Contact, attitude and phonetic distance as predictors of inter-Scandinavian communication[1]

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Abstract
L'intelligibilité des trois principales langues scandinaves (le Danois, le Norvégien et le Suédois) a été testée parmi 17 groupes de personnes au Danemark, en Norvège, en Suède et en Finlande. Tous les sujets avaient la langue scandinave de leur pays comme langue maternelle. L'attitude, le contact et les distances phonétiques entre les langues furent utilizes pour établir le pointage. Il en ressort que les distances phonétiques sont les meilleures gages de prédictions de l'intelligibilité de la langue.

1. Introduction

This paper reports on an investigation of the mutual intelligibility of the three mainland Scandinavian languages (Danish, Swedish and Norwegian). These languages are so closely related that the speakers mostly communicate in their own languages. However, this kind of communication sometimes requires a great effort of the speakers (e.g. Maurud 1976, Bø 1978, Börestam 1987). Recently there has been an investigation to research how well people understand each other in the Nordic countries, the project *Internordisk sprogforståelse i en tid med øget internationalisering* ('Inter-Nordic communication in an era of increasing internationalization', hence referred to as the INS-investigation, see Delsing & Lundin Åkesson 2005).[2] In this investigation intelligibility was assessed as well as contact and attitude. I have analyzed a limited set of the INS-results and added extra material myself with the aim of gaining insight into the role of contact, attitude and phonetic distances for the mutual intelligibility between speakers of the three Scandinavian languages.

2. Intelligibility

My investigation pertains to the intelligibility of the three Scandinavian languages among young Scandinavian speaking subjects from nine towns in Denmark, Norway, Sweden and Finland. In this section I will describe the material from the INS-investigation which I used for my investigation.

The grey area in Table 1 shows which groups of subjects and which languages I included. Except for Vaasa (Finland), where no subjects were tested for Danish, the two neighbouring languages[3] were tested in nine towns. Since in each town (except Vaasa) one group of subjects was tested for each neighbouring language, a total of 17 groups were tested. In total there were 690 secondary school pupils between the age of 16 and 19 years. Only those subjects who reported to speak the official Scandinavian language (Danish, Norwegian or Swedish) of the country at home were included. Subjects who spoke more than one language at home were excluded to make sure that the subjects all had a high native competence in the Scandinavian language of the country.[4]

Table 1. *Overview of the number of subjects, per intelligibility test and town (grey area) and total, percentage of boys and girls, and mean age per town. The percentage of boys and girls does not always add up to 100, since not all subjects answered the question about their sex.*

Subjects	Danish test	Norwegian test	Swedish test	Total number of subjects	% boys	% girls	Mean age
Denmark							
Århus	-	33	59	92	43.5	54.4	18.1
Copenhagen	-	62	44	106	28.3	65.1	17.5
Norway							
Bergen	47	-	40	87	51.7	46.0	16.8
Oslo	57	-	84	141	36.2	59.8	16.8
Sweden							
Malmö	44	43	-	87	47.1	46.0	16.9
Stockholm	41	47	-	88	40.9	56.8	16.8
Finland							
Mariehamn	22	25	-	47	40.4	59.6	17.2
Vaasa	-	12	-	12	33.3	66.7	16.4
Helsinki	9	21	-	30	56.7	43.3	16.8
Total	220	243	227	690	41.0	55.3	17.1

To assess the intelligibility of a running spoken text, use was made of a news item which was translated from Norwegian into Danish and Swedish and read aloud by three professional newsreaders who were native speakers of the three standard languages. The mean number of words was 257. Each group of subjects listened to the recording in one of the two neighbouring languages. While listening to the recordings, the subjects wrote down their answers to five open questions about the text. The percentage of correct answers formed the intelligibility score.[5]

In Table 2, mean intelligibility results are given, broken down for town and test language. Mutual intelligibility is highest between Norwegians and Swedes; Danish is hard to understand, especially for Swedish-speaking subjects. Intelligibility is not symmetric. For example, Danes understand Swedish better (45.1% and 50.5% correct answers) than Swedes understand Danish (37.3% and 25.1%). In some cases, the percentage of correct answers differs considerably within one country. For example, the subjects in Mariehamn answered 21.8% of the questions about the Danish recording correctly, while only 6.7% of the questions were answered correctly in Stockholm.

