Chapter 7
Towards a model of mutual intelligibility

The results of various investigations presented in the previous chapters show that we have come a long way in identifying and measuring factors that predict and explain how well speakers of closely related languages understand each other. All the linguistic dimensions presented in Figure 1.1 in the introduction (lexical, phonetic, morpho-syntactic, paralinguistic) show clear relationships with scores from functional intelligibility experiments. In addition, many extra-linguistic factors correlate with intelligibility. Since these various linguistic and extra-linguistic factors interact, it is unclear how much each factor contributes to determining mutual intelligibility. Ideally, a model of intelligibility would be developed that includes all of the relevant factors and shows their relative contribution.

Such a model could help us understand what factors *explain* intelligibility and how these factors interact. By correlating linguistic and extra-linguistic factors with intelligibility scores, we get a better understanding of the factors underlying intelligibility. Such knowledge has many theoretical and practical implications, as discussed in Chapter 8.

The model could also serve to *predict* intelligibility. Intelligibility is usually expressed as a single number (for instance, the percentage of correct answers in one of the intelligibility tests discussed in Chapter 2). However, as has become clear, it can be complicated, time-consuming, and not always feasible to carry out intelligibility tests. It is, therefore, desirable to develop a model of mutual intelligibility that can serve as a shortcut to predict intelligibility. The results of intelligibility tests can be assumed to reflect the totality of both social and linguistic factors that play a role in mutual intelligibility. By understanding the factors that contribute to intelligibility, it is possible to estimate intelligibility relations that cannot feasibly be measured or can only be measured with a large effort. Ultimately, it may even afford a more accurate estimate of intelligibility than intelligibility testing itself because of the many problems with testing. However, until we better understand the factors underlying intelligibility and their interactions, modelling may not actually replace the intelligibility testing approach. At present, the two approaches (functional testing and quantification of relevant factors) complement each other.

It is not a simple undertaking to develop a model of intelligibility. As we have seen, there is a large number of linguistic and extra-linguistic factors that should be taken into consideration when predicting and explaining mutual intelligibility. These factors all need to be quantified to include them in a statistical model. However, even if the most important factors are quantified satisfactorily, there is no

https://doi.org/10.1515/9783111134697-007

a priori way of weighing the different linguistic and extra-linguistic dimensions. The relative weight is different per language combination. It is reasonable to expect lexical distances to be the best predictors of intelligibility. Without word recognition, listeners have no way of understanding a message. For example, Gooskens and Swarte (2017) found a correlation of $r = -.95$ between inherent intelligibility scores, including 20 Germanic language combinations and lexical distances, while the correlation with phonetic distance was non-significant ($r = -.28$). Salehi and Neysani (2017) also found lexical distance to be better predictors of intelligibility of Turkish among Iranian-Azerbaijani speakers than phonetic distance. They explain this finding by the fact that the phonetic distances between Turkish and Azerbaijani are small and highly rule-governed. However, even if listeners know all the words they may not be able to recognize them if they are pronounced very differently from the corresponding words in their own language. For this reason, phonetic distances may also play an important role in predicting and explaining intelligibility. Gooskens, Heeringa, and Beijering (2008, see Example 2.15 in Section 2.2.3.4), correlated lexical and phonetic distances with the intelligibility of 18 Scandinavian language varieties among Danish listeners and found phonetic distance to be a stronger predictor of intelligibility ($r = -.86$) than lexical distance ($r = -.64$). This could be explained by the fact that there is little lexical variation between the Scandinavian languages as explained in Section 5.1.

These findings confirm the assumptions by Mckaughan (1964, summarized in Grimes 1992: 28) that it depends on the degree of divergence between languages which linguistic level best reflects intelligibility. For measuring differences between dialects that are only slightly different, McKaughan argues that methods for measuring distances at the phonetic level are more appropriate. Methods for measuring lexical distances are useful for reflecting mutual intelligibility between languages that are more divergent. Finally, widely divergent languages should be measured by structural measures as well. Therefore, instead of choosing one level for measuring linguistic distances, it would often be preferable to include all levels as predictors of intelligibility.

