Chapter 6
Asymmetric intelligibility

It may sound logical to assume that language A should be as intelligible to native listeners of language B as the other way around. However, this is not always the case, as it becomes clear from many observations by speakers themselves. Discussion on social media shows that many people are intrigued by the phenomenon of asymmetric intelligibility. For instance, a short YouTube video titled *Why some speakers can't understand speakers who understand them – Asymmetric Intelligibility*[18] has reached over 1.2 million views. In the comments section, almost 8000 viewers from all over the world participated in the discussion about reasons for asymmetry and provided examples of asymmetric intelligibility between languages and dialects. In many of the comments, asymmetric intelligibility is explained by extra-linguistic factors, as becomes clear from the following examples suggesting the importance of experience and motivation:

> *And then there is the exposure to "midway" languages . . . I'm Czech, I don't speak but can understand Slovak and Polish. Therefore I have an easier time understanding Ukrainian than Czechs who aren't exposed to Polish. The more slavic languages a slav is exposed to the easier it is to understand the rest.*
>
> *The reason I and many of my friends (that are norwegian) its because when we were young there was a lot of popular shows in danish and swedish without norwegian dubs.*
>
> *I remember going to legoland as a kid. This other kid there wanted to be my friend so bad but I couldn't understand him at all while he understood me perfectly. As a grownup now I don't have any particular issues with danish, but that is more through exposure than anything.*
>
> *I think many people in advance tell themselves that they won't understand so they might not even try. Understanding a language that is similar to your own is just a question of learning to listen properly. Learning how to decode it.*

However, many other comments are concerned with linguistic explanations for asymmetry, for example:

> *[. . .] For portuguese it's easier to understand spanish, than it is for spanish to understand portuguese. Because spanish don't understand the different endings in portuguese, while for a portuguese the endings sound easier in spanish.*

18 https://www.youtube.com/watch?v=E042GHlUgoQ&t=15s

https://doi.org/10.1515/9783111134697-006

danish just needs to take out the potato of their mouths so us norwegians and swedish can understand them.

I, as a Slovenian, can mostly understand Croatian, Serbian and Bosnian without ever learning it, but they have a hard time understanding me. It all comes down to us moving the stressed syllable, which makes us difficult to understand . . .

I as an Egyptian Arabic speaker tend not to understand Iraqis because of the obscure vocabulary they have; but the catch is that they usually have multiple words to refer to things either due to them being synonyms or having different senses for each word whereas we have one: English: chair, *Egyptian:* korsi,

I'm Russian and we have two words for cat, koshka and miska. The previous one is the "official" word while miska is sometimes used in some circumstances, in Belarusian miska is the official word and I don't know if they also use koshka but if they don't Russians can understand Belarusians saying cat but not the other way around. That may be another reason for the thing.

I would add that some communities speak slower and therefore they are understood more easily. This was revealed to me in my native Texas when I happened to go to a meeting and sat next to a visiting Scottish colleague. We had communicated solely through telecon in large meetings. I told him my apologies but I understood less than 50% of what he said and I relied on co-workers to translate his information after the meeting. I asked him if us Texans were as difficult to understand. I laughed and mentioned that "Texans talk real slowly."

Since early intelligibility studies, researchers have also observed that mutual intelligibility between languages is sometimes asymmetric. Asymmetric intelligibility is fascinating in its own right. However, by understanding the mechanism behind asymmetric intelligibility, we may also advance our understanding of factors that play a role in mutual intelligibility between closely related languages.

As mentioned in Section 1.1, linguists have often assumed that the linguistic prerequisites for mutual intelligibility are symmetric, i.e., that the linguistic barriers that a speaker of language A has to deal with when listening to language B are comparable in magnitude to the barriers that speakers of language B have to deal with when listening to language A. This means that inherent intelligibility between two related languages is assumed to be symmetrical. In the early 1950s, American structuralists included reciprocity in their definition of mutual intelligibility (e.g., Casad 1974: 73). This would mean that any asymmetric intelligibility must be caused by exposure or some other extra-linguistic factor. According to Simons (1979: 81), "discrepancies larger than 10% are due to social factors rather than linguistic factors". Grimes (1992), therefore, suggested using this threshold as a means of identifying such factors and gaining a better understanding of the extra-linguistic determinants of intelligibility. However, he did not rule out that for some language combinations, specific areas of phonology may play a role in

explaining asymmetry. Later, researchers found evidence that asymmetries in the different linguistic structures of the languages involved may be part of the explanation for asymmetric intelligibility in addition to extra-linguistic factors. However, most linguistic distance measures quantifying the difference in linguistic structure between languages that were described in Chapter 5 are symmetric. These measures will be inadequate for explaining the intelligibility asymmetries found for some language combinations.

One of the most well-known cases of asymmetric intelligibility is the Swedish-Danish mutual intelligibility. Danish has the reputation of being difficult to understand for Swedish listeners, while Swedish is more readily understood by Danish listeners. For instance, Maurud (1976) reported that Danes understand Swedish reasonably well, while Swedes perform more poorly when having to understand Danish, a tendency which has been reported repeatedly (e.g., Bø 1978; Börestam 1987; Delsing and Lundin Åkesson 2005). In the literature on Danish-Swedish mutual intelligibility, both linguistic and extra-linguistic explanations are proposed for asymmetric intelligibility. Many examples in this chapter are taken from research on Danish-Swedish mutual intelligibility.

Appendix B lists the percentages of correct answers in the cloze test from the MICReLa project and indicates when the intelligibility scores are asymmetrical. Most asymmetries are found in the Romance area, both when looking at the general intelligibility results and when looking at the inherent intelligibility results. In the Germanic area, there are many asymmetries in general intelligibility as well, especially between language pairs involving the school languages German and English. In the Slavic area, there is only a significant asymmetry between Croatian and Slovene.

Throughout this chapter, possible reasons for these asymmetries are discussed. Extra-linguistic explanations are discussed in Section 6.1. Section 6.2. introduces the idea of measuring linguistic variation asymmetrically. It is shown that the amount of linguistic variation between a speaker of variety A and a listener of variety B may not be equal to the amount of linguistic variation between a speaker of variety B and a listener of variety A.

6.1 Extra-linguistic factors causing asymmetric intelligibility

All the extra-linguistic factors discussed in Chapter 4 could be relevant for understanding asymmetric intelligibility. Some of them could explain the asymmetry in mutual intelligibility between individual speakers, while other factors can be generalized to whole languages rather than individuals. In this section, the extra-

linguistic factors exposure, attitude, orthographic knowledge and plurilingual resources are discussed.

6.1.1 Asymmetric exposure

At the personal level, the amount of exposure may vary a lot. Still, at the language level, it has often been shown that for various reasons, some groups of speakers have more exposure to a certain related language than vice versa. Speakers of "smaller" languages are more likely to get exposed to languages with more speakers because the chance of hearing a language with many speakers is higher, but often also because larger languages generally have a higher status. A higher status may lead to more use of the language in a wider number of contexts. Exposure is a significant determinant of intelligibility (see Section 4.1), and it may explain asymmetric intelligibility in situations where there is an unequal amount of exposure between the speakers of two languages.

The amount of exposure has often been mentioned as part of the explanation for the asymmetric intelligibility between Swedish and Danish that has consistently been found in various investigations (see introduction to this chapter); Danes generally understand Swedish better than vice versa. Maurud (1976) collected self-estimations of exposure to the neighboring language by asking participants to indicate how often ("never", "seldom", "sometimes", "often") they visited their neighboring countries, listened to radio from neighboring countries, and watched television from neighboring countries. The Danes reported much more contact with Swedish than Swedes with Danish. Generally, Danes have more often listened to Swedish, for instance, through the media and interaction with Swedes, than vice versa. More recent studies have also reported this asymmetry (Jörgensen and Kärrlander 2001). The Swedish population is larger (a little more than 10 million) than the Danish (almost 6 million), and Denmark is a geographically smaller country, so for most Danes the distance to Sweden is small. The great majority of Swedes live far away from the Danish border and get little exposure to Danish, while Danes have more opportunities to get exposed to Swedish. The capital of Denmark, Copenhagen, is close to the Swedish border on the west coast of Sweden. For many Danes, the western part of Sweden is easily reached by crossing the bridge across the Øresund, while for Swedes living around the Swedish capital, Stockholm, on the east coast of Sweden, a day trip to Denmark is not within reach.

From an investigation by Delsing and Lundin Åkesson (2005), it became clear that the geographic vicinity plays an important role in the amount of exposure. They collected exposure scores (max. 100 points) from Danes in Copenhagen close

to the Swedish border (30 minutes by car, contact score 21.8) and from Århus, approximately a three-and-a-half hour drive from the border (contact score 14.0) and from Swedes in Malmö just across the bridge to Denmark (contact score 35.7) and from Stockholm, a 7 hour drive to Denmark (contact score 8.3). They found significant correlations[19] between the exposure scores and scores on intelligibility tests. Listeners from Malmö performed better than listeners from Stockholm. However, unexpectedly, listeners from Copenhagen did not perform better than listeners from Århus. The researchers explain this by a lack of interest in the investigation among the listeners from Copenhagen.

In the MICReLa project, the amount of exposure the listeners had to the target language was quantified by having the listeners fill in 6 five-point scales from 1 ("never") to 5 ("every day"), see Section 4.1.1. The mean results can be found in Appendix C. A large part of the asymmetries in intelligibility (see Appendix B) can be explained by asymmetries in previous exposure to the target language. The link between asymmetric intelligibility and asymmetric exposure can be established by correlating the asymmetry scores for both measures. Asymmetric exposure scores are difference scores (also called deltas, Δ) that are calculated by subtracting the mean exposure to language A among speakers of language B (the AB exposure score) from the exposure to language B among speakers of language A (the BA exposure score). In the same way, asymmetric intelligibility scores can be calculated (the AB intelligibility score minus the BA intelligibility score). The exposure deltas can then be correlated with the intelligibility deltas. These deltas are expected to correlate positively: If speakers of two languages have different levels of exposure, they are likely also to have different levels of intelligibility.