Table 2. *Mean results of the intelligibility test broken down for town and test language.*

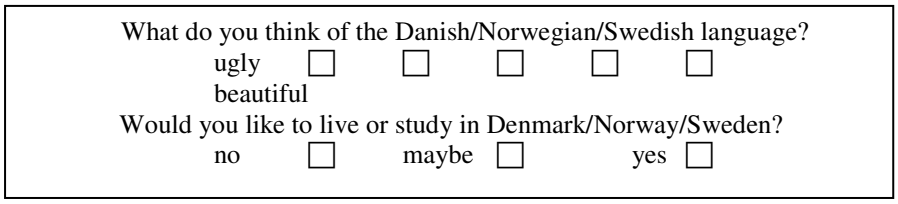
Subjects	Danish test	Norwegian test	Swedish test
Denmark			
Århus	-	55.1	45.1
Copenhagen	-	50.8	50.5
Norway		-	
Bergen	68.5	-	86.5
Oslo	67.2	-	86.9
Sweden			
Malmö	37.3	82.6	-
Stockholm	25.1	83.4	-
Finland			
Mariehamn	21.8	82.0	-
Vaasa	-	86.7	-
Helsinki	6.7	57.1	-
Total	37.8	71.1	67.3

3. Attitude and contact

In the INS-investigation, the subjects were asked questions about their contact with and attitude towards the neighbouring languages. In this section, I will deal with the contact and attitude scores which are relevant for the explanation of the intelligibility results as found in Table 2. It can be expected that a positive attitude will encourage subjects to try and understand the language in question, whereas a negative attitude will discourage subjects from making an effort. Also contact with the language in its written or spoken form is likely to improve the performance on the test.

3.1 Attitude

Two scales had to be filled in by the subjects for each of the neighbouring languages. The first scale, the 'beautiful' scale, is a five-point scale from 1 (least positive) to 4 (most positive). The second scale, the 'live in' scale, is a three-point scale but in the analysis the range of the scale has been changed into a five-point scale (no = 0, maybe = 2, and yes = 4) in order to make it comparable to the first scale.



In Table 3, the mean attitude scores are shown for each town and test language. Within a country, the geographic difference between attitudes can be rather large. Due to lack of space, I will not go into detail about the scores here.

Table 3. *Mean attitude scores (0 = least positive, 4= most positive) broken down for country, town and test language, per attitude question.*

	Danish		Norwegian		Swedish	
Subjects	Live in	Beautiful	Live in	Beautiful	Live in	Beautiful
Denmark						
Århus	-	-	1.15	2.48	0.85	1.85
Copenhagen	-	-	0.65	1.94	1.32	2.00
Norway						
Bergen	1.96	1.46	-	-	1.75	2.55
Oslo	1.79	1.09	-	-	2.05	2.70
Sweden						
Malmö	2.59	0.89	1.95	2.63	-	-
Stockholm	2.00	1.27	2.30	2.09	-	-
Finland						
Mariehamn	1.73	1.13	1.76	2.80	-	-
Vaasa	-	-	3.33	2.92	-	-
Helsinki	2.22	2.33	1.61	2.19	-	-

3.2 Contact

The subjects were asked to fill in four four-point scales from 0 (least often) to 3 (most often) about their contact with each of the neighbouring languages.

I watch Danish/Norwegian/Swedish TV
rarely ☐ once a year ☐ once a month ☐ once a week ☐
I read Danish/Norwegian/Swedish newspapers/magazines
rarely ☐ once a year ☐ once a month ☐ once a week ☐
I meet Danes/Norwegians/Swedes
rarely ☐ once a year ☐ once a month ☐ once a week ☐
I am in Denmark/Norway/Sweden
rarely ☐ once a year ☐ once a month ☐ once a week ☐

In Table 4 the mean contact scores for each town and test language are presented. It becomes clear that young people in Scandinavia in general make little use of the possibilities to have contact with the neighbouring languages. The subjects sometimes watch television from the neighbouring countries. Subjects from Malmö have some personal contact with Danes and also visit Denmark every now and then.