Within the various linguistic levels, some differences influence intelligibility more than others. To weigh the different linguistic differences, Casad (1974: 121–122) suggests ranking features at different levels in order of importance for predicting intelligibility. For instance, he assumes that phonetic differences between individual segments are less important than supra-segmental differences, such as tone or stress, and that changes in the stem of a word are more important than prefix changes. He notes that the ranking of the features must be validated by correlating with intelligibility scores. The rank order values could then serve as weighting factors. This involves summing up the total number of differences in each feature class in a data set, such as a list of sentences, and multiplying each sum by the appropriate class rank value. However, he notes that sociological factors, such as the kind, degree, and purpose of social interaction, as well as attitudes should also be considered when predicting and explaining mutual intelligibility.

There tends to be interaction between the differences at various linguistic levels. Heeringa, Gooskens, and van Heuven (2023) correlated the lexical, phonetic, and syntactic distance measures from the MICReLa project and found weak but significant correlations. The correlations among the linguistic levels were stronger when they were calculated separately for language pairs within the three language families (Germanic, Romance, and Slavic) than when all 35 language pairs were examined together. Extra-linguistic factors also interact with each other and with linguistic distances. Van Bezooijen (2002) formulated the "intelligibility-driven hypothesis" and the "similarity-driven hypothesis", which state that intelligibility and similarity are both factors that may explain attitudes toward languages. She found that, as dialects are more intelligible and closer to the standard, they receive more favorable aesthetic evaluations. An investigation involving the mainland Scandinavian languages found significant correlations between intelligibility scores on the one hand and phonetic distances ($r = -.81$) and attitudes ($r = .56$) on the other. However, only phonetic distances were included in a stepwise regression analysis with both predictors of intelligibility (Gooskens 2007). The reason that attitude did not add significantly to the prediction of intelligibility is that attitude intercorrelated highly with phonetic distance. The correlation was significant at the 1% level ($r = -.62$). Generally, the listeners were more positive about the neighboring languages if they were phonetically similar to their own variety and less positive if the phonetic distance was larger.

Other previous results show that features sometimes correlate only weakly amongst each other while significantly correlating with intelligibility scores individually and can therefore be assumed to all contribute to the explanation and prediction of intelligibility. For example, Heeringa et al. (2014) measured phonetic stem and affix differences between 20 Germanic language combinations, i.e., all possible pairings (AB and BA) of non-identical languages from the set of Danish, Dutch, English, German, and Swedish in the MICReLa project (see Chapter 3). The two linguistic distance measures (stem and affix) did not correlate significantly; when modelling intelligibility, it is therefore important to be aware of the difference between the two measures (see Section 5.3.1).

It depends on the purpose of the model which factors should be included. Only linguistic factors are relevant if the aim is to model inherent intelligibility. This means that intelligibility should be measured in such a way that extra-linguistic factors are excluded as well as possible, as discussed in Section 4.7. However, if the aim is to make a complete model of actual intelligibility in a particular area, extra-linguistic factors should also be included in the model. Figure 1.1 in Chapter 1 shows an overview of the linguistic and extra-linguistic determinants of intelligibility discussed in this book. The various investigations summarized throughout the book have shown that all the determinants can be relevant for explaining intelligibility results. A possible approach can be illustrated with data from the MICReLa project (see Chapter 3). The following section presents statistical models of general and inherent intelligibility based on measurements from this project.

7.1 Models of intelligibility

In the MICReLa project (see Chapter 3), measurements of linguistic and extra-linguistic determinants were collected to explain the results of functional intelligibility measurements. Three linguistic and three extra-linguistic determinants were quantified (see Figure 7.1). The quantifications of the measurements have been described in various sections of the book. The six determinants have been shown to be important predictors of intelligibility. Tables with the measurements can be found in Appendix C and Appendix D. Morphological, prosodic, and paralinguistic distance measures were not available, and the number of extra-linguistic determinants included was limited to three to keep the experiments within a short time limit.

