Content Questions in Sign Language From theory to language description via corpus, experiments, and fieldwork

[1]Robert Gavrilescu, [2]Carlo Geraci, [3]Johanna Mesch
[1,2]Institut Jean-Nicod Dèpartment d'ètudes cognitives
ENS EHESS CNRS PSL Research University Paris
[3]Stockholm University
[1,2]24, Rue Lhmond, 75005 Paris,
[3]Universitetsvägen 10C, 10691 Stockholm
groom7778@gmail.com, carlo.geraci76@gmail.com, johanna.mesch@ling.su.se

Abstract

The theory of language structure informs us about what we should expect when we want to investigate a certain construction. However, reality is often richer than what theories predict. In this study, we start from a theoretically informed set of hypotheses about the structure of wh-questions in sign language, we test them using a sign language corpus, a designed production experiment, and structured fieldwork in three sign languages, Swedish, Greek and French Sign Languages. The results will inform us on what type of contribution each research method can provide to reach accurate language descriptions.

Keywords: Sign Language Methodology, Content questions, Wh-sign

1. Introduction

The body of research on questions in sign language has been conducted either using typological questionnaires (Zeshan, 2006), fieldwork elicitation (i.a., Cecchetto et al., 2009; Neidle et al., 2000; Petronio and Lillo-Martin, 1997), or semi-formal experiments using pre-set elicitation materials (Geraci et al., 2015). To our knowledge, no corpus study has ever been conducted yet on the structure of content questions in sign language. In this work, we will use constituent questions as a case study to illustrate how a broad research question like the description of constituent questions in sign languages can be addressed using different methodologies, and the degree to which they yield comparable results. The purpose of this methodological exercise is not that of identifying the most appropriate method to study sign language syntax, but rather, to illustrate what a researcher can reasonably expect to find using one of the three traditional resources of language data, namely corpus, experiments, and fieldwork, which are treated here as case studies. In the remainder of the paper, we will present a brief overview of the relevant components of sign language content questions both from the perspective of the empirical description of the grammars of sign languages and from the perspective of the theoretical challenges that these constructions represent for formal approaches to language (Section 2). The methods for each case study are then described in Section 3, while in Section 4 the results are presented. In Section 5, we will offer a comparative discussion, while Section 6 concludes the paper.

2. Content questions in SL

Question formation is one of the most investigated topics in sign language syntax. This is due both to empirical and theoretical reasons. The empirical reason is relatively easy to imagine and has to do with the importance of describing main clause types, hence question description is often next to the description of declarative clauses, as opposed for instance to imperatives and exclamatives, which are much less investigated in sign language (Cecchetto, 2012). The theoretical reasons, however, are much more intriguing because they reveal two aspects that make sign languages different from spoken languages: one concerns the use of non-manual components as a distinctive marker for questions; the other concerns the position of wh-signs in content questions. The use of dedicated non-manual components, in particular facial expressions, to distinguish declaratives from questions has been described for both polar (yes-no) and content (wh-) questions. An example of non-manuals used in polar question is illustrated by the Italian Sign Language (LIS) examples in (1) below, where the declarative sentence and the polar question share the same sequence of signs, and are differentiated only by the non-manual components (see also Conte et al., 2010). Specifically, the head/torso is slightly forward and raised eyebrows spread throughout the sentence.[1]

[1]For a comprehensive study on polar questions in a sign language see Cañas (2021)

Proceedings of the 11th Workshop on the Representation and Processing of Sign Languages, pages 86–94

(1) a. MUM MOVIES GO
'Mum goes to the movies.'

b. $\overset{\text{y/n}}{\text{MUM MOVIES GO}}$
'Will mum go to the movies?'

As for non-manuals in content questions, furrowed eyebrows are very often described either to co-occur with the wh-sign only, or to spread of larger portions of the sentence. In American Sign Language (ASL), for instance, the wh-non-manual component spreads over the entire sentence if the wh-sign remains in argument position, while it can be limited to the wh-sign if it is found at the end of the sentence, as shown in (2) from Neidle et al. (2000).