The asymmetry scores are presented in the scattergrams in Figure 6.1. The results are arranged so that for each language pair, the lowest intelligibility score is subtracted from the highest score. In other words, when calculating the asymmetries, the highest score is chosen as the AB score and the lowest as the BA score. This results in asymmetric intelligibility scores that are always positive. The corresponding asymmetric exposure scores are mostly also positive. For example, Romanians understand Italian better (AB scores) than the other way around (BA score), and they also have more exposure to Italian. For a few languages, there are slight negative asymmetric exposure scores. However, in general, a high positive asymmetric intelligibility score corresponds to a high positive asymmetric exposure score, and a low positive asymmetric intelligibility score corresponds to a low positive asymmetric exposure score. The correlation is high (r = .92, p < .001). Even when leaving out the ten language pairs where one of the languages is a school

19 No correlation coefficients were reported.

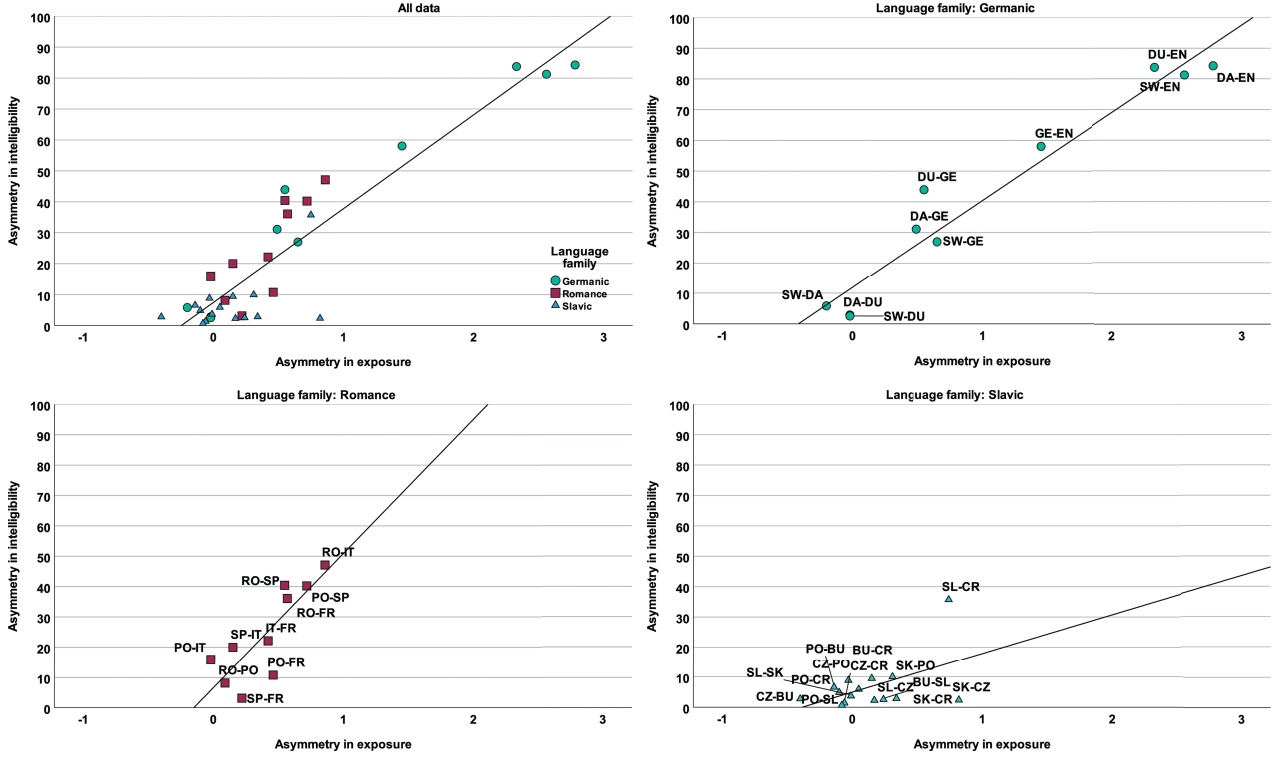

Figure 6.1: Scattergrams showing the relationship between the asymmetric intelligibility scores (AB intelligibility score minus BA intelligibility score) and the asymmetric exposure scores (AB exposure score minus BA exposure score) for 35 language pairs in the MICReLa project, $r = .92$, $p < .001$ for all language combinations, $r = .97$ for Germanic ($p < .001$), $r = .82$ for Romance ($p < .01$), and $r = .49$ for Slavic (n.s.). For explanations, see Figure 4.2.

language (English and German in the Germanic area, French in the Romance area), the correlation is high (r = .75, p < .001). This shows that asymmetric intelligibility can to a large extent be explained by asymmetric exposure even when it is gained outside a formal classroom situation.

In the Germanic language family (green markers in Figure 6.1), the highest asymmetric intelligibility and exposure scores were found in language combinations involving English. Since English and German are school languages, they attract much better scores as target languages than the other languages. Danes had more exposure to Swedish (mean exposure score 2.2) than Swedes to Danish (mean exposure score 2.0). Contrary to most previous investigations, the mutual intelligibility between Danish and Swedish was not asymmetric when measured using the cloze test.

In the Romance language area (red markers), the highest asymmetric exposure scores were found in combinations with Romanian on the one hand and Italian and Spanish on the other hand. Romanians had a mean exposure score of 2.1 to Italian and 1.8 to Spanish, while the scores were only 1.2 and 1.3 in the other direction. Romanians also understood these two languages better (57.7% and 54.0% correct answers to the cloze test) than the other way around (10.6% and 13.6%). Romanians often encounter Italian and Spanish, for instance, via television, and films are rarely dubbed in Romania. Native speakers of other Romance languages are less often exposed to the Romanian language. The Portuguese-Spanish exposure scores were also asymmetric, with Spanish listeners scoring 1.4 and Portuguese listeners 2.2. This corresponds to asymmetric intelligibility scores where Portuguese listeners score better than Spanish listeners (77.4% vs. 37.2%). Jensen (1989) found results in the same direction but with considerably smaller asymmetry for Latin American Spanish and Brazilian Portuguese. Brazilian-Portuguese listeners understood Latin-American Spanish speakers better with a mean accuracy of 58% correct answers to multiple-choice questions about four recorded text readings. Spanish listeners understood Brazilians less well with 50% correct answers.

There were few asymmetric intelligibility and exposure scores in the Slavic language group (blue markers), and the correlation is insignificant. The highest exposure delta in the Slavic group was found for Czech-Slovak. The Slovaks had more exposure to the neighboring language (mean exposure 3.6) than the Czechs (mean 2.8). The Slovaks performed better on the spoken cloze test (95.0 % vs. 92.7%), but the difference might have been larger if there had not been a ceiling effect. When asked to judge their own comprehension of the test language, Slovaks perceived their comprehension of the neighboring language to be higher (95.8%) than the Czechs (87.3%). Historical circumstances have led to more exposure to Czech and higher Czech comprehension among Slovaks than the other way around (Budovičová 1987; Berger 2003; Nábělková 2007). According to Ethno-

logue (Eberhard, Simons, and Fennig 2023) there are currently 9,372,000 Czech speakers in the Czech Republic but only 5,115,000 Slovak speakers in Slovakia. Written Czech texts have always played an essential role in Slovakia and their influence persists today in a diminished form. Spoken Czech texts are present in Slovakia through various mediums, such as the media and films. On the other hand, Czech contact with the Slovak language has been much scarcer, and today it is not an everyday experience for the Czech language community to be exposed to the Slovak language, especially for the younger generation. These circumstances are likely to lead to asymmetric intelligibility between the two languages.

In other language areas, asymmetric exposure has also been linked to asymmetric intelligibility. Gooskens and Schneider (2019) investigated the mutual intelligibility between related language varieties of northern Pentecost, one of the Pacific islands of Vanuatu (see Figure 6.2). They included four varieties: the Raga language in the north and the three Apma dialects, Suru Kavian, Suru Mwerani, and Suru Rabwanga, further to the south. They showed that the amount of exposure is at least part of the explanation for the asymmetric mutual intelligibility between Suru Kavian (spoken in Namaram) and other language varieties spoken on the island in the villages of Loltong, Waterfall, and Tanbok. In a word intelligibility task, Suru Kavian speakers translated more words from the three other closely related language varieties correctly (mean 90.2%) than vice versa (mean 44.1%, see the vertical axis in Figure 4.3). They also had more exposure to the other varieties, as it became clear from the higher number of non-cognates that they translated correctly (mean 85%, see the horizontal axis in Figure 4.3) than vice versa (mean 28.3%). Suru Kavian is spoken in the center of the area, and the speakers have more visitors from outside the village than the other villages do. They are, therefore, more often exposed to the other languages on the island. In addition, Suru Kavian is spoken by only a small number of speakers. For this reason, Suru Kavian speakers need to be able to understand other languages for communicative purposes. Suru Kavian speakers are locally renowned for their tendency to abandon their own variety when conversing with speakers of other languages on the island. Suru Kavian children are often taught in another variety than their own in school because teachers do not speak Suru Kavian. As a result, the number of speakers of Suru Kavian is decreasing, and the variety is on the verge of language shift. This investigation demonstrates that asymmetric exposure may result in asymmetric intelligibility, which in turn may result in language shift.

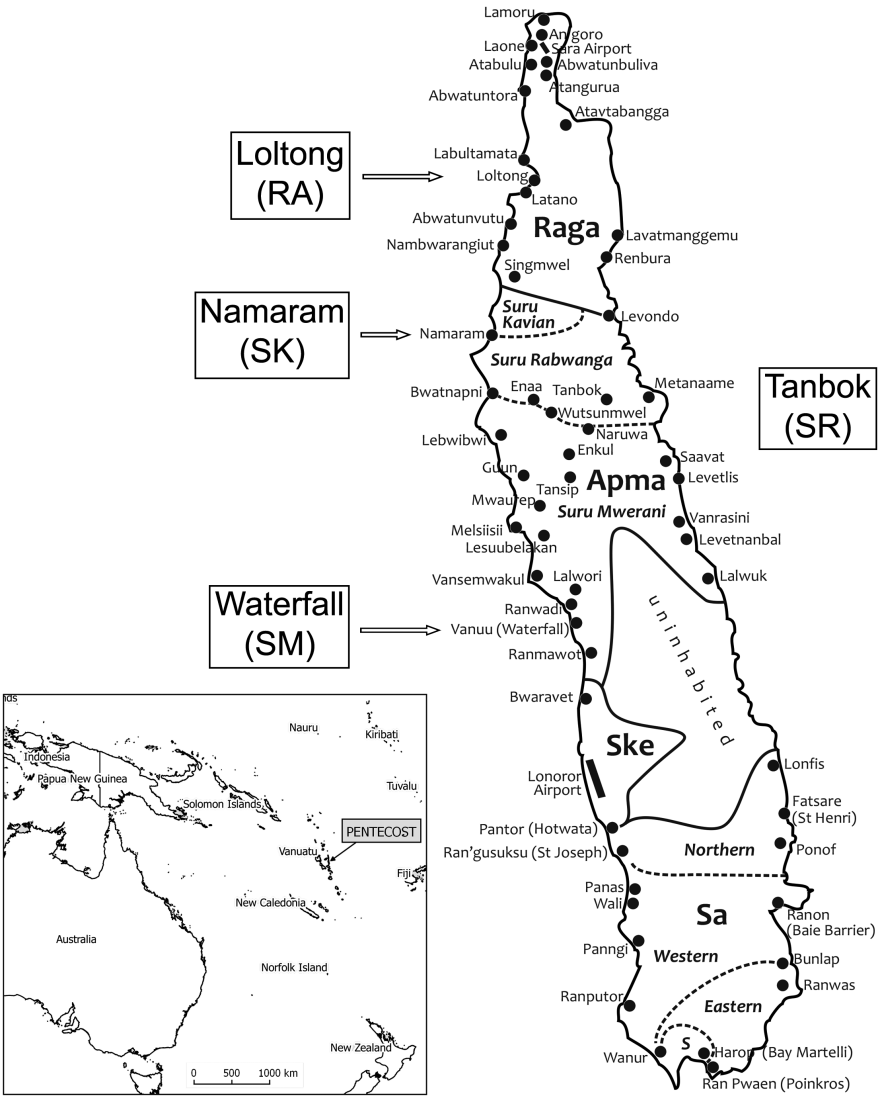

Figure 6.2: Language varieties of Pentecost, one of the islands of Vanuatu. Purported language boundaries are drawn in solid lines; purported dialect boundaries are drawn in dotted lines. For abbreviations, see Figure 4.3. Source: Schneider and Gooskens (2018: 146).

