

Embedding polar interrogative clauses in American Sign Language **Kathryn Davidson and Ivano Caponigro**

1. Introduction

After establishing that American Sign Language (ASL) follows the same basic principles as other natural languages (Stokoe 1965; Klima & Bellugi 1979), there was still debate about whether ASL permits clausal embedding (Thompson 1977). Researchers' doubts rested not on whether a complex thought could be expressed with multiple clauses (for which there is ample evidence), but whether the surface order of one clause following another was expressing a simple linear order of independent matrix clauses or, crucially, a hierarchical structure of clauses embedded inside other clauses. The question is somewhat harder to answer in ASL than in languages that mark clausal embedding with verbal morphology, an overt complementizer in the embedded clause, and/or a change in the word order in embedded clauses; ASL makes use of none of these strategies. Instead, Liddell (1980) and Padden (1988) used phenomena such as the distribution and scope of negation, topicalization, “doubling”, and “subject pronoun copying” to argue that ASL allows for embedded declarative clauses like the underlined clause in (1) in English. Later, Petronio and Lillo-Martin (1997) showed that ASL allows for embedded wh-interrogative clauses like the underlined clause in (2) in English.

- (1) Mary thought her sister had received her gift.
- (2) Bob wondered who received his gift.

However, as far as we know, there has been no discussion about whether ASL allows for embedded polar interrogative clauses, which in English are marked by the complementizers *if* (3) or *whether* (4).

- (3) Mary wondered if her sister had received her gift.
- (4) Susan wasn't sure whether she should drink the water.

In this paper we provide a variety of arguments based on new elicited data and corpus data showing that ASL has embedded polar interrogative clauses. We believe that not only is this important for a fuller understanding of the grammar of ASL, but that it also can help shed light on some outstanding puzzles in the grammar of ASL.

As we will discuss in more detail below, polar interrogative clauses (henceforth, polar interrogatives) are in a unique position in that they share their clause type (interrogative) and semantic type (question) with wh-interrogative clauses (henceforth, wh-interrogatives), while at the same time sharing the same surface string and a lack of wh-words with declarative clauses (henceforth, declaratives). Several grammatical differences (e.g. in nonmanual marking and in focus doubling) have been found between wh-interrogatives and declaratives, and by looking at polar interrogatives we can begin to investigate the factors contributing to these differences. In particular, by embedding a polar interrogative within a larger structure, it becomes possible to dissociate the internal structure of the clause (that has been embedded) from the speech act (because the embedded polar interrogative no longer performs the speech act of asking a question). This, in turns, makes it possible to determine whether these elements are syntactically, semantically, or pragmatically conditioned. In other words, our findings about embedded polar interrogatives, coupled with previous findings about embedded declaratives, allow us to compare these embedded structure with their corresponding matrix structures and determine if the properties that the matrix interrogatives and declaratives share are not attested in the embedded

equivalents (and therefore depend on the matrix/roots status of the clauses) or are attested in the embedded cases as well (and therefore depend on the syntactic nature of the clause: e.g. declaratives and polar interrogatives vs. wh-interrogatives and other kinds of clauses). One overarching theme of the paper is to show that by investigating syntactic and semantic properties together, we can further advance our understanding of the grammar of ASL.

The paper is structured as follows. In section 2, we review tests that have been used as evidence for embedded clauses in ASL, in particular the tests for embedded declaratives (section 2.1) and wh-interrogatives (section 2.2). In section 3, we use some of these tests to argue for the existence of embedded polar interrogatives in ASL, using both elicited data (section 3.1) and corpus data (section 3.2). In section 4, we discuss different varieties of embedding matrix verbs and the semantic properties of their complements. In section 5, we illustrate how embedding polar interrogatives can shed light on two phenomena in ASL, focus doubling and subject pronoun copy. In section 6, we briefly discuss embedded polar interrogatives in Question-Answer Clauses and conclude.

2. Evidence showing clausal embedding in ASL

Various tests have been suggested in the literature to support the conclusions that ASL allows for clausal embedding. In this section, we briefly review them. In particular, in section 2.1 we look at the tests in favor of embedded declaratives in ASL, while in section 2.2 we examine those concerning embedded wh-interrogatives.

2.1. Embedding declarative clauses

Liddell (1980) and Padden (1988) provide several arguments that embedded declarative clauses can be distinguished from coordinated strings or clauses. They suggest three tests for embedding: subject pronoun copy, negation, and topicalization.

The phenomenon of subject pronoun copy is illustrated in (5) (all examples in this section are from Padden 1988: Ch. 3 unless noted otherwise). In (5)a, the pronominal subject in sentence initial position (IX_I)¹ can be repeated/copied at the end of the sentence for emphasis. The subject and its copy must be contained in the same clause: in the case of two coordinated clauses as in (5)b, the copied pronoun at the end of the whole sentence (IX) can only refer to the pronominal subject of the last clause (IX_b), not back to subject of the first clause (IX_a), as indicated by the subscripts on the copied pronoun. However, as long as the subject and its copy are contained in the same clause, they can be separated by a distance: in (5)c, the copied pronoun at the end of the sentence (IX_I) can refer back to the sentence-initial pronominal subject (the pronoun IX_I at the very beginning of the whole string). The contrast between the ungrammaticality of the copy after the coordinated clauses in (5)b² and the grammatical copy at the end of (5)c suggest that the bracketed clause in (5)c is embedded as the clausal complement of the matrix predicate *DECIDE*.

¹ IX stands for *Index*, one conventional way to gloss the use of the point to a location in space that functions as a pronoun (unmarked for gender) in ASL. Throughout, we follow roughly conventions used in Sandler and Lillo-Martin (2006). Of particular note here is that subscripts indicate the location of pointing, e.g. subscript I indicates the speaker (first person), 2 the interlocutor, and further subscript letters indicate persons other than the speaker.

² Padden's original example was [IX_a SIT_a] [IX_b STAND_b $IX_{*a/b}$] 'He sat there and she stood there, she did', but we have changed the subject of the first clause to first person to provide a cleaner minimal pair for comparison (judgments remain the same).

