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The alignment of head nods with syntactic units in Finnish Sign Language and Swedish Sign Language

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Abstract

In this paper we examine the relationship between specific head movement events – head nods, often treated as prosodic boundary markers – and syntactic units in Finnish (FinSL) and Swedish Sign Language (SSL). In the study we investigated the alignment of head nods with syntactic units on the basis of a total of 20 (10+10) FinSL and SSL narratives. The results of the study show that in both languages head nods appeared similarly on syntactic boundaries and that the tendency was to align nods sentence-finally. However, not all head nods behaved this way: for example, a relatively large number of head nods were also found to occur sentence-initially or elsewhere in the sentence. Furthermore, head nods occurring on syntactic boundaries also had non-boundary marking functions, and not all syntactic boundaries occurred with head nods.

Index Terms: boundary marker, head movement, syntactic unit, Finnish Sign Language, Swedish Sign Language

1. Introduction

In this paper we discuss the relationship between head nods and syntactic units in two historically related sign languages, Finnish Sign Language (FinSL) and Swedish Sign Language (SSL). Single head nods have been claimed to occur at prosodic and/or syntactic boundaries in different spoken and signed languages (see e.g. [1], [2]). In sign language literature, these *on-boundary* movements of the head are referred to as "prosodic boundary-markers": It is often argued, at least implicitly, that they occur at the end of sentences ([2], [3]) and are punctual cues that do not spread across entire syntactic domains (e.g. [3]).

However, some studies (e.g. [2], [4]) have suggested that not all nods in signed texts and conversations are produced on a syntactic boundary: nods have also been identified as occurring elsewhere, and they have also been shown to cover whole clauses/sentences if these clauses/sentences are of short duration [4]. Indeed, head nods seem to be frequent elements in signed and spoken discourse, signaling, for example, affirmation, a positive response, or the signers'/speakers' engagement in the discourse (e.g. [6], [7]). Having said that, in order to define single head nods simply as "boundary-markers" in different sign languages we need to first examine the frequency and distribution of head nods performing different functions in different sign languages. This also includes finding out exactly how head nods are positioned in relation to syntactic units.

As in other sign languages, head nods have also been found to occur on syntactic boundaries in FinSL and SSL (see [4], [5]). It is, however, still unclear how nods and syntactic units are aligned in the two languages; how frequently and how exactly nods and syntactic boundaries coincide, and whether the two languages show similarities or differences in this respect. In the current study we examine the use of head nods and their relation to syntactic units by observing annotated data of FinSL and SSL. The goal of the research is to find out whether head nods appear in similar or different ways in FinSL and SSL texts. Our research questions are as follows: (i) How are nods distributed with respect to syntactic units in FinSL and SSL? And (ii), How are on-boundary head nods *exactly* positioned in relation to the syntactic boundaries with which they occur, and how frequent are the nods occurring in these positions? The answers to these questions will lead us to a discussion of whether head nods can be treated as prosodic boundary markers in FinSL and SSL.

2. Data and method

The analysis of head nods in FinSL and SSL was carried out on the basis of a total of 20 (10+10) signed narratives from native FinSL and SSL signers between the ages of 20 and 59 years. For the data collection, both the FinSL and SSL signers were asked to tell a story from one of two picture books: *Snowman* and *Frog, where are you?*. The tasks were carried out in pairs in a dialogue setting in which the recording set-up consisted of cameras directed toward the informants from 4 to 6 different angles (see Figure 1). The material consists of approximately 30 minutes of video data per language.

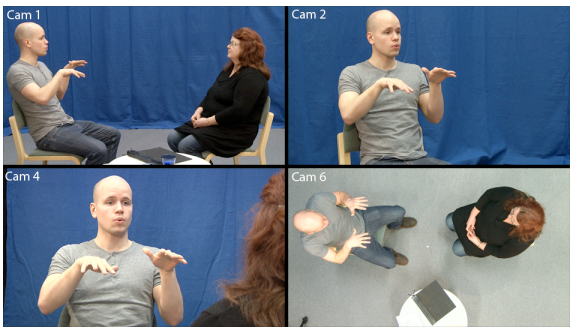

Figure 1: *Screenshots of one frame in the FinSL video material from four different camera angles* [8].

