

Nodding in Estonian First Encounters

Dage Särg

Institute of Estonian and General Linguistics
University of Tartu
Estonia
dage@ut.ee

Kristiina Jokinen

Department of Computer Science
University of Tartu
Estonia
kjokinen@ut.ee

Abstract

This paper discusses nodding as one of the most significant means of feedback signalling in human conversations. It focuses on nodding in Estonian first encounter conversations, and compares nodding with similar feedback behaviour in Finnish, Swedish and Danish. Different types of nods (up-nods and down-nods, one-way, single and repeated nods) are discussed in terms of frequency, durations and variations between individuals and genders.

1 Introduction

Feedback has a central role in human communication, enabling the speakers to understand each other, to build a shared context, and to connect with each other emotionally. In natural conversations, participants have different goals that they aim to achieve more or less consciously (e.g. exchange information, perform a task, learn to know each other, keep communicative channel open) and feedback is a means of monitoring and facilitating the progress of these goals, by acknowledging the partner's contributions and showing interest and willingness to continue the conversation. The conversational model by Clark and Schaefer (1989) introduces feedback as part of the grounding process whereby the participants present information and accept it through a continuing process of presentation-acceptance cycle. In dialogue management, grounding – establishing common ground – has been modelled via specific grounding actions which the agent can plan as part of the dialogue progressing (cf. original idea in Traum 1999), or it has been assumed to take place as a side-effect of the agent planning how to react in the dialogue situation, using conversational principles and rationality considerations (cf. Jokinen 1996).

Feedback can be signalled in several ways, using various verbal and non-verbal means. It can consist of short linguistic morphemes like “ok”, “fine”, or backchannelling vocalisations like “hmm”, “uhm”, or some form of multimodal gesturing, facial expressions, head movements, body posture, etc. Often more than one modality is used simultaneously to give feedback, e.g. feedback combines both verbal and non-verbal forms such as head nodding while saying “yeah”. Much research exists about the various aspects of feedback, its timing, form and function in the interaction in general (Allwood, Nivre, Ahlsén 1990; Allwood et al. 2008; Toivio and Jokinen 2012). Recently feedback has been studied especially in the context of multimodal communication, based on the holistic view of communication, as well as in different cultural and technological contexts. For instance, Navarretta et al. (2012) compared nodding in the three Nordic countries, while Nunn and Tamura (2003) studied nodding behaviour of Japanese and foreign students in intercultural communication context.

The aim of this paper is to study nodding as a feedback signal in Estonian first encounter dialogues, and also to compare and contrast the Estonian data with the results reported in Navarretta et al. (2012) on Danish, Swedish and Finnish data. Since the activity type is the same in all data (first encounter dialogues), it is easier to compare nodding behaviour in the four languages. Moreover, it is interesting to study nodding in the neighbouring countries which share geographical closeness and are linguistically related such as Finnish and Estonian. We assume that feedback is expressed in a language specific manner and interpreted through learnt cultural contexts, so it is not a straightforward conversational

action, but forms complicated behaviour patterns even in closely related cultures like the Nordic countries. Thus comparison of different feedback strategies in different cultural contexts and among different speakers does not only contribute to the research on feedback functions in different communicative contexts, but also to a deeper understanding of human interaction in general.

The rest of the paper is structured as follows. Section 2 gives a brief review of nodding in general. Section 3 describes the data used for the present study, and Section 4 discusses the annotation of the data. Section 5 presents the results of nodding frequency received on the Estonian data, Section 6 brings out the interpersonal variations in nodding, and Section 7 regards the duration of different types of nods in Estonian. Finally, Section 8 compares and contrasts the Estonian results with the results received by Navarretta et al. (2012).

2 Review of nodding

As already mentioned, feedback is crucial in smooth communication. Nodding can be regarded as one of the conversational signals universally inherent to humans although it should also be emphasised that the interpretation of head nods is culture-specific. Even though in many cultures (including Estonian), nodding serves as a sign of agreement, this is not universal. For instance, Andonova and Taylor (2012) describe that the similar nodding behaviour is interpreted as negative agreement in Bulgaria. However, nodding is one of the main ways to give feedback. For instance, Navarretta et al. (2012) found that nodding is the most common communicative signal among the various head gestures, while Knapp and Hall (1997) regard head nodding as the “primary non-verbal signals” in back-channelling. In automatic agents and social robotics, it is also common to enable the agent to provide feedback to the user by nodding (e.g. Jokinen and Wilcock, 2013).