Table 4. *Mean contact scores (0 = least contact, 3 = most contact) broken down for town and test language, per contact question.*

	Danish				Norwegian				Swedish			
Subjects	TV	news-paper	pers. cont.	visit	TV	news-paper	pers. cont.	visit	TV	news-paper	pers. cont.	visit
Denmark												
Århus	-	-	-	-	1.06	.06	.64	.20	1.19	.15	.46	.14
Copenh.	-	-	-	-	.76	.12	.50	.24	1.20	.37	.76	.68
Norway												
Bergen	.81	.38	.66	.38	-	-	-	-	1.10	.22	.53	.20
Oslo	.44	.32	.84	.52	-	-	-	-	1.89	.52	.94	1.12
Sweden												
Malmö	1.66	.33	1.02	1.21	.27	.12	.27	.15	-	-	-	-
Stockh.	.39	.03	.24	.28	.32	.13	.38	.06	-	-	-	-
Finland												
Marieh.	.23	.00	.09	.09	.52	.04	.20	.00	-	-	-	-
Vaasa	-	-	-	-	.42	.33	.25	.00	-	-	-	-
Helsinki	.11	.22	.00	.00	.52	.29	.38	.10	-	-	-	-

4. Phonetic distances

In addition to attitudes and contact, intelligibility is likely to be influenced by the linguistic distance between the languages involved. In order to investigate the importance of pronunciation differences for the intelligibility, I measured the phonetic distances between the language variety of each group of subjects and the three standard languages (corresponding to the 17 mean intelligibility scores in Table 2).[6] For example I wanted to measure how difficult it was for the pupils from Stockholm in Sweden to understand the news item spoken in Danish. Therefore I measured the phonetic distance between the Stockholm variety and Danish as pronounced by the Danish news reader on the tape used for the intelligibility experiment. This means that I had to make new recordings in each of the nine towns.

The texts were spoken onto tape by pupils from the participating schools. The language of these pupils was regarded as representative for the language of the subjects participating in the listening experiment by their teacher and their classmates. They were instructed to read the text aloud in the language variety which they used for daily communication with their class mates. The language of the pupils could in all cases be characterized as a locally coloured accent (regiolect) rather than dialect.

All recordings, the versions read by the newsreaders as well as the version read by pupils from the nine towns, were transcribed phonetically by the same phonetician

and checked by another phonetician. In this way consistent transcriptions were achieved. All recordings were transcribed using the machine-readable phonetic alphabet SAMPA.[7] I wanted to measure the distances between each of 17 combinations of language varieties showed in table 1, for example the distance between the Bergen variety and standard Danish. Therefore, for each combination of language varieties the texts were aligned, i.e. the corresponding words of the texts were placed next to each other. The degree of similarity between word forms was assessed by means of the so-called Levenshtein distance. This is an objective measure which can be calculated automatically by computer. The measure has been used with success to measure dialect distances and to characterize dialect areas (Heeringa 2004). The Levenshtein distances were based on the phonetic transcriptions of the aligned cognate words.[8]

The Levenshtein distance is based upon the minimum number of symbols that need to be inserted, deleted or substituted in order to transform the word in one language into the corresponding word in another language. The fewer operations are needed, the greater the similarity. In the present study insertions and deletions were assigned a cost of 1 point, substitution of identical symbols 0 point, substitutions of a vowel by a vowel or a consonant by a consonant 0.5 point, and substitutions of a vowel by a consonant or of a consonant by a vowel 1 point. Diacritics were joined with the preceding symbol, adding an extra 0.25 point. So, for example the distance between [a] and [a:] was 0.25, that between [a] and [o] 0.5, and that between [o] and [a:] 0.75. The unwanted effect of word length was compensated for by dividing the total sum of costs by the number of symbol alignments.[9] As an example we present the calculation of the distance between the Danish word *trives*, 'thrive', in the pronunciation of Århus and the corresponding standard Swedish word *trivs* from the original recording of the news reader.

alignments	1	2	3	4	5	6	7
Århus	t	R	i		w	ə	s
Swedish	t	r	i	j	ʊ		s
costs	0	0.5	0	1	0.5	1	0

It can be seen that the transformation involved two substitutions of a consonant by another consonant (R by r and w by ʊ), one insertion (j), and one deletion (ə). The sum of costs (0.5 + 1 + 0.5 + 1 = 3) is divided by the number of alignments (7). The result is a distance of 42.9%. The total distance between two language varieties is the mean distance over all word pairs. The maximum score is 100%. In order to make the phonetic scores comparable to the attitude scores and the contact scores, the phonetic distance scores were subtracted from 100. This results in a similarity score rather than a distance score. All scales are now expected to have a positive correlation with intelligibility scores. A positive attitude, much contact and phonetic similarity are factors which can be assumed to contribute to a higher level of understanding of a closely related language.