6.1.2 Asymmetric attitudes

Wolff (1959) was perhaps the first to attribute asymmetric intelligibility to the attitudes of speakers toward each other's communities, stemming from the hierarchical relations between the groups. He investigated mutual intelligibility between Kalabari and Nembe, two closely related Nigerian Ijo languages spoken in the Eastern Niger Delta. His findings revealed that Nembe speakers reported high linguistic similarity between their own language and the Kalabari language and expressed an ability to understand Kalabari. On the other hand, speakers of Kalabari judged Nembe to be linguistically distant and unintelligible to them. Wolff suggested that this asymmetry in intelligibility should be linked to an asymmetry in language attitudes. When his study was conducted, the Kalabari were arguably the most prosperous group in the Eastern Niger Delta, and they regarded other Ijo-speaking groups as inferior to them. Therefore, Nembe speakers were more positive towards Kalibari speakers and more willing to make an effort to understand their language than the other way around.

The general rationale is clear: the more positive the attitude towards a language and/or its speakers, the more likely a person is to make an effort to understand that language. Consequently, if speakers of two languages have different attitudes towards each other's languages, this may result in asymmetric intelligibility. Still, the relationship between language attitudes and intelligibility is rather elusive (see Section 4.3) and has only been mentioned sporadically as an explanation for asymmetric intelligibility. Swedish and Danish form an exception. It has repeatedly been suggested that the asymmetric intelligibility between Swedes and Danes can be traced back to asymmetric attitudes. Swedes may have a less positive attitude toward the Danish language, culture, and people than Danes do towards the Swedish language, culture, and people. Sweden has been referred to as the "big brother" in Danish public opinion (Sletten et al. 2004; Thorvaldsson 2011). This draws on the fact that Sweden has historically been more influential than the other Scandinavian countries, and this may be a reason for Danes to be more positive about Swedish than Swedes about Danish and for Danes to make a greater effort to understand Swedish than for Swedes to understand Danes.

Haugen (1966) elicited language attitudes in a survey on mutual intelligibility in Scandinavia by means of the question "How do you like the sound of Y?" with the response alternatives "Compared with X (the informant's own language), Y (the target language) is: more beautiful, equally beautiful, less beautiful." He found that 42% of the 81 Danish informants thought that Swedish sounded more beautiful than their own language, while none of the 54 Swedish informants thought that Danish sounded more beautiful than Swedish. Jörgensen and Kärrlander (2001) as well as Lundin and Christensen (2001) studied the mutual intelli-

gibility of Danish and Swedish in the Øresund region, which is the border area between Sweden and Denmark connected by the Øresund Bridge. The results showed that Danes were better at understanding Swedish than Swedes were at understanding Danish. Since the Danish listeners held more positive attitudes towards Swedish than vice versa, the researchers suggested that attitudes could be part of the explanation for the asymmetric Danish-Swedish intelligibility results. Unfortunately, they did not report correlations between attitudes and intelligibility. The same conclusions have been drawn by Delsing and Lundin Åkesson (2005), who tested the intelligibility of the three Scandinavian languages in a large number of places in the Nordic countries and asked the listeners to state their attitude towards the other languages on 5-point scales. The results showed that Danish participants considered the Swedish language more beautiful than Swedish participants considered the Danish language. They reported significant correlations between attitudes and intelligibility but did not report any correlation coefficients.

In the investigations by Haugen and by Delsing and Lundin Åkesson, listeners did not base their judgments on recordings of the target languages. Instead, they were asked to give their opinions based on their knowledge about them. The assumption here is that Danes and Swedes are likely to have sufficient experience with each other's languages to be able to form opinions about them (see Section 4.3). However, it is uncertain whether this is the case for all listeners. Schüppert, Hilton, and Gooskens (2015) carried out a matched-guise experiment (see Section 4.3.1) employing recordings of a balanced bilingual speaker proficient in both Danish and Swedish. Participants consisted of groups of Danish and Swedish children aged between 7 and 16 years, who evaluated recordings in both Swedish and Danish, along with four other languages, using 5-point semantic differential scales indicating how normal, beautiful, smart, modern, kind, and rich the speakers sounded to them (see Section 4.3.1). According to the findings, the bilingual speaker received more favorable ratings from Danish participants when speaking Swedish compared to the ratings from Swedish participants when she spoke Danish, across all seven scales. The investigation with recordings by Schüppert, Hilton, and Gooskens (2015) thus confirms the results of previous Danish-Swedish attitude investigations where the participants did not base their opinions on recordings. Since the matched-guise technique was applied, we know for sure that differences in speaker characteristics did not cause the asymmetric attitudes. The listeners heard the same text in both languages so the asymmetry cannot be due to the content of the recording, either. It was therefore assumed that the asymmetric attitudes found should be explained by imposed norms and social connotations, thus confirming the big brother hypothesis mentioned above. However, as explained in Section 4.3, there is also evidence that some languages have specific linguistic characteristics that make them sound

more aesthetically attractive than others. Swedish is a tonal language resulting in a higher degree of variation in pitch contours than in Danish, with its rather monotonous intonation. This may make Swedish sound more attractive than Danish.

It is possible to calculate attitude asymmetry (or deltas, Δ) for the MICReLa-project in the same way as the exposure asymmetry in Section 6.1.1 (AB minus BA scores) and correlate them with the asymmetric intelligibility scores. In general, the language combinations with positive attitude deltas should also have positive intelligibility deltas. However, this is not always the case. For instance, Swedes understand German better than vice versa ($\Delta > 0$), but they have a more negative attitude towards German ($\Delta < 0$). The correlations are lower than for the exposure deltas but still significant ($r = .53$, $p < .001$) when including all languages. However, when examining each language family separately, the correlation is significant only in the Germanic language family. The corresponding scattergrams are presented in Figure 6.3. These results show that asymmetric intelligibility may, at least for some groups, be linked to asymmetric attitudes as suggested in previous investigations.

6.1.3 Asymmetric orthographic knowledge

As mentioned in Section 4.4, orthographic differences between Danish and Swedish may also cause asymmetric intelligibility, even in spoken language. By calculating entropies (a measurement of uncertainty, see Section 6.2.2) between phoneme-to-grapheme and grapheme-to-phoneme mappings for 16 European languages, Schüppert et al. (2017) showed that Swedish orthography is more transparent than Danish orthography. This can be explained by the fact that the Danish orthography is very conservative, while spoken Danish has changed faster than most other Germanic languages, including Swedish (Brink and Lund 1975; Grønnum 1998; Elbro 2005). Due to the large number of changes (especially lenition processes, i.e., the weakening of consonants) in the phonology of Danish, the letter-to-sound correspondences that were rather straightforward around a century ago have become more opaque during the twentieth century. Many sounds lost in pronunciation are still preserved in the orthography. In Swedish, the corresponding sounds are still preserved both in the orthography and in the pronunciation.

According to Teleman (1987: 76), the many changes in the Danish pronunciation may have made it more difficult for a Swede listening to Danish to "find the letters behind the sounds" than vice versa. Danes can often understand spoken Swedish words due to their similarity to written Danish, while Swedes cannot draw on written Swedish to the same degree when understanding spoken Danish. For example, Danes presented with the spoken Swedish word *tolv* /tɔlv/ 'twelve' can probably use their orthographic knowledge to match this word to the written cog-