Nodding is an intuitively clear means of communication but like many other gestures, nodding can serve different purposes. As already discussed, nodding is the main means to provide feedback to the partner concerning if the communication is successful or not. It can also be used to manage turns in conversations, e.g. to indicate the next speaker explicitly, and it can be used in sequencing turns, i.e. as a speech act, or as a part of a dialogue (Allwood et al. 2008; Poggi et al., 2010).

Nodding features moving one’s head vertically up and/or down, either once or repeatedly. Therefore, nods can also be divided into different types based on the direction that they start with (up-nods with an upward movement and down-nods with a downward movement) and the number of movements performed (single nods with maximum one movement in both directions, repeated nods with more). In MUMIN coding scheme, four types of nods are distinguished: single up-nod, single down-nod, repeated up-nod and repeated down-nod (Navarretta et al. 2012).

The different nodding types can also function differently in the interaction. For instance, Toivio and Jokinen (2012) observed that different types of nods are used in different ways in communication. Their research on Finnish nodding has confirmed their hypothesis: they found that up-nods usually mark the information that is new to the listener, while down-nods signal that the information is already known. Poggi et al. (2010) have explored this topic more thoroughly, describing in detail what kind of nods are used for which purpose in political TV debates in Swiss French. They noticed that backchannelling is indicated by repeated nods in their data.

Considering interactions between human users and future communicating machines in general, such as social robots and embodied conversational agents, it is important to understand multimodal feedback in order to support natural communication. Cassell (2001) discusses how humans use all the opportunities offered by their bodies in conversations, and accordingly, she proposes that when human-computer conversations are designed, the opportunities that come from human bodies have to be taken into account as well, in order to make the conversation feel like a real conversation. This view accords with the notion of affordance discussed in Jokinen (2009), as a property of natural language interactive systems (the notion is an extension of affordance in product design, introduced by Norman (1999)). If an interface or a communication offered by a computer agent is affordable, this means that the agent suggests to the user the natural intuitive ways to communicate by its own behaviour. The agent can also adjust itself to the user’s needs and expectations, and provide useful feedback to the user concerning shared tasks and their completion. The automated agent can also adapt to different user strategies and to different emotional situations (e.g. Cassell 2001; Csabo et al. 2012; Beck et al. 2010).

3 Data

The data used for this paper was collected in the framework of the project MINT (Multimodal Interaction – intercultural and technological aspects of video data collection, analysis, and use), described in Jokinen and (2012). The videos were collected according to the same principles as the NOMCO files (Paggio et al. 2010) and featured encounters with two people who meet for the first time. The purpose of the conversation was to become acquainted with each other and the videos are thus unique situations. The snapshot of one of the videos is in Figure 1.

There are 12 videos that were analysed, and among them there are 4 female-male conversations, 4 female-female conversations and 4 male-male conversations. All the participants are either university students or they already had a university degree.

The lengths of the videos vary from slightly under 5 minutes to almost 7 minutes, and the total duration of the analysed video files is 68 minutes 45 seconds. As for the nods, altogether there are 1342 nods, and the average duration of a nod is 1.29 seconds (i.e. almost 29 minutes of nodding behaviour). The average nodding frequency is 0.16 nods/second (including single and repeated nods).



Figure 1. A snapshot of an Estonian first-encounter video.

4 Annotation

The ELAN software (version 4.6.1) was used to annotate the videos, and the MUMIN annotation scheme (Allwood et al. 2008) was used as a guideline for annotations. The annotation thus followed the one in Navarretta et al. (2012), and the same types of basic nods were distinguished as follows:

1. single up-nod – the person moves their head first upwards and then downwards
2. single down-nod – the person moves their head first downwards and then back upwards
3. repeated up-nod – the person moves their head upwards and downwards several times, starting with an upwards movement
4. repeated down-nod – the person moves their head downwards and upwards several times, starting a downwards movement

In addition, two more single nods were distinguished, since they were present in the videos but did not fit in the description of single up-nod or down-nod. These one-way nods were distinguished from the other single nods and annotated differently:

5. one-way up-nod – the person moves their head upwards but not back downwards
6. one-way down-nod – the person moves their head downwards but not back upwards

In cases 5 and 6, the person of course moves their head up/down but this happens some time later and cannot be considered as part of the up-down nodding feedback; rather it is related to some other function in conversation such as focussing attention back to the speaker.

