination are presented as well as the overall means per listener group and test language.

The mean intelligibility score in the Germanic language group involving all listeners is 40%, but there are large differences in intelligibility among the various language combinations. The overall effect of language pair was highly significant by a one-way Analysis of Variance (ANOVA), $F(19, 406) = 74.3$ ($p < .001$, $\eta^2 = .777$). Most language pairs (113) differed significantly from one another by *post hoc* tests with Bonferroni's correction for multiple comparison ($p \leq .01$). Appendix 2 lists all 190 comparisons of language pairs. Nine of the listener groups score below 20% but there are also four groups that have high mean scores (>80%). These latter groups all involve English as the test language. These high scores were expected because of the role of English as a lingua franca and the importance of English in the educational system. The lowest scores are found with combinations of languages where listeners and test languages are from different main branches of the Germanic language tree (West or North), such as Swedish-Dutch, as well as intelligibility of Dutch for English listeners. Finally, there is a middle group of seven language combinations with intelligibility scores between 20% and 80%. Four of these combinations

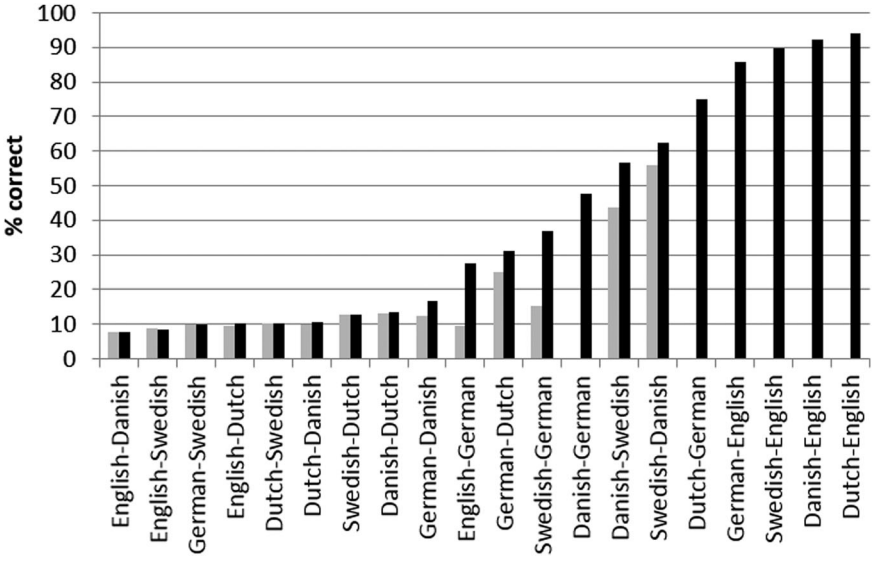

Figure 1. Results of cloze tests in the Germanic language area. For each language combination, listener language is given first, test language second (e.g. 'English-Danish' means 'English native speakers listening to Danish'). Black bars show mean results of all listeners ordered from lowest to highest percentage of correct answers (acquired intelligibility), grey bars show mean results for listeners with minimal exposure (inherited intelligibility).

Table 2. Intelligibility scores (% correct) on cloze tests in the Germanic language area.

	Speaker					
Listener	DA	DU	EN	GE	SW	Mean
DA		13.3	**92.1**	**47.8**	56.7	52.5
		(13.3)			(43.8)	(34.7)
DU	10.5		**94.0**	**75.0**	10.4	47.5
	(9.9)				(10.4)	(10.2)
EN	**7.9**	**10.3**		**27.7**	**8.3**	13.6
	(7.9)	(9.6)		(9.5)	(8.7)	(8.9)
GE	**16.7**	**31.1**	**85.7**		**10.0**	35.9
	(12.5)	(25.5)			(10.0)	(16.0)
SW	62.5	13.0	**89.6**	**37.0**		50.5
	(56.0)	(13.0)		(13.1)		(29.2)
Mean	24.4	16.9	90.4	46.9	21.4	40.0
	(23.0)	(15.4)		(11.3)	(21.3)	(24.7)

Notes: In parentheses, the results for listeners with minimal exposure. Scores indicated in bold are significantly different (asymmetrical) within a language pair at the .01 level (Bonferroni's test, see Appendix 2).

involve German as the test language. German is a school language for many children in the other Germanic countries, which explains why German is so well understood even among listeners from the North Germanic group. Furthermore, we see that German listeners understand some Dutch (31% correct responses) and that the Danish-Swedish mutual intelligibility is fairly high (57% and 63% correct).

Turning now to the selection of listeners with minimal exposure to the test language (grey bars in Figure 1), we see the effect of language pair on inherent cross-language intelligibility is smaller than on acquired intelligibility, $F(13, 217) = 12.7$ ($p < .001$, $\eta^2 = .432$). Twenty-seven language pairs differ from one another (out of 91 comparisons, see Appendix 2, lower triangle, for details). Only Swedes and Danes reach a fair degree of mutual understanding (44% and 56%). The Danish-Swedish mutual intelligibility is good enough to allow successful communication by means of receptive multilingualism, though with some effort (see Section 1). Germans understand some Dutch (25%) and we know from the literature that receptive multilingualism is used as a means of communication, especially in the Dutch-German border regions (Ház, 2005). However, at a first confrontation speakers of Dutch and German will mostly only be able to communicate at a very basic level.