The following sections present correlations between each determinant and the intelligibility results to assess how well each measure predicts intelligibility. In addition, the correlations between the determinants are included to get an impression of intercorrelations. Based on a regression analysis, a simple statistical model of intelligibility with a limited number of determinants can be developed. First, a model of general intelligibility is developed (Section 7.1.1), including data from all participants. Next, inherent intelligibility is modeled by making a selection of the data (Section 7.1.2).[24] Finally, a model is presented that demonstrates the separate contributions of consonant and vowel substitutions, insertions, and deletions (Section 7.1.3).

24 Similar analyses were presented in Gooskens & van Heuven (2020). This chapter uses a partly different set of explanatory factors and measurements.

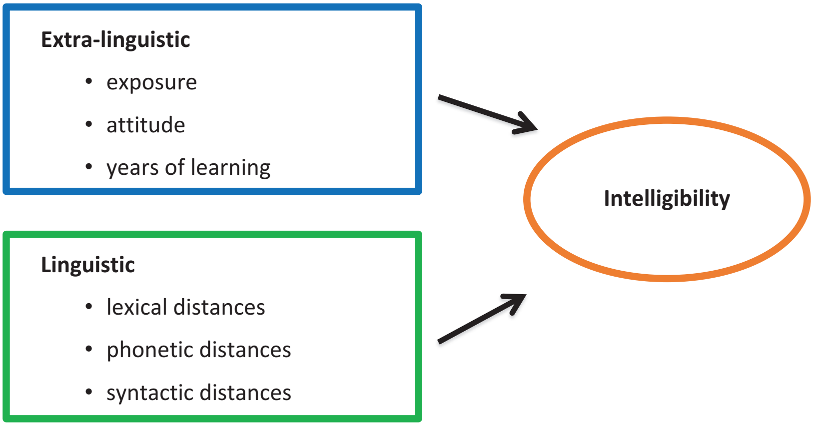

Figure 7.1: Linguistic and extra-linguistic determinants of intelligibility from the MICReLa project included in the statistical model of general intelligibility. In the model of inherent intelligibility, only linguistic determinants are included.

7.1.1 A model of general intelligibility

The model of general intelligibility presented here includes intelligibility scores of all 1833 listeners who participated in the spoken cloze test. Some of the listeners had learned the target language at school or had been exposed to it in other ways to varying degrees, while others had little or no previous exposure to the language. This means that the results reflect inherent and acquired intelligibility to various degrees.

First, the mean intelligibility results of each language combination were correlated with six linguistic and extra-linguistic determinants. The results are presented in Table 7.1. Correlations were calculated including all 70 language combinations and for each language family separately (20 language combinations for Germanic and Romance and 30 for Slavic). Table 7.2 also shows the correlations between linguistic and extra-linguistic determinants since this may help interpret the results of the regression analyses.

The correlations between intelligibility (top row) and exposure are significant and strong, ranging from r = .87 for Romance and .93 for Germanic, and reaching .90 when all language combinations are included. In the Slavic language area, there tends to be little exposure to closely related languages. Still, the correlation between intelligibility and exposure is high in the Slavic area (r = .92) due to three outliers (see Figure 4.2).

Some target languages are school subjects in the Germanic (English and German) and Romance (French) language areas. The correlation between intelligibility and the number of years listeners learned the target language is significant only for the Germanic group (r = .86). As anticipated, the correlation between exposure and years of learning is strong in the Germanic group (r = .92), but weaker in the Romance group (r = .45). This is probably because many Romance listeners learn French at school but have limited exposure to it outside of the classroom (see Appendix C). In the Slavic group, the correlation is not significant, primarily because the Slavic target languages are seldom taught in schools across the six Slavic countries involved.

Attitude shows rather high significant correlations with intelligibility scores (between r = .60 and .81 for the three language families). A strong positive correlation was found between exposure and attitude (ranging from r =.68 to .78). This implies that individuals generally hold more positive attitudes towards languages they are familiar with than to those they are less exposed to. However, the direction of cause and effect is not clear: it could also be that listeners listen to languages that they have positive attitudes towards more often.

Intelligibility in the Slavic language family shows significant correlations with all linguistic distance measures (between r = −.62 and −.85). In the Germanic and the Romance groups, the correlations between intelligibility and linguistic variables are insignificant (except for a low correlation with phonetic distances in the Romance group, r = −.51).