(2) a. $\overset{\text{wh}}{\text{WHO LOVE JOHN}}$
'Who loves John?'

b. ___LOVE JOHN $\overset{\text{wh}}{\text{WHO}}$
'Who loves John?'

The contribution of non-manual markers in questions is often compared to that of prosody in spoken language, because it can play a primary cue in sentence type detection as that, for instance, of rising intonation in languages like spoken Italian. For instnace, polar questions are not syntactically differentiated from declaratives in spoken Italian (same word order, no question particles, etc.). They are, however, prosodically different because declaratives are typically associated with a falling intonation, while polar questions are normally associated with a rising intonation.

However, non-manuals have syntactic correlates that do not find an immediate equivalent in spoken languages. In fact, the distribution of interrogative non-manuals in ASL is associated with the c-command domain of the relevant projection (Neidle et al., 2000, but see Sandler, 2010 for a pure prosodic analysis), while it marks the syntactic chain in LIS (Cecchetto et al., 2009). This is best illustrated by the *in situ* content questions in (3). In fact, wide spreading crucially includes the subject (c-command domain) in ASL, while it is excluded in LIS.

(3) a. $\overset{\text{wh}}{\text{TEACHER LIPREAD WHO}}$
'Who did the teacher lipread yesterday?'

b. PAOLO $\overset{\text{wh}}{\text{BOOK WHICH STEAL}}$
'Which book did Paolo steal?'

The second theoretical aspect concerns the fact that the privileged position for wh-signs in content questions often corresponds to the end of the sentence in several sign languages (Cecchetto, 2012). Such clause final position, which is virtually unattested in spoken languages, is at the core of a debate in theoretical syntax since it seems in clear contrast with some of the basic tenets of contemporary syntax.[2]

3. Methodology

We took the sections about constituent questions of the SignGram blueprint as our starting point (Quer et al., 2017). As of today, the SignGram blueprint constitutes the most valuable resource for grammarians who are willing to begin a descriptive analysis of a sign language. Specifically, we focused on the *Syntax part, Chapter 1: Sentence type*. Section 2 of that chapter is devoted to interrogative sentences and it includes instructions on what to look for and provides references on how to elicit content questions. At the lexical level, the main topics to be covered are the identification of manual wh-signs and non-manual markers distinguishing content questions. At the sentential level, the main topics concern the distribution of wh-signs in the sentence, the scope of the non-manual markers, whether there are content questions without an overt wh-sign, the description of wh-phrases with a restriction (e.g., 'which student'), and whether it is possible to split the wh-sign from its restriction, the presence of wh-doubling, and multiple wh-questions.

We then looked into three sign languages, Greek Sign Language (GSL), French Sign Language (LSF), and Swedish Sign Language (STS), using a semi-formal production experiment, direct elicitation, and corpus resources, respectively. Ideally, these approaches replicate three real scenarios that a researcher might easily face with. We make them explicit here in the shape of case studies.

3.1. Case Study 1: (Semi-formal) Production Experiment

A researcher decides to conduct a study on content questions in GSL. The language does not have an available corpus, and the department cannot hire a language consultant for that specific language. However, since the researcher is going to spend a couple of weeks in Athens, they decided to use their personal network of Greek Deaf friends, plus a mild snowball recruitment (Mouw et al., 2014) to conduct a semi-formal production experiment with the same stimuli used in Geraci et al. (2010,

[2] See for instance the debate about the position of wh-signs in ASL (Neidle et al., 2000; Petronio and Lillo-Martin, 1997) and the alternative analysis based on LIS data and tentatively extended to ASL (Cecchetto et al., 2009), while for the universal principles constraining the position of ex-situ wh-words see Kayne (1994).

2015), which have been reported to be a valuable resource by the blueprint.