In Table 2, the percentages of correct answers in the cloze test are presented numerically to allow us to examine the cases of asymmetric intelligibility. In parentheses, the percentages are given for the groups of listeners with minimal exposure to the test language. Bold face indicates instances where the asymmetry is significant ($p < .01$), i.e. the pairs AB and BA differ from one another as indicated by the Bonferroni test following one-way ANOVA, see Appendix 2 for details). Most of the asymmetries can be explained by previous exposure to the test language. Since English and German are school languages, they attract much better scores as test languages than the other languages. Unfortunately, in most cases we are not able to decide whether the asymmetry would persist if we consider only listeners with a minimal exposure because such listeners are lacking in our investigation. An exception is the case of German-Swedish. There is an asymmetry when looking at all listeners, but this asymmetry must be due to exposure since it is not significant for the listeners with minimal exposure. As far as Danish-Swedish is concerned, we expected an asymmetry. In previous investigations, Swedes have repeatedly been found

to have more difficulties understanding spoken Danish than the other way round. In the present investigation, however, we find no asymmetric intelligibility.

4.1.2. Romance

The mean score of the Romance group is slightly lower than that of the Germanic group (36.7%). However, the scores for the various language combinations are more evenly distributed across the scale. In many Romance language configurations, some degree of mutual intelligibility appears to be present. Spanish is the language that is easiest to understand for all listener groups (a mean of 57.2% correct answers across all listener groups, see Table 3), while Romanian, not unexpectedly, is hardest to understand (mean score of all listeners of 12.5%). The Portuguese listener group has the highest mean score (47.2%), but it is striking that, on average, Romanians understand the other languages almost as well (44.9% correct). The overall effect of language pair is highly significant, $F(19, 561) = 18.3$ ($p < .001$, $\eta^2 = .382$). Out of the total of 190 comparisons, 61 differ significantly from each other (see Appendix 3 for details on the Bonferroni *post hoc* analysis).

When looking at the listeners with a minimal exposure, the differences between language pairs are somewhat reduced, $F(17, 334) = 12.4$ ($p < .001$, $\eta^2 = .387$). The number of language pairs that differ from one another has gone down to 36 out of 162 comparisons (see Appendix 3, lower triangle, for details). Many groups appear to have still some understanding of the test language, especially when Spanish or Italian is involved. Most participant groups tested in French have learned French at school and are excluded from this analysis. Only in the Italian group are enough participants left for an analysis and they have a low intelligibility score (18.6%).

Like in the Germanic group, there are many cases of asymmetric intelligibility in the Romance group (i.e. an AB pair differs significantly from the corresponding BA pair by the Bonferroni test at $p \leq .01$). Romanians are quite successful in understanding the other languages but all other listeners have difficulties with Romanian. This asymmetry persists among Romanian listeners with minimal exposure to Spanish and Italian – but not in the case of Portuguese. Also, all Romanians have had French lessons at school, so we do not know how well a Romanian listener without previous exposure would understand French. There are several possible explanations for the good performance of the

Table 3. Results of cloze tests in the Romance language area.

	Speaker					
Listener	FR	IT	PT	RO	SP	Total
FR		**24.2**	23.5	**11.0**	31.5	22.6
		(22.9)				(22.9)
IT	**46.3**		**33.5**	**10.6**	**65.7**	36.6
	(18.6)		**(23.4)**	**(8.7)**	**(56.0)**	(29.4)
PT	34.3	**49.4**		14.7	**77.4**	47.2
		(44.1)		(14.7)	**(62.0)**	(40.3)
RO	**47.1**	**57.7**	22.9		**54.0**	44.9
		(47.2)	(20.7)		**(46.6)**	(38.2)
SP	28.2	**45.7**	**37.2**	**13.6**		32.2
		(38.2)	**(35.7)**	**(13.7)**		(29.2)
Total	39.0	44.3	29.3	12.5	57.2	36.7
	(18.6)	(38.1)	(26.6)	(12.4)	(54.9)	(32.0)

Notes: For further explanation, see Table 2. For Bonferroni's tests of significance, see Appendix 3.

Romanians. First, as discussed in Section 2, Romanian has been strongly influenced by non-Romance languages, resulting in many loan words. This makes it difficult for the other Romance groups to understand Romanian. However, to Romanians these lexical differences form a smaller obstacle because more words in one of the test languages will have a counterpart in Romanian than the other way round. Furthermore, even if the Romanian listeners often may not have had much exposure to the language itself, they often know another related Romance language, especially French. Romanians also watch a lot of television from Spain and Italy (with subtitles). So, Romanian listeners can use their knowledge of one Romance language when trying to understand another related Romance language.