A noteworthy observation is the significant correlation between exposure and linguistic distances within the Slavic language family, ranging from r = −0.63 to −0.82. This suggests that Slavic individuals tend to have more exposure to languages that share similarities with their own language than to those that are linguistically distant. This can be attributed to the geographic proximity of closely related languages. This relationship between exposure and linguistic distances is not significant in the other two language families, except for a low correlation (r = −.45) with phonetic distances in the Romance language family. There are also significant negative correlations between attitude and linguistic determinants in the Slavic language family. The listeners in this family have more exposure and more positive attitudes to languages that are similar to their own language than to more deviant languages.

Table 7.1 also shows that there are many significant correlations among linguistic distances. Lexical distances correlate significantly with both other linguistic distances in all the language families (between r =.41 and .81). Phonetic and syntactic distances correlate significantly in the Romance and Slavic families (r = .59 and .69). See Heeringa, Gooskens, and van Heuven (2023) for more details.

To investigate how well intelligibility scores can be predicted from the six linguistic and extra-linguistic variables, forward stepwise regression analyses were carried out. A regression analysis can reveal the relationship between a depen-

Table 7.1: Correlation coefficients between general intelligibility scores and the six determinants across all 70 language combinations and for the three language families separately (20 Germanic, 20 Romance, and 30 Slavic language combinations).

	Exposure	Learning	Attitude	Lexical	Phonetic	Syntactic
Intelligibility						
All	.90**	.60**	.65**	−.38**	−.40**	−.40**
Germ.	.93**	.86**	.60**	−.21	−.17	−.30
Rom.	.87**	.19	.70**	−.36	−.51*	−.40
Slav.	.92**	–	.81**	−.82**	−.85**	−.62**
Exposure						
All		.76**	.61**	−.18	−.26*	−.31**
Germ.		.92**	.68**	.07	.06	−.25
Rom.		.45*	.78**	−.41	−.45*	−.40
Slav.		–	.78**	−.70**	−.82**	−.63**
Learning						
All			.32**	.19	.18	.04
Germ.			.61**	.30	.21	−.05
Rom.			.34	−.12	.19	.06
Slav.			–	–	–	–
Attitude						
All				−.38**	−.22	−.51**
Germ.				.04	−.03	−.16
Rom.				−.43	−.27	−.41
Slav.				−.69**	−.76**	−.71**
Lexical						
All					.51**	.52**
Germ.					.70**	.47*
Rom.					.48*	.81**
Slav.					.80**	.41*
Phonetic						
All						.26**
Germ.						.11
Rom.						.59**
Slav.						.69**

* $p \leq .05$; ** $p \leq .01$ (two-tailed).

dent variable (here, the mean intelligibility scores per language combination) and independent variables (the six linguistic and extra-linguistic variables presented in Figure 7.1). In the stepwise regression analyses presented in the rest of this chapter, the variable that explains the highest percentage of variance (expressed as the squared multiple correlation coefficient R^2) is presented in the top row. In the following rows, the remaining variables are added one by one, starting with

Table 7.2: Stepwise regression analyses with mean general intelligibility score as the criterion and six linguistic and extra-linguistic predictors.

Language combination	Predictors	R^2	ΔR^2	t	p
All	Exposure	.82		18.962	< .001
	Lexical distance	.87	.05	−4.994	< .001
Germanic	Exposure	.85		2.316	.034
	Lexical distance	.92	.07	−9.130	< .001
	Years of learning	.97	.05	5.740	< .001
Romance	Exposure	.76		7.566	< .001
Slavic	Exposure	.85		8.437	< .001
	Lexical distance	.91	.06	−4.250	< .001

the variable whose inclusion gives the most statistically significant improvement until the percentage of explained variance is no longer improved significantly.

The results of a regression analysis for all language combinations and separately for each of the language families are presented in Table 7.2. As expected, exposure is the most important predictor of intelligibility for all three language families. Lexical distances are also included in Germanic and Slavic models but add little to the predictive power. The Germanic model incorporates the number of years that the listeners have been studying the target language. However, this extra-linguistic variable adds little to the model, likely due to the high intercorrelation with exposure.