Table 5 shows the phonetic similarity between the language varieties of the subjects and the three Scandinavian standard languages. Clearly, standard Norwegian is the language in the middle. It is most similar to both the Swedish and the Danish language varieties. The smallest similarity is found between standard Danish and Swedish varieties. In contrast with the attitude scores and the contact scores the

differences within one country are not large. This is what could be expected, since the subjects all spoke a regiolect rather than the local dialect.

Table 5. *Phonetic similarity between the varieties spoken in nine Scandinavian towns and the three Scandinavian standard languages.*

Subjects	Danish	Norwegian	Swedish
Denmark			
Århus	-	78.0	71.2
Copenhagen	-	79.3	71.6
Norway		-	
Bergen	76.2	-	76.8
Oslo	76.9	-	78.1
Sweden			
Malmö	69.3	76.7	-
Stockholm	68.6	77.9	-
Finland			
Mariehamn	68.5	79.3	-
Vaasa	69.4	78.5	-
Helsinki	69.8	78.4	-

5. Predictors of intelligibility

In this Section, we will investigate to what extent the extra-linguistic factors (contact and attitude) and the linguistic factor (phonetic similarity) can predict the results of the intelligibility tests. First, the intelligibility scores (the dependent variable) will be correlated with the different extra-linguistic and linguistic factors (the independent variables). Factors which show a significant correlation with intelligibility will then be included in a multiple regression analysis in order to investigate which combination of factors leads to the best prediction of intelligibility.

5.1 Single correlation between intelligibility scores and predicting factors

The results of the intelligibility tests, i.e. the mean results per town and test language (see Table 2), were correlated with the corresponding attitude scores (Table 3), contact scores (Table 4) and phonetic similarity scores (Table 5). The correlation coefficients and the corresponding *p*-values are presented in Table 6.

Table 6. *Correlation coefficients between intelligibility scores and the predicting factors, * = significant at the .05 level and ** = significant at the .01 level (df=16).*

Scales	*r*	*p*
attitude		
live in	.20	.45
beautiful	.56	.02*
contact		
TV	.18	.49
newspapers	.30	.24
personal contact	.27	.30
visit	.02	.94
phonetic similarity	.81	.00**

The correlation between intelligibility scores and attitude scores is low and not significant for the scale 'live in' (r=.20, p=.45). The correlation with the other attitude scale, 'beautiful' is significant at the .05 level (r=.56, p=.02). Unfortunately, a correlational analysis does not give any information about cause and effect. It is possible that the subjects tend to make a greater effort understanding a language which

they find beautiful, but is could also be the case that they find languages which are easy to understand beautiful. Furthermore, there could be one or more intervening variables. In Section 5.2, I will return to this point.

As far as the contact scores are concerned, the highest correlations are found for the scales 'newspapers' (r=.30) and 'personal contact' (r=.27). However, none of the correlations are significant. This is probably due to the fact that there was very little contact in the first place (see Table 4). Furthermore, the contact which had taken place may not be of such a nature that it would improve the passive understanding of the neighbouring languages. Swedish television programs broadcasted in Denmark, for example, are almost always subtitled. It is possible to receive Swedish television in Denmark, but many programs are in English. Personal contact can be very sporadic and Scandinavians sometimes communicate in English.

The correlation with the phonetic similarity scores is higher than the correlation with the extra-linguistic factors and the correlation is significant at the .01 level (r=.81, p>.00), so there is a clear relationship between phonetic similarity and intelligibility. In contrast with the attitude scores, phonetic similarity is likely to be the predictor of intelligibility and not the other way round since phonetic similarity is not expected to be influenced by intelligibility. So in this case there is less doubt about the direction of the possible effect.

5.2 Multiple linear regression analysis

Because phonetic similarity correlates most strongly with the intelligibility scores, it is likely to be the most important factor for a successful understanding. However, the correlation with the attitude scale 'beautiful' was also significant though less high than with phonetic similarity. In order to investigate whether attitude still has a significant additional contribution to the understanding, a multiple regression analysis was performed. The intelligibility scores are the dependent variables and the scores on the scale 'beautiful' and the phonetic similarity scores are the independent variables.