Both Italian and Portuguese listeners understand Spanish better than vice versa. Jensen (1989) found the same asymmetry for Portuguese and Spanish (see Section 2). The fact that the asymmetry is also present for listeners with minimal exposure to the language suggests that there may be something about the Portuguese language itself that makes it difficult to understand for listeners with another Romance background. Reduced syllables and a richer vowel inventory are characteristics of Portuguese that are likely to render Portuguese a more difficult language to understand for Spanish listeners than the other way round. That Portuguese is also more difficult for Italian listeners than the other way round, lends further credibility to this view.

4.1.3. Slavic

In the Slavic language family, there is a lower mean intelligibility (27.6%) than in the other language families (40.0% for the Germanic group and 36.4% for the Romance group), but the effect of language family is not significant by a one-way ANOVA on the 70 language pairs, $F(2, 67) = 1.6$ ($p = .204$, $\eta^2 = .046$). Sixteen of the 30 language combinations show scores below 20%. Exceptions to the low scores are the mutual intelligibility between Czech and Slovak (92.7% and 95.0%), Croatian and Slovenian (43.7% and 79.4%) and, to some degree, Polish and Slovak (40.7% and 50.7%). From Table 4, it becomes clear that, together with Czech, Slovak is the best understood language (38.2% correct across all language combinations) and the Slovaks are also best at understanding the other

Table 4. Results of cloze tests in the Slavic language area.

	Speaker						
Listener	BU	CR	CZ	PO	SK	SL	Total
BU		29.1	10.6	7.1	16.0	20.6	16.7
		(29.2)	(10.8)	(7.1)	(16.0)	(20.2)	(16.7)
CR	19.7		18.1	9.5	23.0	**43.7**	22.8
	(19.7)		(18.1)	(9.5)	(23.0)	**(41.3)**	(22.3)
CZ	13.4	19.4		35.4	92.7	15.7	35.3
	(13.4)	(19.9)		(34.3)	(87.5)	(16.7)	(34.4)
PO	13.7	14.4	26.6		40.7	13.4	21.8
	(13.7)	(14.6)	(24.0)		(40.6)	(13.4)	(21.3)
SK	10.1	25.9	95.0	50.7		15.1	39.4
	(10.1)	(24.5)		(48.7)		(16.0)	(24.8)
SL	18.0	**79.4**	18.0	12.8	18.8		29.4
	(18.6)	**(71.8)**	(18.1)	(12.6)	(18.8)		(28.0)
Total	15.0	33.6	33.7	23.1	38.2	21.7	27.6
	(15.1)	(32.0)	(17.8)	(22.4)	(37.2)	(21.5)	24.6

Notes: For further explanation, see Table 2. For Bonferroni's tests of significance, see Appendix 4.

languages (39.4%). Bulgarian is difficult to understand for all groups (15.0% correct) and the Bulgarians also understand very little of the other Slavic languages in our investigation (16.7%). The effect of language pair is highly significant, $F(29, 793) = 71.2$ ($p < .001$, $\eta^2 = .722$). A total of 151 language pairs differ significantly ($p \leq .01$) from one another (out of 435 comparisons, see Appendix 4 for Bonferroni's tests).

It is very uncommon for listeners from the Slavic area to study the other Slavic languages in our sample and they have very little exposure to them. Therefore, there are hardly any differences between the two sets of intelligibility results. An exception are Slovak listeners, who all had a mean exposure score above 2.0 and were therefore not included in the analysis of listeners with minimal exposure to the test language. Two-thirds of the Slovenians listening to Croatians had mean exposure scores above 2.0 and the remaining third had lower scores in the intelligibility test than the whole group. The overall effect of language pair is still highly significant, $F(28, 642) = 12.8$ ($p < .001$, $\eta^2 = .358$). The number of significantly different language pairs is 124 out of 406 comparisons (see Appendix 4, lower triangle, for details).

There is only one instance of a significant asymmetric intelligibility in the Slavic area. Slovenians understand Croatian better (79.4%) than the Croatians understand Slovenian (43.7%). Only one listener in each group studied the language at school. So, the asymmetry cannot be due to schooling. The Slovenians indicated to have had more exposure to Croatian (mean exposure score 2.3) than vice versa (mean score 1.7). This may explain the asymmetry, at least partly, but as discussed in Section 2 the asymmetry may also be partly due to the large number of Croatian loan words in Slovenian. Intelligibility remains asymmetric when removing listeners with more than minimal exposure (71.8 vs. 41.3% correct answers).

4.2 How well do modern intelligibility structures reflect genealogic characterizations?

We will now attempt to determine how well the cross-language intelligibility measures for our three language families fit the proposals made by linguists with respect to the closeness of these five or six languages from a historical-linguistic perspective. We will use the Germanic family tree to illustrate how we quantified distances between languages in a language tree using so-called cophenetic distance measurements (Jain & Dubes, 1988; Sokal & Rohlf, 1962). Such distances, which are symmetric by definition, can be correlated with the intelligibility scores presented in the previous section. We correlated the tree distances with two kinds of intelligibility scores. First, we correlated mean distances per language combination for the whole data set. Since the trees are meant to reflect the genealogic relations between the languages within a family rather than modern communicative aspects, we also correlated with the data set which was reduced to include only listeners with no schooling or minimal exposure to the test language. As shown in Figures 1–3, some cells remain empty when filtering for exposure. For example, all Germanic listeners learned English at school and therefore there are no results for the combinations with English as a test language. In these cases, we used only the results of the English listeners taking the test in the other four languages rather than the mean distance for the two languages in a language combination. In the case of Czech and Slovak, both groups had to be excluded because of the exposure criterion and we therefore leave the cell empty.