- (5) a. **IX₁ GO-AWAY IX₁**
 ‘I’m going for sure (I am)’
 b. **[IX₁ SIT_a] [IX_b STAND_b IX_{*1/b}]**
 ‘I sat there and she stood there, she did’
 c. **IX₁ DECIDE [IX_a SHOULD_aDRIVE_b SEE CHILDREN] IX₁**
 ‘I decided he ought to drive over to see his children, I did’

We note that the phenomenon of subject pronoun copy (or something similar) has been the subject of a number of subsequent (re)analyses that differ from Padden's (see Neidle et al. 2000, Crasborn et al. 2009, Wilbur 2012), but none reject this clause-marking properties of the double.

The second argument for embedding comes from the duration of negative nonmanual marking. Nonmanual marking is an umbrella term for movements of the face and body, excluding signs made with the hands. Like intonation in spoken languages, nonmanual marking may play various linguistic roles such as focus, question marking, and in ASL, marking the scope of negation, seen in (6)(Padden 1988: Ch. 3). "Neg" nonmanual marking in ASL consists primarily of head shaking.

- (6) a. $\overline{\text{neg}}$
IX₁ WANT [IX_a GO-AWAY]
 ‘It’s not the case that I wanted him to leave.’
 b. $\overline{\text{neg}}$ $\overline{\text{headnod}}$
IX₁ SEE IX_a UNDERSTAND
 ‘He didn’t see it but she understood.’

Example (6)a, with *neg* nonmanual marking extending over the entire sentence, is interpreted with negation taking scope over the entire sentence. In contrast, the sentence in (6)b, with *neg* nonmanual marking only over the first two signs, is interpreted with negation over only the first of two matrix clauses. Since the notion of scope is both syntactic and semantic, the interpretation of negation as scoping over the whole sentence implies that the bracketed clause in (6)a is within the syntactic scope of negation and is therefore an embedded declarative clause acting as the complement of the matrix predicate *WANT*. We can contrast this with examples like (6)b, where the interpretation of negation is restricted to the first clause and head shaking non-manual marking is restricted as well. The second clause is not interpreted as part of the first clause (otherwise the whole sentence would mean that he didn’t see that she understood) and its non-manual marking is different from the first clause (head nodding rather than headshaking). Thus, we can use the tight relationship between the syntactic and semantic scope of negation, and the duration of negative nonmanual marking, to illustrate clausal structure, including embedding.

The final test that has been suggested to separate embedding from coordination uses topicalized constituents to determine clause boundaries. Padden (1988) shows that constituents cannot be moved to the topic position from across coordinated clauses. Therefore, if a constituent is topicalized from one clause to another, this would mean that the clause where the topicalized constituent is interpreted is embedded within the clause where the topicalized constituent has been moved. Padden presents the example (7)(1988: Ch. 3, ex. 34), where *EXERCISE CLASS* is interpreted as the argument of *TAKE*, but is produced first in linear order, with nonmanual marking specific to topics (often described as raising of the eyebrows). Since topicalization is disallowed out of coordinate structures, we can conclude instead that the bracketed clauses in (7) is an example of two declarative clauses, one embedded within the other.

- (7) topic
 EXERCISE CLASS, IX₁ HOPE [SISTER SUCCESS PERSUADE [MOTHER TAKE-UP]]
 'The exercise class, I hope my sister manages to persuade my mother to take it.'

In examples of potential embedding, we want to exclude the possibility that what we are assuming is an embedded clause is actually a quote. This is because when quoting direct speech, the quoted element is left essentially unchanged, and so quotation cannot tell us much about the syntactic/semantic behavior of true complement embedding. To this end, Liddell (1980) suggests two methods for distinguishing direct speech from indirect speech. First, quotation in ASL involves movements of the body and nonmanual marking called *role shift*. Role shift sometimes even obviates the need for the matrix "quoting" predicate: simply by shifting and indicating that the speaker is now taking on the role of John, it will be clear that anything uttered within that shift is what John said (8). This is contrasted with an example of clausal embedding, where there is no shift in location (9), and an embedding verb is required (both examples come from Liddell 1980).

- (8) JOHN (SAY)^{shift} [IX₁ TIRED]
 'John said, "I'm tired."'

 (9) JOHN SAY [IX_a TIRED].
 'John_a said he_a was tired.'

Also present in Liddell's discussion of (8)-(9) is a second method for distinguishing quotation from embedding: binding relationships of pronouns. Under quotation (8), the first person pronoun *IX₁* must be used to refer to *JOHN*, the subject of the clause introducing the quotation and the speaker of the quotation. In contrast, in true embedding the subject *John* must be referred to by the non-first person pronoun *IX_a* (9), as he is no longer the speaker of the embedded clause. We have argued elsewhere (Caponigro and Davidson 2011) in agreement with Liddell that this provides yet another test for determining whether a potential embedded clause is direct quotation versus embedding/indirect speech. We conclude that there is robust evidence showing that ASL allows for embedded declaratives, and that by using a variety of tests for embedding we can separate embedded clauses from coordinated structures and quotation.

2.2. Embedded *wh*-interrogative clauses in ASL

We turn next to tests for the embedding of *wh*-interrogatives in ASL. Petronio and Lillo-Martin (1997) argue that embedded *wh*-interrogatives may be embedded under predicates like *KNOW*, *DON'T-KNOW*, *CURIOUS*, and *WONDER*. An important piece of evidence in favor of their embedding, similar to what we saw in embedded declaratives, comes from the non-manual marking. Matrix *wh*-interrogatives in ASL consistently exhibit 'brow furrow' nonmanual marking (10)-(11), which typically appears in all questions with *wh*-words. However, when a *wh*-interrogative is embedded as the complement of a verb like *KNOW* (12) and *WONDER* (13), the brow furrowing disappears. Instead, the nonmanual marking on the *wh*-clause is an extension of the nonmanual marking on the matrix clause, and varies depending on the embedding verb (a different marking for *KNOW* vs. *WONDER*).

- (10) brow furrow
 WHO JOHN LIKE WHO?
 'Who does John like?'

- (15) _____bf(brow furrow)
 WHO JOHN LIKE.
 ‘Who does John like?’
- (16) _____bf(brow furrow)
 ANN ASK [WHO JOHN LIKE].
 ‘Ann asked, "Who does John like?’
- (17) _____know
 ANN KNOW WHO JOHN LIKE.
 ‘Ann knows who John likes.’