It is evident that individuals who acquire a language through exposure or formal education will understand it better than those with limited prior exposure, irrespective of linguistic differences. Hence, exposure supersedes linguistic factors. However, it is also interesting to know how well intelligibility can be predicted from linguistic distances only. Additional analyses were therefore carried out where the extra-linguistic predictors were left out. The results are presented in Table 7.3.

In the case of the Germanic language family, linguistic distances have no predictive power (no predictors are included in the model), as could be expected from the fact that none of the linguistic determinants correlate significantly with intelligibility measures. As discussed above, high intercorrelations between extra-linguistic and linguistic variables were found for the Slavic family (see Table 7.1). This may explain why Slavic linguistic (specifically phonetic and lexical) distances are rather good predictors of intelligibility: R^2 is .77, which means that 77% of the variance is explained by phonetic and lexical distances together. In the Romance language family, 27% of the variance is explained by phonetic distances. Overall, it can be concluded that linguistic distance measurements are generally uncertain predictors of general intelligibility.

Table 7.3: Stepwise regression analyses with mean general intelligibility scores as criterion variable and three linguistic predictors only.

Language combinations	Predictors (distances)	R^2	ΔR^2	t	p
All	Phonetic distance	.16		−2.940	.004
	Syntactic distance	.25	.09	−2.889	.005
Germanic	–	–		–	–
Romance	Phonetic distance	.27		−2.545	.020
Slavic	Phonetic distance	.71		−6.467	.002
	Lexical distance	.77	.06	−2.592	.018

7.1.2 A model of inherent intelligibility

The regression analyses presented in Table 7.3 demonstrate that linguistic distances are not always good predictors of general intelligibility because they are "drowned out" by extra-linguistically determined variance. However, this does not mean that linguistic distances should be ignored as determinants of mutual intelligibility. To predict inherent intelligibility, it makes sense to include linguistic distances only since extra-linguistic factors should not play a role. To assess the predictive power of linguistic distances on inherent intelligibility, it is preferable to establish a correlation between linguistic distances and intelligibility scores from listeners who have had no prior exposure to the target language. This enables us to evaluate how well listeners comprehend the target language based solely on its resemblance to their native language. The predictive power of linguistic distances in determining intelligibility scores is expected to be more pronounced within this subset of listeners devoid of prior exposure to the target language, in contrast to the broader cohort, which includes individuals with previous exposure. As explained in Section 3.1.4, a subset of listeners was chosen based on their self-reported mean exposure ratings of below 2.0 (with 1 for "no exposure") on six five-point scales and on their absence of formal education in the target language. The intelligibility scores of this group are likely to be based mainly (or even exclusively) on the similarity between the listener language and the target language.

The correlations with linguistic distances obtained with the reduced data set are higher than those obtained for the whole data set (compare top rows in Tables 7.1 and 7.4). In the Germanic language family, the correlation with lexical distances has increased significantly, from $r = -.21$ to $-.95$. Likewise, in the Romance language family, the correlation with lexical distances increased substantially, from $r = -.36$ to $-.69$. The correlations with syntactic distances show similar improvements for the Germanic and the Romance language families. The correlations in the Slavic language family were already high when the results from all listeners were included, and they remained high when filtered for exposure and years of learning the language. This is likely because listeners from this language family had limited prior exposure to the target languages, so that exposure played a minor role in determining general intelligibility.

The only insignificant correlation in Table 7.4 is the correlation with phonetic distances in the Germanic language family. The intelligibility scores for Danish-Swedish and Swedish-Danish language pairs stand out as outliers (see Figure 5.5). The listeners in these two language combinations understand each other well owing to the minimal lexical differences between the two languages (a distance of 4.6% for Danish-Swedish and 5.8% for Swedish-Danish, see Figure 5.2 and Appendix D), while in other language combinations, lexical distances are a greater obstacle. Excluding these two language combinations results in a significant correlation with phonetic distance in the Germanic language family as well (an increase from $r = -.53$ to $-.73$, $p < .01$).

Table 7.4: Correlations between inherent intelligibility and three linguistic distances for all 57 language combinations and for the three language families separately.