The stimuli consisted of two pairs of pictures designed to mimic real-life situations like a car accident plus an insurance form (Fig. 1-2), and a domestic accident plus a medical form (Fig. 3-4). The task is assessed at pairs. One member of the pair receives a scene-picture, the other the corresponding form-picture. After they have looked at their picture, participants are asked to interact. Specifically, the person with the form picture is asked to fill in the form, playing either the role of a car insurance agent (Fig. 2), or the role of a doctor (Fig. 4). At the end of a trial, the participants change pictures and switch roles. These pictures have been designed specifically to elicit wh-questions in a semi-spontaneous environment. The participants are instructed not to follow the scenes strictly, but to take them as a hint to further elaborate the exchange. The forms, on the other hand, provide a memo for a wide variety of content questions (who, what, when, how, why, at what time, etc.).

Thirteen Deaf GSL signers participated to the study (7 pairs, one participant took part to two session to match a spare signer). The total duration of the recordings is of about 16 minutes. The dialogues are recorded with a phone camera and have been annotated using ELAN following the same template as in the corpus study (see below). The annotation (still on-going) is conducted by one of the author (Robert Gavrilescu), with the assistance of a GSL signer[3].

3.2. Case Study 2: Elicitation study

Within a funded project to study some psycholinguistic aspects of the syntax of LSF, a researcher is asked to conduct a preliminary study on content questions. The study is necessary to provide essential information on how to properly construct the experimental stimuli. The LSF researcher does not have a large annotated corpus at their disposal, but can count on one/two language consultants who regularly collaborate with the linguistic group. They then decide to study content questions in LSF using the playback method (Schlenker, 2014; Lettieri et al., 2023). As illustrated in Lettieri et al. (2023), the playback method consists of a sequence of at least six steps:

(4) a. Definition of the paradigm to investigate
b. Recording the paradigm from one consultant
c. Playing-back the paradigm to the informant(s)
d. Recording acceptability and felicity judgments
e. Discuss possible issues
f. Repeat steps (4c-4e) at least once

[3]We are grateful to Dimitris Papapetrou for his help

Figure 1: Car accident: scene.

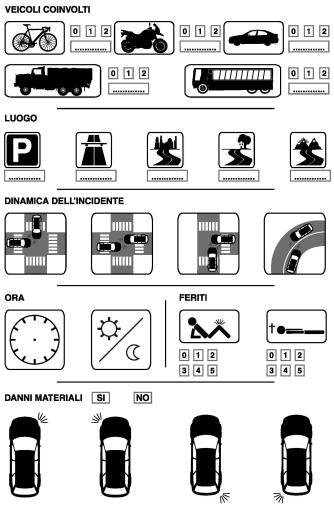

Figure 2: Car accident: form.

For this particular study, the scope of the research is given by the need of creating adequate stimuli for a psycholinguistic work, while the definition of the paradigm was given by the SignGram blueprint. The identification of wh-signs was done via LSF dictionaries and sign repositories (e.g., Spreadthesign Hilzensauer and Krammer, 2015 and Le Dico Elix). To illustrate how a subject wh-question paradigm was elicited, see the example in (5). The recording of the paradigm items was done by giving the language consultant a random sequence of signs (5a) to order in a grammatical sentence (5b) and then by substitution, asking to replace a noun with a wh-sign (5c), and reordering the signs in the sentence (5d-5e). Once one target sentence was finally reached, minimal variants are also recorded. Once the paradigm was obtained, in subsequent sections (at least a week apart) felicity and acceptability judgments were collected.

(5) a. MOTHER, MARKET, SUNDAY, VEG., BUY
Random sequence of signs
b. SUNDAY POSS MOTHER BUY VEG. MARKET
Baseline sentence
'My mom bought vegetables at the market last Sunday.'
c. SUNDAY **WHO** BUY VEG. MARKET

Figure 3: Home accident: scene.

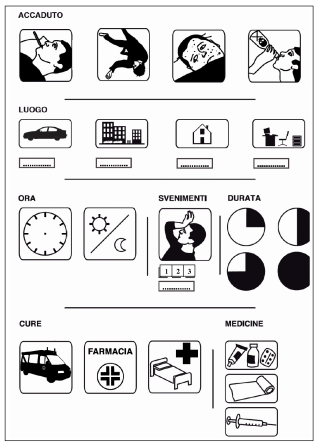

Figure 4: Home accident: form.