We see that there are clear distinctions between the non-manual marking of quoted dialogue, as in (16), and true embedded wh-interrogatives, as in (17).

In addition to non-manual marking, there is also a syntactic difference between matrix and embedded wh-interrogatives related to the availability of doubled wh-words. We will have more to say on their distribution in section 4, but for now we simply note that matrix wh-interrogatives allow wh-words to be doubled in the same clause (18), even if it is in a quotation (19), while true embedding does not (20) (our examples, based on Petronio and Lillo-Martin 1997)

- (18) _____bf(brow furrow)
WHO LIKE JOHN WHO?
 ‘Who likes John?’
- (19) _____bf(brow furrow)
 ANN WONDER **WHO LIKE JOHN WHO**.
 ‘Ann wondered, "Who does John like?’
- (20) _____know
 *ANN KNOW **WHO LIKE JOHN WHO**.
 ‘Ann knows who John likes.’

We conclude that there is evidence based both on syntax and on nonmanual markings supporting the existence of embedded wh-interrogative clauses in ASL, examples that are clearly neither coordination nor quotation.

3. Embedded polar interrogative clauses in ASL

The previous section reviewed previous work that has argued in favor of clausal embedding in ASL based on embedding of declaratives and wh-interrogatives. This section addresses the issue at the core of this paper: whether embedded polar interrogatives are possible in ASL. To the best of our knowledge, this issue hasn’t been addressed before and is still open. In what follows, we show that ASL does allow embedding of polar interrogatives as well by providing new elicited data (section 3.1, all data are ours unless noted otherwise), looking at corpus data (3.2), and in each case applying tests for embedding that have previously been used for other kinds of embedded clauses in ASL.

3.1. Elicited embedded polar interrogative clauses

Embedded polar interrogatives in ASL can't be detected by means of an overt lexical marker such as a complementizer (e.g. *if* or *whether* in English), because ASL doesn't require any such overt complementizer. Additionally, word order also cannot distinguish embedded declaratives from embedded polar interrogatives, because matrix declarative clauses and matrix polar interrogatives share the same word order and no lexical element marking the distinction. The only obligatory difference between the declaratives and polar interrogatives is in the nonmanual marking, which involves raised eyebrows ("br") for the duration of the interrogative (21), compared to the plain, or "default" marking on the declarative (22).

(21) _____ br
 BROTHER LIKE SALAD?
 "Does (my) brother like salad?"

(22) BROTHER LIKE SALAD.
 "(My) brother likes salad."

Unfortunately, nonmanual marking cannot work as a cue to embedded polar interrogatives. Nonmanual marking in embedded clauses depends on the matrix predicate rather than the nature of the embedded clause, as we discussed above for embedded declaratives and *wh*-interrogatives, and there are predicates like *SAY* and *KNOW* that can select for either an embedded declarative or interrogative as their complement. In addition, there's no a priori reason to expect a contrast between matrix declaratives and interrogatives to hold when embedded as well. For instance, subject-auxiliary inversion distinguishes matrix declarative from matrix (polar) interrogatives in English, but this distinction is lost under embedding (at least in standard American English).

Instead, the first test we turn to in order to identify embedded polar interrogatives is based on the semantic properties of embedding predicates. A predicate like *WONDER* is semantically compatible only with a complement clause that conveys a question meaning, as in the bracketed embedded *wh*-interrogative in (23).

(23) MOM WONDER [WHO LIKE SALAD]
 "Mom wonders who likes salad."

WONDER may also take a clausal complement that doesn't contain any *wh*-word, and resembles the matrix declarative (21) and polar interrogative (22), as shown in (24).

(24) MOM WONDER [BROTHER LIKE SALAD]
 "Mom wonders whether her brother likes salad."

Since the semantics of *WONDER* is incompatible with a declarative clause as its complement and (24) contains no *wh*-word, then the bracketed clause in the complement position of *WONDER* in (24) must be an embedded polar interrogative. This conclusion is further strengthened by the English translation (24) provided by our consultants.

We suggest three additional tests supporting the conclusion above: topicalization, negation, and binding, and briefly discuss each in turn. First, consider the topicalization test, reviewed in section 2.1 above. In (25) the constituent *SALAD*, which is an argument of the verb *LIKE*, has been topicalized all the way to the sentence initial position, above the matrix predicate *WONDER* and the matrix subject *MOM*. It even has special topicalized nonmanual marking (involving brow raising). There is no role shift, so this does not seem to be an instance of quotation.

- (25) _____t
SALAD, MOM WONDER [BROTHER LIKE _____]
 “Mom wonders whether her brother likes that salad.”

Since the resulting sentence is acceptable (even, as a reviewer notes, despite a possible island restriction that we might have expected), we may conclude that the bracketed clauses in (25), out of which the topicalized element has been extracted, must be an embedded clause. Because of the semantic restrictions requiring the complement of *WONDER* to be a question, and because of the lack of a wh-word, the bracketed clauses in (25) can be taken to be an embedded polar interrogative.

Another piece of evidence in support of embedded polar interrogative clauses in ASL comes from the negation test, reviewed in section 2.1 above. In (26), the nonmanual marking associated with negation is extended to the entire string, which shows that the entire string forms a single clause. The interpretation of this sentence is also consistent with negation taking scope over the entire clause. Thus, we can conclude that bracketed clause inside it is an embedded polar interrogative occurring as the complement of the matrix predicate *WONDER*.

- (26) _____negation
 MOM WONDER [BROTHER LIKE SALAD],
 (MOM WONDER SISTER LIKE SALAD)
 'Mom doesn't wonder whether her brother likes salad
 (she wonders whether her sister likes salad).'

Finally, we can look at the pronominal binding/coreference properties of a close variant of the bracketed clause in (25). In previous examples the identity of the brother was inferred from context to be the brother of the subject of the sentence, *MOM*. In (27), the signer uses a possessive to overtly indicate that she is referring to her mother's brother by signing the possessive marker *POSS* in towards the direction of the location in space where *MOM* was signed. This contrasts with an example of quotation, where the possessive is signed on the signer to indicate first person (28). Note also that in (28) there is brow raise nonmanual marking on what is now a matrix clause, and *THAT SALAD* cannot be topicalized out of the quotation (29).