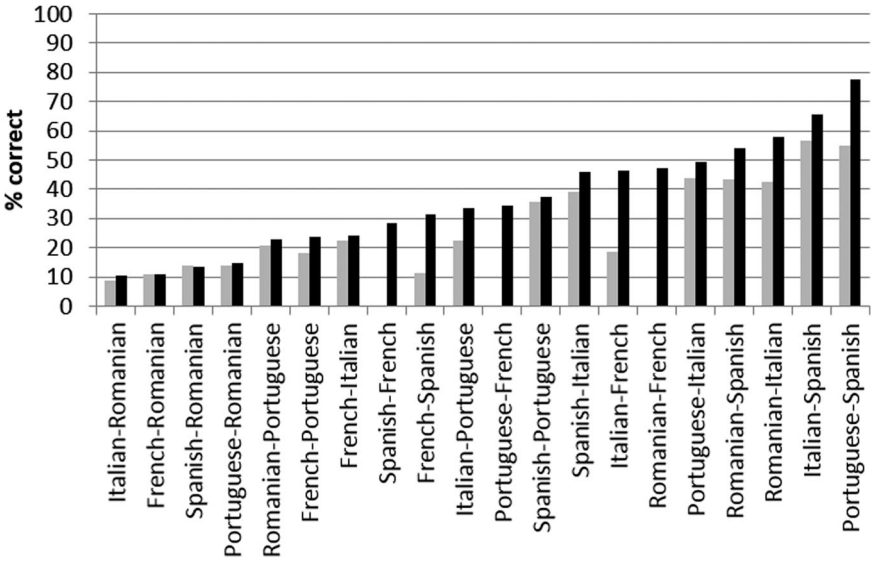

Figure 2. Results of cloze tests in the Romance language area. For further explanation, see Figure 1.

4.2.1. Germanic

The language tree of the Germanic family including only the five languages in our investigation is shown in Figure 4 (see Section 2). In such a tree, the languages are terminal nodes, which are gathered hierarchically into higher order nodes. The cophenetic distance between any two terminal nodes in such a tree is defined as the number of nodes one has to go up from language A to the lowest common node shared between the members of the pair, and then down again to language B. For example, the tree distance between English and Dutch would be 4: (i) from English to North Sea, (ii) from North Sea to West

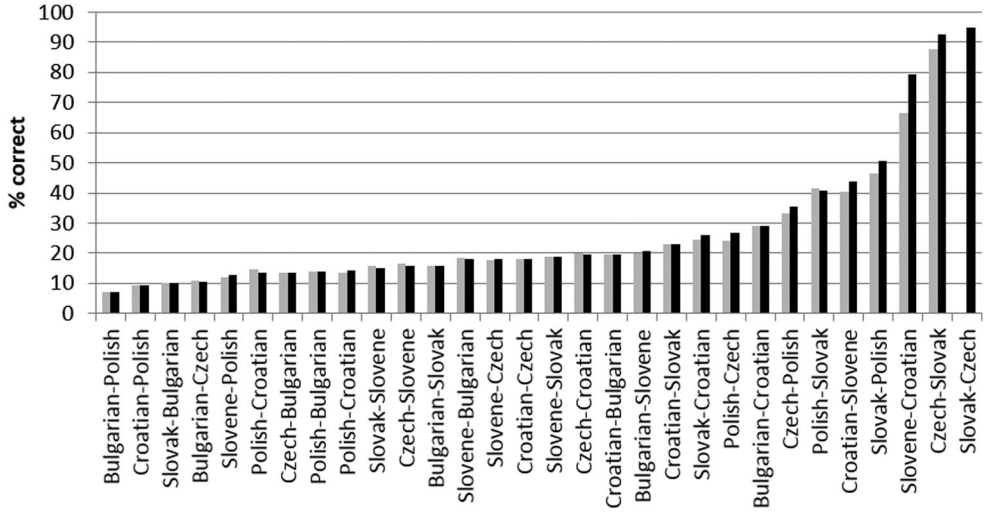

Figure 3. Results of cloze tests in the Slavic language area. For further explanation, see Figure 2.

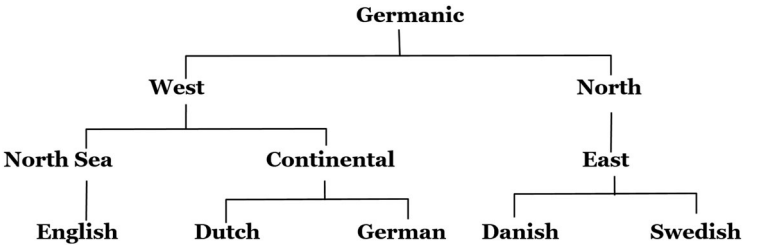

Figure 4. Germanic language tree.

