What Corpus-Based Research on Negation in Auslan and PJM Tells Us About Building and Using Sign Language Corpora

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Abstract

In this paper, we would like to discuss our current work on negation in Auslan (Australian Sign Language) and PJM (Polish Sign Language, *polski język migowy*) as an example of experience in using sign language corpus data for research purposes. We describe how we prepared the data for two detailed empirical studies, given similarities and differences between the Australian and Polish corpus projects. We present our findings on negation in both languages, which turn out to be surprisingly similar. At the same time, what the two corpus studies show seems to be quite different from many previous descriptions of sign language negation found in the literature. Some remarks on how to effectively plan and carry out the annotation process of sign language texts are outlined at the end of the present paper, as they might be helpful to other researchers working on designing a corpus.

Our work leads to two main conclusions: (1) in many cases, usage data may not be easily reconciled with intuitions and assumptions about how sign languages function and what their grammatical characteristics are like, (2) in order to obtain representative and reliable data from large-scale corpora one needs to plan and carry out the annotation process very thoroughly.

Keywords: sign language, corpus linguistics, corpus building, annotation, tagging, negation, non-manuals

1. Introduction

Representative and reliable data are indispensable in conducting linguistic research on sign languages. Due to significant sociolinguistic variation, resulting from numerous distinctive acquisition and usage patterns found in signing communities, researchers are often unable to draw clear generalizations concerning sign language grammars from individual signers' intuitions (as such judgments are not always accepted unanimously by other signers). The fact that sign language grammars have not been standardized to the extent typical for languages with a long tradition of writing and schooling (like English) comes as no surprise taking into account that Deaf people usually live dispersed within much larger speaking communities; sign languages are fairly young; and the inter-generational transmission of language in signing communities is often interrupted. To explore the extensive inter- and intra-signer variation, more and more research groups have decided to undertake the task of creating a corpus of the sign language they work on. Among those projects are: the Dutch Sign Language (NGT) corpus[1] (Crasborn and Zwitserlood, 2008), the British Sign Language (BSL) corpus[2] (Schembri et al., 2013) and the German Sign Language (DGS) corpus[3] (Hanke et al., 2010). More projects are underway. Basing linguistic analyses of the communication of the Deaf on real usage data (rather than on intuitions of individual signers) is becoming a methodological standard worldwide.

Our current work also belongs to the field of sign language corpus linguistics. In this paper, we would like to discuss our study on negation in Auslan (Australian Sign Language) and PJM (Polish Sign Language, *polski język migowy*) as an example of experience in using corpus data for research purposes (cf. Filipczak et al., 2015). The Auslan and PJM teams agreed upon fundamental methodological issues but actually worked separately on their own corpus material. Interestingly, both teams then made very similar observations about their annotation procedures and the phenomena they were revealing. These findings are outlined in the present paper as they might be of interest to other researchers working on corpus annotation and, in particular, on negation in sign languages.

2. Building and Annotating a Sign Language Corpus

Needless to say, building a sign language corpus is extremely time-consuming and labor-intensive. In most projects that are currently being developed, Deaf people are filmed in pairs as they respond to elicitation materials shown to them on a screen (see, e.g., Hanke et al., 2010; Rutkowski et al., 2017). Once videos are collected, they need to be annotated (Johnston, 2010). When starting the annotation process, it is vital to create written translations of as much of the recordings as possible as a matter of priority, even before glossing annotation starts. Translations are invaluable for being able to locate potentially interesting parts of the text in order to prioritize what should be glossed first. Translations can be prepared by Deaf signers, bilinguals, or hearing interpreters. It is important to employ a number of translators in order to have each chunk inspected by more than one person to ensure there is broad agreement. Individual sign glossing can be compromised if the overall meaning is not first established. (However, if there is unresolved disagreement among competent signers, this is also relevant and interesting. It may point to some real ambiguity or indeterminacy in the structure of the utterance that linguists need to take account of.)