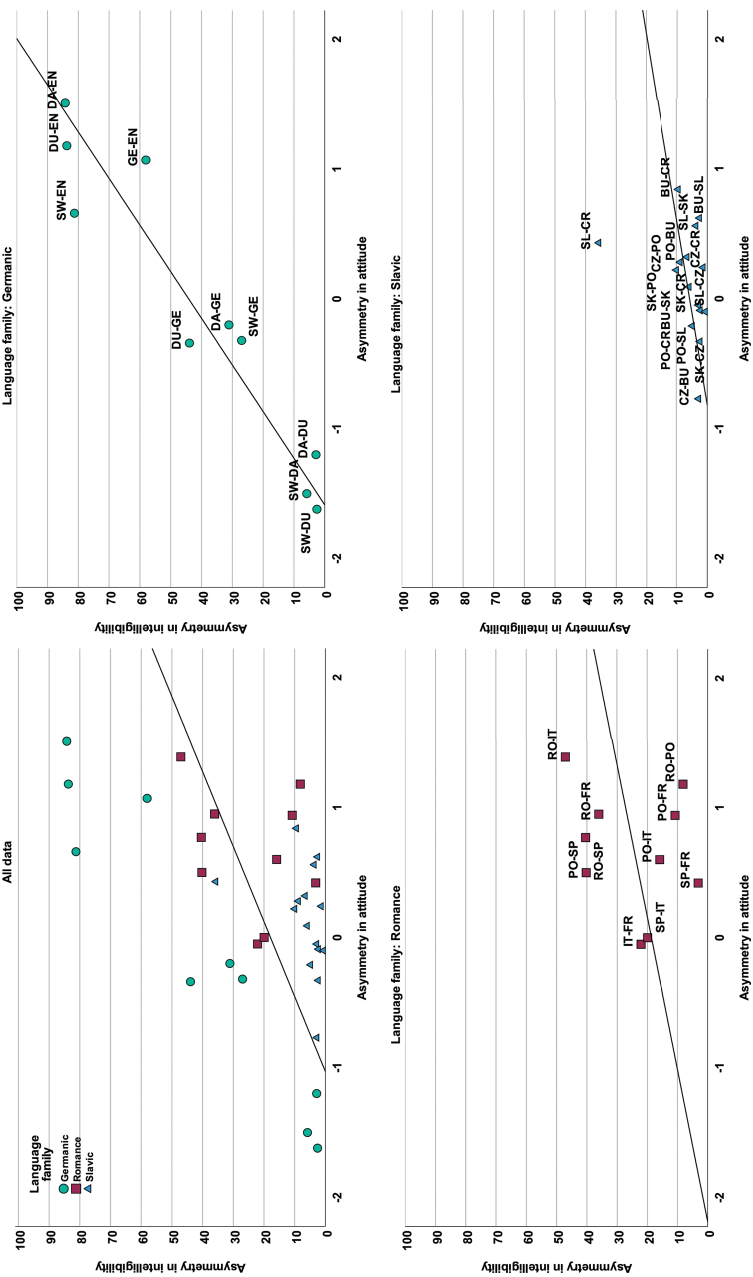

Figure 6.3: Scattergram showing the relationship between the asymmetric intelligibility scores (AB intelligibility score minus BA intelligibility score) and the asymmetric attitude scores (AB attitude score minus BA attitude score) for 35 language pairs in the MICReLa project, $r = .53$, $p < .001$ for all language combinations, $r = .95$ ($p < .001$) for Germanic, $r = .26$ for Romance (n.s.), and $r = .34$ (n.s.) for Slavic. For explanations, see Figure 4.2.

nate in their native language *tolv*, even though the Danish pronunciation is different /tɔlˀ/. On the other hand, Swedes listening to the spoken Danish word do not get help from their native orthography. The phoneme /v/ is present in Swedish pronunciation as well as in the orthography but absent in the Danish pronunciation.

Gooskens and Doetjes (2009) showed that the proportion of Swedish words that Danes can potentially understand by means of the orthography of the corresponding Danish cognates is larger than the proportion of Danish words that Swedes recognize using their own orthography. Table 5.3 in Section 5.2.1 shows how phonetic distances corrected for orthography were calculated using the Levenshtein algorithm between the Danish and Swedish words for 'pan' (*pande* and *panna*). The distance is calculated by assigning no weight to phonemes that could be understood by means of the native orthography. For Danes, the phonetic distance with corrections for orthography is smaller (25%) than that with the uncorrected Levenshtein distance (50%). This is because Danes hearing this word spoken in Swedish can recognize the initial /a/ in the word (pronounced as [a]) as one of the two possible realizations of written Danish <a> (the other realization being [æ]). Conversely, the corrected calculation has no consequences for the distance calculation for this word pair when taking the situation of Swedish listeners as a starting point (see Table 6.1). Swedish has only one way of pronouncing the <a>, and therefore, a Swede may have difficulties recognizing the Danish [æ] as a possible pronunciation of written <a>. The corrected distance is thus greater for a Swede (50%) than for a Dane (25%), which indicates that it is probably more difficult for a Swede to understand the word in the neighboring language than it is for a Dane.

Table 6.1: Phonetic distances corrected for orthography for a Dane presented with a Swedish cognate (25%) and for a Swede presented with a Danish cognate (50%). Source: Gooskens and Doetjes (2009: 214).

	Phonetic distance corrected for Danish orthography		**Phonetic distance corrected for Swedish orthography**
Danish listener:	p a/æ n ə	Swedish listener:	p a n a
Swedish target:	p a n a	Danish target:	p æ n ə
Differences:	0 0 0 1	Differences:	0 1 0 1
Distance	1/4 = 25%	Distance	2/4 = 50%

The distance representing a Swede's comprehension of Danish, as determined by phonetic distances corrected for orthography by Gooskens and Doetjes (2009), is greater, averaging 46% across all 86 cognates used for the measurements, compared to the distance representing a Dane's comprehension of Swedish, which is

30% on average. This shows that, potentially, Danes can make better use of their native orthography than Swedes when understanding the neighboring language. This argument is further supported by the fact that the corrected distances show higher correlations with the results of a word translation experiment with the 86 Swedish words among a group of Danish listeners (r = −.63) than the uncorrected distances (r = −.54). It is also supported by the finding by Schüppert and Gooskens (2012) that the intelligibility is symmetric among illiterate children, since they do not have support from the orthography when listening to the neighboring language.

Summarizing the Swedish-Danish results, we have seen that the orthographic transparency of Danish is lower than the Swedish transparency (Schüppert et al. 2017, 2022). Moreover, we know that literate Danish speakers show activation of their native orthography during word recognition tasks for spoken Swedish (see Section 4.4.1). It can, therefore, be assumed that the potential advantage that Danes have from their orthography, as demonstrated by Gooskens and Doetjes (2009) is also actually used. The asymmetric intelligibility between Swedish and Danish may be partly explained by the fact that when listening to Swedish, Danish listeners appear to use the additional information provided by the native orthography more than Swedes do when listening to Danish. This is supported by the fact that in contrast to adult Danes, Danish children did not perform better in a word-recognition task than their Swedish peers (Schüppert and Gooskens 2012).

Orthographic characteristics may also explain asymmetric mutual intelligibility between other language pairs. Schüppert et al. (2017) showed an asymmetry between phoneme-to-grapheme and grapheme-to-phoneme mappings for Spanish and Portuguese, which is comparable to the Danish-Swedish asymmetry. Spanish orthography is more transparent than Portuguese orthography. Previous research has also found asymmetric intelligibility in the same direction between these two languages (Jensen 1989 and Appendix B). Phonological lenition processes (such as consonant deletion and vowel apocope) have altered some Portuguese words to an extent that they have become unrecognizable to native speakers of other Romance languages. Portuguese listeners, however, may easily recognize the non-lenited forms in the neighboring language. To illustrate, Portuguese listeners can be expected to easily understand the spoken Spanish word for 'river' *rio* ['ri.o] because they can recognize it from the spelling of the Portuguese equivalent *rio.* It will be much more difficult for a Spanish person to understand the spoken Portuguese word because the Portuguese pronunciation ['ʁi.u] is rather different from the Spanish pronunciation and orthography (see Table 6.2).

Table 6.2: Example where Spanish has a stronger letter-to-sound correspondence than Portuguese.

	Portuguese	Spanish	English
Spelling	<rio>	<rio>	'river'
Pronunciation	['ʁi.u]	['ri.o]	

6.1.4 Asymmetric plurilingual resources

As explained in Section 4.2, when people know a language other than their native language, this can sometimes be used as a "bridge language" that can help them understand a language that they have not learned before. They may understand non-cognates in the target language because they know them from this bridge language. Sometimes, knowledge of such bridge languages can result in asymmetric intelligibility between speakers of related languages.

In the Romance part of the MICReLa project, where the mutual inherent intelligibility between five Romance languages was tested, asymmetric intelligibility was found between all language combinations involving Romanian as either the target language or as the listener language. None of the Romanian listeners had more than marginal previous exposure to the target language, but still, they got higher scores when tested in Italian, Spanish, and Portuguese (inherent intelligibility scores between 20.7% and 47.2%) than Italian, Spanish, French, and Portuguese listeners who were tested in Romanian (scores between 8.7% and 14.0%). As explained in Section 6.1.1, Romanians often encounter other Romance languages, while this is less the case for native speakers of the other four languages. Therefore, even when the Romanian listeners had no exposure to the target language, they may have used their knowledge about the vocabulary of other related Romance languages to understand the target language. Unfortunately, since the listeners were not asked about their exposure to these other related languages, this explanation could not be confirmed statistically. Speakers of other Romance languages are less able to use their knowledge of related languages when listening to Romanian because the Romanian language has a very deviant vocabulary with many non-Romance words.

Past studies on inter-Scandinavian intelligibility have shown that, typically, Norwegians exhibit greater proficiency in understanding the closely related languages Danish and Swedish compared to Danes and Swedes do in understanding Norwegian. Various explanations for this asymmetric intelligibility in favor of Norwegian listeners are found in the literature. This includes higher motivation to understand the target language or more familiarity with the neighboring lan-

guages, but the high degree of experience with language variation within their own country has been especially stressed as an explanation for the superiority of the Norwegians (Börestam Uhlmann 2005). For historical reasons, dialects have a strong position in Norway, and many Norwegians are familiar with and often speak more than one variety of Norwegian. Additionally, there are two official forms of written Norwegian, Bokmål (literally 'book tongue') and Nynorsk ('new Norwegian'), each with its own variants. Conversely, the position of dialects is exceptionally weak in Denmark, and fewer people speak and hear dialects regularly (Pedersen 2003). Swedish dialects take a position between these two extremes. Both Danish and Swedish have only one standard written form. These circumstances may give Norwegians an advantage when it comes to inter-Scandinavian intelligibility. As people are more accustomed to dialectal variation in Norway, they are assumed to have a better-developed language awareness (Torp 1998), which makes them better at understanding the Danish and Swedish standard languages. They can use their linguistic experience with Norwegian dialects to guess the meaning of cognates in other related languages, in this case, Danish and Swedish (inferencing strategies, see Section 4.2). Compared with Norwegians, Danes and Swedes, in general, less often encounter their own dialects, especially if they live in the capital areas. It is often assumed that this lack of experience with language variation may be part of the explanation for their poorer understanding of the neighboring languages (Börestam Uhlmann 2005).