The annotation was done by the first author and checked by the second author. It must be emphasised that in some cases it is hard to distinguish whether the repeated nod actually begins with a downward or an upward movement, even when watching the video in slow motion. In these cases, the first intuition of the movement direction was used.

5 Frequency of Nods and Gender Variation

The total length of the 12 files was 4125 seconds (doubled to 8250 for calculations as there are two speakers in each file) and there were 1342 annotations altogether. Table 1 shows the nod counts, percentage and time-wise frequencies of the different nod types averaged over time.

Considering nod counts, down-nods (almost 71%) are twice as common as up-nods (29 %) and the most numerous nodding type is a single nod: almost half of all the occurrences (49 %, 661 occurrences of all the occurrences) are single nods, although repeated nods are fairly close (41%, 550 occurrences). Within the down-nods, the difference between single down-nods (48 %, occurred 450 times) and repeated down-nods (45 %, 429 times) is small, but within the up-nods, single up-nods (53 %, 211 occurrences) are almost twice as common as repeated up-nods (31 %, 121 times). One-way nods are the least common ones (10%, 131 occurrences of all occurrences), but there is a significant difference if we compare one-way nods relative to down-nods and up-nods: one-way up-nods are about twice as common among up-nods (16% of type) as one-way down-nods among down-nods (7 % of type).

Considering the nod frequencies (number of nods per second), the tendencies are also clear: single nods are more frequent than repeated ones, down-nods are more than twice as frequent as up-nods, and single down-nods are the most frequent nod type. The difference between single and repeated down-nods is not significant, whereas the difference between single and repeated up-nods is; the single up-nods are almost twice as frequent as repeated up-nods. One-way nods are the least frequent, but compared with the count percentages above, that there is no difference between the frequency of one-way up-nods and one-way down-nods: we now compare the frequency of nods relative to the whole length of the dialogue, not relative to number of up-nods and down-nod types in the dialogue.

		PERCENTAGE		FREQUENCY (n/sec)		
TYPE	COUNT	of all	of type	TOTAL	FEMALE	MALE
ALL NODS	1342	100 %		0.163	0.163	0.162
One-way	131	10 %		0.016	0.016	0.016
Single	661	49 %		0.080	0.079	0.081
Repeated	550	41 %		0.067	0.068	0.065
DOWN-NODS	947	71 %	100 %	0.115	0.107	0.123
One-way	68	5 %	7 %	0.008	0.007	0.010
Single	450	34 %	48 %	0.055	0.049	0.060
Repeated	429	32 %	45 %	0.052	0.051	0.053
UP-NODS	395	29 %	100 %	0.048	0.056	0.039
One-way	63	5 %	16 %	0.008	0.009	0.006
Single	211	16 %	53 %	0.026	0.030	0.021
Repeated	121	9 %	31 %	0.015	0.017	0.012

Table 1. The frequency of different types of nods in Estonian (nods/sec)

Considering the differences between male and female nodding, it can be seen that, on average, the frequencies of female and male nodding are practically the same: the figures differ only in the third decimal place. Indeed, t-tests (two-tail t-tests with two-sample unequal variance) also support this conclusion: none of the differences between male and female nodding frequencies can be considered statistically significant as the p-value always exceeds 0.1.

However, it can be seen in Figure 2 that although men and women seem to use one-way and repeated nods almost at the same frequency, they differ in their use of single down-nods and single up-nods.

