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ANOTHER WAY TO MARK SYNTACTIC DEPENDENCIES: THE CASE FOR RIGHT-PERIPHERAL SPECIFIERS IN SIGN LANGUAGES

CARLO CECCHETTO
University of Milan–Bicocca

CARLO GERACI
University of Milan–Bicocca

SANDRO ZUCCHI
University of Milan

The occurrence of WH-items at the right edge of the sentence, while extremely rare in spoken languages, is quite common in sign languages. In particular, in sign languages like LIS (Italian Sign Language) WH-items cannot be positioned at the left edge. We argue that existing accounts of right-peripheral occurrences of WH-items are empirically inadequate and provide no clue as to why sign languages and spoken languages differ in this respect. We suggest that the occurrence of WH-items at the right edge of the sentence in sign languages be taken at face value: in these languages, WH-phrases undergo rightward movement. Based on data from LIS, we argue that this is due to the fact that WH-NONMANUAL MARKING (NMM) marks the dependency between an interrogative complementizer and the position that the WH-phrase occupies before it moves. The hypothesis that NMM can play this role also accounts for the spreading of negative NMM with LIS negative quantifiers. We discuss how our analysis can be extended to ASL (American Sign Language) and IPSL (Indo-Pakistani Sign Language). Our account is spelled out in the principles-and-parameters framework. In the last part of the article, we relate our proposal to recent work on prosody in spoken languages showing that WH-dependencies can be prosodically marked in spoken languages. Overt movement and prosodic marking of the WH-dependency do not normally cooccur in spoken languages, while they are possible in sign languages. We propose that this is due to the fact that sign languages, unlike spoken languages, are multidimensional.*

Keywords: sign language, Italian Sign Language (LIS), WH-questions, prosodic marking of syntactic dependencies, negation, specifiers

1. THE PROBLEM. In the overwhelming majority of the languages that have been investigated up to recent years, WH-phrases have been observed to occur either at the left edge of the sentence or in situ. Cases of spoken languages in which WH-phrases systematically occur at the right edge of the sentence are extremely rare.[1] This picture, which might have been an adequate description of our knowledge until a decade ago, needs to be revised today, because of data that have been accumulating since syntactic investigation was extended to sign languages. In this article, we present data from Italian Sign Language (Lingua dei Segni Italiana, LIS) showing that WH-phrases, except for a restricted set of cases in which they can remain in situ, must occur at the right edge of the sentence and never appear at the left edge. Furthermore, LIS is not an isolated case. The occurrence of WH-phrases at the right periphery is reported for many sign languages, although, for some of them, occurrence of WH-phrases at the left periph-

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[1] Concerning the generalization according to which WH-phrases in spoken languages move to a dedicated position in the left periphery (when they are not left in situ), Petronio and Lillo-Martin (1997:21) note that 'its strength is striking'. Possible exceptions to this generalization are presented by Kenstowicz (1987) and Tuller (1992), who report that Tangale and Ngizim, two Chadic languages spoken in North-Eastern Nigeria, display systematic occurrences of WH-items at the right periphery. Poletto and Pollock (2004) also report cases of right-peripheral WH-phrases in some Romance dialects, but these occurrences are restricted to internal arguments and adjuncts. Finally, within the entire 'World Atlas of Language Structures Online' database, which covers more than 1,200 spoken languages, Dryer (2009) indicates Tennet, a Nilo-Saharan language spoken in Sudan, as another potential exception.

ery is also possible. Table 1 summarizes the data reported in the literature concerning the position of WH-items in different sign languages.[2]