If it is the case that Norwegians have more language awareness, they could be expected to be better than Danes at understanding varieties with the same phonetic distance to their native variety. Gooskens and Heeringa (2014) set up an investigation to get an answer to the question of whether Norwegians are indeed better at understanding Nordic varieties (Danish, Faroese, Icelandic, Norwegian, and Swedish language varieties, see Figure 6.4) than Danes when influence of the phonetic distances between their own and the neighboring language are neutralized. The results of a sentence translation task involving 18 language varieties showed that Norwegians (from the capital of Oslo) are generally better than Danes (from Lyngby, close to Copenhagen) at understanding Nordic language varieties. While the Danish listeners translated only 39.0% of the words in the 18 language varieties correctly, the Norwegian listeners had 67.8% correct translations. At first glance, this overall result confirms the impression of Scandinavian scholars that Norwegians are better at understanding the neighboring languages. However, a closer look at the relationship between the intelligibility scores and the phonetic distances shows that the Norwegians were not better at understanding the 18 varieties *relative* to the phonetic distances between their own variety and the test varieties than the Danes (see Figure 6.5). If Norwegians indeed have higher language awareness than Danes, they can be expected to at-

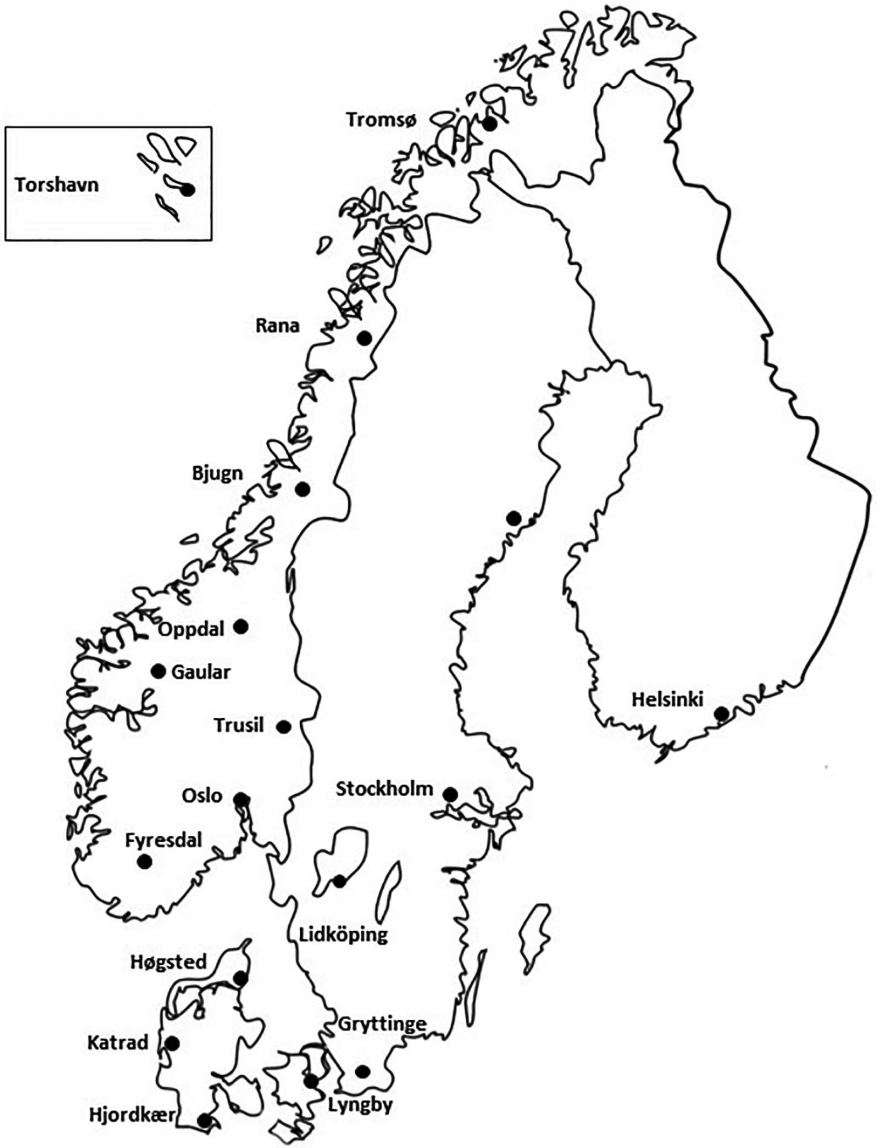

Figure 6.4: The 18 Nordic language varieties in the investigation by Gooskens and Heeringa (2014: 254).

tain higher intelligibility scores in relation to the phonetic distance. This would mean that the Norwegian regression line (blue line in Figure 6.5) would generally be situated to the right of the Danish regression line (red line). However, this is

not the case, and it therefore looks as if the Danes are just as good at breaking the phonetic code as the Norwegians.[20]

The higher intelligibility scores of Norwegian listeners found in previous investigations may be due to the fact that these investigations focused on the intelligibility of the standard languages. Norwegians might have more experience with the

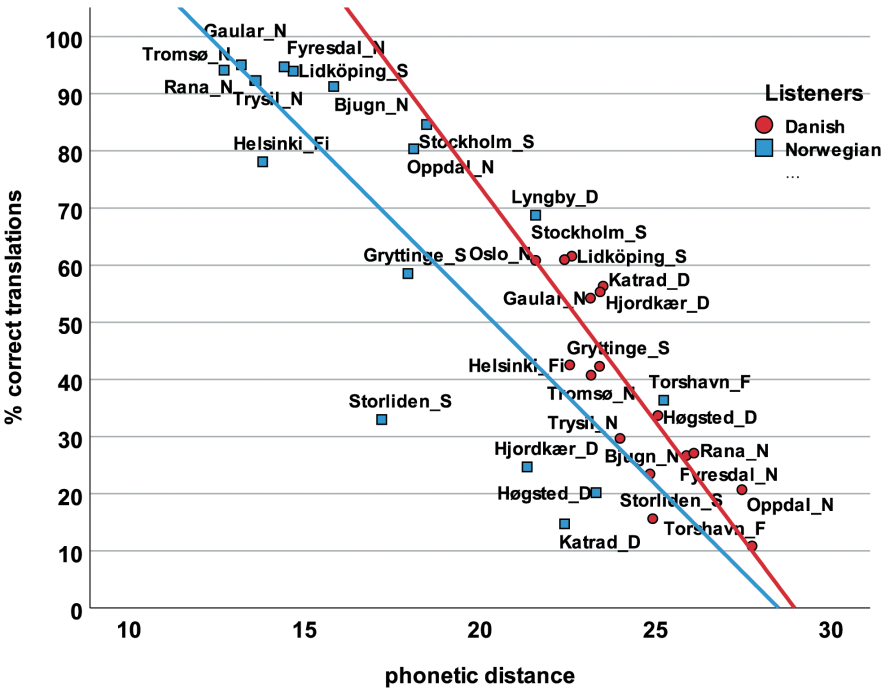

Figure 6.5: Scattergram showing the relationship between phonetic distances to the standard language of the listeners and intelligibility among Danish (red circles, $r = -.86$, $p < .01$) and Norwegian listeners (blue circles, $r = -.82$, $p < .01$). After each dialect is indicated in which country the dialect is spoken (D = Denmark, N = Norway, S = Sweden, F = Faroe Islands, Fi = Finland). Adapted from Gooskens and Heeringa (2014: 262).

20 To test whether the scores for the two listener groups were significantly different, the Norwegian residuals were compared to those of the Danes. The residuals represent the variation in the intelligibility scores that cannot be explained by phonetic distance but is determined by other factors. The results of an independent samples t-test showed that the difference between the Norwegian and the Danish residuals was not significant ($t = 1.353$, $df = 32$, $p = .185$ for all results, $t = 1.621$, $df = 22$, $p = .119$ when excluding results from the country of the listeners and $t = 1.596$, $df = 9$, $p = .149$ when including only results from the country of the listeners).

standard languages than the Danes. Danish movies and television series are popular in Norway, while Danes do not watch Norwegian programs to the same extent. Norwegian has also sometimes been referred to as "the language in the middle". Results of phonetic (Levenshtein) distance measurements between two Norwegian, two Danish, two Swedish, and two Finland Swedish varieties showed that the mean distance from the Norwegian varieties to all other Scandinavian varieties was smaller than the distances from the Swedish and the Danish varieties (Gooskens 2007). Figure 6.5 shows a similar picture. The distances from "Standard Danish" (represented by the Lyngby variety close to Copenhagen) to the other 17 Scandinavian dialects are all above 20% (see the red circles in Figure 6.5). The distances from "Standard Norwegian" (represented by the Oslo variety) are often lower (blue circles). These smaller phonetic distances probably make it easier for Norwegians to understand Scandinavian varieties than for Danes and Swedes. It is also possible that the Norwegian listeners in the investigation by Gooskens and Heeringa (2014) had less language awareness than Norwegians in general because they were all from Oslo, the capital of Norway. This group of listeners may be less exposed to a large variety of Norwegian dialects than Norwegians from other parts of the country and, therefore, have less language awareness. Recent research has shown that even in Norway, dialects are losing ground and that the Oslo variety is becoming increasingly dominant (Røyneland 2009; Hilton 2010). To test this hypothesis, the intelligibility tests should be repeated with groups of Norwegians with more dialect exposure.

6.2 Linguistic factors causing asymmetric intelligibility

As mentioned in the introduction to this chapter, there is evidence that in some language pairs, asymmetric intelligibility has its origin in linguistic factors. Simons (1979) already noted this, and since then, experimental evidence has been amassed by various researchers. In this section, a number of these investigations are discussed.

As explained in the introduction to Chapter 5, ideally, the influence of extra-linguistic factors must be excluded to investigate the role of linguistic factors in explaining intelligibility. Therefore, asymmetric intelligibility results from the MICReLa project presented in this section are based on measurements of inherent intelligibility. Some of the other investigations also took precautions to exclude the influence of extra-linguistic factors as much as possible.

As noted by Abunasser (2015), distances cannot be asymmetric in a strictly mathematical sense. The distance from language A to language B equals the distance from language B to language A. However, to explain intelligibility, it seems

reasonable to talk about asymmetric distances in a non-mathematical sense. It can be compared to geographic distances. Mathematically, the distance from place A to place B is equal to the distance from place B to place A. However, in real life, the effort that it takes to travel distances is often asymmetric due to one-way roads, going uphill or downhill, different public transportation schedules, congestion, etc. In this chapter, asymmetric distances between languages are referred to in this non-mathematical sense.

6.2.1 Lexical asymmetry

The fact that the lexical distance from language A to language B can be different from the distance from language B to language A can be illustrated with an example. In Table 6.3 (from Golubović 2016), words in five Slavic languages have been aligned to the Croatian word for 'woman' (*žena*). In Slovene, Bulgarian, Czech, and Slovak the words are perfect counterparts, as they are similar in form and share the same meaning. In Polish, the word *żona* means 'wife', but it could still be included because it points the listener in the right direction.

Table 6.3: The word for 'woman' in the target language (Croatian) and the corresponding cognates in five Slavic languages. Adapted from Golubović 2016: 116.

Target language	**Language of listener**				
Croatian	Slovene	Bulgarian	Czech	Slovak	Polish
žena /ˈʒěna/	ženska /ˈʒɛ̀:nska/	Жена /ʒěˈna/	žena /ˈʒɛna/	žena /ˈʒena/	żona /ˈʒɔ̃na/

Table 6.4: The word for 'woman' in the target language (Polish). There is no corresponding cognate in the five Slavic languages. Adapted from Golubović 2016: 116.

Target language	**Language of listener**				
Polish	Croatian	Slovene	Bulgarian	Czech	Slovak
kobieta	–	–	–	–	–

Table 6.4 illustrates the same procedure, only this time with Polish as the target language. The Polish word for 'woman' is *kobieta,* and it does not have a cognate in any of the other five languages.