- (27) _____t
THAT SALAD, MOM_a WONDER [POSS_a BROTHER LIKE]
 'Mom wonders whether her brother likes that salad.'

- (28) _____brow raise
 MOM_a WONDER [POSS₁ BROTHER LIKE THAT SALAD?]
 'Mom wonders: “Does my brother like that salad?”'

- (29) _____t _____brow raise
 *THAT SALAD, MOM_a WONDER [POSS₁ BROTHER LIKE ?]
 'Mom wonders: “Does my brother like that salad?”'

In conclusion, the semantic properties of embedding predicates, topicalization, the scope of negation, and pronominal binding/coreference all support the conclusion that ASL allows for embedded polar interrogatives.

3.2. Corpus data and embedded polar interrogative clauses

One reason why little attention has been paid to embedded polar interrogatives in ASL is that they seem to occur less frequently than *wh*-interrogatives, and definitely less frequently than declaratives. For this reason also, it would be difficult to identify them based only on a small corpus sample. However, a large corpus of children’s ASL language development has been collected as part of a larger language acquisition project (Lillo-Martin and Chen Pichler 2008). We present some examples below taken from adults signing in the presence of a single native ASL signing deaf child, “ABY.” None of the utterances are from the child ABY herself, but many are from her parents or deaf researchers interacting with ABY and other adults. The status of the interlocutors in the corpus data varies (they’re naturally occurring examples in people’s homes over the course of many years), but for the most part there is always at least one other deaf adult present; usually, the only adults present are deaf or native signers. Nevertheless, it is possible that the child-directed nature of the communication could influence the structures that we find, and so we present these examples as a supplement to the elicited examples in section 3.1.

Embedded polar interrogatives were found in the corpus using two different methods. First, each ASL utterance in the corpus is associated to an English translation, and so we searched for utterances whose English translations used *if*, *whether*, or any of a number of common embedding verbs³. Second, two hour-long transcripts were searched by hand in their entirety. Results were sparse: in a corpus of spontaneous signing spanning 79 approximately one-hour long films, only 12 examples were potential cases of embedded polar interrogatives. Sentences (30)-(37) were all found by searching the translation of the transcribed ASL signing of adult signers for *if* and *whether*.

- (30) IX_I ASK IX_{ABY} FINISH DV(wash-car) POSS_a CAR BEFORE.
IX_{ABY} SAY YES.
'I asked her if she did wash your car before. She said yes.'
- (31) IX_I ASK IF TIGER IX_{book}
'I asked her if it is a tiger.'
- (32) ASK IX_a WANT MORE FINISH IX_{popcorn}
'Ask her if she wants more (popcorn) or if it’s enough.'
- (33) SCARE IX_a? HEY, ASK SCARE ASK SCARE IX_a IX_{ABY}
'Are you scared? Hey, Aby, ask Laura if she is scared.'
- (34) HEY ASK IX_{toy} LIKE ASK IX_{toy}
'Hey ask the bear if it likes that.'
- (35) HEY ASK IX_{toy} WANT TOMATO IX_{toy} WANT TOMATO IX_{toy} WANT
'Hey, ask the bear if it wants tomato.'
- (36) TEST CHECK IF O-K
'Test to check if he’s okay'
- (37) SEE IX_a SICK IX_a. MAYBE TEST.
'See if he’s sick Maybe he is, test him.'

³ Verbs searched include: *know*, *wonder*, *curious*, *ask*, *think*, *remember*, *certain*, *tell*, *surprise*, *agree*, *realize*, *find out*, *guess*, *forget*

These examples illustrate two embedding strategies in ASL: marking the embedded clause with an *IF* 'if', as in English, or with an overt pronominal *IX* (despite otherwise frequent argument omission of subjects in ASL), or with a null complementizer. In this corpus and elsewhere there is no sign translated into English as 'whether.' Two signers consulted for elicitation data report that they find the sign *IF*, as in examples (30)-(37) and elsewhere, very "English-like", perhaps indicating that overt complementation of polar interrogatives using *IF* is not a feature of ASL for all signers. If this is so, it puts them in the same category as *wh*-interrogatives and declaratives in not having an overt complementizer. We believe that our sample likely over-generated examples using *IF* because these were more likely to suggest *if* in the English translation, and thus to be found in our search.

One may question how many of these examples are true embedding, and for that we can return to the tests previously presented that were proposed by Liddell (1980) and Padden (1988). Consider example (33): this sentence has a pronoun that corresponds to the embedded subject (IX_a), and the second person subject of the imperative clause (IX_{ABY}) at the end of the sentence. We note that while on the surface these aren't technically "copies", since there is only one overt instance of them, a likely analyses would take them to be the same phenomenon, because ASL has subject-verb-object (SVO) word order, and also allows null subjects, so their sentence-final appearance would be "copying" the (here, null) subject at the end of the clause. (For the same reasons, we can use the basic SVO word order of ASL to determine that IX_a is a copy of the embedded subject and not the indirect object of *ASK*: if IX_a were the indirect object of *ask*, it should immediately follow *ASK*; instead, it occurs sentence-finally, after *SCARE*.) Finally, we see that the use of the index to refer later to the subject, IX_{ABY} , suggests that this is indeed an embedded clause. Example (37) could potentially be analyzed as having subject pronoun copy as well. Moreover, Josep Quer (p.c.) notes that if the matrix verb is in the imperative mood, then typically quotation is degraded as the complement of a predicate in the imperative mood. For example, for many speakers the English sentence *Ask him 'Are you coming?'* only works when the target of the question is present; otherwise, one uses *Ask him whether he is coming*. We see in (32)-(37) many matrix verbs which are in the imperative mood, an indication that what follows is not quotation.

While it is encouraging to find examples in natural discourse, the sample in this section contained only three matrix predicates: *ASK* (inflected in various ways for person), *CHECK*, and *SEE*, and tests for embedding do not always present themselves in natural discourse. Therefore, elicited examples will continue to be most helpful in subsequent sections when for investigating different verbs and types of embedding.

