

Biased polar question forms in Sign Language of the Netherlands (NGT): Two functions of headshake

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Abstract

We identify several polar question forms in Sign Language of the Netherlands (NGT) through a production experiment in which we manipulate two types of biases: (i) the prior expectations of the person asking the question, and (ii) the evidence available in the immediate context of utterance. Our analysis in the present paper focuses on forms involving headshake. We find that in some cases headshake expresses negation, as expected, but in other cases it fulfils another function, namely, it is part of a sentence-final phrase either expressing uncertainty or signalling a request for a response from the addressee, or possibly both at the same time. We further observe that each question form has a distinct ‘bias profile’, indicating a certain combination of prior expectations and contextual evidence. Besides these empirical findings, our study also makes a methodological contribution: our experimental design could be used in future work to identify polar question forms with different bias profiles in sign languages other than NGT, as well as visual cues accompanying polar questions with different bias profiles in spoken languages.

Keywords: Sign Language of the Netherlands (NGT), polar questions, bias, headshake

1 Introduction

A polar question is a question to which the answer is expected to be either affirmative or negative. Polar questions can be expressed in different ways to reflect what the person asking the question expects the answer to be. Each of the question forms in (1), for instance, has the same sentence radical (‘you’re taking the car’) and raises the same issue (whether or not the addressee is taking the car). Yet, the question forms are appropriate in different contexts and convey different expectations.

- (1) (a) Are you taking the car?
- (b) You’re taking the car, aren’t you?
- (c) Are you not taking the car?!

We know from research on spoken languages that various contextual factors affect the felicity conditions of question forms like those in (1) (see Ladd 1981; Romero and Han 2004; Krifka 2015; Farkas and Roelofsen 2017; Goodhue 2022, among many others). These factors

are referred to in the literature as *biases*. In this paper, we focus on two types of biases. *Original speaker belief* (SB) refers to the speaker's belief about the truth of the proposition p expressed by the sentence radical – in (1), the proposition that the addressee is taking the car – prior to the current situational and conversational context. *Contextual evidence* (CE) refers to evidence concerning the truth of p provided within that context.

Both SB and CE are known to affect the felicity of different polar question forms in spoken languages (e.g. Büring and Gunlogson 2000; Sudo 2013; Roelofsen, Venhuizen, and Sassoon 2013; Domaneschi, Romero, and Braun 2017). We currently know very little, however, about the relation between different types of bias and polar question forms in sign languages. In fact, rather little is known about (the marking of) different polar question forms in sign languages in general. It is often said that polar questions in sign languages are typically marked by raised eyebrows (see Schermer and Koolhof 2009 and Klomp 2021 for NGT specifically, and Zeshan 2004 among others for a broader typological claim). Other non-manual markers that are often cited as appearing in polar questions across sign languages include wide-opened eyes, addressee eye contact, and a forward position of the body and/or head (Zeshan 2004). Yet, it is also clear from various experimental and corpus-based studies that there is more variation than this, including in brow position (e.g. Coerts 1992; Vos, Kooij, and Crasborn 2009 for Sign Language of the Netherlands (NGT)). We hypothesized that at least part of this variation can be accounted for by investigating how SB and CE influences question form. To test this hypothesis, we designed a production experiment in which we systematically manipulated these factors, and carried out this experiment for NGT.

1.1 Previous studies on biased polar questions in sign languages

As far as we know, only three studies have previously investigated biased polar question forms in sign languages. Gökgöz and Wilbur (2017) and Sze and Lee (2023) studied question forms corresponding to high negation polar questions ('Don't you have a car?') in Turkish Sign Language (TİD) and Hong Kong Sign Language (HKSL), respectively. Both studies show that signers primarily use non-manual means to distinguish this polar question type. An example from TİD is given in (2) (Gökgöz and Wilbur 2017, 27; adapted to match glossing conventions). In the example, forward head movement ('h.fw') and upward chin movement ('ch.u') signal negation, while the backward head movement ('h.bw') and downward chin movement ('ch.d') halfway through the example, as well as eyebrow raise ('b.r'), are typical non-manual markers of polar questions. According to the authors, the specific sequential non-manual pattern illustrated in (2) triggers a positive epistemic implicature, making the question form appropriate in a context in which the signer expects an affirmative answer to the question.