This example shows that while a word in language A (Croatian *žena*) may have a cognate with a similar meaning in language B (Polish *żona*), the word for the same concept in language B (Polish *kobieta*) may not necessarily have a cognate (with a similar meaning) in language A. This would be the case if language B uses two words for a concept (i.e., synonyms) covered with only one word in language A. By comparing the two examples in Tables 6.3 and 6.4, it is clear that a Polish speaker reading or listening to the word *žena* in Croatian has a general idea of a female person, while a Croatian speaker who has not previously been exposed to Polish would probably understand the word *żona* but would have no clue what *kobieta* might mean (see Figure 6.6). With more cases such as this one, two languages could have an asymmetry in their lexical distance, i.e., language A might share more of language B's vocabulary than vice versa, which in turn might yield asymmetric intelligibility.

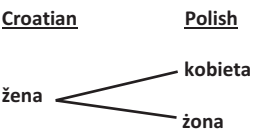

Figure 6.6: Example of language A (Croatian) that has one word žena that corresponds to two different words in language B (Polish) kobieta and żona.

When calculating the lexical distances in the MICReLa project, the words in the texts used for the cloze test in each of the target languages were translated to the corresponding cognates in the languages of the listeners if such cognates existed, in the same way as illustrated in Table 5.1. The lexical distances were expressed as the percentages of non-cognates for each combination of stimulus text in the target language and the corresponding translations in the languages of the listeners. The full matrices of distances can be found in Appendix D (see also Heeringa, Gooskens, and van Heuven 2023). The way the distances were calculated sometimes resulted in different distances from language A to language B and from language B to language A. For example, the lexical distance from Spanish (listener language) to Italian (target language) is 10.4% but larger (14.4%) in the other direction.

To investigate whether asymmetric lexical distances can predict asymmetric inherent intelligibility, the asymmetric inherent intelligibility scores were correlated with the lexical asymmetries (the lexical distances from listener language A to target language B minus the lexical distances from B to A) in the same way as for the exposure and attitude scores in Figures 6.1 and 6.3. The results presented in Figure 6.7 show that lexical asymmetries are weak predictors of asymmetric

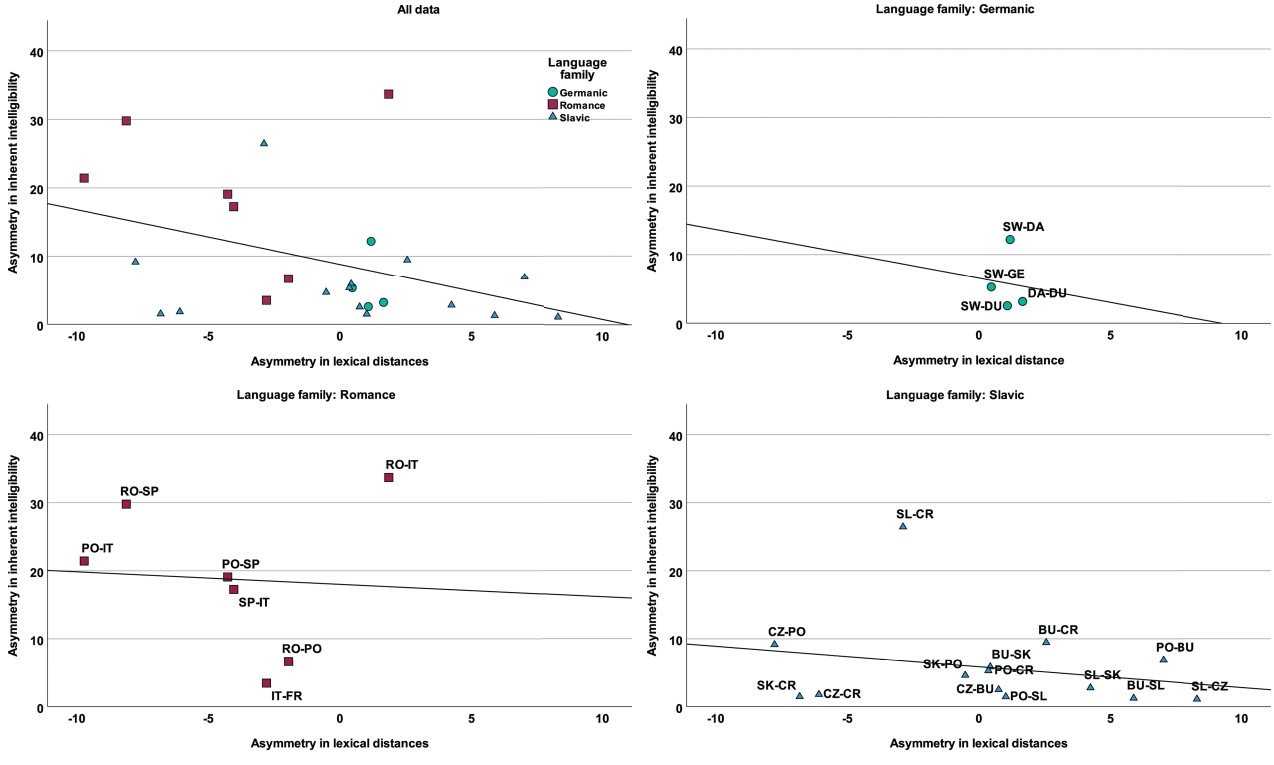

Figure 6.7: Scattergram showing the relationship between the asymmetric inherent intelligibility scores (AB intelligibility score minus BA intelligibility score) and the asymmetric lexical distances (the AB exposure score minus the BA exposure score) for 35 language pairs in the MICReLa project, $r = -.42$, $p < .05$ for all language combinations, $r = -.08$ for Germanic, $r = -.33$ for Romance, and $r = -.23$ for Slavic (all n.s.). For explanations, see Figure 4.2.

inherent intelligibility. In fact, for many languages, there even seems to be a tendency for a positive asymmetric intelligibility to be linked to negative asymmetric lexical distance combinations (the combinations on the left side of the figure). For example, the distance from Spanish to Portuguese is 1.8%, and 6.0% from Portuguese to Spanish. This would predict that Spanish is more difficult for Portuguese speakers to understand than the other way around, but this is not what was found. Portuguese listeners had 54.8% correct answers in the spoken cloze test (see Section 3.2) when tested in Spanish, while the Spanish listeners had an inherent intelligibility score of 35.7%. The weak link between inherent asymmetric intelligibility and asymmetric lexical distances is probably caused by the fact that most asymmetric inherent intelligibility scores are quite low, i.e., a bottom effect, which reduces variability and causes a restricted range effect, resulting in a weakened correlation coefficient. In addition, other linguistic asymmetries may play a more important role, and finally, it is possible that extra-linguistic factors still play a role even if an attempt was made to only include results from participants who had a minimum of previous exposure to the target language (inherent intelligibility).

6.2.2 Phonetic asymmetry

In Section 5.2, it was shown that phonetic distances measured with the Levenshtein algorithm correlate significantly with intelligibility scores. A number of potential improvements and refinements of the algorithm were discussed. Such refinements may not be universal but differ depending on the language combination. For instance, the importance of vowels compared to consonants is likely to depend on the phoneme inventories of the languages involved. Some phonetic characteristics of languages may lead to asymmetric intelligibility between language pairs. This has been argued by a number of researchers. Grimes (1992: 26) assumed that the origin of asymmetric intelligibility between Spanish and Portuguese, as well as between Chinese dialects, can be attributed to certain aspects of phonology. In several more recent investigations, additional evidence has been presented for phonetic differences causing asymmetry.

Gooskens, van Bezooijen, and van Heuven (2015) presented highly frequent Dutch and German cognate nouns to Dutch and German children between 9 and 12 years old. The words were recorded by a balanced bilingual speaker to avoid the influence of different speaker characteristics (see Section 2.1.1.5). The children had no prior knowledge of the target language or any related dialects and held equally neutral attitudes toward the target language. In this way, language exposure and attitudes were ruled out as factors in the study. The results showed that

the Dutch children had a notably higher comprehension rate (50.2% correct translations) for the German cognates than the German children had for the Dutch cognates (41.9%). Since the relevant extra-linguistic factors had been excluded, the asymmetry could be attributed to linguistic factors. An examination of the 16 cognate pairs with a mean asymmetric intelligibility score greater than 20% revealed that phonetic detail and asymmetric perception of corresponding sounds played a significant role in explaining the asymmetry. For instance, the Dutch children made only a few mistakes interpreting German *Zeit* /tsait/ 'time' while the Dutch equivalent *tijd* /tɛit/ was very difficult for the German children. 89.3% of the Dutch listeners gave the correct response, while only one German child (2.9%) translated the word correctly. Dutch children had no problem relating German /ts/ to Dutch /t/. They probably considered it an allophone of /t/, or they analyzed it as a consonant cluster and disregarded the /s/. Also, they easily linked German /ai/ to Dutch /ɛi/, presumably because in avant-garde Dutch, /ai/ is used as a new form of standard Dutch /ɛi/, so that /ai/ functions as an allophone of /ɛi/ for the Dutch listeners. On the other hand, the German children interpreted Dutch /ɛi/ as /e/ or /ɛ/, presumably because the onset is more open in German. When hearing the initial /t/ in /tɛit/, the German children did not think of /ts/ but mostly translated into words starting with /d/. Dutch /t/ sounds like /d/ to a German listener because of phonetic differences in the realization of Dutch and German /t/. Dutch voiced plosives are prevoiced (negative voice onset time, VOT), whereas their German counterparts have zero VOT. Conversely, German voiceless plosives are aspirated (long positive VOT), whereas their Dutch counterparts are not.

Härmävaara and Gooskens (2019) carried out a similar investigation with adult Finnish and Estonian adult participants with minimal exposure to the neighboring language. They were tested in a word translation task with both written and spoken words. The mutual intelligibility was symmetric in the written mode, but in the spoken mode, Estonian participants translated significantly more words correctly than the Finnish participants. Since the difference between the words in the written and spoken mode is phonetic, this seems to confirm that phonetic characteristics can cause asymmetric intelligibility between related language pairs. A detailed error analysis of the spoken word pairs with asymmetric intelligibility showed that cognate word pairs with fewer syllables in Estonian than in Finnish were harder to recognize for the Finnish listeners than for the Estonian listeners. An example is the word for 'school', which is *koulu* /kou̯lu/ in Finnish and *kool* /koːl/ in Estonian. The results also showed that Finnish listeners have problems with Estonian sounds that do not exist in Finnish, such as the vowel written as *õ* and pronounced as [ɤ], for example, in the word for 'right' (Estonian *õigus*, Finnish *oikeus*). Another difficult sound for Fins is the palatalized *n* in the word for 'hour' (Estonian *tund* /tunʲd̥/, Finnish *tunti* /tunti/). Finnish lacks

the feature palatalization, and therefore, the quality of the nasal is interpreted as a quality of the vowel, resulting in it being perceived as a diphthong (*oi* or *ui*).