(which is the lowest common node), (iii) from West down to Continental and then (iv) from Continental to Dutch.

Since the family tree distance is symmetrical, the number of pairs is $N \times (N-1)/2 = 10$. These distances between members of pairs of languages can be correlated in a straightforward fashion with the mean intelligibility scores per language combination, i.e. averaging out any asymmetries that may exist within the language pairs AB and BA.

The correlation with the tree structure distances is $r = -.67$ ($p < .05$) when all listeners are included, i.e. the smaller the cophenetic distance between two languages, the better their mutual intelligibility. As explained above, we expected the correlations to be higher when the influence of exposure is minimised and this was confirmed by our findings ($r = -.75$, $p < .05$).

4.2.2. Romance

The Romance tree, which is based on Hall's (1974) ideas, is presented in Figure 5. The correlation with the full data set is slightly lower ($r = -.61$) than for the Germanic data and non-significant, probably reflecting the disagreement on the sub-grouping within the Romance family (Posner, 1996). Contrary to our expectations, the correlations are even lower when the analysis only includes the results from listeners with minimal exposure ($r = -.41$).

4.2.3. Slavic

The genealogic characterisation of the Slavic area is straightforward (see e.g. Sussex & Cubberley, 2006, and results in the tree presented in Figure 6). The tree distances correlate strongly with the intelligibility test scores based on all listeners ($r = -.88$, $p < .01$)

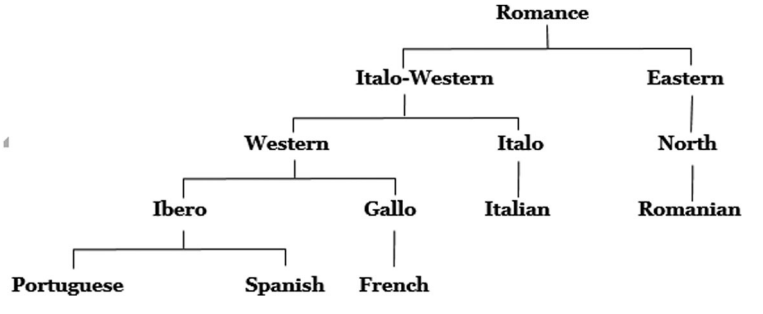

Figure 5. Romance language tree.

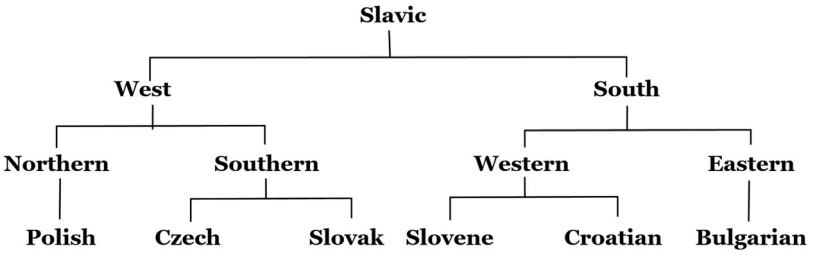

Figure 6. Slavic language tree.

confirming the genealogic characterisation found in the literature. Only very few listeners were excluded when filtering for exposure so that the correlation hardly changes ($r = -.86$, $p < .01$).

5. Conclusions and discussion

In this paper, we established the level of mutual intelligibility between 16 closely related languages from three language families in Europe by means of a spoken cloze test. We presented the results of two sets of data, a selection of listeners representing the mutual intelligibility between young, educated Europeans and a selection of listeners who had had only a limited amount of exposure to the test language.

The first selection enables us to ascertain the feasibility of receptive multilingualism as a mode of communication in Europe. The Danes who had had no previous exposure to Swedish had a score of 43.8% correct in the cloze test (the Swedes got a higher score, 56.0%). We know that with some effort Swedes and Danes are able to communicate successfully each using their own language, even without previous exposure. Therefore, a score of 40% correct could be set as a possible threshold. The mutual intelligibility between other Germanic language combinations is lower. The Germanic listeners with high scores have learned the language (English or German) at school, but German and English listeners would not be able to be involved in a conversation in the mode of receptive multilingualism.

In the Romance group, five groups have scores above 40% that we set as a tentative threshold for successful communication. The Romanian listeners have high scores in all languages except Portuguese. However, since Romanian is a difficult language for other speakers of Romance languages, receptive multilingualism is not likely to be a successful mode of communication with Romanians. The same goes for communication with French speakers. From the perspective of receptive multilingualism, our results show that the combination Italian-Spanish is likely to be most successful and also Spanish-Portuguese could be a successful combination even though Spanish speakers have some difficulties with Portuguese.