When it comes to assigning glosses to individual signs one can either have a predefined lexical database or build the lexicon as one annotates the material. From our experience, either strategy will help ensure that the task is carried out consistently. Each lexeme needs to have its own unique label (assigned to every occurrence of the sign). Once glossed, the video material is machine readable and ready

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to be used in linguistic research. (One must have confidence that the sign tokens identified during any searching, sorting and counting of the corpus are *all instances of the particular type* that one is interested in, as well as representing *all of the instances of that type* in the corpus.)

3. Negation study

The study reported in this paper is one of the first studies on sign language negation discussing corpus data. There is a corpus-based study by Oomen and Pfau (2017) concerning sentential negation in NGT. However, our work is the first one to compare negation data extracted from two independently created sign language corpora. It should be noted that there exists a widely-cited typology of negation patterns in sign languages (Zeshan, 2004; 2006), however, it was proposed on the basis of individual signers' grammaticality judgments and questionnaire data. Research based on corpus findings (for NGT, as well as for Auslan and PJM) offers a completely new perspective on Zeshan's typology.

3.1 Sources of Data

The source of data for the Australian negation study was the Auslan corpus – the first sign language corpus in the world. The Auslan archive[4] consists of 1100 video clips which, taken together, last approximately 300 hours. 100 Deaf signers were recorded for the purpose of creating the corpus; each of them performed 11 elicitation tasks during the recording session. Video recordings were edited and uploaded into the ELAN annotation software (Crasborn and Sloetjes, 2008). The Auslan corpus annotation is an on-going process. So far, more than 350 clips have annotation files containing annotation at different levels of detail.

For the Polish negation study data were drawn from the PJM Corpus that is currently being compiled at the University of Warsaw by the Section for Sign Linguistics[5]. As of 2017, 134 Deaf informants were recorded. As each recording session lasts approximately 4-5 hours, the whole dataset exceeds 600 hours of raw HD video material. Obtained films were compressed and uploaded to the iLex software (Hanke and Storz, 2008), used for the purposes of annotation. Before being annotated, each video recording is segmented into more than 20 short video clips that correspond to elicitation tasks performed by the informants during the recording session. In the annotation process, the PJM Corpus team has so far identified over 5500 different lexemes (which have been divided into approximately 15,000 sublexemes), glossed approximately 505,000 individual sign tokens, translated more than 10,000 PJM clauses into Polish sentences and tagged approximately 100,000 tokens for their grammatical features. The annotation of the PJM Corpus is an ongoing process.

3.2 Data Annotation and Tagging

When analyzing negation in Auslan and PJM, we needed to be able to identify all manual signs associated with negation, as well as all occurrences of headshaking, a non-manual feature that is often interpreted as the marker of negation in sign languages (Zeshan, 2004; 2006; Pfau, 2015). Each team conducted two rounds of annotation/tagging specifically for the purposes of this study, on top of already existing annotations in each corpus. As the general annotation guidelines for the Auslan and PJM corpora are different, the negation tagging systems employed by the two teams also differed substantially, which makes the fact that the results were quite similar (as shown below) even more interesting.

For the Australian negation study, 413 video clips (24.7 hours of signed interaction) that had previously been segmented into signs and then glossed were examined. The annotation files for these clips were produced by 89 of the 100 individuals in the corpus. At the beginning of this study, approximately 9000 clauses had already been identified in these files during previous research. However, in only 89 of these was the entire text segmented into clauses and given time-aligned translation into written English. The remaining 324 clips already contained clause boundary annotations only at points that had been relevant to corpus-based research prior to this study. The 89 texts contained monologic spontaneous narratives, re-tells or elicited responses to visual stimuli (pictures and videos), or responses to interview questions involving dialogue with the interviewer and another participant also being interviewed. 375 of the 413 files had comprehensive time-aligned translations in written English and these accounted for 12 hours of recordings.