In Table 7, the outcomes of the regression analysis are presented. As expected, the analysis found phonetic similarity to be the main predictor. Attitude does not contribute significantly and was therefore excluded by the procedure. This means that in this study, attitude does not play a significant role for the explanation of the intelligibility scores. A combination of attitude scores and phonetic similarity scores is not a better predictor of intelligibility than phonetic similarity alone. Still, correlation between phonetic similarity and intelligibility is not perfect. Phonetic distance only explains 66% of the variance (r^2). Part of the remaining variance may be explained by noise, but it is also possible that at higher correlation will be achieved if linguistic distance is calculated in a more detailed way, including for example lexical distance.

Table 7. *Results of multiple regression analysis, where intelligibility scores are the dependent variable and phonetic similarity and attitude scores on the scale 'beautiful' are the independent variables.*

Independent variables	*r*	*t*	*p*	
phonetic similarity	.81	5,495	.000	included
beautiful	.56	,494	.629	excluded

The reason that attitude does not add to the prediction of intelligibility might be that attitude does in fact correlate highly with phonetic similarity. The correlation is significant at the one percent level (r=.62). The subjects are in general more positive about the neighbouring languages if they are phonetically similar to their own variety

and less positive if the phonetic distance is larger. Therefore it is also reasonable to conclude that the subjects are in general more positive about the neighbouring languages if they understand them well. It is less likely to be the case that they understand varieties well if they are positive toward them.

6. Conclusions

The present investigation has shown that phonetic distances between cognates are good predictors of mutual intelligibility of the three Scandinavian languages. Distances at other linguistic levels, such as for example the lexical level, may of course also play a role. In future research more detailed studies will be carried out into the relationship between linguistic distances and intelligibility by carrying out more refined linguistic measurements on more linguistic levels.

Also attitude scores on a scale from 'beautiful' to 'ugly' correlate significantly with intelligibility scores, but this seems to be due to the fact that there is also a high correlation between attitude and phonetic distances. More detailed studies on the relationship between attitude and intelligibility are planned for the future.

References

Bø, I. (1978). *Ungdom og naboland*. Stavanger: Rogalandsforskning (rapport 4).

Börestam, U. (1987). *Dansk-svensk språkgemenskap på undantag*. Uppsala: Uppsala Universitet.

Delsing, L.-O. & Lundin Åkesson, K. (2005). *Håller språket ihop Norden? En forskningsrapport om ungdomars förståelse av danska, svenska och norska.* Köpenhamn: Nordiska ministerrådet..

Heeringa, Wilbert (2004). *Measuring dialect pronunciation differences using Levenshtein distances.* Groningen: Groningen dissertations in linguistics (Grodil).

Maurud, Ø. (1976). *Nabospråksforståelse i Skandinavia: en undersøkelse om gjensidig forståelse av tale- og skriftspråk i Danmark, Norge og Sverige*. Stockholm: Skandinaviska rådet.

Notes

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[2] See www.nordkontakt.nu for a description of the project and some preliminary results.

[3] 'Neighbouring language' is the translation of the Scandinavian *nabosprog/grann(e)språk* and refers to the two Scandinavian languages spoken in the other Scandinavian countries. For example, the neighbouring languages of a Norwegian person is Swedish and Danish.

[4] An exception was made for bilingual Finnish/Swedish subjects since in this case at least one of the parents can be expected to speak Swedish as a mother tongue. The Finnish subjects all attended schools where Swedish was used as the language of instruction.

[5] In the INS-report (Delsing & Lundin Åkesson 2005) the results are presented as absolute numbers.

[6] In future work, linguistic distances will be calculated at the lexical level as well.

[7] See http://www.phon.ucl.ac.uk/home/sampa/

[8] The phonetic similarity distances were calculated on the basis of the cognates only. It makes no sense to calculate phonetic distances between non-related words by means of the Levenshtein distance since phonetic similarities between non-cognates are purely coincidence.

[9] In Heeringa (2004) a more extensive explanation of the procedure is given and a more advance method is presented where the phonetic distances between the individual sounds are taken into account.