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From the data, annotations were created in ELAN [9] on the levels of manual signs, sentences, translation and head movements. The annotation work on the movements of the head was carried out by a native FinSL signer who was also familiar with SSL and experienced in annotation procedures. Different head movement events were identified from the data through a detailed process of observing the motion of the head in different dimensions in all the narratives in the data. This annotation work benefited greatly from the possibility of viewing several videos, recorded from multiple camera-angles, simultaneously in ELAN. It should also be noted that, in addition to the traditional video material, the data of the current study also included computer-vision based analysis of the movement of the head, obtained with SLMotion software (see [10] and [11]). The detection of the movement of the signer's head resulted in numerical data which was then imported into ELAN and viewed as graphic visualizations. These detailed measurements provided support for the re-examination of particular annotations, as well as for the detailed analysis of the alignment of single head nods with syntactic units.

On the basis of the annotations, the nods in the data were classified as either i) nods occurring on syntactic boundaries (i.e. on-boundary nods) or ii) other sentence/clause-internal nods. On-boundary nods were then divided, according to their timing with syntactic units, into 6 subtypes (see Table 1).

Table 1. *The classification of different head nods occurring on syntactic boundaries in the data.*

On-boundary nods	Explanation
Sentence-final	During or after the last sign(s) of a sentence
Sentence-initial	During the first sign(s) of a sentence
Sentence border	On the border between two sentences
Inter-sentential	During a pause between two sentences
Sentence-internal boundary	During a clause or phrase boundary
Sentence-internal listing	Separating elements in multiple co-ordination

Table 2. *The classification of different sentence/clause-inner head nods in the data.*

Other sentence/clause-internal nods	Explanation
Sentence-internal other	Functions such as emphasis or affirmation
Whole sentence	During a whole sentence
Sentence-internal X	Unclear cases

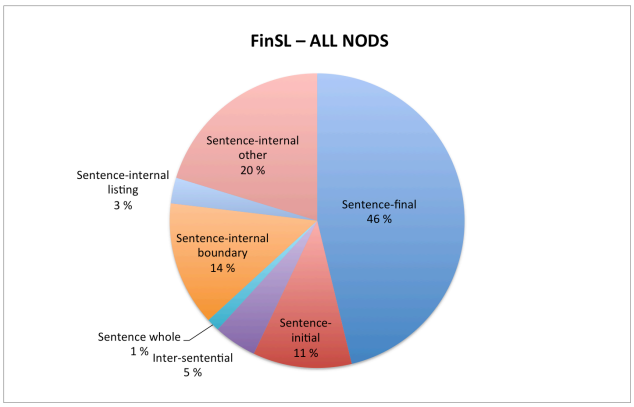
When a nod was produced during a transition from one sentence to another, it was defined as *sentence-final* or *sentence-initial*, depending on which "side" of the sentence boundary the stroke of the nod movement was produced. If this could not be distinguished, the nod was labeled as *sentence-border*. If a nod was produced during a pause between two sentences it was labeled as *inter-sentential.* Nods that occurred on boundaries of smaller syntactic units were defined as *sentence-internal boundary* nods, which marked clausal or phrasal boundaries, and *sentence-internal listing* nods, which marked coordinative lists. Sentence/clause-internal nods, on the other hand, were divided into three groups: *sentence-internal other*, nods which were not aligned with syntactic boundaries but had other functions such as affirmation or emphasis, nods with whole utterances labeled as *whole sentence*, and unclear cases labeled as *sentence-internal X* (see Table 2).

3. Results

When examining the overall distribution of head nods in the data, it was found that the average number of nods per narrative was higher in FinSL than in SSL. The average story in FinSL included over twenty head nods whereas in SSL there were only half that number in the average story. Altogether the FinSL data consisted of 212 and the SSL data of 107 instances of head nods. The difference in the number of head nods between FinSL and SSL narratives may be explained either by the fact that FinSL narratives were longer in duration than SSL narratives, or by the fact that the number of sentences in FinSL was higher than in SSL (see Table 3). In addition, in both FinSL and SSL narratives the number of head nods per narrative showed a lot of variation between individual signers (see Table 3). This may be a result of several factors, such as differences in the age and background of the signers.

Signer	Duration (min:sec)	Nr Nods	Nr Sentences
FinSL			
S1	1:56	21	42
S2	2:20	28	55
S3	4:15	15	104
S4	4:40	11	112
S5	5:54	17	90
S6	1:34	33	42
S7	1:47	30	62
S8	4:34	32	63
S9	2:56	13	76
S10	2:35	12	55
Total	**32:31**	**212**	**701**
SSL			
S11	2:07	13	36
S12	3:37	19	55
S13	4:49	11	54
S14	3:19	7	41
S15	2:38	19	36
S16	1:25	12	27
S17	2:24	6	34
S18	2:53	4	39
S19	2:00	12	25
S20	2:38	4	40
Total	**27:50**	**107**	**387**