Taking into account that the Auslan data were prepared as outlined above, there were three ways in which it was possible to locate all instances of negation in them:

- searching the gloss annotations for all instances of Auslan signs known to be associated with negation or negative semantics, and investigating the relevant clauses for headshaking;
- searching the English translations for any words or word forms associated with negation in English and investigating the aligned Auslan clause or clauses for negative signs and/or headshaking;
- visually inspecting videos for all headshakes and annotating the co-occurring clause for the presence or absence of negation.

Each identified gloss that was negation-related was tagged for the presence or absence of head movement: headshake (HS), one strong turn of the head (HS1) wobbling (WOBBLE), tilting-back (TILT-BACK), or a side to side motion (SIDE-TO-SIDE). Any signs in the clause that did not display any of these movements was tagged as having no headshake (NHS) to clearly signal that the clause had been investigated for head movement, and to enable later searches for negation-related clauses that did not have a headshake in them. Headshakes that were observed to occur when no manual sign was being performed were also annotated over a place-holder gloss annotation on the glossing tier. Each identified clause was given a free translation and a literal or close translation into written English, if this had not already been done.

While applying the third tagging strategy – visually scanning the videos in search of the headshakes that did not co-occur with any negative manual sign – two phenomena became obvious: first, that headshake occurring during a manually-negated clause often seemed to make its own semantic contribution to the clause rather than just being another marker of negation; second, that nodding was also not only an extremely frequent head movement generally,

but even also occurred during manually-negated clauses. Consequently, the second round of annotation was conducted with more detailed tagging in order to identify when and why headshaking and nodding were used. In this round, negated clauses were tagged in such a way as to distinguish a number of pragmatic or semantic contexts in discourse by further specifying the grammatical class tag of the negation-related sign or by tagging added to the clause. A few different functions of negation-related signs were distinguished and tagged:

- response – if the clause within which the negation-related sign was found was in immediate response to a question from the interlocutor, or expressed a negative appraisal of what the interlocutor had just said;
- reprise – if temporally the sign was the second negation-related sign in a clause and appeared after the verb or another core constituent;
- imperative – used when inspected clauses were imperative;
- contrastive – used when inspected clauses presented an alternative.

With respect to the clause as a whole, two types of self-directed responses by the signer were identified: one to a topic and the other to a rhetorical question. The former were tagged as *clause internal responses* and the latter as *clause external responses*.

With respect to nodding, the head movement annotation of signs within negated clauses were changed from the default NHS for those that did not have a HS, to NOD if that is in fact the head movement that co-occurred with that sign.

In sum, all the manually-negated clauses and their associated head movements were identified in 413 ELAN files. Of these 89 files had all clauses and all headshaking behavior identified, irrespective of the presence or absence of negation. These 89 files comprised of 6327 clauses, of which 144 were negated. The number of clauses identified in the entire reference dataset had risen from approximately 9000 to 12,661 of which 1672 were tokens of clause negation[6].

The PJM team proceeded with their data in a slightly different manner. Note that the PJM Corpus material is generally glossed in the first step of the annotation process and translated and segmented into clauses on the basis of that. Since the negation study started before the segmentation and translation of the inspected data, it was not possible to search for cases of negation via Polish written translations in the whole dataset. In the first round of negation tagging, the Polish team focused solely on the third of the above-mentioned methods of locating cases of negation. The PJM Corpus was visually inspected for all occurrences of headshakes and negative signs, whether they co-occurred or not. Two tiers dedicated to this study were created in the iLex software and added to all transcripts. The NMNS_HEAD tier was used to tag all observed horizontal (left-to-right) head movements with respect to their role in the signed text. The following tags were used:

- hsh_NEG – when the observed headshake was associated with negation;
- hsh_ALT – when the occurring headshake was a marker of alternative;
- hsh_CL – meaning that the occurring headshake

was part of the classifier (depicting sign) construction;
- hsh_Q – meaning that a left-to-right head movement was associated with a question, either produced with hands or purely non-manual;
- hsh_OTH – meaning that the observed headshake had a different function than any of the above.