- (2)
- | | | | |
|---|-------------|-------------|-------------|
| | <u>ch.u</u> | | <u>ch.d</u> |
| | <u>h.fw</u> | <u>h.bw</u> | <u>h.fw</u> |
| | <u>b.r</u> | | |
| STUDENT HOMEWORK DO NOT PALM-UP | | | |
| “Isn't the student doing (his) homework?” | | | |

The scope of both Gökgöz and Wilbur (2017) and Sze and Lee (2023) is limited to one specific biased polar question form. Cañas Peña (2019) provides the most extensive study in this domain to date, focusing on Catalan Sign Language (LSC). Cañas Peña (2019) elicited

question forms in different contexts from two native LSC signers. In these contexts, epistemic bias (comparable to SB in our study) and evidential bias (comparable to CE) were manipulated. In a follow-up step, the same signers were shown different combinations of contexts and question forms to determine which forms are appropriate in which contexts. Cañas Peña found that different combinations of epistemic and evidential bias were associated with different combinations of brow configuration (raised vs. furrowed) and head and body position (backward vs. forward). In total, Cañas Peña describes five different marker combinations. Example (3) (Cañas Peña 2019, 12; ‘b.fw’ = body forward) illustrates one such a combination, felicitous when epistemic bias is positive and evidential bias is not negative (3 a), and infelicitous otherwise (3 b). The English translation and context descriptions have been slightly adapted for clarity.

- (3) $\frac{\text{b.r, h.fw, b.fw}}{\text{INDEX}_2 \text{ TRAVEL}}$
 ‘Are you traveling?’
- (a) *Felicitous context:* You know I was going to travel with the whole family this month. You meet me at the bus station, all my family is also there, and I have my suitcase and bus ticket prepared.
- (b) *Infelicitous context:* You know I was going to travel with the whole family this month. You meet me at the bus station, all my family is also there, but I neither have a suitcase nor a bus ticket.

Although the study by Cañas Peña is the broadest in scope out of the three studies cited, it does not cover the entire empirical domain: it describes only a single felicitous question form for some but not all possible combinations of epistemic and evidential bias.

1.2 Aims and outline of the paper

The aim of the production experiment that we describe in this paper was to identify as many different question forms as possible in a broad variety of contexts in NGT. In the present paper, we zoom in on question forms that include *headshake*, the main marker of negation in NGT (Coerts 1992; Oomen and Pfau 2017). Biased question forms often involve negation across languages, as shown for instance by examples (1 b) and (1 c) above.

In Section 2, we describe the experimental design of the production study and the data annotation procedure. In Section 3, we describe the different question forms with headshake that we encountered in our data, focusing on manual and non-manual markers as well as sentence structure. We also determine the range of contexts in which each of these forms were used. In Section 4, we discuss what the functions of headshake are in the question forms in our data set. We also formulate preliminary distributional generalizations for the various question forms, which can be tested against the entire data set in follow-up work. Section 5 concludes the paper.

2 Production experiment

We elicited data from seven deaf NGT signers (data from one signer are excluded) in a controlled production experiment in which SB and CE were manipulated through interactive role plays between the study participants and two confederates. Below, we describe the experimental design and the annotation procedure.

Table 1: Target questions with headshake / all questions per experimental condition.

| CE | SB | | |
|----|-------|-------|-------|
| | + | 0 | - |
| + | | 2/29 | 4/28 |
| 0 | 6/29 | 8/30 | 12/29 |
| - | 15/29 | 21/27 | |

2.1 Experimental setup

The study design was loosely based on work by Domaneschi, Romero, and Braun (2017) on biased polar questions in English and German, which in turn builds on Roelofsen, Venhuizen, and Sassoon (2013). In a role-play setting, we prompted participants through pre-recorded context videos to ask questions to our two confederates, both L1 signers of NGT, whose responses introduced positive (+), neutral (0), or negative (-) SB and CE.¹ The exchanges were designed to trigger a target question directed toward the second confederate at the end of each role play. We designed five different scenarios (and a practice scenario); for each scenario, we tested seven different combinations of SB and CE. The combinations [+SB, +CE] and [-SB, -CE] were not included in the experiment, as such contexts make it entirely unnatural to ask a polar question. For a more detailed description of the stimuli, the recording studio, the experimental procedure, and the participants in this study, we refer to <https://doi.org/10.21942/uva.21701954.v2>.