Target: wh-sign *in-situ* (substitution)

d. **WHO** SUNDAY BUY VEG. MARKET
Target: wh-sign in initial position (reordering)

e. SUNDAY BUY VEGETABLES MARKET **WHO**
Target: wh-sign in final position (reordering)
'Who bought vegetables at the market last Sunday?'

The data for this study were recorded during 13 sessions, while judgments were collected during 4 sessions. Data from other projects were also collected within a session so that in a typical two-hour session, an alternation between tasks (recording and judgments) and projects (content questions, subordination, phonemic inventory, etc.) was guaranteed. This procedure avoids heavy and boring sessions on a single topic.

3.3. Case Study 3: Corpus study

Stockholm University has a large STS corpus which has been annotated since 2009 (or since 2003 if the ECHO project is included). The first release was in 2012, and a later release in 2021 contained the gloss tier fully annotated (Mesch, 2023; Börstell et al., 2016). The corpus contains free conversations, presentations, and elicited narrative tasks (e.g., the *Frog Story*), but nothing similar to the task used in the Case Study 2. Since no systematic description of content questions is available for the language, the researcher decides to look into the corpus and see what type of information is available. The corpus contains 190,000 tokens, from 42 participants from three regions of the country; and it has already been successfully used to study valency (Börstell et al., 2019) and the syntax-prosody interface (Puupponen et al., 2016).

The corpus search was done by looking both at wh-signs in the gloss tier and wh-words in the translation tier. A manual check was then used to exclude sentences in which wh-phrases are used in non-interrogative sentences (e.g., relative clauses). Since no systematic description of wh-questions is available for the language, new annotation tiers specific to the project have been added: question type, wh-position, position of nominal element in restricted wh-phrases, distribution of the non-manuals. These are indented to be used as potential dependent variables or categorical predictors in quantitative analyses with the levels indicated in (6):

(6) a. **question type:** direct, embedded, constructed action

b. **wh-position:** initial, finial, in-situ, duplicated

c. **Restricted wh-phrases:** adjacent to the wh-sign, split

d. **distribution of non-manuals:** Absent, 1 sign, 2 signs, 3 signs, more

The annotation (still ongoing) is conducted by one of the authors (Johanna Mesch), who is also part of the research group that is responsible for the STS corpus at the University of Stockholm (see figure 5).

4. Preliminary Results

As for the inventory of wh-signs, all three methods of research have been able to spot a wide range wh-signs, indicating that the three languages have dedicated wh-forms for specified syntactic and semantic functions: WHO for animate/human individuals, WHAT for inanimate individuals in argument position, WHERE for locatives, etc. LSF combines specific

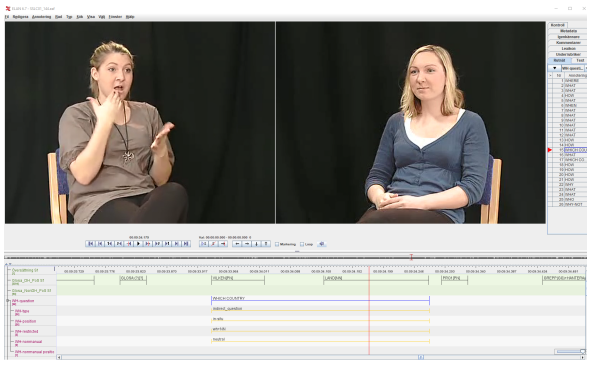

Figure 5: Corpus mining with coding schedule for the STS Corpus.

wh-signs depending on the restriction e.g., PRESIDENT WHO (*which president*), BOOK WHAT (*which book*), etc. STS uses the sign for WHO/WHICH in all types of restricted wh-phrases (the equivalent of English *which*), although there are cases in which the sign for WHAT is also used (e.g., WHAT REASON) No which-questions were found for GSL. One particular use of the sign for HOW was found in STS. The sign is used to create a sort of tag question eliciting an opinion from the addressee, as shown by the example in (7).

