



Why is Danish so difficult to understand for fellow Scandinavians?☆

Anja Schüppert*, Nanna H. Hilton, Charlotte Gooskens

University of Groningen, Center for Language and Cognition Groningen, Postbus 716, 9700AS Groningen, Netherlands

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Abstract

It has consistently been shown that among the three mainland Scandinavian languages, Danish is most difficult to understand for fellow Scandinavians. Recent research suggests that Danish is spoken significantly faster than Norwegian and Swedish. This finding might partly explain the asymmetric intelligibility among Scandinavian languages. However, since fast speech goes hand in hand with a high amount of speech reduction, the question arises whether the high speech rate as such impairs intelligibility, or the high amount of reduction. In this paper we tear apart these two factors by auditorily presenting 168 Norwegian- and Swedish-speaking participants with 50 monotonised nonsense sentences in four conditions (quick and unclear, slow and clear, quick and clear, slow and unclear) in a translation task. Our results suggest that speech rate has a larger impact on the intelligibility of monotonised speech than naturally occurring reduction.

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1. Introduction

In Scandinavia, it has long been the tradition to communicate by relying on mutual intelligibility, i.e. by using one's own native Scandinavian language with speakers of other Scandinavian languages. That means that a speaker of Danish might speak Danish to Norwegians who then reply in Norwegian. Several studies have shown, however, that the three mainland Scandinavian languages are not mutually intelligible to the same extent. Norwegian is the language which is generally the most intelligible to Scandinavians, and Norwegians do better in comprehending their neighbouring languages as well (cf. [Delsing and Lundin-Åkesson, 2005](#)). One of the central explanations has been the fact that the Norwegian lexicon is very similar to the Danish lexicon, a result of Norway having been part of the Danish empire between 1380 and 1814, while Norwegian pronunciation is similar to Swedish pronunciation both on a segmental and on a prosodic level ([Gooskens, 2007](#); [Haugen, 1966](#)).

Lower intelligibility scores are generally found for Danish-Swedish communication, and particularly so for Swedes listening to Danish. Several factors have been suggested to cause this asymmetry. Research by [Delsing and Lundin Åkesson \(2005\)](#), [Maurud \(1976\)](#), [Schüppert and Gooskens \(2011\)](#) and [Schüppert et al. \(2015\)](#) suggest that Danes hold a more positive attitude towards Swedish than vice versa. A widespread belief is that Danes therefore might make a greater effort understanding Swedish, which results in higher intelligibility scores. However, [Gooskens \(2006\)](#) points out that the causal relationship between a positive attitude and higher intelligibility scores is hard to establish. It might also be the case that participants who have fewer difficulties understanding the neighbouring language have a more positive attitude towards this language.

Other suggested explanations for the variation in intelligibility scores within and between Scandinavian countries have been that of geographic proximity and contact frequency. [Gooskens and Hilton \(2013\)](#) find no differences in intelligibility of Danish between Norwegian teenagers living 2000 km from Denmark and those who live close enough (300 km) to frequently visit the country. Nor does [Gooskens \(2006\)](#) report significant correlation coefficients for the amount of personal contact or visits, or contact with the language via television or newspapers, with intelligibility. However, this missing

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* Corresponding author. Tel.: +31 503635850; fax: +31 503635821.

E-mail addresses: a.schueppert@rug.nl (A. Schüppert), n.h.hilton@rug.nl (N.H. Hilton), c.s.gooskens@rug.nl (C. Gooskens).

correlation might be due to the fact that the contact index was generally very low and thereby little variance was observed.

Other factors that previous research has considered in order to establish to which extent they influence mutual intelligibility in Scandinavia are linguistic: Kürschner et al. (2008) indicate that lexico-phonological factors such as word length and neighbourhood density might play a role for successful intelligibility of Danish by Swedes. They also show a significant correlation between phonetic (Levenshtein) distances and intelligibility, earlier established by Gooskens (2007). Hilton et al. (2013) indicate that word order differences between the languages can influence intelligibility levels negatively, but conclude that phonological factors are more crucial to successful comprehension between speakers of Scandinavian languages.

