

# Multimodal feedback expressions in Danish and Polish spontaneous conversations

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## Abstract

This paper presents a pilot comparative study of feedback head movements and vocal expressions in Danish and Polish naturally occurring video recorded conversations. The conversations involve three well-acquainted participants who talk freely in their homes while eating and drinking. The analysis of the data indicates that the participants use the same types of head and spoken feedback in the two languages. However, the Polish participants express more often feedback multimodally, that is through the two modalities, and they use more repeated multimodal feedback expressions than the Danish participants. Moreover, we found a stronger relation between repeated head movements and repeated speech tokens in the Polish data than in the Danish one. Our data also confirms that there is a correlation between familiarity and feedback frequency and familiarity and repetitiveness of feedback expressions as suggested in preceding studies (Boholm and Allwood 2010, Navarretta and Paggio 2012).

**Keywords:** multimodal communication, multimodal corpora, feedback, comparative analysis

## 1 Introduction

Many factors influence communication, inter alia the cultural and social situation, the communicative setting, the number of participants, their roles and relations (Allwood and Ahlsén 2008). Thus, it is important to investigate the relation between specific multimodal (speech and body) behaviors and the different communicative situations and cultures in which they occur.

While communicating, people are attentive to how their interlocutors react to what they say and, at the same time, they show their attention and provide response to their interlocutors' contributions. The function of giving (backchanneling) or receiving feedback involves both speech and body behaviors, especially head movements which are extremely frequent not only in face to face conversations, but also in interactions where

the interlocutors are not able to see each other (Navarretta and Paggio 2010).

This paper compares the occurrences of multimodal feedback expressions in Danish and Polish video recorded naturally occurring conversations. The multimodal behaviors which we include in our study are head movements and speech. The conversations are comparable under many aspects comprising the number of involved participants, their age, gender and degree of familiarity. Furthermore, the settings of the conversations are similar, and the data have been coded following the same annotation scheme (Allwood et al. 2007) and annotation manual.

In this paper we focus on feedback expressed through speech and head movements in Danish and Polish conversations between three participants who are familiar with each other. We also investigate the repetitiveness of feedback expressions in these two languages, inspired by Boholm and Allwood (2010) who study repeated feedback in Swedish first encounters.

The paper is organized as follows. In section 2 we discuss background literature, and in section 3 we describe the Danish and Polish conversations and their multimodal annotations. In section 4, we present the comparative analysis of the annotated corpora, while in section 5 we account for the use of repeated multimodal feedback expressions in these data. In section 6 we discuss our results. Finally, we conclude in section 7.

## 2 Background

Numerous studies on video recorded conversations in different languages have shown that head movements, and especially nods and shakes, are often related to the communicative function of feedback (Yngve 1970, Maynard 1987, McClave 2000, Cerrato 2007, Paggio and Navarretta 2011a, Truong et al. 2011).

Paggio and Navarretta (2011a) analyze feedback head movements and facial expressions and their

relation to speech in the Danish NOMCO corpus of first encounters which was annotated according to the MUMIN scheme (Allwood et al. 2007). They find that 40% of the occurring head movements and facial expressions are related to feedback in the first encounters. The most frequently occurring visible feedback body behaviors in the Danish data are nods and smiles, but also tilts and forward and backward movements of the head are often related to feedback. Paggio and Navarretta (2011b) apply machine learning to investigate to which extent the various modalities can be used to predict feedback in the same data, and obtain promising results. Navarretta (2011) analyses multimodal feedback in Danish dyadic and triadic naturally occurring conversations. Her analysis confirms that head movements are the body behaviors that are most frequently used to express feedback, but she notices that also facial expressions and body postures often have a feedback function. Also in these data, nods are the most frequently occurring feedback head movement, but also side turns are often related to feedback. Finally, she finds differences in the frequencies of feedback body behaviors between the dyadic and triadic conversations.

Navarretta and Paggio (2012) investigate the effect of familiarity on the expression of verbal and non-verbal feedback in two types of conversations with participants having different degree of familiarity. They find that the degree of familiarity influences feedback body behaviors in those data. They also notice that not only the content of the conversations, but also the physical setting and the number of participants influence feedback behaviors.

For Polish, the only reported study on feedback in speech and gesture is by Malisz and Karpiński (2010). They investigate short verbal responses to instruction givers in an origami folding task. They study one- or two-syllable responses in terms of dialogue acts and intonation and analyse head movements, smiles and hand gestures co-occurring with those verbal expressions. In their data, the responses most frequently have a feedback function. Their analysis also shows that verbal feedback in Polish is often accompanied by head gestures. 90 % of nods in their data are produced with positive feedback expressions: *tak* (yes), *no* (yeah) and *mhm*, while head shakes co-occur with negative responses.