When a sign associated with negation was produced with hands but no headshake was visible, the hsh_Ø tag was inserted into the NMNS_HEAD tier. Then, each of the identified headshakes was annotated with respect to its part-of-speech status on the second tier dedicated to negation (labeled as NEG_MAN). When the produced headshake was not associated with any manual sign or when it clearly did not target the manual sign it was co-articulated with, the Ø tag was used in the NEG_MAN tier. In total, 725 individual tasks (video clips) from the PJM Corpus were examined in this manner. Those clips were produced by 75 Deaf signers; they lasted approximately 103 hours in total and contained 244,000 individual sign tokens. Text types represented in the dataset included: re-tells of signed texts or visual stimuli, responses to visual stimuli, narratives and elicited, as well as free, conversations.

After the first stage of negation annotation was completed, the second round was conducted in order to specify the function of 'non-negating' headshakes. In this second round, 140 video clips, consisting of approximately 47,000 tokens, were inspected once again for all occurrences of negative headshakes that did not target any manual sign (i.e., the combinations of hsh_NEG and Ø tags). Those cases were marked with one of the following tags:

- neg_dec – when the headshake was used to change the polarity of the clause;
- neg_resp – when the headshake functioned as a marker of a question asked in the discourse (either by the interlocutor or the signer himself/herself);
- neg_imp – when the headshake functioned as an imperative marker;
- phatic – when the headshake was used only to show the signer's engagement in the discourse;
- meta-comment – when the headshake was a meta-comment to the narration built by the signer;
- discourse() – when headshake was an additional discourse marker; additional information was inserted in the brackets.

Simultaneously, all occurrences of morphologically-negated signs that were not accompanied by a headshake (namely all hsh_Ø + V_neg tag combinations) were inspected to assess whether different types of head movements (e.g. nodding, tilting-back or turning of the head) did not appear in such cases. When this was the case, the annotation was corrected accordingly.

3.3 Key Findings

In her seminal paper, Zeshan (2004) proposed a typology of sign languages with respect to negation. She studied 38 sign languages in her cross-linguistic survey and on the basis of this research distinguished two types of languages: manual-dominant sign languages that use mainly manual elements (negative particles and verbs articulated by hands)

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[6] Note that this last figure does not represent an accurate guide to the proportion of negated to non-negated clauses in the corpus overall: negated clauses have been deliberately targeted as part of this study so their numbers are inflated.

to express negation, even though headshake could accompany these negative lexical signs; and non-manual-dominant sign languages in which negation is primarily conveyed by non-manual elements occurring during the production of the negated constituent, even though the non-manuals could also sometimes be accompanied by negative lexical signs.

Part of the present study aimed at classifying Auslan and PJM with respect to this typology. In order to perform this task, we analyzed and compared the data obtained during the annotation process.

We found that almost all (approximately 97%) of the grammatically negative clauses in the Auslan corpus included a negation-related sign and of these 61% overall also included a headshake during, at minimum, the production of that sign. In other words, only 3% were negated only non-manually. On these figures one would conclude that Auslan is an extreme manual-dominant sign language for negation: only a tiny fraction of negated clauses appear to use only headshake.

However, while scanning the data, more variation in the head movements accompanying negation was revealed. For example, nodding was observed to occur over the negation-related sign in 43 negated clauses. The role of this head movement was independent of the manual clause negation: it could not be construed as a negating element itself. Rather it appeared to reinforce the negation already present in the clause and/or expresses part of the signer's stance towards what the interlocutor has just signed or some discourse presupposition they both share. So the question arose: is it possible that in some manually-negated clauses headshake is also, like nodding, not part of the negation, but contributes additional information, albeit negative, about those grammatically-negated clauses?