4. Variation in Semantics of Embedding Predicates

We have shown examples of clausal complement embedding of polar interrogatives using both elicited data and corpus data. In this section, we focus on further details of the relationship between the matrix verb and the embedded clause. In particular, we briefly introduce the semantic types of declaratives and interrogatives (section 4.1), provide a taxonomy of different embedding predicates in ASL (section 4.2), and show that ASL patterns with spoken languages in the interpretation of embedded polar interrogatives in different semantic contexts (section 4.3). All examples have been elicited by us unless noted otherwise.

4.1. Semantics of declarative and interrogative clauses

In this section, we briefly and informally summarize the core ideas behind a standard approach to the meaning of declaratives and interrogatives in formal semantics and related semantic distinctions within predicates that take interrogatives as their clausal complements.

In spoken languages, the clausal complements of embedding verbs can be divided into classes based on semantic properties. One major distinction is whether the embedding verb selects a declarative clause or an interrogative clause as a complement. In English, verbs like *know* and *think* can embed declarative clauses, while *wonder* cannot (38). Other verbs can embed interrogative clauses (39); some of these verbs, like *wonder*, only embed interrogatives, while others, such as *know*, embed both declaratives and interrogatives.

(38) Mary knew/*wondered/thought [DECLARATIVE that Susan drank the tea].

(39) Mary knew/wondered/*thought [INTERROGATIVE who drank the tea].

Because this paper focuses on embedding polar interrogatives, we are interested here mostly in predicates like *know* and *wonder* that embed interrogatives. These can be further divided into two classes: predicates like *wonder* and *ask* that take both types of interrogatives but not declaratives (40), and predicates like *know* and *discover* that take both types of interrogatives as well as declaratives (41).

(40) a. Mary wondered/asked [WH-INTERROGATIVE who drank tea].

b. Mary wonder/asked [POLAR INTERROGATIVE whether Susan drank tea].

c. *Mary wondered/asked [DECLARATIVE Susan drank tea].

(41) a. Mary knew/discovered [WH-INTERROGATIVE who drank tea].

b. Mary knew/discovered [POLAR INTERROGATIVE whether Susan drank tea].

c. Mary knew/discovered [DECLARATIVE Susan drank tea].

To discuss these two classes further, we want to introduce the two semantics concepts of a *proposition* and a *question*. We take as given that the denotation of a (typical) declarative clause is a proposition, i.e. the set of worlds where the declarative is true. For instance, the meaning of a declarative sentence like *Ann drank tea* is the proposition ‘that Ann drank tea’, i.e., the set of worlds in which Ann drank tea, i.e. the set of worlds in which the sentence *Ann drank tea* would be true.⁴

How, then, is the meaning of an interrogative related to the meaning of a declarative? Since Hamblin (1973) and Karttunen (1977), the prevailing semantic approach is that the meaning of an interrogative is a question, i.e. the *set* of all propositions that are possible answers to that interrogative clause.⁵ For instance, consider the English wh-interrogative *Who drank tea?* In a context in which the only relevant individuals are Ann and Bob, the following propositions can be provided as an answer: ‘that Ann drank tea’ and ‘that Bob drank tea’.⁶ Therefore, the meaning of

⁴ We use italics for expressions from natural languages (e.g. *Ann drank tea*), while we use ‘that ...’ for propositions, a non-linguistic object (e.g. ‘that Ann drank tea’).

⁵ See Groenendijk and Stokhof (2011) for a detailed survey on the semantics and pragmatics of interrogative clauses and the proposals that have been advanced to account for them.

⁶ The proposition ‘that Ann and Bob drank tea’ can be used as an answer to the interrogative clause as well, but it’s not included since it can be derived by the union of that two simple propositions above (‘that Ann and Bob drank tea’ = ‘that Ann drank tea’ ∪ ‘that Bob drank tea’).

the wh-interrogative *Who drank tea?* is the set of propositions {‘that Ann drank tea’, ‘that Bob drank tea’}. Similarly, the meaning of a polar interrogative like *Did Susan drink tea?* is the set of propositions that can be used as possible answers to it: {‘that Susan drank tea’, ‘that Susan didn’t drink tea’}. The distinction between the meaning of a declarative clause (i.e., a proposition) and the meaning of a wh- or polar interrogative clause (i.e., a set of propositions) is important for the discussion that follows.

Consider now the two classes of interrogative-embedding verbs in (40)-(41). Those predicates that only embed interrogatives, like *wonder* or *ask*, are usually called "intensional" embedding predicates. Intensional predicates combine semantically with a complement denoting a question, i.e. a set of propositions. This fits with most native speakers' intuition that one wonders or asks a *question*. On the other hand, verbs that embed both declaratives and interrogatives, such as *know* or *discover*, are called "extensional". There is a sense in which even when extensional predicates embed interrogative clauses, they are not interpreting interrogative clauses as questions: one does not know a question, or discover a question, but rather, one knows or discovers the *answer* to the question. An answer to a question is a proposition, not a set of propositions. Because of this intuition and because extensional interrogative-embedding predicates are exactly those that also take a declarative clause (which denotes a proposition) as their complement, many researchers have taken the final meaning of an embedded wh- or polar interrogative in the complement position of extensional predicates to be a proposition, rather than a question (Berman 1991, Lahiri 1991).

The extensional/intensional distinction is particularly relevant for the issue of embedded polar interrogatives because of an interesting asymmetry exhibited by two different types of polar interrogatives in different semantic environments. Although most glosses of polar interrogatives in English so far have used the complementizer *whether*, English also permits *if*. Intensional embedding predicates like *know* allow both declarative clause complements (42)a and *whether* complements (42)b, but for many (but not all) speakers they sound less acceptable with *if* complements (42)c. However, when the matrix sentence is negated or turned into an interrogative, the *if* complement is improved (42)d-e for these speakers.

- (42) a. The queen knew that it was a holiday.
 b. The queen knew whether (or not) it was a holiday.
 c. ?*The queen knew if it was a holiday.⁷
 d. The queen did not know if it was a holiday.
 e. Did the queen know if it was a holiday?