Comparative studies of video recorded first encounters indicate that there are both similarities and dissimilarities in the way different cul-

tures express feedback through speech and especially head movements and facial expressions, inter alia (Rehm et al. 2008, Allwood and Liu 2010, Navarretta et al. 2012). In particular, Rehm et al. (2008) compare Japanese and German first encounters in order to generate culturally adapted software agents. Lu and Allwood (2010) examine the use of feedback multimodal expressions, comprising smiles, in Swedish and Chinese data and find a number of cultural specific differences. Navarretta et al. (2012) compare feedback expressing nods in Danish, Finnish and Swedish and find differences in the frequency of repeated up- and down-nods in these data. They also compare the most frequently occurring feedback speech tokens in Danish and Swedish, which are linguistically closely related, and conclude that the most frequent feedback speech tokens in the two languages correspond to each other.

Boholm and Allwood (2010) analyze repetitiveness of feedback head movements and vocal expressions in Swedish first encounters. They conclude that there is no correlation between repetitiveness in the two modalities. Furthermore, they suggest that familiarity can be a facilitator for repetition, explaining the low frequency of repeated feedback expressions in their data.

Differing from the studies which concern first encounters interactions, the conversations on which we work involve subjects who are well-acquainted. The age of the participants and the physical settings also differ from those in the first encounters. While in the first encounters corpora the participants were students recorded in a studio, our data feature participants over 50 years old recorded during free conversation at home. Similarly to Navarretta et al. (2012), however, we investigate feedback expressing head movements and their co-occurring feedback vocal expressions in comparable data. Here, however, we compare Danish and Polish, which culturally are not very distant, while linguistically they are not as strictly related as Danish and Swedish which were compared in (Navarretta et al. 2012). We also look at the relation between repetitiveness of the feedback expressions in speech and head movements, as Boholm and Allwood (2010), but we analyze this aspect in two languages.

### 3 The Data

In the following, we present the conversations and an overview of the annotations.

### 3.1 The conversations

The study is conducted on comparable video recorded conversations. The first involves three Danish native speakers while the second features three native speakers of Polish. The participants in the study are family members or near friends, thus they have a high degree of familiarity.

The pilot study covers 35 minutes interactions, approx. 17 minutes in each language. The interactions are comparable with regard to several dimensions: the participants are all female, aged 50+, and have similar degree of familiarity.

The social activity and the physical setting are also akin. The participants are video and audio recorded in their private homes while they sit around a table, drink, eat and talk freely about various subjects.

The Danish data were extracted from the MOVIN database (MacWhinney and Wagner 2010) and were orthographically transcribed and multimodally annotated as part of the Danish CLARIN-DK project (Navarretta 2011), while the Polish data were collected, transcribed and annotated under the on-going European CLARA project.

The Danish participants were filmed by one video-camera, and Figure 1 shows a snapshot from these data.



Figure 1: Snapshot from the Danish data

Two cameras were used to record the Polish participants. Snapshots from the Polish conversations are in Figure 2.

The subjects were aware that they were videotaped, but the recording equipment was well incorporated in the space. The recorded Danish conversation is quite long and only the first part of it has been included in the study so that its length is approximately the same as that in the Polish conversation.

### 3.2 The Annotations

Both the Danish and Polish data were orthographically transcribed in PRAAT with word

time stamps. The transcriptions were then imported in ANVIL where head movements were annotated according to the MUMIN scheme (Allwood et al. 2007).



Figure 2: Snapshots from the Polish conversations

This scheme provides predefined features describing the shape and the communicative functions of body behaviors. Furthermore, body behaviors can be linked to words if the annotators judge that they are semantically related. Body behaviors are multi-functional, but in the following we only focus on head movements signaling feedback. Table 1 contains the attribute and value pairs for annotating head movements.

Behavior Attribute	Behavior Value
HeadMovement	Nod, Jerk, HeadBackward, HeadForward, Tilt, SideTurn, Shake, Waggle, HeadOther
HeadRepetition	HeadSingle, HeadRepeated

Table 1: Features for Head Movements

Feedback is annotated via three features inspired by the work of Allwood et al. (1992), who define feedback as an unobtrusive behavior that has the purpose of either signaling or eliciting

signals of contact, perception and understanding. Table 2 shows the features describing the feedback function in the MUMIN scheme.