	REFERENCES	left periphery (no doubling)	right periphery (no doubling)	doubled at left and right periphery	in situ (no doubling)
American SL (ASL)	Petronio & Lillo-Martin 1997, Neidle et al. 2000	yes	yes	yes	yes
Australian SL (Auslan)	Johnston & Schembri 2007	yes	no	yes	yes
Austrian SL (Österreichische Gebärdensprache, ÖGS)	Schalber 2006	yes	no	(yes)	—
Brazilian SL (Língua de Sinais Brasileira, LSB)	Müller de Quadros 2006	yes	yes	yes	—
Croatian SL (Hrvatski Znakovni Jezik, HZJ)	Kuhn & Wilbur 2006	yes	yes	yes	—
Finnish SL (FinSL)	Savolainen 2006	yes	yes	—	no
Hong Kong SL (HKSG)	Tang 2006	no	yes	no	yes
Indo-Pakistani SL (IPSL)[a]	Zeshan 2003, Pfau 2004, Aboh & Pfau 2009, Aboh et al. 2006	no	yes	no	no
Israeli SL (ISL)	Meir 2006	(no)	yes	yes	—
Italian SL (LIS)	this study	no	yes	no	(yes)
Japanese SL (Nihon-Shuwa, NS)	Morgan 2006	(yes)	yes	(yes)	(yes)
New Zealand SL (NZSL)	McKee 2006	(yes)	yes	yes	—
SL of the Netherlands (Nederlandse Gebarentaal, NGT)	Aboh & Pfau 2009	(yes)	yes	(yes)	—

TABLE 1. Position of WH-items in sign languages.

Key
no: WH-item cannot occur in this position
(no): not a natural position for WH-item
yes: WH-item can occur in this position
(yes): WH-item can occur in this position, though not commonly
—: not reported whether WH-item can occur in this position

[a] Indo-Pakistani Sign Language is also referred to as Indian Sign Language by Gordon (2005) and Aboh, Pfau, and Zeshan (2006). Here, we follow Pfau (2004) and Zeshan (2003) in using the name Indo-Pakistani Sign Language.

Zeshan (2004), in a macrotypological study that includes data from thirty-five different sign languages, claims that:

> Across the signed languages in the data, the most common syntactic positions for question words are clause initial, clause final, or both, that is, a construction with a doubling of the question word . . . In situ placement of question words . . . seems to occur less frequently across signed languages and may be subject to particular restrictions . . . (2004:24–25)

Some caution must be exercised in drawing conclusions from these data, since they are based only on a subset of the sign languages of the world and, at least for some of these sign languages, the research is still at an early stage. It is clear, however, that

[2] It should be mentioned that the extent to which the options described in the table are available for ASL remains controversial. In particular, according to Neidle and colleagues (2000), WH-items at the left periphery (preceding the subject) are ungrammatical if not doubled at the right periphery or in situ. Petronio and Lillo-Martin (1997), by contrast, suggest that there is a stylistic preference for doubling when WH-items occur at the left periphery. Moreover, Petronio and Lillo-Martin report that judgments vary when sentences with WH-items at the right periphery without doubling are presented in isolation.

there are some sign languages (LIS, IPSL, and HKSL being the clearest cases and ISL being another plausible candidate) in which the right periphery of the clause is the only natural position for WH-items. In other sign languages, the pattern is more complicated, since other positions for WH-items are available as well. In only one sign language in this group (ÖGS), the right periphery might not be accessible at all. Based on these data, a fundamental difference between spoken and sign languages emerges: WH-items can naturally occur at the right edge in sign languages, while this occurrence is extremely rare in spoken languages.

Since, as we saw, some sign languages allow both right-peripheral and left-peripheral occurrences of WH-items, a possible research strategy is to explore the possibility that in sign languages, as in spoken languages, WH-phrases undergo only movement to the left periphery, and right-peripheral occurrences result from some device that does not involve rightward movement. For example, Petronio and Lillo-Martin (1997) propose to account for the behavior of WH-items in ASL by assuming that a null WH-element moves to the left and that WH-items at the right edge are, in fact, interrogative complementizers. Poletto and Pollock (2004) have accounted for the occurrence of WH-items at the right edge in Bellunese and other Northern Italian dialects by assuming that they move to the left and then the constituent out of which they are moved (the remnant) is further dislocated to the left, leaving the WH-items at the right edge of the clause.[3] In principle, a device similar to the one posited by Poletto and Pollock may be adopted to account for right-peripheral occurrences of WH-items in sign languages.[4] If this research strategy is adopted, then what needs to be explained is why sign languages, unlike spoken languages, make such a systematic use of devices that result in locating WH-items at the right periphery of the sentence.