In the Slavic language family, five groups score above the 40% threshold. The Czech and Slovak speakers show a high level of mutual intelligibility, the highest of all tested European language combinations. Also, Slovene and Croatian are likely to be able to communicate successfully in the mode of receptive multilingualism and the same goes for speakers of Polish and Slovak. The rest of the Slavic listeners had rather low scores.

At this juncture, it is important to realise that communication through receptive bilingualism involves more than just the cross-language intelligibility between two languages at first confrontation (i.e. inherited mutual intelligibility). For one thing, there is convincing evidence that listeners are fast to adapt to non-native speakers (e.g. Cutler, 2012), quickly discovering how perceptual categories should be adjusted and what unusual properties should be ignored. We also know that native speakers are prone to change their speaking (and writing) style in order to accommodate to the needs of non-native recipients. Speakers using this so-called foreigner talk will typically speak at a slower pace, with greater loudness and wider pitch range, avoid the use of complex grammatical structures and contracted forms, choose easy (i.e. short and high-frequency) words, or circumscribe less frequent words (e.g. Ferguson, 1971; Hatch, 1983; Wesche, 1994). The speakers who produced the speech materials in our experiment were never aware that their recordings would be presented to non-native listeners. We assume, therefore, that our speech materials are more difficult to process by non-native listeners than would have been the case if the same contents had been elicited in real-life interaction between receptive bilinguals. At the same time, we assume that the duration of the sound fragments used was too short to allow the listener to discover how to adjust perceptual categories or to develop some other strategy to deal with the deviant speech input. The implication is that our results should be considered as conservative estimates of the potential success of receptive bilingual communication in European languages.

We would conclude from our results that a number of language groups should be able to communicate successfully in their own languages under the present circumstances. However, with little effort it would probably be possible to introduce this mode of communication for many additional language combinations. Golubović (2016) gave four and a half hours of instruction to speakers of Czech in understanding Croatian. They were taught to recognise cognates, common phoneme correspondences and syntactic similarities but did not learn to speak Croatian. Her results showed that this short instruction was sufficient to improve the Croatian understanding among Czech speakers substantially. Future research needs to be carried out to gain more information about which language combinations are candidates for this kind of acquired receptive multilingualism and how the level of intelligibility required for successful communication can be reached as efficiently as possible.

While the first selection of data includes listeners who learned the language at school or had often been exposed to it, the second selection of data involved only participants who had limited exposure to the test language. We were interested in establishing the relationship between intelligibility scores and the genealogic characterisation of the European languages included in our investigation. We presented the traditional genealogic classifications of the 16 languages involved in our investigation by means of language trees and showed how distances between languages in such cladistic trees can be quantified. Next, we correlated the cophenetic tree distances with the intelligibility scores of both data sets. We expected the second data set to show higher correlations with the tree distances and this was indeed the case for the Germanic language family. In the Romance language family we showed that the cladistic tree proposed by Hall (1974) reflects intelligibility to some degree, but the correlation is not significant. This does not come as a surprise, since, as mentioned in the introduction, there has been considerable disagreement on the classification of the Romance languages. For the Slavic language tree, it makes no

difference whether the tree distances are correlated with the first or the second data set since very few listeners were excluded from the second data set. Both correlations are very high, which shows that the present communicative situation in the Slavic area is well reflected in the Slavic language family tree.

Notes

1. A well-known example from the mass media is the television series *Broen* (The Bridge) in which a Danish and a Swedish detective work together to discover who murdered the person whose body was found straddling the Swedish-Danish border halfway the Sont Bridge separating the two countries. Each of the detectives continues to speak their own language to the other, and yet they manage to solve the mystery.
2. See http://www.micrela.nl/ for more details about this project
3. In our project, we also tested intelligibility by means of two other tests, a word translation task (testing detailed vocabulary knowledge) and a text-to-picture matching task (testing global understanding of the contents), which were administered in both the spoken and written modality – to different groups of participants. The results of the spoken cloze test had the highest correlation with intelligibility as estimated by the participants (r = .97; see Gooskens & van Heuven, 2017), and differentiated better between high and low intelligibility language pairs. The present article therefore presents a detailed analysis of the cloze test results only. Other intelligibility testing techniques have been proposed (see a review by Gooskens, 2013). Notwithstanding their merits, they all suffer from practical shortcomings which prompted us not to use them in our project. For instance, the SIL (Summer Institute of Linguistics) developed the Recorded Text Testing (e.g. Casad, 1974; Kluge, 2010) which asks listeners to retell a recorded text in as much detail as possible. The retold versions then have to be manually analyzed in terms of the number of propositions in the retold versions that are missing relative to the original. A text summary task would be even more difficult to score, since not only is an analysis needed of textual ingredients (propositions) but now they also have to be classified as either essential or non-essential elements in the text.
4. http://www.cambridgeenglish.org/exams/preliminary

Acknowledgements

We thank Aleksandar Mancic for programming the web application.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) [grant number 360-70-430] (principal investigators Charlotte Gooskens and Vincent van Heuven).

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Appendices

Appendix 1. Texts used for the cloze test

The words that were replaced by beeps are indicated in bold.