We elicited five target items per participant per condition (different combinations of SB and CE), for a total of 210 items (5 scenarios × 7 conditions × 6 participants). Nine items had to be discarded because the target responses were not questions (any form that invited a yes/no response was counted as a question form) or were otherwise unclear. Target questions were subsequently prepared for analysis in ELAN (2023).

For the current analysis, we focus exclusively on question forms containing headshake (N=82). Two of these items were excluded because they involved a headshake at the beginning of the sentence, which appeared to convey a direct response to a previous utterance from the confederate. An additional twelve examples are complex constructions involving embedding; these will not be further discussed in this paper. This leaves us with 68 items for analysis. Table 1 indicates how many question forms with headshake we analyzed for each condition.

All items are available online at <https://doi.org/10.21942/uva.21666203>. Each video file includes five question forms, one per scenario, involving the same participant and the same experimental condition. Glossed examples from the data in this paper include a code (e.g. 03-NeutNeg-04) which refers to a unique target question form. The first part of the code indicates the video file name (03-NeutNeg, for participant 03 and experimental condition [0SB, -CE]); the final two numbers indicate the specific question form (04 for question form 4 in the video file). The corresponding annotation files are available at <https://doi.org/10.21942/uva.22737074>.

1. Note that CE can be provided directly by the addressee or indirectly through circumstantial evidence mutually available to all conversational participants (cf. Buring and Gunlogson 2000). In our experiment, CE was always provided directly by the interlocutor.

2.2 Data annotation and analysis

In ELAN, we first determined the scope of each target question and gave each target item a unique identifier code (as described just above). We then added ID-glosses, in English and in Dutch, for manual signs, corresponding to the ID-glosses in the NGT database on Global Signbank (<https://signbank.cls.ru.nl/>) where available. Signs that are not included in Signbank were prefixed with % in the annotations.

All target questions were subsequently annotated in detail across a total of 18 tiers. For the annotation of non-manual markers, we developed, evaluated, and then applied a new annotation guideline that went through several development stages. We created twelve tiers for different non-manual features and used Controlled Vocabularies for each tier containing between three to nine values, i.e. different non-manual feature specifications, which always included at least the options ‘neutral’ and ‘other’ (specify value on comment tier). We refer to Oomen et al. (Forthc.) for a detailed report of this process. We added three additional tiers to annotate potential manual markers of question sentences (e.g. PALM-UP) and possibly relevant mouthings of Dutch spoken words accompanying manual signs.

In a next step, we added more interpretative annotations for sentence structure. On the tier ‘Structure’, we indicate the general sentence structure of each question sentence. Preliminary analysis of the data revealed that each question sentence consisted of either just the sentence radical (‘SR’), or a sentence radical followed by one (‘SR-T1’) or two (‘SR-T1-T2’) sentence-final phrases, which we refer to as *tags*. We define tags as particular combinations of manual and non-manual markers following the sentence radical, fulfilling a specific pragmatic function (see Section 3 for examples). On the tier ‘Structure-components’, we specified further detail about the properties of the sentence radical and tags. For the sentence radical, we indicated (i) whether it was overtly marked for polarity, e.g. by means of head nodding or headshaking, and (ii) whether it included a prosodically integrated PALM-UP sign. For tags, we annotated the tag type, as further discussed in the results section. The tier ‘Structure-elements’ was used for annotating additional potentially relevant information. For instance, several items included a contrastive discourse particle in the sentence radical.

3 Results

Below, we analyze the 68 question forms containing headshake. In Section 3.1, we briefly discuss some striking non-manual marking patterns in the data. In Section 3.2, we categorize the question forms in our data set based on their sentence structure, and we show how the forms are distributed across experimental conditions.

3.1 Non-manual markers

Although we leave an in-depth exploration of patterns in the data concerning non-manual markers beyond headshake – and how they interact with sentence structure – to future work, we would still like to highlight a couple of interesting preliminary observations. Particularly striking is that *almost all* analyzed items involve either brow lowering or inner brow raise, while brow raise was attested in just six examples. Instead, the most consistently attested non-manual across all items was a head or body forward position, typically marking either the entire sentence or just the final part. This finding contrasts with what Cañas Peña (2019) reports for LSC, where she found a backward head/body position in conditions with negative CE. As for non-manual markers use in specific contexts, it is worth noting that we frequently

found the non-manual markers ‘head up’ and ‘nose wrinkle’, in addition to ‘eye squint’, in the contrastive conditions [-SB,+CE] and [+SB,-CE].