In order to answer this question, headshaking in non-negative sentences was investigated. When we systematically scanned the subset of 89 recordings that had comprehensive annotations, we found almost 200 non-negated clauses with headshakes but only 5 clauses negated only by means of a headshake. This means there are 40 non-negating headshakes to every one headshake-only negator. These 89 files contained in total 145 negated clauses. Since 65% of manually-negated clauses were also accompanied by a headshake this means that this non-manual is associated with approximately 94 instances of clause negation, compared with approximately 250 instances where it is not. Clearly headshaking in Auslan is used more frequently outside of grammatical clause negation than within it.

The tagging of headshakes in negative environments with different discourse functions allows seeing the impact of the context on the likelihood that headshake will also be present during the production of a manually-negated clause. The co-articulation of headshake with apparently straightforward manual negation reduces from 65% to 50%. More telling, the rate of headshaking increases significantly (up to 89%) when the utterance is part of a response frame rather than merely the assertion of a negative state of affairs (which the manual negation is achieving anyway in virtually all Auslan negated clauses). The cases marked as 'contrastive' are accompanied by a headshake in 81% and 'reprises' in 62%. Negation was found to be fairly uncommon in imperative clauses.

As for PJM, even before starting the study presented in this paper, we were aware that the language does not fit easily in any of the types proposed by Zeshan. A pilot study conducted in 2014 revealed that there were as many instances of morphologically-negated signs accompanied by a negative headshake as instances of headshake-less negative signs (Rutkowski et al., 2015). That clearly indicated that headshaking is optional when negation is conveyed manually and suggested that headshakes reinforce negation in negative contexts rather than grammatically mark it. This observation was endorsed when we analyzed the whole annotated dataset – out of all occurrences of morphologically-negated signs (4060 cases) 47% were accompanied by a headshake, while 53% occurred without this non-manual feature. This observation raises the question of the point at which corpus researchers are likely to experience plateau effects for various linguistic phenomena, making adding new annotations redundant. This has implications both for the planning of other research on the same language and corpus, and for proposed research using other corpora of other sign languages.

In the process of annotation of the PJM data for the purposes of the present study we inserted more than 18,000 tags into the NMNS_HEAD tier and the same amount into the NEG_MAN tier in the iLex software. While the whole dataset contained 244,000 tokens, we note that negation concerns approximately 7% of all produced signs only. Among the 18,000 NMNS_HEAD tags, we identified more than 15,000 instances of left-to-right head movements and approximately 3,000 negative manual signs without any kind of head movements. Out of all instances of headshakes (approximately 10,000), 73% were classified as negative (this is the count for movements appearing in clauses as well as loosely in the discourse). This count is bigger than for the Australian data, probably because of a broader dataset, but we still find a lot of examples of headshakes with other functions (27%, i.e., approximately 2700 cases). What is interesting, in the whole dataset we found only 450 examples of manual verbs negated solely by means of a headshake. However, there were as many as 1900 cases of headshakes accompanying morphologically-negated verbs. This provides further support for the claim that the PJM headshake's nature might be gestural rather than grammatical.

As for nodding, it was only marked in the second round of annotation, in the data subset. It occurred 6 times in negated clauses and was articulated together with a morphologically negated sign (NOT*KNOW, NOT*WAS, NOT*HAVE or NOT*PERMITTED, meaning something like: 'yes, it is forbidden'), once it was co-articulated with the manual sign meaning 'NO' and 3 times occurred having a phatic function and marking the interlocutor's acceptance of the signer's negative utterance. Since in the subset of 140 clips we identified 10 cases of nodding in the negative contexts, we might expect approximately 50 such cases in the whole dataset. We also found 3 cases of head tilting in the negative contexts, but no instances of head turning.