(7) **Signer A:** STOP AGAIN YES OR HOW
'Stop, (do a recording) again, right?'
Signer B: YES
'Yes.'

No variation among wh-signs is documented for LSF or STS, although it is known that there is a variant for the sign for WHO that is used in some regions of Sweden. Variation for the sign WHAT was found in GSL, where a two-handed palm-up sign (Fig. 6 right) or a two-handed 1-handshape form can be used (Fig. 6 left). The latter form is used by signers from the area of Athens.

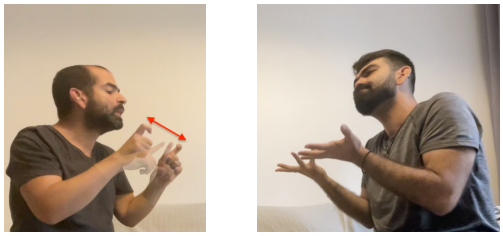

Figure 6: WHAT in GSL. Standard variant (right) and Athens variant (left).

Wh-questions without an overt wh-sign are documented in all three languages. Specifically, wh-phrases like *what time*, *how old*, and *how many* are often produced without a manual wh-sign (see Fig. 7, but are marked with the specific wh-non-manuals (see below).

Figure 7: HOW-MANY in STS. Only the sign MANY is produced.

Moving on to the syntactic part, the preliminary annotation of three videos of the production task returned 23 content questions in GSL, while approximately 250 content questions were recorded with the fieldwork method for LSF. The search for wh-signs in STS returned 2051 hits. Since, the STS corpus does not have an annotation tier for sentence type (declarative, interrogative, imperative, exclamative), a cross search to remove uses of wh-signs in non-interrogatives could not be performed at this stage. Nonetheless, a qualitative analyses of the corpus data is possible.

Indirect questions have been obtained for all languages. An example from GSL is given in (8).

(8) ASK TIME ACCIDENT APPROX
'I am asking at what time approximately the accident happened.'

Content questions within a constructed action (role shift) are found in the STS corpus, while they have not been found in the production task, and were not elicited as part of the fieldwork activities. Two examples from STS are given in (9).

(9) a. BOY SEARCH CALL VOICE
constructed action
WHERE FROG WHERE FROG
'The boy searches and calls for the frog.'

b. constructed action
MAN DS:PICK-UP WHO POSS IX-ON-GLASS
'When the window cleaner found the beer glass, he wondered whose it was.'

Concerning the position of wh-signs in the sentence, LSF allows wh-signs to remain *in situ*, to be found in sentence final position (after a locative phrase) and in sentence initial position (before a temporal adverb), as shown in (5) above. The fieldwork study revealed that the most preferred options are the *in situ* position (5c) and the sentence final position (5d), with the sentence initial position slightly marked.

For GSL, wh-signs are found in final position (10a), initial position (10a), and duplicated in initial and final position (10c).

(10) a. IX2 COME HOW
'How did you come (here)?'

b. HOW CITY SAY
'How do you say it was a city?'

c. WHY COME WHY
'Why did you come?'

For STS, wh-signs can appear sentence initially (11a), finally (11b), repeated at both edges of the clause (11c), and it can be omitted (11d).

(11) a. [...] HOW WHAT DO IX2 TODAY
'[...] And what are you doing today?'

b. FILM FESTIVAL THINK COMPARE ÖREBRO STOCKHOLM TWO DIFFERENT WHAT
'Although I mean what is the difference between the film festivals in Örebro and Stockholm, what is the difference?'

c. HOW TEACH LANGUAGE HOW
'How does the teaching take place purely linguistically?'

d. POSS2 FIRST WORK TO-BE SAAB IX2 MALMÖ IX2
'What was your first job? Was it at SAAB, in Malmö?'