3.2 Question forms and their distribution

Based on their sentence-structural properties, we can distinguish four different basic question forms in the data set. We discuss each in turn with the use of representative examples.

The most basic and also most frequently attested question form in our data set (N=33, including two with prosodically integrated PALM-UP) involves a negative sentence radical and no tags. The specific non-manual markers used may differ (see Section 3.1), but generally include at least a forward body or head position. Negation is expressed by headshake, which typically accompanies the predicate and sentence-final pointing signs but usually not the (nominal) subject (cf. Oomen and Pfau 2017). In representative example (4), non-manual markers signaling inquisitiveness include a slight widening of the eyes (‘e.w’) as well as a head forward position toward the end of the clause. Headshake (‘h.s’) accompanies the predicate and the sentence-final locative pointing sign.

Table 2 shows that, while being the most common question form in the data set, the distribution of this form is restricted to experimental conditions that involve negative SB or CE. Furthermore, we did not find cases in which SB is negative and CE is positive.

(4) **Negative sentence radical:**

| | |
|--|---------------|
| | h.fw |
| | h.s |
| | e.w |
| INDEX ₃ MONEY [^] FREE-OF-CHARGE INDEX _{up} | |
| ‘Is it not free of charge there?’ | |
| | 03-NeutNeg-03 |

Table 2: Distribution of form (4).

| CE | SB | | |
|----|-------|-------|------|
| | + | 0 | - |
| + | | -/2 | -/4 |
| 0 | -/6 | -/8 | 4/12 |
| - | 11/15 | 18/21 | |

In the remaining 35 items in our dataset, the sentence radical was always followed by one (N=33) or two (N=2) tags. Typically there is a prosodic break between the sentence radical and the tag, and there is often a marked change in non-manual markers accompanying the sentence radical and the tag. We found three different tag types, each of which involves a particular combination of manual and non-manual markers, which we describe below.

Firstly, in a handful of sentences (N=4), a sign we gloss as RIGHT follows the sentence radical.² In the example in (5), the sentence radical is marked by eye squint (‘e.sq’) and brow lowering (‘b.l’) in addition to headshake, which functions to negate the clause. RIGHT, which is followed by PALM-UP, is articulated with a head nod (‘h.n’). The tag part of the sentence is also marked by an inner brow raise (‘b.ir’) and a head forward position. Table 3 displays the distribution of the RIGHT tag across conditions.

Secondly, in a total of 21 constructions, the sentence radical is followed by what we will call a ‘tag with inquisitive headshake’, illustrated in Figure 1.³ This tag is formed by a sentence-final manual element such as PALM-UP or HESITATE or a held sign in combination

2. There are two further items that include a RIGHT tag; these are the two items in the data set with two tags. In both cases, RIGHT is followed by an *or* tag with headshake (see discussion further below). We do not include these items in the discussion here but return to them later, because both of them involve a sentence radical which is marked for positive rather than negative polarity.

3. We also include one construction here in which the non-manuals that characterize this tag accompany the sentence radical rather than the tag.

(5) **Negative sentence radical + RIGHT:**

h.n

h.s, e.sq, b.l b.ir, h.fw

KIM HOME, RIGHT PALM-UP

'Kim isn't home, right?'

01-NegPos-04

Table 3: Distribution of form (5).

| CE | SB | | |
|----|------|------|------|
| | + | 0 | - |
| + | | -/2 | 3/4 |
| 0 | -/6 | -/8 | 1/12 |
| - | -/15 | -/21 | |

Figure 1: A tag with inquisitive headshake.



with headshake and, often, a particular mouth configuration where the lips are pressed together and the mouth corners are pulled down ('mouth frown', glossed as 'm.f'). Used in this construction, headshake appears not to express negation but rather functions to mark uncertainty, or to elicit a response, or both (for discussion, see Section 4.2). A tag with inquisitive headshake can follow both positive or neutrally marked sentence radicals (6 a) and negative sentence radicals (6 b). In the latter case, headshake accompanies both the sentence radical and the tag; usually, a brief interruption between the two instances of headshake can be observed.