One such phonological factor could be articulation rate (i.e. the number of linguistic entities per time unit such as phonemes, syllables, or words, excluding pauses; cf. Jacewicz et al., 2009; Tsao et al., 2006). Hilton et al. (2011) report that Danish newsreaders speak significantly faster than their colleagues in Norway and Sweden do if syllables per second are measured. Schüppert et al. (2012) confirmed this finding for Danish and Swedish with a different measure, namely words per second. In both studies, the same material from the non-commercial public service radio stations Danmarks Radio (DR), Sveriges Radio (SR) and, for Hilton et al. (2011), Norsk Rikskringkasting (NRK) was used.¹

The findings that Danish is spoken more quickly than Norwegian and Swedish when it is read by professional news readers to a broad public suggests that an increased tempo impairs native speakers' intelligibility of Danish to a lesser extent than native speakers' intelligibility of Norwegian and Swedish. Janse (2004) and Vaughan and Letowski (1997) showed that the process of time-compressing a given speech sample generally impairs intelligibility more than the process of time-extending a given speech sample. Therefore, it seems reasonable to assume that this difference in articulation rate is at least part of the reason why spoken Danish is so difficult to understand for Norwegians and Swedes.

If we have a closer look at what makes fast speech less intelligible, we can identify at least two different factors which are both inter-correlated with a high articulation rate (Bradlow et al., 2003; Ferguson et al., 2010; Ferguson and Quené, 2014; Lam et al., 2012; Picheny et al., 1986; Rosen et al., 2011; Smiljanic and Bradlow, 2005; Smiljanic and Bradlow, 2008). The first factor concerns the speakers: speaking quickly increases the demands on the articulatory apparatus. Hence, the faster the speech, the more likely the speaker is to reduce

specific sound entities such as phonemes or syllables. The second factor is located in the listener: namely the shorter time frame for the decoding of linguistic units, and hence the higher demands on the decoding process.

Firstly, when listening to fast speech, we need to decompose and process the stream of speech sounds more quickly. Several studies have investigated the effect of presentation rate (usually defined as the number of items presented visually or auditorily per minute) in recalling tasks, where participants are confronted with a sequence of words and are asked to recall this sequence as accurately as possible. While Lilienthal et al. (2014), Mackworth (1962) and Tan and Ward (2008) reported that decreasing the presentation rate, and thereby giving participants additional time to rehearse between the presentations of items, improves memory performance, Conrad and Hille (1958) and Posner (1964) showed that memory performance decreases with an increase in presentation rate. Baddeley et al. (1975) report a systematic relationship between memory span (the number of words a person can recall immediately after hearing them) and the duration of the words, such that memory span is equivalent to the number of words which can be read out in approximately two seconds when read at a normal rate. Their data suggest that the articulatory system has a temporally limited capacity. Part of the explanation why a high articulation rate is linked to poor intelligibility might thus be the fact that speech processing partly relies on the working memory capacities and that the demand on the working memory is higher when the information is dense.

Secondly, the role of reduction on intelligibility of speech has been investigated. By reduced speech we mean abbreviated durations of long sounds, use of a smaller vowel space, as well as elision of entire segments (Gahl et al., 2012). Reduction has shown to cause intelligibility difficulties in subjects listening to their native language (e.g. Bond and Moore, 1994; Hazan and Markham, 2004). In his H&H ('hyper'- and 'hypo'-articulation) theory, Lindblom (1990) argues that speakers of any language are constantly balancing between 'hyperspeech', i.e. clear articulation to maximise intelligibility in the listener, and 'hypospeech', i.e. unclear speech to minimise the articulatory effort for the speaker. Generally, these two opposing efforts lead to speech which contains a certain amount of reduction phenomena but is still fairly intelligible to the listener. The amount of reduction in speech depends on factors such as age of the speaker (Guy 1992), gender (Neu, 1980; Wolfram, 1969; Zue and Laferriere, 1979), speaking situation or style (Coupland, 1980; Ernestus et al., 2015; Labov, 1966; Picheny et al., 1986), and also on the rate at which the speech is produced (Ernestus et al., 2015; Fosler-Lussier and Morgan, 1999; Fourakis, 1991; Guy, 1980; Jurafsky et al., 2001; Labov and Cohen, 1967; Labov et al., 1968; Raymond et al., 2006; Wolfram 1969). Due to articulatory restrictions, fast speech generally is less accurately articulated than slow speech.

The aim of the present paper is twofold: (1) We investigate whether the reported difference in articulation rate can partly account for the fact that spoken Danish is so difficult

¹ Since newscasters are often trained in specific professional styles, we do not know whether these findings can be extended conversational speech or other spontaneous speech tasks. However, we are not aware of any cross-linguistic investigation of spontaneous Danish, Norwegian and Swedish. One clear advantage of news readings is that the setting is roughly comparable across all three languages, which can be assumed to be very difficult to achieve for spontaneous speech even if speech samples are recorded specifically for this purpose.

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