Explanations that avoid positing rightward movement for WH-items, however, are controversial. In particular, Neidle and colleagues (2000) argue, contrary to Petronio and Lillo-Martin, that the position that normally hosts WH-phrases is linearized to the right in ASL. Moreover, we show that neither the approach proposed by Petronio and Lillo-Martin for ASL nor a remnant-movement analysis of the kind suggested by Poletto and Pollock can account for the LIS facts (where WH-items cannot occur left-peripherally). So, we pursue a different strategy: we assume that the grammars of sign languages, unlike the grammars of spoken languages, may provide a canonical landing site for WH-phrases at the right edge of the clause, and we propose an account for why this should be so. In particular, we suggest that this macrotypological difference between spoken languages and sign languages is directly related to the role of nonmanual components in sign languages in a way that we explain. Our account is spelled out in the principles-and-parameters framework (Chomsky 1995, 2001).

The article is organized as follows. We first present some background information about the grammar of LIS. Then, we show that in LIS three different types of categories, namely WH-phrases, negative quantifiers, and a sign functionally corresponding to a relative pronoun, pattern alike in that they all move to the right periphery of the sentence. Next, we argue against conservative approaches that avoid positing a dedicated position at the right periphery for WH-phrases and other categories that appear to move to the right. We conclude that the occurrence of these items at the right edge is to be taken

[3] Kidwai (1999) argues for Tangale that WH-phrases (focused elements) are left in situ and their right-peripheral position is due to the movement of other constituents. See also Haider 1997 for an alternative suggestion on how to account for the Tangale word-order facts without assuming WH-movement to the right.

[4] Indeed, this has been done by Aboh and Pfau (2009) and Aboh, Pfau, and Zeshan (2006) for IPSL.

at face value: they sit where they appear to be. We follow this with our account of why WH-phrases are at the right periphery in LIS: we show that WH-nonmanual marking (WH-NMM) marks WH-dependencies in LIS, and argue that, if WH-phrases moved to the left periphery in LIS, WH-NMM could not properly mark the WH-dependency. We then tackle the question of why WH-phrases that move are normally linearized to the left in spoken languages and discuss how our analysis extends to ASL and IPSL. Finally, we turn to our account of the difference between spoken and signed languages concerning the placement of WH-phrases. First, we discuss how WH-dependencies are marked by prosodic and syntactic devices in spoken languages and we point out some relevant similarities with LIS. Then, we also observe that sign languages differ from spoken languages in the way they use prosodic devices to mark dependencies. We argue that, if this observation is correct, the difference between spoken and sign languages in the placement of WH-phrases is expected.

2. ABOUT LIS. LIS is the language used by native signers belonging to the Italian Deaf community. The data we discuss come from five signers who have been exposed to sign language from birth, because they are deaf children of deaf parents.[5] We do not discuss the linguistic behavior of nonnative signers of LIS. This needs to be stressed because the majority of LIS users are, as is common for sign languages, nonnative signers, since only a small minority of deaf individuals have deaf parents and have been exposed to a sign language from birth. We have not systematically investigated the linguistic behavior of Italian/LIS bilingual individuals (hearing people with deaf parents) either, although one of the authors of this article belongs to this group. Our informants have an excellent knowledge of Italian as a second language, so they have been willing to work with us on this basis: they signed for us what they think is the most natural way to express in LIS the meaning of the Italian sentences that we proposed to them. Videotapes of the data we discuss are available at the website http://www.filosofia.unimi.it/~zucchi/ricerca.html. After we collected the data, a representative selection of the videos coupled with Italian glosses were shown to groups of LIS signers in various public meetings. The audiences of these meetings accepted the LIS sentences as grammatical and deemed the matching between videos and Italian translations adequate. Thus, although the judgments we base our analysis on were originally elicited from five signers only, the core facts that we describe appear to hold for a larger community of LIS signers.