(examples modified from Eckardt 2001)

⁷ The original data used *admit*, because there is an interfering factor with *know* in English where the *if*-clause can be interpreted as the antecedent of a conditional sentence. This can be mitigated by conjoining a concealed question NP with the *if*-clause, to force a question interpretation. Most speakers find this also clearly degraded compared to (ii), although there is variation.

- (i) ?*The queen knew the date and if it was a holiday.
 (ii) The queen knew the date and whether it was a holiday (or not).

We used *know* in the English examples here because it was a common elicited embedding verb in ASL, and in ASL the polar interrogative could not be mistaken for the antecedent of a conditional sentence (which has its own (optional) lexical item *IF* and brow raising nonmanual marking).

In contrast, predicates like *wonder* can embed *if* complements (43) without any restrictions.

- (43) The queen wondered if it was a holiday.

Adger and Quer (2001) provide a syntactic feature analysis for the puzzle in (42), arguing that the degraded grammaticality of a polar interrogative introduced by *if* as the complement of an extensional embedding predicate is due to a covert determiner that takes the *if* clause as its complement, and then combines with the matrix predicate. They suggest that this operator shows the same semantic sensitivity as negative polarity items, i.e. it is only licensed under negation, or within interrogative clauses and other environments categorized as "downward entailing." This determiner has the advantage of acting as the bridge between these extensional predicates who otherwise take only propositions as complements, and would be in complementary distribution with *whether*, which can help explain why (42) is grammatical. A quite different proposal was suggested by Eckhart (2001), who argues that pragmatic considerations can explain the discrepancy. In particular, competition within the language between the interpretation of the embedded clause as a declarative statement vs. a polar interrogative gives rise to the general lack of availability of the embedded polar interrogatives with such verbs. Under both accounts, embedding polar interrogatives is predicted to be degraded in the cases where the predicate also embeds declaratives, and this should be ameliorated in certain environments (whose properties can receive a semantic characterization). In the next section, we determine whether the same pattern holds in ASL, where there is not necessarily an overt *if/whether* distinction and the surface string of the embedded polar interrogative is identical to the corresponding declarative clause.

4.2. Semantics of embedding polar interrogatives in ASL

In section 3, we showed that the intensional predicate *WONDER* in ASL can embed wh- or polar interrogatives without any restrictions, similarly to *wonder* and *ask* in English. The same is true for the ASL intensional interrogative predicate *ASK*, as shown in (44). We show the entire matrix predicate under the scope of negation, which ensures that this is an example of embedding and not quotation or role shift.

- (44) $\overline{\text{MOM ASK-ME [BROTHER LIKE SALAD]}}$ ^{neg}
'Mom didn't ask me whether my brother likes salad'

In contrast to *WONDER* and *ASK*, the extensional interrogative-embedding predicate *KNOW* seems to exhibit variation in grammaticality, a similar pattern to the English variation. Take (45), which is grammatical only under an interpretation in which the embedded clause is interpreted as a single proposition (a); the two native signers consulted were unable to have an interpretation for this sentence under which the embedded clause is interpreted as a question (b).

- (45) MOM KNOW [BROTHER LIKE THAT SALAD].
a. 'Mom knows that her brother likes that salad'
b. #'Mom knows whether her brother likes that salad.'

In other words, a polar interrogative is judged to be awkward as the complement of *KNOW* in (45), a parallel to the degraded status of the English *if*-clause. Moreover, just as in the English case, the restriction disappears in certain semantically definable environment, such as if the whole sentence is under the scope of negation (46) or is marked as a polar interrogative and therefore interpreted as a polar question (47).

(46) *Context: I was talking with Mom about this, and...*

neg

MOM KNOW BROTHER LIKE THAT SALAD
'Mom doesn't know whether her brother will like that salad.'

(47) I WANT MAKE THAT SALAD.

brow raise

MOM KNOW BROTHER WILL LIKE?
'I want to make that salad. Does mom know if her brother will like it?'

We have shown that embedded polar interrogatives show the same pattern in ASL as English *if*-clauses (and, unlike English *whether* clauses). In ASL, there is an especially strong competition between the declarative clause and polar interrogative readings for the clause embedded under extensional predicates like *know*. This lends some support to Eckardt's (2001) pragmatic analysis, in that the strong competition should consequently make the polar question interpretation unlikely in a typical sentence like (45) but more available in certain semantically definable environments like negative and question contexts. However, our finding in ASL is not inconsistent with Adger and Quer's (2001) analysis, either, although their account would require the same covert determiner to appear in ASL, which has been argued to not have obligatory determiners (Koulidobrova 2012). We leave further investigation of these issues to future research.

In sum, we have shown that polar interrogatives can be embedded under two different classes of predicates, the intentional and extensional embedding predicates. Like English, ASL shows variation in the environments which license the embedding of a polar question under extensional embedding predicates, despite a lack of overt *whether* (and for many speakers, a lack of an overt *if*) and despite the identity of the declarative and polar interrogative surface strings. These results are consistent with both types of analyses of the phenomenon in spoken languages, but further investigation could be worthwhile in making use of the unique properties of ASL to untangle these issues.

4.3. Taxonomy of embedding predicates in ASL

We have shown that ASL allows for embedded polar interrogatives in ASL in section 3, and discussed the semantic properties of different classes of declarative- and interrogative-embedding predicates in section 4.1-4.2. Here we briefly discuss a wider selection of predicates in ASL and their behavior in embedding declarative clauses, wh-interrogatives, and polar interrogatives.

Liddell (1980) lists embedding predicates in ASL, though he does not distinguish those which embed interrogatives versus declaratives (48).

(48) *Non-embedders*: HAPPY, ANGRY, SURPRISED, RELIEVED, SORRY, PROMISE

Possible Embedders: KNOW DOUBT BELIEVE? STOP FORGET

Embedders: KNOW, REMEMBER, WANT, EXPECT

(from Liddell 1980: Ch. 3)

Liddell's data was framed as part of the larger argument that clausal embedding *does* occur in ASL, although it may not be exactly the same as in English (e.g. sometimes the ASL predicates that translates an English embedding predicates does not embed in ASL).