Child athletes

Parents whose children show a special interest in a particular sport have a difficult decision to make. Should they allow their children to train to **become** top sportsmen and women? For many **children** it means starting very young. School work, going out with friends and other interests have to take **second** place. It's very **difficult** to explain to young children why they have to train for five hours a day. That includes even the weekend, when most of their friends are **playing**. Another problem is of course money. In many **countries** money for training is available from the government for the very best young athletes. If this help cannot be given the parents have to find the time and **money** to support their children. Sports clothes, transport to competitions, special equipment etc. can all be very **expensive**. Many parents are understandably worried that it's dangerous to start serious training in a sport at an early age. Some doctors agree that **young** muscles may be damaged by training before they are properly developed. Trainers, however, **believe** that you can only reach the top as a sports person when you start young. What is clear is that very few people do **reach** the top. So both parents and children should be prepared for failure. It happens even after many years of **training**.

Catching a cold

Hello, my name is Christina and I give advice to people with questions about their health. I get a lot of **letters** at this time of year. People **complain** that they have a cold which won't go away. There are so many different stories about how to **prevent** or cure a cold. So it's often difficult to **know** what to do. Colds are rarely dangerous, except for people who are already **weak**, such as the elderly or young babies. Still, colds are always **uncomfortable** and usually most unpleasant. Of course you can buy lots of **medicines** which will help to make your cold less unpleasant. But remember that nothing can actually **cure** a cold or make it go away faster. Another thing is that any medicine which is strong enough to make you feel better could be **dangerous**. If you are already taking medicine for other illnesses always check with your **doctor** if that's all right. And remember that it could happen that they might make you sleepy. Please don't try to drive if they do! Lastly, there are no magic foods or **drinks**. The best answer is to keep **strong** and healthy. You'll have less chance of catching a cold, and if you do, it shouldn't be so bad!

Driving in Winter

Winter is dangerous because it's so difficult to know what is going to happen. Accidents **take place** so easily. Fog can be waiting to meet you over the top of a hill. Ice might be hiding beneath the **melting** snow, waiting to send you off the road. The car coming towards you may suddenly **slide** across the road. Rule Number One for driving on **icy** roads is to drive smoothly. Uneven movements can make a **car** suddenly very difficult to control. Every **time** you turn the wheel, brake or increase speed, you must be gentle and slow as possible. Imagine you are driving with a full cup of hot **coffee** on the seat next to you. Drive so that you wouldn't spill it. Rule Number Two is to pay attention to what might happen. The more ice there is, the further down the road you have to look. Test how **long** it takes to stop by gently braking. Remember that you may be **driving** more quickly than you think. In general, allow double your normal stopping distance when the road is **wet**. Use three times this distance on **snow**, and even more on ice. Try to stay in control of your car at all times and you will **avoid** trouble.

Riding a bike

Getting enough exercise is part of a healthy lifestyle. Along with jogging and swimming, riding a bike is one of the best all-round forms of exercise. It can **help** to increase your strength and energy. Also it gives you more efficient muscles and a stronger **heart**. But increasing your strength is not the only **advantage** of riding a bike. You're not **carrying** the weight of your body on your feet. That's why riding a bike is a **good** form of exercise for people with painful feet or backs. However, with all forms of exercise it's important to **start** slowly and build up gently. Doing too much too quickly can damage **muscles** that aren't used to working. If you have any doubts about taking up riding a bike for health reasons, talk to your doctor. Ideally you should be riding a bike at least two or three times a week. For the exercise to be doing you good, you should get a little out of breath. Don't worry that if you begin to lose your breath, it could be **dangerous**. This is simply not **true**. Shortness of breath shows that the **exercise** is having the right effect. However, if you find you are in pain then you should **stop** and take a rest. After a while it will get **easier**.

Appendix 2. Post hoc *tests on differences between Germanic language pairs (Bonferroni's correction applied for multiple comparisons)*

	Da-Du	Da-En	Da-Ge	Da-Sw	Du-Da	Du-En	Du-Ge	Du-Sw	En-Da	En-Du	En-Ge	En-Sw	Ge-Da	Ge-Du	Ge-En	Ge-Sw	Sw-Da	Sw-Du	Sw-En	Sw-Ge
Da-Du		***	***	***		***	***								***		***		***	
Da-En			***	***	***			***	***	***	***	***	***	***		***	***	***		***
Da-Ge					***	***	***	***	***	***		***	***		***	***		***	***	
Da-Sw	***				***	***		***	***	***	***	***	***	***	***	***		***	***	
Du-Da				***		***	***							*	***		***		***	***
Du-En							**	***	***	***	***	***	***	***		***	***	***		***
Du-Ge								***	***	***	***	***	***	***		***		***		***
Du-Sw				***										*	***		***		***	***
En-Da				***										**	***		***		***	***
En-Du				***										*	***		***		***	**
En-Ge				***											***		***		***	
En-Sw				***										**	***		***		***	***
Ge-Da				***											***		***		***	
Ge-Du				*	**			**	**	*		**			***	**	***		***	
Ge-En																***	*	***		***
Ge-Sw				***										*			***		***	**
Sw-Da	***				***			***	***	***	***	***	***	***		***		***	**	*
Sw-Du				***													***		***	*
Sw-En																				***
Sw-Ge				**													***			

Notes: Acquired cross-language intelligibility (cloze test score) in top triangle of matrix; inherent intelligibility in bottom triangle. See text for explanation. Grey cells in the bottom triangle represent language pairs that were excluded in case of insufficient number of participants ($N \leq 1$). Da: Danish; Du: Dutch; En: English; Ge: German; Sw: Swedish. The first member of each pair is the native language of the listener, the second member is the test language.