	Lexical	Phonetic	Syntactic
All	−.76**	−.66**	−.56**
Germ.	−.95**	−.53	−.68**
Rom.	−.69**	−.68**	−.77**
Slav.	−.80**	−.80**	−.52**

* $p \leq .05$; ** $p \leq .01$ (two-tailed).

Table 7.5 presents the results of stepwise regression analyses with the three linguistic variables as independent variables (predictors) and inherent intelligibility scores as the dependent variable (criterion). The results show that a combination of three linguistic distance measurements can predict inherent intelligibility to a relatively high extent. When comparing the results to those of the regression analyses with general intelligibility (Table 7.3), we observe a markedly higher predictive power of the linguistic variables, particularly in the Germanic language family, where lexical distances alone account for 90% of the variance. Given that this pertains to spoken language, we might expect phonetic distances to be a contributing factor. However, as discussed earlier, the correlations between intelligibility and phonetic distances are low in the Germanic language family, mainly due to the Danish-Swedish outliers. In the Slavic family, the percentage of explained variance is also substantial, with phonetic and lexical distances together accounting for 73% of the variance. While the predictive power is high for the Germanic and the Slavic families, the situation is not as straightforward for the Romance family. Surprisingly, syntactic distance is the only variable that needs to be included in the model. This can be explained by intercorrelations between the three linguistic distance measurements (see Table 7.1). For instance, there is a high correlation between syntactic and lexical distances (r = .81). The predictive power of the optimal model is rather low (59%).

Table 7.5: Stepwise regression analyses with mean inherent intelligibility scores per language combination as the criterion and three linguistic distances as predictors.

Languages	Predictors (distances)	R^2	ΔR^2	t	p
All	Lexical distance	.57		−4.743	< .001
	Phonetic distance	.70	.13	−5.154	< .001
	Syntactic distance	.73	.03	−2.290	.026
Germanic	Lexical distance	.90		−10.567	< .001
Romance	Syntactic distance	.59		−4.329	.001
Slavic	Phonetic distance	.65		−2.918	.007
	Lexical distance	.73	.08	−2.805	.009

7.1.3 Consonant and vowel substitutions, insertions and deletions

Section 5.2.1 discussed the nature of edit operations (substitutions, insertions, or deletions) and their contribution to intelligibility. There is evidence that when listeners hear a target word in a closely related language, they first look for a word that differs from the test word in one segment (substitutions) and next for correspondences that have one segment more or one segment less (insertions/deletions) in their native variety. This is explained by the fact that segment insertions or deletions may change the structure of words, while in the case of a substitution, the segmental framework of a word remains unaltered. This effect is likely to be stronger for consonants than for vowels.

To investigate the role of consonant and vowel substitutions and insertion/deletions (indels), a separate analysis was carried out with measurements for vowel indels, consonant indels, vowel substitutions, and consonant substitutions. The measurements were calculated in a similar manner as for the overall measurements. First, the full phonetic strings of the cognate pairs per language combination were aligned to each other using the Levenshtein algorithm (see Section 5.2). Once the optimal alignment was found, the distance was based on the alignment slots in which only the relevant operation was involved, i.e., slots with either vowel indels, consonant indels, vowel substitutions, or consonant substitutions. This distance was divided by the length of the full alignment. In the example in Table 5.2, there are two vowel operations (a substitution and an insertion), one consonant operation (a deletion) and 8 alignment slots. Each operation counts for 1/8 = 0.13 or 13%.

Table 7.6 shows the correlations between intelligibility scores and all four phonetic distances. In the Germanic language family, the distances based on consonant substitutions (Csubst) and vowel substitutions (Vsubst) correlate significantly with intelligibility (r = −.66 and −.65), while insertions/deletions (Vindel

Table 7.6: Correlation coefficients between inherent intelligibility scores and six linguistic predictors for 61 language combinations and for the three language families separately. Vindel = vowel insertions/deletions, Vsubst = vowel substitutions, Cindel = consonant insertions/deletions, Csubst = consonant substitutions.