Behavior Attribute	Behavior Value
FeedbackBasic	CPU, FeedbackOther
FeedbackDirection	FGive, FELicit, FGiveElicit
FeedbackAgreement	FAgree, FDisagree

Table 2: Features describing feedback

Feedback is described by three attributes. The first attribute, FeedbackBasic is used to annotate if there is feedback and whether it involves all three aspects (Contact, Perception and Understanding), or only one or two of them (FeedbackOther). The second attribute, FeedbackDirection, indicates whether the behavior signals that the gesturer is giving or eliciting feedback, or whether the head movements signal both. Finally, the attribute FeedbackAgreement indicates whether the gesturer agrees or disagrees with the interlocutor.

Figure 3 and 4 show snapshots of the Danish and Polish multimodal annotations in ANVIL, respectively.

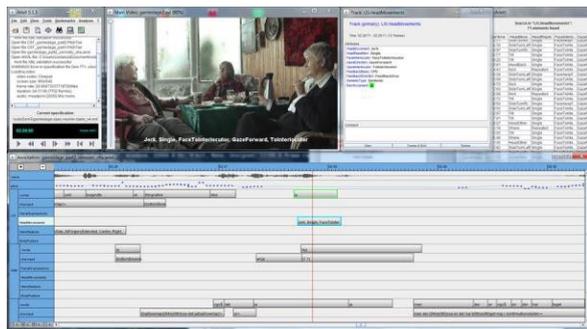


Figure 3: A snapshot of the ANVIL tool with the Danish data

#### 4 Feedback expressions in the Danish and Polish data

In the following, we analyse feedback head movements and speech expressions in the two datasets.

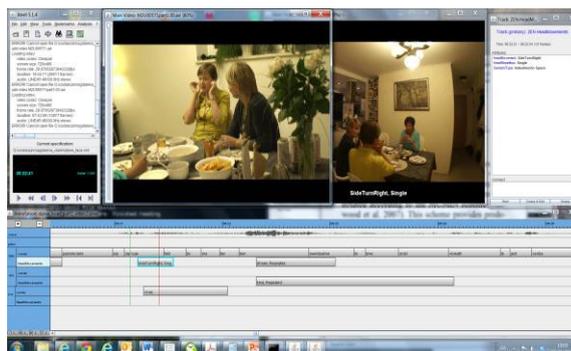


Figure 4: A snapshot of the ANVIL tool with the Polish data

#### 4.1 Head Movements

The study comprises in total 965 head gestures. In the Danish data 476 feedback head movements are recognized, while there are 489 feedback head movements in the Polish data. The most frequently occurring feedback related head movement in both the Polish and Danish conversations is Nod (188 and 196 nods respectively), but other movements such as Tilt and SideTurn are also related to feedback in the conversations. In both the Danish and Polish data there are only 20 feedback shakes.

The occurrences of unimodal feedback head movements, that is head movements which occur without co-speech, and of multimodal head movements is in Table 3.

Feedback	Danish	Polish
Unimodal (head movements)	0.64	0.32
Multimodal (head movements and co-speech)	0.36	0.68

Table 3: Occurrences of uni- and multimodal feedback in Danish and Polish data

In Danish, 36% of the feedback head movements co-occur with speech, and 64% do not, while 68% of the feedback head movements in Polish co-occur with speech and 32% occur alone. Thus, there are much more occurrences of unimodal feedback head movements in the Danish than in the Polish data. The difference in the frequency of occurrence of unimodal and multimodal feedback in the two languages is significant. Significance in the article is measured with unpaired two-tailed t-test and the threshold for significance is  $p$  less than 0.05 while that for slight significance is  $p$  less than 0.1. In the case of unimodal feedback head movements we have

df=6 and  $p=0.00043$ , while for multimodal-feedback df=6 and  $p=0.00045$ .

In the following, we focus on nods and shakes as well as the most frequent verbal expressions with which they co-occur. As Navarretta et al. (2012) we distinguish between two types of nods: down-nods and up-nods.

Table 4 contains the occurrences of feedback nods and shakes per second in the two data sets. The table also specifies the occurrences of single and repeated nods and shakes.