After the second round of annotation (functional tagging), we found out that when a headshake does not target the co-articulated manual sign, it most frequently plays the role of a response marker (330 out of nearly 900 tagged cases). It is also fairly common for the headshake to be a meta-comment of the built narration (180 cases) or to serve a purely phatic function (113 cases – most of them being

articulated without any manual sign), which is not surprising, given the conversational character of the corpus material. Negative imperatives appeared only 4 times.

In the light of the presented observations, we can no longer certainly state whether it is possible to classify Auslan and PJM accordingly to Zeshan's typology (the fact that negative constructions in sign languages exhibit much more variation than could be predicted on the basis of Zeshan's typology is also noted by Oomen and Pfau, 2017, and Huddlestone, 2017). We tentatively suggest that headshaking appears not to have been incorporated into the linguistic systems of Auslan and PJM in any unexpected way, serving rather gestural than grammatical function in the discourse. The analyzed corpus data suggests that headshaking behavior in negative environments may not be all that different from the way in which the hearing people in their vocal communication use it.

4. Some Observation on Preparing and Annotating Sign Language Corpus Data

Besides shedding some new light on negation in sign languages, our work on the reported project also resulted in a number of observations that are relevant when it comes to building and using sign language corpora. The most important ones are listed below:

1. Our experience shows that the process of annotation benefits greatly if both signers' videos are visible to the annotator at the same time whenever possible. This is due to the conversational character of the data. The interlocutor's feedback is important for understanding the discourse context of most signed utterances. This is only a matter of settings in annotation programs, but is often overlooked by researchers, which can lead to some disorientation while glossing and translating signed texts.

2. It is advisable to create a separate annotation tier for each phenomenon under inspection. In the PJM project, head movements relevant from the point of view of the negation study were marked independently from other non-manuals that may have been co-articulated with negative sentences. This helped to avoid confusion, as some head movements did not play any role in expressing negation.

3. While studying negation we learned the importance of not only tagging for relevant head movements, but also paying attention to the overall syntactic structure. Dividing the data into clauses (or clause-like units) is crucial for analyzing what is being negated: the constituent, the clause, or some discourse presupposition. If no annotations are made to the corpus above the level of the individual sign at all (e.g., phrase level, clause level, or sentence level) then it is seriously limited in being able to serve as a basis for linguistic research. This is why the division into clause-like units was included into the annotation process of the PJM Corpus and is now the second step in the annotation workflow.

4. Written translations may be of great help when trying to locate areas of the text that include some device expressing negation (as the relevant translation is likely to involve a negative expression). This method speeds up the process of locating non-manual only expressions of negation. Other than this, one can only search visually for such cases, but they are often easy to miss.

5. It is useful to introduce a ø (zero) tag meaning "this sign/clause was inspected but there is nothing interesting happening here when it comes to the study in question". If this kind of annotation is omitted, annotators and researchers don't know if something has been done in the particular place or not, and it could lead either to enormous waste of time (by requiring the data to be re-inspected) or to significant numbers of missing annotations and hence empty cells if annotations are exported to spreadsheets for processing.

6. It is important to carry out quantitative analyses of the data at several stages of the study in order to control whether the obtained results are changing with new material analyzed. There is no need to add new annotations if the material has hit the plateau effect and is sufficient for providing answers for the research questions posed.

5. Conclusions

Conducting linguistic research on the basis of corpus data definitely adds to our understanding of sign languages. Analyzing extensive datasets might provide new counter-evidence to claims made exclusively on the basis of grammaticality judgments or elicitation. Usage data may not be easily reconciled with intuitions and assumptions about how sign languages function and what their grammatical characteristics are like. The corpus-based study presented in this paper finds more variety in negation patterns than previously described in typological studies. On the other hand, conducting corpus research is time-consuming and, in order to provide credible linguistic data, has to be thoroughly planned and carried out.

We hope that our remarks will be of use to researchers that plan on carrying out detailed analyses of sign language phenomena on the basis of corpus material.

6. Acknowledgements

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