	Phonetic	Vindel	Vsubst	Cindel	Csubst
Intelligibility					
All	−.66**	−.17	−.34**	−.45**	−.39**
Germ.	−.53	.12	−.66*	−.18	−.65*
Rom.	−.68**	−.37	.03	−.74**	.21
Slav.	−.80**	−.25	−.48**	−.70**	−.51**
Phonetic					
All		.56**	.51**	.74**	.37**
Germ.		.26	.64*	.73**	.29
Rom.		.76**	−.15	.54*	−.23
Slav.		.41*	.65**	.82**	.42*
Vindel					
All			.18	.42**	−.10
Germ.			−.23	.14	−.12
Rom.			−.20	.35	−.55*
Slav.			.31	.22	−.28
Vsubst					
All				.26*	.08
Germ.				.19	.15
Rom.				−.03	.09
Slav.				.36	−.02
Cindel					
All					.30*
Germ.					−.12
Rom.					−.54*
Slav.					.37*

* $p \leq .05$; ** $p \leq .01$ (two-tailed).

and Cindel) do not. On the other hand, consonant indels correlate highly with intelligibility in both the Romance and the Slavic language family (r = −.74 and −.70), and in the Slavic family, vowel and consonant substitutions also show significant correlations with intelligibility (r = −.48 and −.51).

There is generally not a lot of intercorrelation between the four phonetic sublevels. In particular, there are no intercorrelations in the Germanic language family. Therefore, in a stepwise regression analysis (see Table 7.7), all four levels are included in the model for this language family. The explained variance R^2 is very high (94%). It seems counterintuitive that the combination of the four phonetic levels results in such a high percentage of explained variance, while the overall phonetic distances have a lower percentage of explained variance (28%). A closer look at the data shows that there are only a few vowel and consonant substitutions between Swedish and Danish. The small distances and high intelligibility scores for this language combination cause the overall correlations to be very high. When leaving out the language combinations with Swedish and Danish (see the extra rows in Table 7.7*)*, the Germanic and the overall results change considerably. Now only consonant indels remain as predictors.

In the Slavic model, three phonetic levels are included (65% explained variance). In contrast, only consonants indels are included in the Romance model (55%). Importantly, consonant indels are included in all three models, thus confirming the special role of consonants and indels in predicting intelligibility.

Table 7.7: Stepwise regression analyses with mean inherent intelligibility scores per language combination as the criterion and four phonetic distances as predictors.

Languages	**Predictors (distances)**	R^2	ΔR^2	t	p
All	Consonant indel	.20		−2.520	.015
	Consonant substitution	.27	.07	−2.340	.023
	Vowel substitution	.32	.05	−2.034	.047
All without Danish and Swedish	Consonant indel	.35		−5.349	< .001
Germanic	Vowel substitution	.44		−8.379	< .001
	Consonant substitution	.75	.31	−6.642	< .001
	Consonant indel	.86	.11	−4.676	.001
	Vowel indel	.94	.08	3.577	.006
Germanic without Danish and Swedish	Consonant indel	.34		−2.243	.049
Romance	Consonant indel	.55		−3.971	.002
Slavic	Consonant indel	.49		−3.267	.003
	Consonant substitution	.56	.07	−2.720	.012
	Vowel substitution	.65	.09	−2.508	.019

7.2 Conclusions

The statistical models presented in this chapter exemplify how intelligibility modeling can be approached. For several reasons, developing a model that can predict intelligibility perfectly is not realistic at this time. Such a model would have to be highly language-dependent and involve many linguistic and extra-linguistic factors (see Chapters 4 and 5). We have seen that even within the same Indo-European language family, there are large differences in the relative importance of the various determinants of intelligibility. In future research, to make better generalizations about the relative weight of the determinants, it is therefore important to include data from various contexts and from many different languages and language families. Additionally, an improved model may include more factors and subfactors. As discussed in Chapters 4 and 5, the various measurements should also be refined to better predict intelligibility since each determinant can vary in many dimensions.

However, even incomplete models like the ones presented in this chapter can often explain and predict intelligibility to a high degree and may provide valuable insights. They can show us what factors are central in predicting intelligibility and how they intercorrelate, advancing our knowledge of the mechanisms behind intelligibility. They may also be helpful in situations where we need information about intelligibility but where it is not feasible to conduct intelligibility testing.