(6) (a) **Positive or neutral sentence radical + inquisitive headshake:**

h.n h.s, m.f

e.sq, b.l b.ir e.sq, b.l

h.fw, h.t

HEY KIM VEGETARIAN INDEX₃, PALM-UP

'Hey, is Kim a vegetarian?'

07-NegNeut-01

(b) **Negative sentence radical + inquisitive headshake:**

h.s h.s, m.f

b.l, h.fw, h.t

ENTRANCE MONEY^FREE.OF.CHARGE, PALM-UP

'Is entrance not free of charge?'

01-NeutNeg-03

As shown in Table 4, questions with a tag with inquisitive headshake occur across many

different contexts. However, we observe that the sentence radical is usually compatible with the CE, with only one exception. This is a case where the sentence radical is positive but the CE is negative (and SB positive). We suspect that this exceptional case involves further ingredients that we do not fully understand just yet, but which make it essentially different from other cases with inquisitive headshake.

Table 4: Distribution of form (6) ...

| (a) ... with positive or neutral SR. | | | | (b) ... with negative SR. | | | |
|--------------------------------------|------|------|------|---------------------------|------|------|------|
| CE | SB | | | CE | SB | | |
| | + | 0 | - | | + | 0 | - |
| + | | 2/2 | 1/4 | + | | -/2 | -/4 |
| 0 | 2/6 | 4/8 | 4/12 | 0 | -/6 | -/8 | 1/12 |
| - | 1/15 | -/21 | | - | 3/15 | 3/21 | |

Finally, ten sentences (two of which also include a RIGHT tag) include what we refer to as an ‘*or* tag’, which serves to introduce an alternative to the sentence radical. This tag is very similar to the previous tag, with the crucial exception that the signer does something different with their mouth. Similar to tags with inquisitive headshake, we can distinguish two subtypes of polar question forms with an *or* tag, depending on the polarity of the sentence radical. When the *or* tag follows a sentence radical which is either marked for positive polarity or not overtly marked for polarity, the tag is formed by a combination of headshake, the mouthing ‘*of (niet)*’ (‘*or (not)*’), and a sentence-final manual element like PALM-UP, HESITATE or a pronoun copy (7 a).⁴ When the tag follows a sentence radical marked for negative polarity by means of headshake, the tag is formed by a combination of the mouthing ‘*of*’ (‘*or*’) and a sentence-final manual element (7 b) (where ‘h.t’ = head tilt). There are two such items in the data set; in both these cases, as shown in (7 b), headshake accompanies the tag as well. Again, headshake appears to have the semantic function here of expressing hesitation and/or soliciting a response from the addressee. Given this, it is possible that in questions with a positive sentence radical followed by an *or* tag such as (7 a) headshake in fact fulfils a dual function – expressing both negation *and* inquisitiveness.

(7) (a) **Positive or neutral sentence radical + mouthed ‘or (not)’:**‘of niet’h.s

e.sq, b.l, h.fw

KIM INDEX₃ VEGETARIAN, INDEX₃

‘Is Kim a vegetarian or not?’

06-NeutNeut-01

4. This includes the two cases with a RIGHT tag preceding the *or* tag; both these cases are also included in Table 5a.

(b) **Negative sentence radical + mouthed ‘or’:**

| | |
|------------------------------|-------------------|
| <u> </u> | <u> </u> |
| h.s | h.s |
| <u> </u> | <u> </u> |
| e.sq | h.fw, h.t |
| <u> </u> | |
| b.ir | |
| NOT HOME, HESITATE | |
| ‘Is [Kim] not home, or ...?’ | |

02-NeutNeut-04

In terms of their distribution, question forms with an *or* tag only occurred in contexts in which CE is neutral, as shown in Table 5.

Table 5: Distribution of form (7) ...

(a) ... with positive or neutral SR.

| | SB | | |
|----|------|------|------|
| CE | + | 0 | - |
| + | | -/2 | -/4 |
| 0 | 2/6 | 3/8 | 1/12 |
| - | -/15 | -/21 | |

(b) ... with negative SR.

| | SB | | |
|----|------|------|------|
| CE | + | 0 | - |
| + | | -/2 | -/4 |
| 0 | -/6 | 1/8 | 1/12 |
| - | -/15 | -/21 | |

4 Discussion

In Section 4.1, we discuss the possible functions of different non-manual marker patterns we observed in the data, and in Section 4.2, we focus on the functions of headshake in the various question forms we identified. In Section 4.3, we formulate some generalizations based on the distributions of the different question forms as described in the previous section.