Male participants use more down-nods than women, while female participants use more up-nods than men (single and also repeated). Toivio and Jokinen (2012) noticed that in Finnish, down-nods are used to acknowledge information as part of the shared context, i.e. down-nods signal that the presented information is already known to the listener, while up-nods are used when information is new to the listener in the given context, i.e. up-nods contain an element of surprise. If the same hypothesis is applied to Estonian, it can be concluded that women express more frequently than men, that the information is new for them – it may be further assumed that this is because female participants try to be polite and show interest in their partner by indicating that what the partner says is new and interesting information to them, whereas men show politeness by acknowledging the partner's message and indicating that they share the information with the speaker

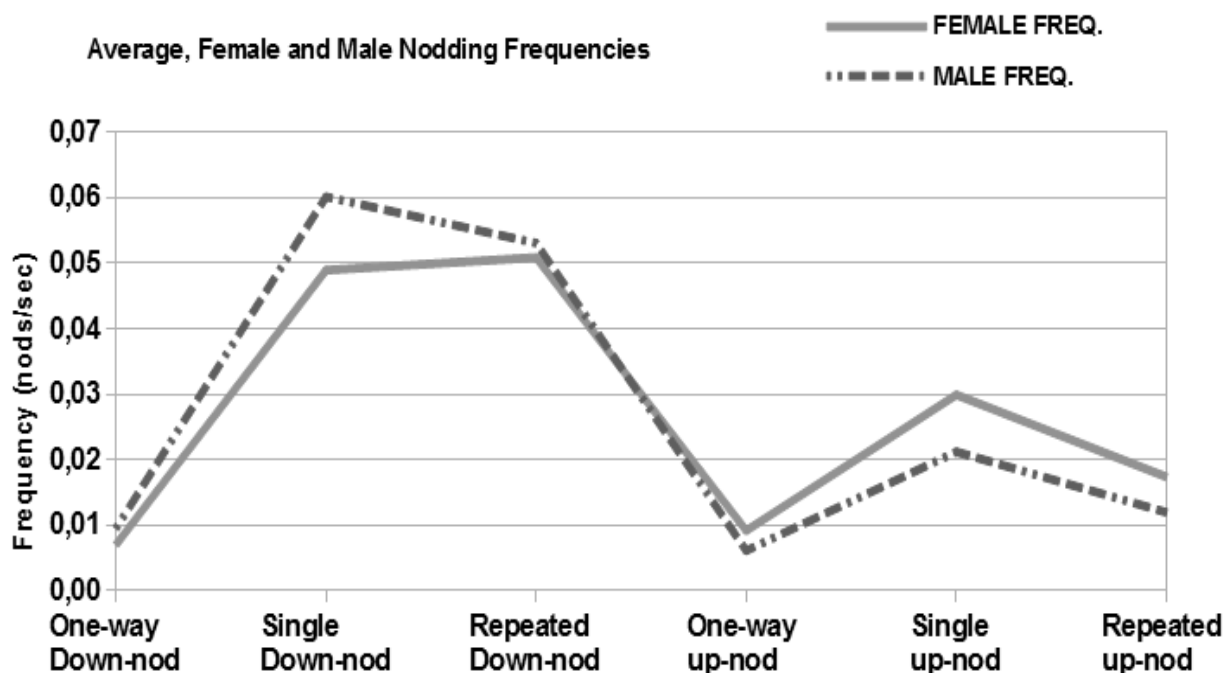


Figure 2: The frequency of different types of nods in Estonian (average, female and male)

6 Interpersonal Variations in Nodding

Navaretta et al. (2012) report on large variation in the nodding behaviour of different persons, and this is true of Estonian speakers, too. Some participants nod in a big and strong manner, so it is easy to recognize their nodding, while others move their head only slightly. Table 2 lists variation in the frequency of nodding by the analysed 18 persons, and large variation can be seen between individual speakers. Some speakers participated in two conversations, and there is also a small difference in their nodding behaviour depending on the partner.

Table 2 shows that the overall variability in nodding frequency is almost 4-fold: the smallest nodding frequency is 0.08 nods/second and the largest is 0.31 nods/second. It is interesting to note that the least frequent nodder (ID4 right) and the most frequent nodder (ID18 left) were both female participants engaged in a female-female conversation. The smallest nodding frequency among male participants is 0.11 nods/second (ID 12 right) and the largest is 0.26 nods/second (ID15 left). The standard deviation of the nodding frequency for male participants is 0.039 nods/second and for female participants 0.069 nods/second, so it can be said that the men's nodding frequency is more constant than that of women's. The nodding frequency in mix gender female-male conversations (IDs 2, 7, 11, 20) varies between 0.13-0.25 nods/second, and both the most and the least frequent noddors in these conversations are female (ID11 left and ID20 left, respectively).