As mentioned in Section 5.4.1, Bleses et al. (2008) have shown that Danish children exhibit slower early vocabulary development when compared to children with other native languages, including English and Swedish. Trecca et al. (2021) provide a review of recent work that shows that Danish may be processed differently from other languages, even by adults. In particular, the lenition of consonants and other reduction phenomena, such as schwa assimilation and schwa deletion, would make it difficult to segment words and utterances. This can be illustrated with the sentence *Det er hårdere at årelade* ('it is harder to bleed'). The last three words are pronounced [hɒ:::::lɛˑð], containing one overlong vowel comprising six syllables, which makes it very difficult to segment. This example may be rather extreme, but there are many examples of this vocalization process in Danish.[21] Bleses et al. proposed that the unique features of the Danish language may also contribute to the asymmetric intelligibility between Danish and Swedish.

Schüppert, Hilton, and Gooskens (2016) found experimental evidence that confirmed this hypothesis. They showed that Danish is spoken significantly faster (in terms of the number of canonical syllables per second) than Norwegian and Swedish, resulting in assimilation and reduction phenomena. As explained in Section 5.4.1, their results suggest that a fast speech rate has a larger impact on intelligibility among non-native listeners than unclear articulation; however, both factors still influence intelligibility. Therefore, it can be concluded that these phonetic characteristics of the Danish language are likely to be part of the explanation for the Danish-Swedish asymmetric intelligibility.

In the MICReLa project, Italian and Portuguese listeners with minimal previous exposure to the target language understood Spanish better than vice versa (see inherent intelligibility scores in Appendix B). Jensen (1989) found the same asymmetry (but smaller) for Latin-American Portuguese and Spanish (see Sections 6.1.1 and 6.1.3). The presence of asymmetry even among listeners with minimal exposure to the language implies that there might be inherent characteristics of the Portuguese language itself that pose challenges for individuals with a different Romance language background. Portuguese is characterized by reduced syllables and a rich vowel inventory compared to Spanish. For example, Spanish has only five monophthongs: /i/, /e/, /a/, /o/ and /u/, while Portuguese has nine oral and five nasal monophthongs. This is likely to render Portuguese a more difficult language for Spanish listeners to understand than the other way around. That Portuguese is also more difficult for Italian listeners than vice versa lends further

21 See https://schwa.dk for more examples.

credibility to the suggestion that the linguistic characteristics of Portuguese make it difficult to understand for other Romance speakers.

The investigations discussed above show that differences in sound inventories between language pairs could be at least part of the explanation for the asymmetry found in intelligibility research. Ideally, phonetic distance measurements that aim to model intelligibility should be able to capture such asymmetries. High correlations were found between intelligibility measurements and Levenshtein distances (see Section 5.2). In its basic form, the Levenshtein algorithm cannot be used to explain asymmetry since distances from language A to language B are the same as the distance from B to A. However, in the same way that lexical differences can cause asymmetry if there are two synonyms for a concept in one language and only one word another, phonetic differences may cause asymmetry (see the example in Figure 6.8). A sound in language A may correspond to two different sounds in language B. For instance, both English /e/ (as in *bet*) and /æ/ (as in *bat*) are typically perceived and reproduced as instances of /ɛ/ by Dutch learners of English (e.g., Collins and Mees 1981; Escudero, Simon, and Mitterer 2012: 285). They will match English *bet* and *bat* onto their own word *bed*, which they pronounce as [bɛt] (with final devoicing). Conversely, a native English listener will not know whether a Dutch speaker of English saying [bɛt] means *bet* or *bat* (or even *bed* or *bad*).

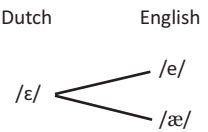

Figure 6.8: Example of phonetic asymmetry. Dutch has one sound /ɛ/ that corresponds to two different sounds in English /e/ and /æ/.

The phonetic complexity scores developed by Cheng (1997, see Section 5.2) for Chinese language varieties result in different scores between AB/BA pairs of languages and predict the corresponding asymmetries in mutual intelligibility. Cheng did not test this prediction experimentally, but Tang and van Heuven (2009) tested mutual intelligibility at the word and sentence level in 15 Chinese languages (see Section 2.2.2.2). In a follow-up analysis (Gooskens and van Heuven 2021), the influence of exposure was excluded to get inherent intelligibility scores by comparing only the nine non-Mandarin (southern) languages in the sample.[22] Correlations between

22 Standard Mandarin (the official language of the People's Republic of China) is known by all listeners, so it serves as a bridge language to all six northern (Mandarin) dialects in the sample.

the asymmetries found in Cheng's complexity scores (the AB score minus the BA score) and the asymmetries found in the word and sentence intelligibility scores by Tang and van Heuven (2009) could be computed in the same way as described for the lexical asymmetries in the MICReLa project (see Section 6.2.1). The correlations were significant (r = .454, p = .003, one-tailed for tests at the word level and r = .331, p = .024, one-tailed at the sentence level). This shows that Cheng's complexity scores reflect the asymmetric intelligibility scores to some degree.

Later investigations have used conditional entropy[23] to account for asymmetric phonetic relations. Conditional entropy measures the complexity of sound mappings and is sensitive to the frequency and regularity of sound correspondences between two languages. Specifically, it measures how predictable a given sound in language A is when mapping it to its corresponding sound in language B. The lower the entropy score, the higher the predictability, and thus, the greater the potential for intelligibility. Therefore, lower entropy scores correspond to higher intelligibility scores. One of the strengths of the entropy measure is that it can be asymmetrical: the conditional entropy between language A and language B may differ from that between language B and language A. This is an advantage compared to the Levenshtein distance, which is symmetrical in its basic form.

In the example in Figure 6.8, an English speaker who encounters an /ɛ/ when listening to a Dutch speaker has two options when trying to find the equivalent phoneme in English cognates. On the other hand, when hearing an /e/ in English, a Dutch speaker can always know that the proper correspondence is /ɛ/. The entropy in this example is, therefore, higher for speakers of English who listen to Dutch than for Dutch speakers who listen to English. Since the algorithm expresses the frequency and regularity of sound correspondences, a substantial amount of data is needed for a reliable measurement. According to Moberg et al. (2007), at least 800 words are required for reliable (stable) entropy measures. More technical details of the algorithm are explained in Frinsel et al. (2015) and Moberg et al. (2007).

To account for the asymmetric intelligibility between Danish, Norwegian, and Swedish, Moberg et al. (2007) calculated conditional entropy in the phoneme mappings for corresponding (cognate) words to express regularity and frequency correspondences in the Scandinavian languages. They measured conditional entropy between Danish, Norwegian, and Swedish based on a corpus of approximately 2200 words per language pair, of which approximately 1900 were cognates with

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Listeners outside the Mandarin part of China are expected to have little knowledge of the remaining nine dialects (except their own).

23 A similar measure is word adaptation surprisal (Stenger, Avgustinova, and Marti 2017; Jágrová et al. 2019).

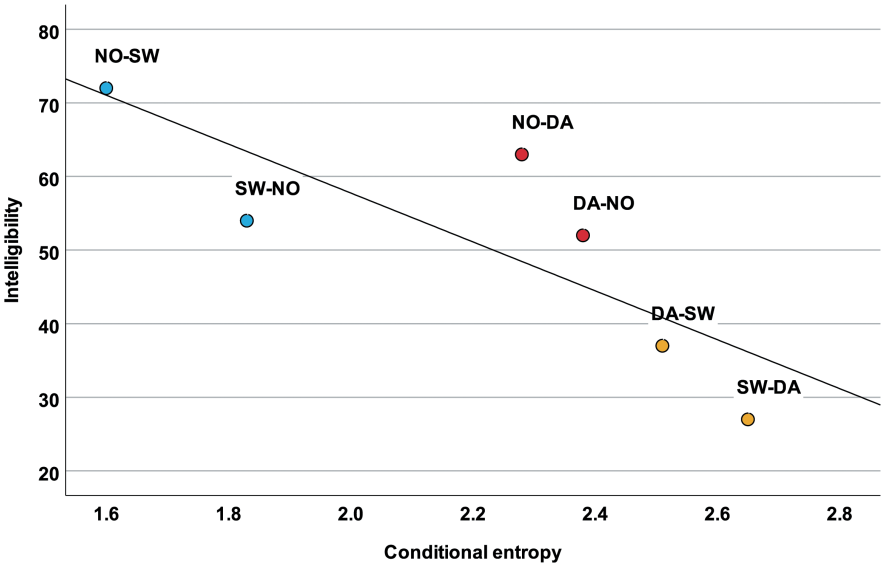

Figure 6.9: Conditional entropies between Danish (Da), Norwegian (No), and Swedish (Sw) in relation to mean percentage correct answers of three spoken intelligibility tests (Maurud 1976; Bø 1978; Delsing and Lundin Åkesson 2005). The first language in each language pair is the language of the listener, the second is the target language. DA = Danish, NO = Norwegian, SW = Swedish. Adapted from Moberg et al. (2007: 14).

each of the neighboring languages. The results are good reflections of the asymmetric intelligibility results found in the literature, $r = -.82$ ($p < .05$). For instance, the entropy was higher for Swedes listening to Danes than the other way around, corresponding to lower intelligibility scores among Swedes listening to Danes than among Danes listening to Swedes (yellow circles in Figure 6.9).

Kyjánek and Haviger (2019) measured entropy between spoken Czech, Slovak and Polish on the basis of almost 7,700 cognate words per language pair. The entropy measurements showed a large asymmetry between Slovaks and Czech, predicting that Slovaks understand Czech better than the other way around. This reflects the general observations that speakers of Slovak understand Czech better than vice versa, which has been a much-debated topic after the breakup of Czechoslovakia (Nábělková 2007). It also confirms the asymmetry found in the MICReLa project for this language combination (see Figure 3.2 and Appendix B). The entropies also predict that Slovaks understand spoken Polish better than vice versa, confirming the MICReLa results as well. Contrary to the MICReLa findings, entropy predicts that Poles understand spoken Czech better than vice versa. However, in the MICReLa results, this asymmetry was small. There is not very exten-

sive sociolinguistic literature on the mutual intelligibility between Czech and Polish and other Slavic language combinations, so it is unclear how well the entropy results reflect observations for these languages.