Head Movement	Danish N/sec	Polish N/sec
Nod (Down and Up)	0.196	0.228
Single Nod	0.071	0.052
Repeated Nod	0.125	0.176
Down-nod	0.188	0.192
Down-nod single	0.062	0.046
Down-nod repeated	0.125	0.176
Up-nod	0.008	0.006
Up-nod single	0.008	0.006
Up-nod repeated	0	0
Shake	0.025	0.018
Single shake	0.009	0.005
Repeated shake	0.024	0.013

Table 4: Nods and shakes in the data

As table 4 indicates, the frequency of the category Nod, including Up-Nod and Down-Nod, calculated as movement per second in the two data sets is higher in Polish than in Danish, and the difference is slightly significant (df=9 and  $p=0.07$ ). However, single Nod and Shake are more frequent in Danish than in Polish, while Repeated Nod and Shake are more frequent in Polish. The difference in frequency of single head movements in the two languages is slightly significant (df=9 and  $p=0.0875$ ). Also the difference in frequency of repeated head movement is only slightly significant (df=9 and  $p=0.0793$ ).

In the following analyses, we only consider single and repeated nods since they are the most common feedback head movements in the two corpora, and they are the head movements that were included in preceding studies on repetitiveness (Boholm and Allwood 2010) and feedback in Nordic first encounters (Navarretta et al. (2012) with which we will compare our data.

In Table 5, the percentage of unimodal and multimodal nods in Danish and Polish is given.

	Nods	Unimodal	Multimodal
<b>Danish</b>	Single Nods	0.70	0.3
	Repeated Nods	0.52	0.48
<b>Polish</b>	Single Nods	0.63	0.37
	Repeated Nods	0.34	0.66

Table 5: Unimodal and Multimodal Nods in Danish and Polish

Nearly two third of single nods and over half of the repeated nods are unimodal in the Danish, while most of the single nods are unimodal, and most of the repeated nods are multimodal in the Polish data. Thus, repeated nods are more often multimodal in Polish than in Danish and the difference is significant (df=6,  $p=0.039$ ).

## 4.2 Feedback words

The verbal expressions with which nods co-occur most frequently in the two datasets are ‘yes’ expressions. In Polish they are: *tak* (yes), *no* (yah) and *aha* (yah) as well as *mm*, while in Danish they comprise *ja*, *jo* (yes), *jamen* (certainly) and *hmm*.

Shakes mostly co-occur with ‘no’ expressions (Polish *nie* and Danish *nej*) and with utterances containing negations, such as Polish and Danish equivalents of ‘I don’t know’, ‘I don’t remember’.

## 5 The repetitiveness study

In the following, we present our study of repetitiveness of feedback nods and co-speech.

### 5.1 Single and repeated feedback in Polish

Table 6 shows the types of speech tokens which co-occur with the single and repeated multimodal nods in the Polish conversations.

The data indicate that 62% of the occurrences of multimodal Single Nod in Polish co-occur with single tokens, and out of these under 0.3% co-occur with the quasi-word “mhm”. 35% of the multimodal single nods co-occur with more non-feedback words, and only 3% of them co-occur with repeated feedback words.

	Single feedback speech tokens	Repeated feedback speech tokens	Multiple non-feedback speech tokens
Single Nods	0.62	0.03	0.35
Repeated Nods	0.15	0.8	0.05

Table 6: Nods co-occurring with speech in Polish data

Out of the multimodal Repeated Nod occurrences, 15% co-occur with single feedback words, and out of these 16% co-occur with prolonged quasi-words such as “mhm”. 80% of the repeated nods are related to repeated feedback speech tokens, and 5% are related to more non-feedback words. The vast majority of the occurrences of Repeated Nod co-occur with repeated ‘yes’ expressions, such as *tak tak tak*, *no no* and their combinations, e.g. *tak no no*.

## 5.2 Single and repeated feedback in Danish

Table 7 shows the types of speech tokens which co-occur with the single and repeated multimodal nods in these data.

	Single feedback speech token	Repeated feedback speech tokens	More non-repeated speech tokens
Single Nods	0.86	0.003	0.14
Repeated Nods	0.28	0.33	0.39

Table 7: Nods co-occurring with speech in Danish

In the Danish interactions, single ‘yes’ expressions are more frequent than repeated ones. Out of the multimodal feedback single nods, 14% co-occur with more non feedback speech tokens and only 0.3% co-occur with repeated feedback words, and 86% of the multimodal single nods co-occur with single feedback expressions.

More complex is the situation for repeated feedback expressions. Repeated nods co-occur with multiple non-repeated words in 39% of the cases, while 33% of the multimodal repeated nods co-occur with repeated feedback words, and

finally 28% co-occur with single feedback words.