Video ID	PARTICIPANT	GENDER	FREQ		Video ID	PARTICIPANT	GENDER	FREQ
2	left	F	0.23		7	left	M	0.16
	right	M \$	0.17			right	F	0.18
9	left	M \$	0.19		15	left	M	0.26
	right	M	0.19			right	M &	0.13
4	right	F	0.08		16	left	M &	0.15
	left	F #	0.14			right	M	0.13
5	left	F #	0.14		18	left	F	0.31
	right	F	0.09			right	F %	0.12
11	left	F	0.25		19	right	F %	0.14
	right	M □	0.16			left	F £	0.18
12	right	M □	0.11		20	left	F £	0.13
	left	M	0.13			right	M	0.17

Table 2. The participants' frequency of nodding (nods/sec) and their gender. A person participating in two conversations is indicated by the matching symbols after their gender (\$, #, etc.)

Six people participated in two conversations (3 females and 3 males), and these are marked with a matching symbol in Table 2 (e.g. the participant on the left side in the videos 4 and 5 was the same person). We notice that the nodding frequency of these participants is not precisely the same in both conversations, but if compared with the overall variability in the nodding frequency between persons, the differences are quite small: the largest difference between an individual's nodding frequency is 0.05 nods/second (ID 11 left and ID 12 left, as well as ID19 left and ID20 left), while among different participants, this is 0.23 nods/second (ID 4 right and ID18 left).

Three of these six participants had partners of the same gender in both of their conversations (e.g. a woman in ID4 left and ID5 left participates in two female-female conversations). The differences in their nodding frequencies were negligible: 0.00–0.02 nods/second. The other three had one conversation with a female and one with a male partner, and their nodding frequencies in two conversations differed slightly: in one case the difference was 0.02 nods/seconds, but in two cases it was 0.05 nods/second. Thus we could anticipate that the gender of the partner has an influence on the person's nodding frequency, although the data is too scarce to draw any definite conclusions about which way the influence goes, and it is likely that the influence is more dependent on the personal characteristics of the partners than their gender.

Navarretta et al. (2012) also notices that in the Finnish data, strong nodding is typical while greeting. This seems to be typical in the Estonian data as well, since 12 out of 18 different participants nodded while greeting (3 participants did the greeting before reaching the filming spot, so there is no information whether they nodded or not). Of the persons who participated in two conversations, one participant nodded during both greeting and two nodded in one but not in the other one. All the persons who did not nod during greeting (or about whom there is no information) were male, so it can be said that in Estonian, at least women typically nod while greeting.

7 Durations of Nods

Given that there is a significant difference between single and repeated nods, it is also interesting to study their lengths. The average durations of the different types of nods in the Estonian data is given in Table 3. As was anticipated, one-way nods (just an upward or downward head movement) are the shortest, then come single nods, and repeated nods have the longest duration. The differences in durations are also confirmed by t-tests (two-tail t-tests with two-sample unequal variance) as p-values for both the durations of one-way nods versus single nods and for single nods versus repeated nods were <0.001. There are also slight differences in the average duration of up-nods and down-nods. However, two-tail t-tests with two-sample unequal variance were performed in order to find out whether the differences are statistically significant or not, and the only one that could be considered statistically significant is the difference in the duration of repeated up-nods versus repeated down-nods where up-nods are significantly longer than down-nods (p-value = 0.05; <0.1).

However, comparing the length of single and repeated nods, it can be noticed that single nods are about half of the length of the repeated ones, indicating that individual up-down movements in repeated nods are not necessarily much faster than the single nods. There may be a physiological reason for this due the same motor control mechanism for the head movement up-and-down. However, an interesting observation is that the one-way nods are significantly slower movements than single (or repeated) nods, indicating that they are intentionally different from the other nod types and also have a different function in conversations. It can be hypothesised that the slowness of one-way nods indicate thinking and pondering about the presented information, so that the reaction is not a straightforward acknowledgement or surprise feedback, but includes some hesitation.