Moving to restricted wh-questions, LSF allows the restriction to be stranded (12a) or pied-piped along with the wh-sign (12b). Interestingly, when the restriction is stranded, the sentence becomes ambiguous between a reading in which the wh-sign is interpreted as restricted by the subject or the object, as indicated in the possible translations for (12b). Crucially, (12a) cannot be interpreted as a stranded restricted wh-question on the object.

(12) a. WHO DOG SCRATCH CAT
'Which dog scratched the cat?'

b. DOG SCRATCH CAT WHO
'Which cat did the dog scratch?'
'Which dog scratched the cat?'

Restricted wh-questions are rare in the production task, so no conclusions can be drawn for GSL.

As for STS, the search returned 62 hits of restricted wh-phrases with the order wh-sign + noun (WHICH YEAR, WHICH CITY, ETC.), while only 7 hits of sequences of noun + wh-sign, indicating a strong preference for the order in which the wh-sign precedes its restriction. Interestingly, STS does not seem to differentiate the wh-sign based on the animacy of the restriction. In fact, the sign for WHO is used across the board in restricted wh-questions. Restricted wh-questions in STS illustrate another interesting aspect of the syntax of content questions in SL, namely the possibility of having partial copy of the wh-phrase. The example in (13a) shows a case in which the wh-sign is repeated, while the restriction is duplicated in (13b). Example (13c) shows a case in which the restriction and the wh-sign are repeated but the restriction is only partially repeated with the alternating pronoun (i.e., only the grammatical features of the restriction are repeated, and not its encyclopedic content).

(13) a. WHICH BOOK WHICH
'Which book?'

b. BRING BOOK WHICH NEW BOOK
'Which new book did you bring?'

c. TERRACED HOUSE WHICH EASY CONTACT NEIGHBOURS WHICH IX-alt
'In which house was it easier to contact neighbours?'

Finally, turning to the non-manual components. These are present in all languages. As for GSL, the proper distribution is yet to be determined, but there seems to be a head leaning forward and a slight eyebrow raising in correspondence of the wh-signs, although this seems to be optional. As for LSF, the non-manuals attested in the sample are furrowed eyebrows and squinted eyes. They often co-occur with manual wh-signs, but there are tokens in which those non-manuals are absent. When they occur, they may spread over portions of the sentence larger than the wh-constituent, although this is not the most common option. STS non-manuals for wh-questions are similar to those of LSF (see Fig. 7), but they appear to have a larger spreading in the sense that the non-manuals co-occur with several signs and are not restricted to the wh-sign only.

5. Discussion

Although preliminary, the results reported in Section 4 reveal interesting aspects of each methodology.

The production task is particularly effective in eliciting short wh-questions, typical of the spontaneous interaction, as already documented for LIS (Geraci et al., 2015). Despite the small number of tokens, it also shows a considerable amount of syntactic variation illustrating that GSL allows wh-signs to occur at either edge of a clause and even repeated at both edges. Although the population sample was not selected for this purpose, the method is also robust enough to record some lexical variation and elicit complex constructions like embedded wh-questions. For different reasons, the particular task does not seem to be adequate to study questions inside constructed actions, or *in situ* wh-questions. In fact, the participants' roles in the task somehow prevent constructed actions from occurring. As for *in situ* wh-signs, considering the overall small number of signs per sentence, it is complicated to find

syntactic evidence of the correct position of the wh-sign in the sentence.

The corpus study provided a considerable number of hits, although some of them may not be genuine content questions. Since the corpus contains data from a variety of tasks (narratives, presentations, conversations), it is crucial to notice that most of the hits come from the conversation task (see figure 8). So, if one were to start a corpus annotation for a study on content questions, the advice is to start looking into conversation videos before narratives or presentations. At the syntactic

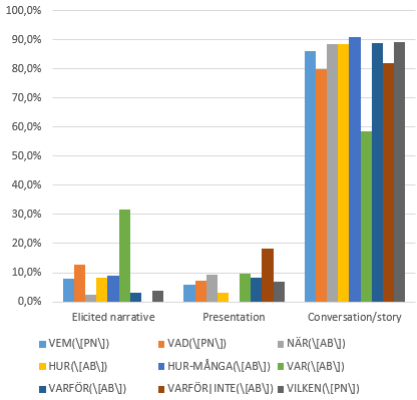

Figure 8: The distribution of wh-signs in the STS Corpus.