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$.

Appendix 3. As Appendix 2 but for Romance languages

		Sp-Fr	Sp-Ro	Sp-It	Fr-Pt	Fr-Sp	Fr-Ro	Fr-It	Ro-Pt	Ro-Sp	Ro-Fr	Ro-It	It-Pt	It-Sp	It-Fr	It-Ro	Pt-Sp	Pt-Fr	Pt-Ro	Pt-It
Sp-Pt							*							***		***	***			
Sp-Fr										*		**		***			***			
Sp-Ro		*		***						***	**	***		***	***		***			***
Sp-It			**				***		*							***	***		**	
Fr-Pt										***		***		***	*		***			*
Fr-Sp														***			***			
Fr-Ro		**		**						***	***	***		***	***		***			***
Fr-It										**		***		***			***			
Ro-Pt										***		***		***	**		***			**
Ro-Sp			***		*	*	***		*							***			***	
Ro-Fr																***	*		*	
Ro-It			**				**						*			***			***	
It-Pt														***		**	***			
It-Sp		*	***		***	***	***	***	***				***		*	***		***	***	
It-Fr														***		***	***		***	
It-Ro		***		***						***		***		***			***			***
Pt-Sp			***		**	**	***	*	**				*		*	***		***	***	**
Pt-Fr																				
Pt-Ro		*		*						**		*		***			***			***
Pt-It			***		**	**	***		**				*			***			***	

Note: Sp: Spanish; Fr: French; It: Italian; Pt: Portuguese; Ro: Romanian.

Appendix 4. As Appendix 2 but for Slavic languages

	Cr-Sn	Cr-Bu	Cr-Cz	Cr-Sk	Cr-Po	Sn-Cr	Sn-Bu	Sn-Cz	Sn-Sk	Sn-Po	Bu-Cr	Bu-Sn	Bu-Cz	Bu-Sk	Bu-Po	Cz-Cr	Cz-Sn	Cz-Bu	Cz-Sk	Cz-Po	Sk-Cr	Sk-Sn	Sk-Bu	Sk-Cz	Sk-Po	Po-Cr	Po-Sn	Po-Bu	Po-Cz	Po-Sk
Cr-Sn		***	***	**	***	***	***	***	***	***		**	***	***	***	***	***	***	***			***	***	***		***	***	***	*	
Cr-Bu	***					***													***	***				***						***
Cr-Cz	***					***													***					***	***					***
Cr-Sk	**					***													***					***	***					*
Cr-Po	***					***													***	***				***	***				*	***
Sn-Cr	***	***	***	***	***		***	***	***	***	***	***	***	***	***	***	***	***		***	***	***	***	*	***	***	***	***	***	***
Sn-Bu	***					***													***	*				***	***					***
Sn-Cz	***					***													***					***	***					***
Sn-Sk	***					***													***					***	***					***
Sn-Po	***					***													***	***				***	***					***
Bu-Cr						***													***					***	*					
Bu-Sn	**					***													***					***	***					*
Bu-Cz	***					***													***	***				***	***					***
Bu-Sk	***					***													***					***	***					**
Bu-Po	***					***													***	***				***	***					***
Cz-Cr	***					***													***					***	***					***
Cz-Sn	***					***													***	*				***	***					***
Cz-Bu	***					***													***	***				***	***					***
Cz-Sk	***	***	***	***	***		***	***	***	***	***	***	***	***	***	***	***	***		***	***	***	***		***	***	***	***	***	***
Cz-Po					***	***	*			***			***		***		*	***	***		**	***	***			***	***	***		
Sk-Cr						***													***					***	***					
Sk-Sn	***					***													***	**				***	***					***
Sk-Bu	***					***													***	***				***	***				*	***
Sk-Cz						***	***	***	***	***		***	***	***	***	***	***	***							***	***	***	***	***	***
Sk-Po		***	***	***	***	***	***	***	***	***	*	***	***	***	***	***	***	***	***		***	***	***			***	***	***	***	
Po-Cr	***					***													***	***					***					***
Po-Sn	***					***													***	***					***					***
Po-Bu	***					***													***	***					***					***
Po-Cz	*				*	***													***				*		***					
Po-Sk		***	***	*	***	***	***	***	***	***		*	***	**	***	***	***	***	***			***	***			***	***	***		

Note: Cr: Croatian; Cz: Czech; Sn: Slovene; Sk: Slovak; Po: Polish; Bu: Bulgarian.