A possible concern is that our way of eliciting sentences could have induced the informants to produce structures influenced by the Italian input rather than productive LIS sentences. We are well aware of this risk and we have tried to minimize it by working with informants with a strong Deaf identity who are proud of their language and know that it is not inferior in any way to the language dominant in the society they live in, namely Italian. However, we believe that the best guarantee that Italian did not influence the data we collected is that LIS and Italian turn out to differ quite sharply in the domain we are exploring, namely the structure of WH-questions and negative sentences.

In this section, we present those aspects of the grammar of LIS with which one must be acquainted to follow our discussion of WH-constructions. For a more extensive presentation of LIS syntax we refer to Cecchetto et al. 2006. Although in LIS, like in

[5] How to identify native signers is still an open issue in the sociolinguistic literature about sign language (see, among others, Costello et al. 2006). Currently, there is no test to evaluate the competence of LIS signers. Our informants meet the criteria indicated for ASL in Neidle et al. 2000.

other sign languages, word order is not rigid, our informants agree that the unmarked word order in simple declarative sentences is SOV (we use capitalized English words to indicate LIS signs); see the example in 1.[6]

(1) GIANNI MARIA LOVE
'Gianni loves Maria.'

LIS lacks auxiliaries (which, in spoken languages, are taken to sit in functional projections). In LIS, however, there are functional signs other than auxiliaries that reveal the position of functional categories in the structure. Interestingly, all these lexical elements are postverbal. One example is modal verbs, as in 2.

(2) GIANNI METER 80 JUMP CAN
'Gianni can jump 180 cm.'

(3) GIANNI APPLY CAN
'Gianni can apply.'

Another example is the marker DONE, indicating that the action described by the verb is completed (see Zucchi 2009 for discussion). Like modal verbs, DONE occurs postverbally.

(4) GIANNI HOUSE BUY DONE
'Gianni bought a house.'

Manual negation is also found after the verb in LIS (see Geraci 2006a,b for discussion of LIS negative items).

(5)
GIANNI MARIA LOVE $\overline{\text{NOT}}^{\text{neg}}$
'Gianni doesn't love Maria.'

(The gloss $\overline{\quad}^{\text{neg}}$ indicates the presence of the nonmanual marker for negation, a headshake, which in 5 is coarticulated with the manual sign NOT.) Time adverbs like 'some time ago', 'in the past', 'tomorrow', 'in the future', and so forth are found in sentence-initial position.

(6) SOME-TIME-AGO/YESTERDAY/TOMORROW GIANNI HOUSE BUY
'Some time ago/yesterday/tomorrow Gianni bought a house.'

Manner adverbs articulated by an independent manual sign, such as 'in time', 'punctually', 'late', and so forth, are found postverbally.

(7) GIANNI ARRIVE IN-TIME/PUNCTUALLY/LATE
'Gianni arrived in time/punctually/late.'

WH-phrases are found at the right periphery of the sentence. The gloss $\overline{\quad}^{\text{wh}}$ indicates the presence of the nonmanual marker for WH-questions (furrowed eyebrows).

(8)
GIANNI BUY $\overline{\text{WHAT}}^{\text{wh}}$
'What did Gianni buy?'

(9)
HOUSE BUY $\overline{\text{WHO}}^{\text{wh}}$
'Who bought a house?'

There is clear evidence that WH-phrases are 'more peripheral' than the adverbs in 7, negation, and DONE.

[6] See Appendix A for a summary of the notational conventions adopted in the glosses of sign language sentences.