Conditional entropies reflect asymmetric intelligibility as found in the literature to some degree. Conditional entropy, however, does not measure the actual similarity or distance between two languages. Instead, it measures how predictable (or straightforward) the correspondences are between the members of a particular language pair. A /p/ in one language that always corresponds to a /p/ in another language yields the same amount of entropy as when the /p/ always corresponds to an /f/. However, the latter correspondence may not be obvious for listeners who have never encountered the target language before. Some exposure to the language is necessary for the listeners to discern the patterns in the correspondences. Only then will they get an optimal advantage from low entropy, that is, high regularity. This means that the results of listeners with previous exposure to the target language are expected to show a higher correlation with entropy measures since the listeners may have discovered correspondence rules. On the other hand, listeners with no prior exposure can only recognize words in the target language based on similarities with their native language and on their intuitions of possible sound correspondences.

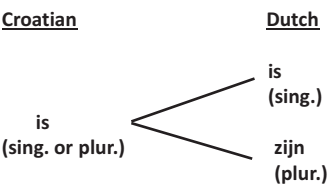

Figure 6.10: Example of language A (Afrikaans) that has one form of the third-person singular and plural of the verb *is* ('to be'), which corresponds to two different forms in language B (Dutch), *is* (third-person singular) and *zijn* (third-person plural).

6.2.3 Morpho-syntactic asymmetry

The investigations summarized in previous sections have demonstrated that asymmetries in lexical and phonetic measures may predict intelligibility asymmetry. In this section, research is presented that shows that morphological or syntactic asymmetries between language pairs may also cause asymmetric intelligibility.

In Gooskens and van Bezooijen (2006), mutual intelligibility between Dutch and Afrikaans was established using written cloze tests based on two newspaper articles. The results suggested that it is easier for Dutch participants to understand

written Afrikaans than for South African participants to understand written Dutch. They showed that in addition to a correct interpretation of the lexical meaning (see Section 5.2), a correct interpretation of the grammatical meaning of a word is necessary for a good understanding of a text (see Section 5.3.1). Figure 6.10 shows an example of asymmetric grammatical transparency that may at least partly be part of the explanation for this asymmetry. The Afrikaans verb *is* is familiar to Dutch readers because they know it from their own language as the third person singular present tense of the verb *zijn* 'to be'. They will not have great trouble understanding the meaning of this word, even in cases where it refers to a plural subject. However, the Dutch form *zijn* is unfamiliar to speakers of Afrikaans, and they may have problems recognizing it as the plural of 'to be'.

As explained in Section 5.3.1, the words in the cloze test were given grammatical transparency ratings between 0 and 2. The results showed a clear asymmetry in grammatical transparency (mean 0.05 for Afrikaans participants reading Dutch texts and 0.29 for Dutch participants reading Afrikaans texts). The asymmetric transparency of the grammatical meaning is caused by the fact that many Dutch words have been preserved in Afrikaans but with a more general grammatical meaning. For example, in Dutch, there are two forms for the first person plural of the personal pronoun, namely *wij* 'we' for the subject and *ons* 'us' for the object. Afrikaans only has *ons* for both cases. Afrikaans *ons* will be familiar to Dutch readers because of its paradigmatic relationship with *wij* in their own language, whereas the South African readers will encounter Dutch *wij,* which has no related form in Afrikaans.

Similarly, the analyses of translation errors made by speakers of the two Kurdish language varieties, Kurmanji and Zazaki, when presented with each other's language (Özek, Sağlam, and Gooskens 2021), provide evidence for the role of morphology in explaining asymmetric intelligibility. Zazaki listeners have an advantage in comprehending certain Kurmanji verbs due to the language struc-

Table 6.5: The target word for 'to die' in Zazaki and Kurmaji with asymmetric percentages correct translations. Between brackets, the verb form in Zazaki that helps Zazaki listeners to understand the Kurmaji target word is shown. Source: Özek, Sağlam, and Gooskens (2021).

	Target language		
	Zazaki	Kurmanji	English
infinitive	*merdış*	*mirin*	'to die'
	2.4%	60.3%	
(3rd person plural progressive)	*(merını)*		

ture of Zazaki, while Kurmanji listeners do not have this advantage when listening to Zazaki. In Zazaki, the infinitives of verbs can be completely different from conjugated forms. As a consequence, the Kurmanji listeners get low scores on these words. On the other hand, the conjugated forms of Zazaki and infinitives of Kurmanji are similar. Therefore Zazaki listeners could infer the meaning of some verbs because the target words were presented in the infinitive. In Table 6.5, an example is provided. The infinitive form of the Zazaki verb 'to die' is *merdış*, while the conjugated form for 3rd person progressive is *merını.* When Zazaki listeners were presented with the infinitive form of the Kurmanji verb *mirin* 'to die', they could understand its meaning (60.3% correct translations) since they associated it with the Zazaki infinitive *merını*. On the other hand, hardly any Kurmanji listeners could understand the Zazaki target word *merdış* (2.4% correct), which is quite different from the Kurmanji equivalent *mirin*.

Härmävaara and Gooskens 2019, see Section 2.2.1.1 and Section 6.2.2) provide examples of word-final elements that Finnish and Estonian listeners confuse with inflectional endings when they hear the words in the neighboring language. The Finnish listeners in the investigation often interpreted the final *-s* in some Estonian words as a marker of the inessive case corresponding to the English preposition 'in' (ending in *-ssa/-ssä* in Finnish, and sometimes shortened to *-s* in spoken language). For instance, the Finnish listeners translated Estonian *kursus* 'course' incorrectly as *korsussa* 'in a dugout' and *kirkossa* 'in a church', and some listeners translated Estonian *kohus* 'court' incorrectly as *kohdussa* 'in uterus', *kohdassa* or *paikassa* 'on a spot' or 'at a place' because they misinterpreted the Estonian *-s* for an inessive case ending. The Finnish listeners also linked the word final *-l* in Estonian and the Finnish adessive case *-lla/-llä* (corresponding to the English preposition 'at'). This ending is often represented in spoken Finnish as *-l*. That can be seen in the incorrect translations of the Estonian stimulus word *nädal* 'week' into *lähellä* 'near' or *täällä* 'here' by many listeners. The Estonian listeners, too, were sometimes guided by the word final elements in their translations (see also Kaivapalu and Martin 2014). For instance, the Finnish nouns ending in *-ma/-mä* that resembles the Estonian infinitive ending *-ma*, e.g., Finnish *elämä* 'life' and *järjestelmä* 'system', were interpreted as verbs in translations like *elama* 'to live' and *järjestama* 'to rank'. However, it seems the Finnish listeners were more often confused, which may be part of the explanation for the Finnish-Estonian asymmetric intelligibility.

Section 5.3.2 showed how the trigram measure can be used to establish syntactic distances. Syntactic distances were measured based on the texts used in the MICReLa project. These distances were measured by manually translating the texts as literally as possible into the other four (or five) languages in the same language family while ensuring that they were still syntactically correct. Therefore, the syntactic distances between the members of a language pair are computed bi-directionally, i.e., from the

original text in language A to its literal translation in B, and from the original text in language B into its literal translation in A. This means that like for the lexical distances (see Section 6.2.1), two different distances per language pair are calculated, which makes it possible to express asymmetric relations.

Asymmetries occur when one language allows more syntactical variants than another. As an example, the English sentence:

The house that he has seen

can be translated into Dutch without changing the word order:

Het huis dat hij heeft gezien

However, the Dutch sentence also has an equivalent with the same meaning but a different word order than in English:

Het huis dat hij gezien heeft

Het huis dat hij gezien heeft cannot be translated into English without changing the word order in the final verb cluster *gezien heeft* into *has seen*.

Heeringa et al. (2018) calculated asymmetric syntactic distances for the Germanic languages in the MICReLa project on the basis of 66 sentences in four cloze tests (see Appendix A). The asymmetries that they found are presented in Figure 6.11. They predict that it is easier for native speakers of Dutch to understand

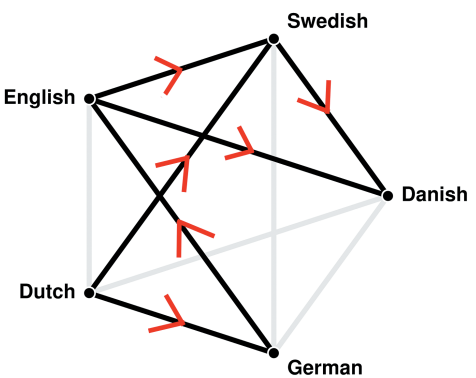

Figure 6.11: Asymmetries in syntactic trigram distance. Asymmetries were established using paired-sample t-tests. An arrow from language A to language B predicts that the native speakers of language A understand language B significantly more easily than native speakers of language B understand language A at the .05 level. Source: Heeringa et al. (2018: 291).

texts in Swedish and German than the other way around. For native speakers of English, it may be easier to understand texts in Swedish and Danish, than the other way around. Swedes may more easily understand Danish texts than Danes understand Swedish texts. Germans may more easily understand English texts than the English understand German texts. Unfortunately, it was not possible to correlate asymmetric intelligibility scores with the asymmetric syntactic scores, as all language combinations involving German or English had too few participants who had not learned the target language in school. Therefore, inherent intelligibility scores were only available in both directions (from A to B and from B to A) for four language combinations. Three of these language combinations had asymmetric intelligibility scores in the predicted direction.

6.3 Conclusions

The investigations presented in this chapter show evidence for the role of various linguistic and extra-linguistic factors in explaining the asymmetric intelligibility observed in some language combinations. Unfortunately, at this point, it is not possible to draw conclusions about which factor is most central. This depends on the socio-political circumstances and linguistic characteristics of the individual language combinations. To investigate the relative importance of the various factors, we need to quantify all factors in such a way that they can be compared in a statistical manner, and the measurements should all be based on the same material. However, the various investigations discussed in this chapter do not all lend themselves to this purpose.

The results from the MICReLa project showed statistical correlations between asymmetric intelligibility and asymmetry in extra-linguistic factors. The highest correlation was found between asymmetric intelligibility scores and asymmetric exposure scores (r = .92, see Figure 6.1). This seems logical as it was already concluded in Section 4.1 that exposure is the most important factor in explaining and predicting intelligibility. Asymmetric attitude scores showed low correlations with asymmetric intelligibility (r = .53 for all language combinations and insignificant correlations for the Romance and Slavic language families; see Figure 6.3). Even though various investigations showed that linguistic factors may also explain asymmetric intelligibility, it was only possible to establish a statistical link with the lexical asymmetries from the MICReLa project (r = −.42, see Figure 6.7).