Now that most researchers agree that ASL does embed clauses, and we have shown this to include polar interrogatives, we ask what variation we see in embedding predicates, especially as compared to English. To update Liddell's line of investigation, we tested 17 different embedding predicates in their ability to take various clausal complements. Each was placed in a sentence frame that takes as a complement a declarative clause (49)a, a wh-interrogative (49)b, and a polar interrogative (49)c.

- (49) a. STUDENT _____ [HER FRIEND DRINK HER TEA]
 'The student _____ [that her friend drank her tea]'
- b. STUDENT _____ [WHO DRINK HER TEA]
 'The student _____ [who drank her tea]'
- c. STUDENT _____ [HER FRIEND DRINK HER TEA]
 'The student _____ [whether her friend drank her tea]'

Results are shown in Table 1. The extensional/proposition-only embedding verbs were each ungrammatical in the sentence frame in (49)a, consistent with the findings discussed in section 4.2. In all instances that we were able to test (a subset of the verbs tested), the ungrammaticality of the polar interrogative as the complement of an extensional embedding predicate was improved under negation or in a matrix question environment. A collection of intensional embedding predicates were only acceptable in the sentence frames in (49)b-c, and were unable to have an embedded declarative interpretation as in (49)a. Finally, a number of verbs only take declarative clauses as their complements; these were only acceptable in sentence frame (49)a.

Behavior	Predicate
Take only declarative clauses and wh-interrogatives (extensional/proposition-embedding)	<i>KNOW, GUESS, REMEMBER, FORGET, FIND-OUT, TELL</i>
Take only wh- and polar interrogatives (intensional/question-embedding)	<i>ASK, WONDER, CURIOUS, DON'T-KNOW</i>
Take only declarative clauses	<i>THINK, BE-TRUE/REAL, SURPRISE, AGREE-ON, REALIZE</i>

Table 1: Embedding predicates in ASL

5. Doubling and Subject Pronoun Copy in Embedded Polar Questions

of these sentence-final wh-words has been the subject of much debate in ASL, with some arguing that it is an example of rightward wh-movement (Neidle et al. 2000), while others have argued that the sentence-final wh-words are base generated in a focus position that occurs to the right (Petronio and Lillo-Martin 1997), just as in doubled verbs, modals, and negative elements. What is not under contention is the finding that doubled wh-words do not seem to be permitted in embedded wh-interrogatives. Consider, first, that the wh-word may be embedded at the end of a matrix wh-interrogative (54)a. We also saw above that wh-interrogatives may be embedded as the clausal complement of an embedding verb (54)b. However, wh-words may not be doubled in embedded wh-interrogatives (54)c. What is especially puzzling about this restriction on doubled wh-words in embedded wh-interrogatives is that doubling of other elements is grammatical in embedded *declarative* clauses (54)d.

- (54) a. **WHO YOU KNOW [JOHN SEE YESTERDAY] WHO?** --> *matrix double*
 “Who do you know that John saw yesterday?”
 b. **YOU KNOW [WHO JOHN SEE YESTERDAY]** --> *embed wh*
 “You know who John saw yesterday.”
 c. ***YOU KNOW [WHO JOHN SEE YESTERDAY WHO]** --> *embed wh-
double*
 “You know who John saw.”
 d. **YOU KNOW [JOHN CAN’T READ CAN’T]** --> *embed double*
 “You know John can’t read.”

Petronio and Lillo-Martin (1997) claim that embedded wh-interrogatives in ASL carry a [+WH] feature marking their status as wh-words, but not a [+F] feature, which marks the focus property of wh-words in matrix interrogatives. In addition to explaining why doubled wh-words can’t appear in embedded wh-interrogatives, the lack of [+F] is also suggested to being the reason that indirect interrogatives do not carry the same nonmanual marking as matrix interrogatives (i.e. because that nonmanual marking comes from the +F). Figure 1 (from Petronio and Lillo-Martin) illustrates the positions of both of these wh-words relative to the rest of the clause.

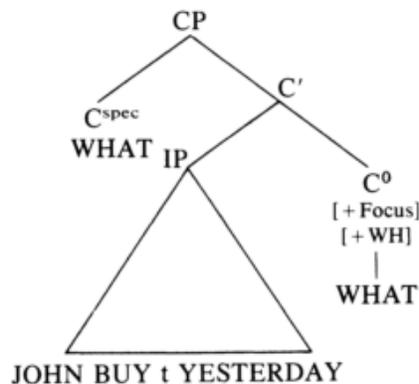


Figure 1: Wh-doubling in Matrix wh-interrogatives (Petronio and Lillo-Martin 1997)

Despite the attention given to (the lack of) wh-word doubling in embedded clauses in ASL, very little has been said about how this compares with doubling in embedded polar interrogatives. Although there is no wh-word to be concerned with, we may imagine that a matrix interrogative (wh- or polar) always allows a [+F] in matrix clauses, while it’s not permitted in embedded interrogatives of any kind.

To test this hypothesis, we investigated doubles in embedded polar interrogatives. In (55), we can see that even non-wh doubles are ungrammatical in embedded wh-interrogatives (though, we saw above they are grammatical in embedded declaratives). Then, moving to embedded polar interrogatives, we see that doubling the verb is ungrammatical in a polar interrogative that is the complement of *WONDER* (56). In (57) we use a negative sentence in order to create the highest chance for the grammaticality of the extensional embedding verb *REMEMBER* (section 4.2). This results in ungrammaticality, but one that might be due to a more general preference against doubles that aren't negative when the whole sentence is negative (58) (in (54)d, the double *CAN'T* is negative). This means there are two things working against the doubles in the embedded interrogatives under extensional embedding in (57): the fact that when interrogatives are embedded under extensional predicates they prefer negative polarity contexts while non-negative doubles don't work well in negative contexts, and the more general dispreference seen in (56) that embedded interrogatives don't permit doubles. In general, we see that the lack of any doubling in embedding interrogatives contrast with examples of doubling the matrix verb in a sentence with an embedded polar interrogative, which is accepted as grammatical (59).