Table 3. *The overall duration, number of nods, and number of sentences in each narrative in the data.*



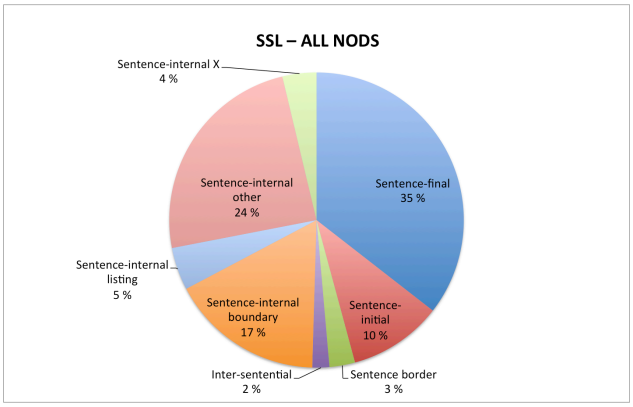


Figure 2: *The distribution of different types of head nods in the data in FinSL* (n=212) and SSL (n=107).

Despite the differences in the total number of head nods between FinSL and SSL, the distribution of different head nods in both languages was relatively similar (see Figure 2). We found that in both FinSL and SSL narratives, there was a strong tendency to produce a head nod sentence-finally. In both languages, the largest groups of head nods in the data, in order of frequency, were sentence-final nods (35–46%), sentence-internal other nods (20–24%), sentence-internal boundary nods (14–17%) and sentence-initial nods (10–11 %). These groups constituted 91 percent of all nods in FinSL and 86 percent of all nods in SSL. The most infrequent nods were nods during whole sentences (0–1%), nods on the borders of two sentences (0–3%), and nods between two sentences (2–5%). All in all, in FinSL narratives 80 percent and in SSL narratives 73 percent of all nods were produced on syntactic boundaries (i.e. on sentence-final, sentence-initial or sentence-internal clausal boundaries). Some of these nods co-occurring with syntactic boundaries performed also other simultaneous functions, such as affirmation.

When examining the distribution of different subtypes of on-boundary head nods (see Figure 3), we found that in both languages sentence-final nods were clearly more common than, for example, sentence-initial nods or nods which occurred at sentence-internal clausal boundaries. However, although sentence-final nods were the most frequent on-boundary nods in both languages, the percentage of sentence-final nods in all boundary-marking nods was larger in FinSL (59%) than in SSL (49%).

4. Discussion

Concerning research question (i), the results of the current study show that although the overall number of head nods differs significantly in FinSL and SSL narratives, the patterns in which head nods align with syntactic units are very similar in both languages. The majority of head nods produced in the narrative texts in FinSL (80 %) and SSL (73 %) were on-boundary, and the remaining head nods were mostly nods not occurring on syntactic boundaries but performing functions such as emphasis or affirmation (FinSL 20 %, SSL 24%) These head nods emphasized, for example, the form or meaning of single manual signs, or conveyed meanings of strong or neutral affirmation (such as 'indeed' or 'yes') independently or together with manual signs (see e.g. [4]).

Concerning research question (ii), when examining how exactly on-boundary head nods occur in relation to syntactic boundaries, we found that, in both SSL and FinSL, nods were especially common in sentence-final positions, on sentence-internal clausal or phrasal boundaries, and sentence-initially. Although both languages had a strong tendency to produce on-boundary head nods sentence-finally, also sentence-initial head nods were surprisingly frequent. In this respect our results differ from previous observations made of other sign languages (see [2], [3]).

However, the data also showed differences in the distribution of different on-boundary nods between the two languages: sentence-final nods were more frequent in FinSL (59 %) than in SSL (49 %). Besides possible differences in translation strategies, also different ways of constructing the narratives in the two languages can be seen as causing the difference between them in the alignment of nods with syntactic units. It has been argued that the use of gestural elements and constructed action may influence the grammatical structure of signing in different ways (see e.g. [12], [13]). In the current study, *showing* an event (gestural enactment) was a more common strategy in SSL narratives and *telling about* an event more common in FinSL narratives. If constructed action can function as predicates and arguments in clauses and therefore result in the lower use of conventionalized signs in narratives (see [12]), the results of this study raise the interesting question of whether gestural enactment also influences the frequency and use of prosodic cues in discourse. Finally, as these observations are based on the analysis of narrative texts, comparison of the results with the use of nods in turn-final and turn-internal boundary marking in spoken and signed dialogues would be an interesting topic for future work.