	DURATION		
	TOTAL	UP-NODS	DOWN-NODS
ALL NODS	1.29	1.24	1.32
one-way	0.77	0.78	0.77
single	0.98	0.96	0.99
repeated	1.79	1.96	1.74

Table 3. The average duration of nods in the Estonian data (seconds)

8 Cultural Comparison

Table 4 presents frequency results on the Estonian data together with the results presented in Navarretta et al. (2012). As there is no equivalent to the one-way nod in Navarretta et al. (2012), we regarded one-way nods as single nods for the purpose of comparing Estonian results with the ones on Danish, Finnish and Swedish, and added the one-way nod frequencies to our single nods. Even though it is possible that one-way nods have a different interpretation from single nods (as discussed above), they nevertheless provide feedback to the partner and as sometime it may be difficult to distinguish them from single nods, we consider this combination reasonable. The Estonian nodding frequencies calculated in this way can be seen in column Estonian in Table 4, while the original 3-decimal numbers separating one-way nods and single nods are in their own separate column.

	Danish	Finnish	Swedish	Estonian	3-decim+one-way
Nod (Down-nod + Up-nod)	0.17	0.16	0.14	0.16	= 0.163
Single	0.08	0.12	0.05	0.10	= 0.080+0.016
Repeat	0.09	0.04	0.09	0.07	= 0.067
Down-nod	0.14	0.11	0.07	0.12	= 0.115
Down-nod single	0.05	0.08	0.02	0.06	= 0.055+0.008
Down-nod repeated	0.09	0.03	0.05	0.05	= 0.052
Up-nod	0.03	0.05	0.07	0.05	= 0.048
Up-nod single	0.03	0.04	0.03	0.03	= 0.026+0.008
Up-nod repeated	0.00	0.01	0.04	0.02	= 0.015

Table 4. Comparison of the frequency of different nod types (nods/sec). The figures of Danish, Finnish, and Swedish are from Navarretta et al. (2012).

The average frequency of nodding in Estonian seems to be the same as in Finnish (0.16 nods/ second). Moreover, the frequency of down-nods (0.12 nods/sec) and up-nods (0.05 nods/sec) are also the same as for Finnish. Yet another similarity with Finnish is the fact that there are more single nods than repeated nods while in Danish and Swedish the opposite is the case. However, the difference between the frequency of single and repeated nods is smaller in Estonian than that in Finnish. The differences are not huge but indicate the differences between neighbouring countries.

9 Conclusions and Future Work

In this paper we studied nodding in Estonian first encounter conversations in terms of frequency and durations of the nods. Interpersonal variations were considered as well. We observed that down-nods are more than twice as frequent as up-nods, and single nods are more frequent than repeated nods. In

fact, single up-nods are almost twice as frequent as repeated up-nods, but the difference between single and repeated down-nods is not significant. As for the gender differences in nodding, they were not statistically significant. However, an interesting difference was observed regarding single up-nods and down-nods: female participants tended to use more single up-nods than the male participants, while the male participants used more single down-nods. We hypothesise that this may be related to different politeness strategies.

In this paper, we also distinguished a new type of nodding, that of one-way nod where the head is moved up or down slowly and not returned back to the original position but sometime later. We hypothesised that this kind of feedback may signal hesitation and pondering upon the presented information, and thus differ from the straightforward acknowledgement of proper nodding.

Finally, the frequency of nodding in Estonian was compared with the figures presented in Navarretta et al. (2012), concerning nodding frequencies in the similar Danish, Swedish and Finnish data. It turns out that Estonian nodding is comparable with nodding in the Nordic countries and mostly resembles the Finnish nodding. The Estonian nodding frequency was the same as in Finnish (0.16 nods/sec) and also the distribution of nods into up-nods and down-nods was the same. This is expected considering the close linguistic relationship between the two languages.

In the future, we aim to have more data, and use another annotator, so as to achieve more consolidated results and comparisons. With the larger data, it would be useful to study the one-way feedback signal further and compare its function in other languages, too. It would also be good to study the given-new status of the presented information with respect to different nodding types so as to confirm the hypothesis of the interpretation of down-nods and up-nods, and also shed light on one-way nods. It would also be interesting to study nodding in relation with vocal feedback in Estonian, as has already been done for Finnish (Toivio and Jokinen, 2012). When it comes to individual nodding, we have mainly concentrated on interpersonal variations, but it would be good to study also intrapersonal variations, i.e. how the nodding of a person depends on the partner with whom they converse with. In general, the work presented here provides a fruitful and interesting basis for future research which would enrich our understanding of Estonian communication and conversational interactions in general.

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