4.1 Functions of non-manual markers in (biased) polar questions

As we discussed in Section 3.1, eyebrow raise rarely occurred in our data set. This is striking, since it has been reported in the literature that polar questions are primarily marked by raised eyebrows in NGT (Schermer and Koolhof 2009; Klomp 2021). We suggest that brow lowering and inner brow raise, which are typically accompanied by eye squint, may be markers of *uncertainty* about the question radical. Indeed, brow lowering combined with squint occurs frequently in experimental conditions in which the participant has just received neutral CE from one of the confederates. An alternative explanation is that lowered brows are connected to *negation* (cf. the ‘not face’; Benitez-Quiroz, Wilbur, and Martinez 2016). These two hypotheses may be teased apart in future work by considering the larger data set including items without headshake.

As for the combination of upward head movement, nose wrinkle, and eye squint which we often observed in the two contrastive conditions, [-SB,+CE] and [+SB,-CE], we suggest that this combination of markers signals *unexpectedness* of the question radical on the part of the signer. This hypothesis, too, will be tested in future work on the full data set. We also intend to further explore the interaction between non-manual marking patterns and sentence structure in biased question forms in NGT in the future.

4.2 Functions of headshake

We can identify two main functions of headshake in the question forms in our data set. In the question forms exemplified by examples (4), (5), (7 a), and in the sentence radical in forms (6 b) and (7 b), headshake functions to express negation of the sentence radical (all forms except (5)) or the tag (form (5)). However, in the tag in forms (6 a), (6 b), and (7 b) – and probably also (7 a) – we see a headshake with a different function, which we have referred to as ‘inquisitive headshake’. In this function, headshake does not express negation but, in combination with the other manual and non-manual elements in the tag, either expresses uncertainty, or signals a request for a response from the addressee, or both.

We know that headshake can be used in co-speech gesture as a means to convey a comment on or attitude toward a speaker’s own utterance, such as in situations in which “the speaker expresses doubt about what he is saying” (Kendon 2002, 152). The inquisitive headshake that we observed in NGT is possibly related to this co-speech gesture. At the same time, a clearer pattern seems to exist in NGT regarding where and with which other elements inquisitive headshake occurs compared to what we see in gesture (see, for instance, the examples in Kendon 2002) – similar to headshake in its function of expressing negation in sign languages versus gesture (Pfau 2015). That is, our data appear to demonstrate some degree of conventionalization of inquisitive headshake. We consider this an interesting avenue for further study.

4.3 Distributional constraints

Based on the distributions of the various question forms across experimental conditions, as discussed in Section 3.2, we can formulate the following four generalizations. Given that these are based on a relatively small dataset, they are preliminary in nature and need to be further corroborated in future work.

Negative sentence radical All questions with a negative sentence radical except those with a RIGHT tag require negative CE or SB, and are incompatible with positive CE (see examples (4), (6 b), and (7 b)).

RIGHT tags Questions with a negative sentence radical and a RIGHT tag (5) require negative SB. They are compatible with either positive or neutral CE.

Inquisitive headshake Questions with an inquisitive headshake, ((6 a), (6 b), and (7 b)), require that the sentence radical is compatible with the CE, which means that if the sentence radical is positive, CE cannot be negative, while if the sentence radical is negative, CE cannot be positive.

Or tags Questions with an *or* tag (7) require neutral CE.

5 Conclusion

We have identified several polar question forms in NGT involving headshake, each associated with its own ‘bias profile’, i.e., indicating a certain combination of prior expectations and contextual evidence. In future work, our experimental design could be used to identify and compare polar question forms with different bias profiles in sign languages other

than NGT, as well as visual cues accompanying polar questions with different bias profiles in spoken languages. Another natural avenue for future work would be to carry out a felicity rating experiment pairing the different question forms we identified with the different types of contexts that we considered in our production experiment (cf. Cañas Peña 2019 for LSC). Pursuing further insights into how polar questions are expressed in sign languages is not only of scientific interest, but is also essential to better support sign language learners, including hearing parents of deaf children and sign language interpreters in training. In future work, we intend to work with sign language teachers to investigate how teaching materials may be enhanced based on our findings.

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