All on-boundary head movements cannot be directly interpreted as prosodic boundary markers. For example, not all the sentence-final or sentence-initial head nods in our data were punctual, but they spread over several manually produced signs. In addition, it should be noted that on-boundary head nods were not compulsory for the marking of syntactic boundaries, nor were they the only possible markers separating syntactic and/or prosodic domains in either of the languages. When we compare the overall numbers of head nods and sentences given in Table 3, we see that head nods *may* occur on syntactic boundaries but they are by no means compulsory. Other properties in the articulation of the hands and other parts of the body, such as velocity differences, pauses, and durational features, are involved in the organization of manual and non-manual movement patterns into understandable chunks of discourse.

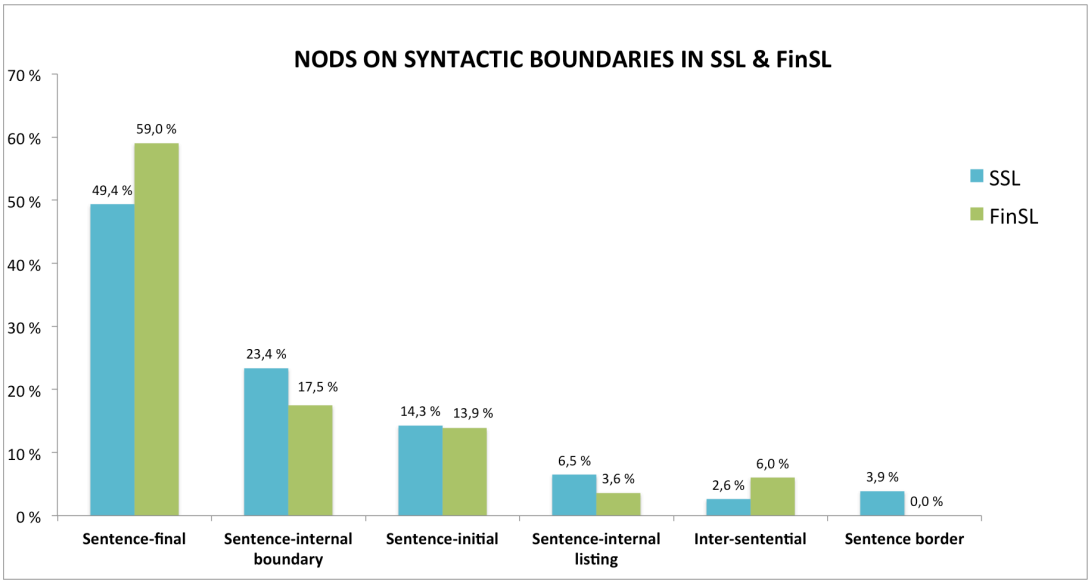


Figure 3: *The distribution of different types of nods occurring on syntactic boundaries in FinSL (n=166) and SSL (n=77).*

However, according to the results of the current study, the distribution of nods in the data was consistent and similar in both languages: most of the head nods produced in narrative texts in both FinSL and SSL were punctual head movements which occurred immediately before or after a syntactic boundary. These observations indicate that head nods in FinSL and SLL show characteristics of prosodic boundary-marking and, moreover, that the use of nods as boundary markers is similar in FinSL and SSL. Some of these nods did not only occur with syntactic boundaries but also had other, overlapping functions. For example, some sentence-final nods in the data conveyed meanings of neutral or strong affirmation, described earlier in this section. The separation of prosodic domains cannot therefore be seen as their only function.

5. Conclusion

In this paper we presented a study of the relationship between head nods and syntactic units in FinSL and SSL. According to the results, head nods in FinSL and SSL are aligned similarly and rather systematically with syntactic boundaries in narrative texts. The majority of nods occurred immediately before or after a sentence boundary, or at sentence-internal clausal boundaries. The observations presented here lead us to the conclusion that, in both FinSL and SSL, head nods perform a prosodic boundary-marking function in addition to, or simultaneously with, other functions. This further implicates that, when it comes to single and more or less punctual head movement events, the prosody and syntax are connected and "co-operating" in the construction of understandable signed texts in FinSL and SSL. In addition, the tendency for the sentence-final alignment of head nods in both FinSL and SSL indicates that the way in which nods participate in the rhythmic patterning of signing is similar in the two languages. However, when consulted on issues related to rhythmic features in FinSL and SSL, native signers have reported an intuitive sense of rhythmic difference between the two languages [14]. In our future work we plan to investigate further how single head nods contribute to the rhythm of signing, and whether the similar patterns found in the distribution of nods in FinSL and SSL can also be found in other sign languages.

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