- (55) *ANN WANT KNOW [WHO CAN'T READ CAN'T]
- (56) *MOM WONDER [BROTHER LIKE SALAD LIKE]
 "Mom wonders whether her brother likes salad."
- (57) ______{neg}
 *MOM REMEMBER [BROTHER LIKE SALAD LIKE]
 "Mom doesn't remember whether her brother likes salad."
- (58) ______{neg}
 *MOM REMEMBER [BROTHER LIKE SALAD LIKE]
 "Mom doesn't remember that her brother likes salad."
- (59) ______{neg}
 MOM DON'T KNOW [BROTHER LIKE SALAD] DONT-KNOW
 "Mom doesn't know whether her brother likes salad or potatoes."

We conclude that embedded wh- and polar interrogatives generally do not permit doubling. Put in the framework of Petronio and Lillo-Martin (1997), embedded polar interrogatives seem to lack the [+F] feature, similarly to embedded wh-interrogatives but unlike embedded declaratives. Thus, if this is the right analysis of embedded wh-interrogatives, it should likewise be extended to embedded polar interrogatives as well.

5.2. Subject Pronoun Copy

The second phenomenon we turn to is SPC, which involves copying the subject at the end of the clause (60). As we discussed earlier, when the subject is not itself a pronoun, the sentence-final copy is a pronoun co-referential with the subject (61) (Padden 1988, Bos 1995, but see Crasborn et al. 2009)

- (60) **IX₁ WILL LEAVE IX₁.**
 'I will leave.'

- (61) ANN WILL LEAVE **IX**_{Ann}.
'Ann will leave.'

SPC has typically been categorized as a separate phenomenon from doubling, despite the superficial similarity of having a sentence-final copy of a sentential element. One major reason that they have been analyzed separately is that SPC can occur *in addition to* other doubles, as in (62) (copied pronouns are in bold while doubles are in italics).

- (62) **IX**₁ WILL LEAVE WILL **IX**₁
'I will leave.' (Petronio 1993)

It appears that under any analysis, the double and the SPC do not occupy the same syntactic position, then, since they may appear together. However, the SPC occurs *after* the double, which would suggest that it occurs at an even more peripheral syntactic position than the double and may not be available in embedded clauses.

When we turn to interrogatives, we see that SPC is licensed in matrix polar interrogatives (63) (our example).

- (63) _____ br
BROTHER LIKE SALAD **IX**_{brother?}
"Does (my) brother like salad?"

Interestingly, it appears that SPC can be licensed by both the subject of the matrix declarative clause, as well as the subject of the embedded polar interrogative (64): either *IX*_{MOM} or *IX*_{BROTHER} is an acceptable double.

- (64) _____ n
MOM REMEMBER BROTHER LIKE SALAD (**IX**_{MOM}/**IX**_{BROTHER})
"Mom doesn't remember whether her brother likes salad."

We take this to mean that the SPC is licensed by a syntactic position that higher than the double [+F] (since it can hold the matrix clause subject double), but one which is not sensitive to the clause type (declarative vs. interrogative).

In general, we note that embedded polar interrogatives can serve as a crucial additional clause type, for better understanding the behavior of phenomena occurring in embedded positions in declaratives and wh-interrogatives.

6. Further remarks and conclusions

In this paper, we have presented evidence in favor of the existence of embedded polar interrogatives in ASL, a form of clausal embedding in ASL that had not been investigated before. We have provided new elicited and corpus data and have elaborated a series of tests to identify embedded polar interrogatives unambiguously.

We briefly surveyed and tested the predicates that introduce embedded clauses and showed that the ASL typology of clause embedding predicates looks very similar to spoken languages: (i) predicates that embed only declaratives, (ii) predicates that embed only wh- and polar

interrogatives, and (iii) predicates that embed declaratives and wh-interrogatives without restrictions, and can embed polar interrogatives as well, if certain semantic conditions hold.

We have shown that our novel findings about embedded polar interrogatives can be used to shed further light on two puzzling areas of ASL syntax: focus doubling and Subject Pronoun Copy. In the case of doubling, the lack of doubles permitted within embedded polar interrogatives suggests that feature (perhaps [+F] focus) that licenses doubles in declaratives and in matrix interrogatives is unavailable in all embedded interrogatives, and is unrelated to wh-movement in wh-interrogatives. Though SPC requires further research, we have shown that unlike doubles, SPC may occur in embedded polar interrogatives, another piece of evidence suggesting SPC is a separate phenomenon from doubling.

Finally, we want to mention how our new findings are further supported by (and bring further support to) previous work of ours on a completely different topic in ASL. In Caponigro and Davison (2011), we provided a syntactic, semantic, and pragmatic analysis of the construction in (65) and (66), which we labeled Question-Answer Clauses (QACs). A QAC is signed by the same signer and can be embedded as a unit within another clause.

(65) [JOHN EAT WHAT], [PASTA].
'John ate pasta.'

(66) [JOHN LAUGH], [NO].
'John did not laugh.'

We argued that QACs such as (65) and (66) are syntactically declarative sentences, which are comprised of an embedded interrogative (e.g. JOHN EAT WHAT in (65)) followed by a declarative clause (e.g. (HE EAT) PASTA in (65)), where part (e.g. HE EAT) is elided. The two are connected by a copula (BE) (which we know independently is covert in ASL). The structure is similar to what has been proposed as the underlying structure for English pseudoclefts (e.g. *What John ate was pasta*), although we argue that this analysis is much more well-suited to the ASL structure than the English structure. Semantically, we argued that the QAC semantically equates the meaning of an answer to the interrogative clause (i.e. a proposition) to the meaning of the declarative clause (i.e. a proposition).

What ties in our analysis of QACs and the current discussion of embedded polar questions is that in our earlier work we gave the very same analysis for examples like (66) as we did for (65), arguing that JOHN LAUGH was syntactically an embedded polar interrogative and semantically a question ('Did John laugh?'). Indirectly, this provided a first piece of evidence that embedded polar interrogatives exist in ASL. We can now put together those conclusions together with the novel ones in this paper to further support the core finding of this paper: that ASL allows for embedded polar interrogatives.

More broadly, we would like to highlight how in our past research and in the one we developed in this paper, a close attention and investigation of syntactic and semantic facts and their interaction has turned to be extremely useful and insightful. Further work is definitely needed to better understand several open issues we touched on, but we hope to have provided some preliminary robust data and conclusions about embedded polar interrogatives in ASL.

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