## 5.3 Danish and Polish

The analysis of the Danish and Polish data indicates that the feedback multimodal behavior in the two languages is not the same. The difference between the occurrences of repeated nods with repeated feedback speech tokens and multiple feedback speech tokens in the two languages is significant ( $df=6$  and  $p=0.031$  and  $p=0.002$ , respectively). The difference in frequency of single nods and single or multiple non-repeated speech tokens is also significant ( $df=06$  and  $p=0.049$  and  $0.044$  respectively), while the remaining differences are not significant. Summing up, the Polish participants use significantly more often repeated nods with repeated or multiple feedback words than the Danish participants, and the Danish participants use more often single nods with single speech tokens.

## 6 Discussion

Our study shows similarities between Danish and Polish speakers in terms of the type of feedback head movements and spoken expressions. The most common feedback head movements are nods, but also shakes, tilts and side turns are used to express feedback. Furthermore, feedback head movements co-occur with similar feedback speech tokens in the two datasets. Our analysis confirms the findings of preceding monolingual studies on Danish and Polish (Paggio and Navarretta 2011a, Malisz and Karpiński 2010), as well as studies of feedback on other languages (e.g., Lu and Allwood 2010), Navarretta et al. 2012, Rehm et al. 2008).

The frequency of feedback head movements is nearly the same for Danish and Polish speakers, but the Polish participants nodded more than the Danish ones. Given that the Polish nods are often repeated increases the difference between the two languages indicating that the Polish participants gave more body feedback in these data than the Danish participants. In general, the frequency of feedback head movements in both the Danish and Polish data is higher than in first encounters data reported in Navarretta et al. (2012). This is in accordance with the results in the study by Navarretta and Paggio (2012), who found that head gestures rate increases with familiarity and who compared this effect to the increase in speech flow among well-acquainted subjects (Campbell 2007).

Our analysis also shows a clear difference between Danish and Polish speakers in the occurrence of unimodal and multimodal feedback expressions. Overall, in the Danish interactions most feedback head movements are unimodal, while in Polish they more often co-occur with speech. While in both languages single nods are usually not accompanied by spoken feedback, the repeated nods are multimodal in Polish more often than in Danish. Differences in terms of uni- and multimodality of feedback expressions were observed for Swedes and Chinese by Lu and Allwood (2010). In the first encounters, although both groups gave multimodal feedback much more often than non-verbal unimodal one, the Swedes used gestural unimodal feedback twice as often as did the Chinese. It should be tested further whether this is a general characteristic of the different languages or it depends on other factors, such as the content of the conversations.

In both Danish and Polish data single nods co-occur most often with single words. While for Danish there is no clear-cut pattern for repeated nods in these data, for Polish repetitiveness in nodding co-occurs with repetitiveness of feedback words. Our data also show that in Polish repeated multimodal feedback expressions are more frequent than in Danish even though the degree of familiarity between the participants is the same and despite the fact that there are individual variations in both datasets. This suggests a difference between Danish and Swedish on the one hand and Polish on the other hand.

Overall, repeated feedback nods occur more frequently in our corpora of well-acquainted Danish and Polish speakers than in the first encounters corpora for Danish, Finnish and Swedish (Navarretta et al. 2012). The explanation might be that repetition is facilitated by familiarity, as suggested by Boholm and Allwood (2010).

To which extent the differences reported in our study depend on familiarity, the setting, the social activity and age of the participants or on the languages should be investigated further. Since our datasets are small, more data should be analyzed.

## 7 Conclusions

In this study, we compared feedback head movements and spoken tokens in Danish and Polish video recorded conversations between well-acquainted participants.

The analysis of the data indicates both similarities and dissimilarities in the two datasets. The

types of multimodal feedback in the two corpora are similar, but the Polish subjects use more frequently feedback nods than the Danish subjects. There are significantly more repeated and multimodal feedback nods in Polish than in Danish and there is a stronger correlation in Polish between repetitiveness of feedback nods and speech tokens than in Danish. No correlation between feedback repetitiveness of nods and of speech tokens was found in Swedish by Boholm and Allwood (2010).

Finally, our data indicate that the feedback expressed by head movements is more frequent in the Danish and Polish conversations between people who know each other well, than in first encounters corpora (Navarretta et al. 2012), confirming preceding studies (Navarretta and Paggio 2012) which suggest that the level of familiarity influences the frequency of feedback expression.

Since our corpora are small and regard only one communicative situation, the results of our analysis should be tested on more data and on more types of conversation.

In future, we will also investigate to which extent the differences between uses of single and repeated feedback behaviors are language related or are connected to familiarity as hypothesized by Boholm and Allwood (2010).

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