level, we could not evaluate the quantitative distribution of wh-signs because the annotation has not yet been completed. However, from a qualitative inspection, the data seem to be rich enough to determine the amount of variation in the position of wh-signs. The richness of the data will also allow an understanding of the distribution of restricted wh-questions. The corpus data also revealed the presence of questions inside constructed actions and tag constructions, which did not emerge from the production experiment and can be very hard to discover from fieldwork sessions.

Unfortunately, pure production data cannot provide negative evidence, this is true for both the experimental method and the corpus method. Specifically, understanding the conditions in which tag questions are acceptable might require the construction of *ad hoc* paradigms that might be better investigated using a different method.

As for fieldwork data, the identification of the target paradigms is much simpler to obtain than other with other methods and the possibility of getting negative evidence is something that is extremely valuable to create grammatical theories. At the level of grammatical description, fieldwork methods provide quick access to basic facts, but they are less suitable for capturing a wide range of variation. The method is ideal for a deep understanding of complex grammatical constructions (especially with long sentences) but a bit less for pure exploration (and accidental discoveries). For instance, tag questions in STS would be very hard to discover using the elicited method, unless the researcher is already prompted about the existence of that construction and of what type of lexical material is needed.

Table 1 summarizes how the description of content questions can be accomplished using fieldwork, corpus, and experimental resources.

Level	Exper.	Fieldwk.	Corpus
Manual signs	ok	ok	ok
Non-manuals	*	ok	ok
Position of wh-signs	?	ok	ok
Content Q with no wh-sign	ok	ok	ok
Restricted wh-phrases	NA	ok	ok

Table 1: Summary of the descriptive adequacy of the three methods. ok = objective reached, * = objective not reached, ? = objective partially reached, NA = not assessable.

Although these are only preliminary, the picture that emerges is that fieldwork and corpus methods provide similar results, proving adequate tools for linguistic description. On the other hand, the experimental task does not allow for a satisfactory analysis of the non-manuals and restricted wh-phrases, while the distribution of wh-signs in the sentence is only partially accomplished. We believe that this is due to the fact that the experimental task elicited very short questions. Short sentences are not ideal to analyze the spreading of non-manuals or the syntactic distribution of wh-signs because sentences with few signs do not allow to conclusively understand the underlying structure of the construction. Furthermore, the specific task was not designed to elicit restricted wh-questions. So, it is not a surprise that with the small sample we considered here none was actually produced. One final note on this methodology. Experimental studies are an excellent tool for hypothesis testing but are rarely used for descriptive purposes. However, if one were aiming to obtain a satisfactory description of the content question, more than one experiment is likely needed.

6. Conclusions

In this work, we addressed the methodological question of what types of information can be obtained when different methodologies are used to accomplish a similar task. We used three different case studies to explore how experimental, field-

work and corpus methods gather linguistic data to describe content questions in sign language. Overall, the results of the first case study, experiment data, offer a pilot of what can be further and more extensively explored with more controlled settings and more participants. Still, if this method is to be pursued, it should be paired with a comprehension study, although admittedly the analysis of complex constructions might reveal difficult using this method. The results of the second case study, elicited data, is a deep description of some aspects of the syntax of content questions in LSF with little exploration of variation and of the effects that variation may have on the constructions. In this respect, an experimental or a corpus study, if the resource is available, would be an ideal complement. The results of the third case study, corpus data, is a rich set of wh-constructions, which has only been qualitatively investigated, but that provided an interesting glance at the amount of variation in the language. The downside of this method, as already observed, is the lack of negative evidence, and the difficulty of probing the deep properties of the constructions. Hence, if a researcher starts with a corpus study, after a qualitative and quantitative analysis of the data, complementary fieldwork data are ideal.

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