(10) ARRIVE IN-TIME $\overline{\text{WHO}}^{\text{wh}}$
'Who arrived in time?'

(11) CAKE EAT NOT $\overline{\text{WHO}}^{\text{wh}}$
'Who did not eat the cake?'

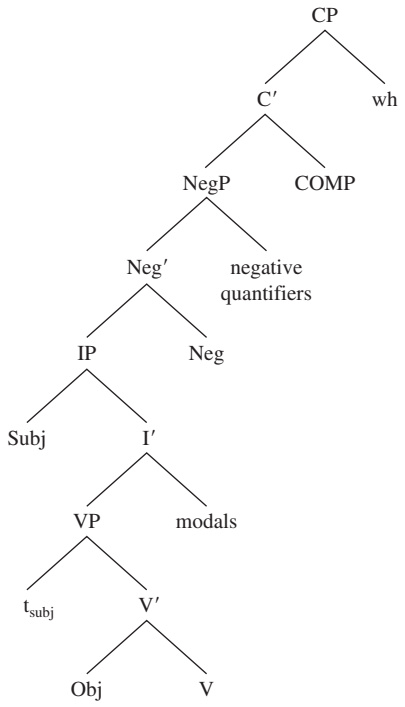
(12) HOUSE BUILD DONE $\overline{\text{WHO}}^{\text{wh}}$
'Who built the house?'

Finally, as 13 shows, negation must follow manner adverbs.

(13) GIANNI ARRIVE IN-TIME NOT
'Gianni did not arrive on time.'

Following Cecchetto et al. 2006, we take LIS to be a head-final language, at least in the clausal domain, since the verb follows the object, and the functional heads that host aspectual markers, negation, and modals follow the verb.[7] As for WH-phrases, we argue below that they sit in a position linearized to the right, which is identified as Spec,CP in the framework that we are assuming (see Chomsky & Lasnik 1993 for a general introduction and Rizzi 1997 for a detailed description of the CP area). On the basis of these assumptions, a tentative representation of the structure of the LIS sentence is given in 14 (the representation is simplified in many respects; see Cecchetto et al. 2006 for a more complete structural representation).

(14)



[7] A technical comment is in order. The existence of genuine head-final languages has been questioned (mainly on conceptual grounds) at least since Kayne 1994. In this article, we do not follow Kayne's antisymmetric framework because the right placement of WH-phrases in LIS is not compatible with it.

Many aspects of LIS syntax are still waiting for proper investigation. One of them is the structure of DPs. LIS does not have articles, and the definite or indefinite character of a DP is retrieved from the context or by pointing to an area of the signing space that acts as a discourse marker for an object previously introduced in discourse. LIS numerals and quantifiers naturally occur postnominally, though they may also precede the noun (the reason why they may occur in both positions is not clear at the moment).

(15) a. STUDENT THREE ARRIVE DONE
b. THREE STUDENT ARRIVE DONE
'Three students arrived.'

(16) a. STUDENT ALL ARRIVE DONE
b. ALL STUDENT ARRIVE DONE
'All the students arrived.'

A further aspect of LIS that deserves attention is the role of the nonmanual component. Like other sign languages, LIS has a rich system of facial expressions and body postures that are coarticulated with the manual signs and convey grammatical information (from now on, we refer to them as NMMs). These markers are distinct from facial expressions and body postures that convey the emotional status of the signer.[8] As anticipated above, the convention to gloss NMMs is a line above the glosses of the manual signs they are coarticulated with. For example, in 5 above, the line above the gloss for the negative sign NOT indicates that there is a specific NMM that is coarticulated with NOT and does not spread over adjacent signs. Previous research has clearly established that NMMs are involved in key grammatical phenomena such as agreement (Bahan 1996, Neidle et al. 2000, Meir 2002), tense (Zucchi 2009), negation (Liddell 1980, Neidle et al. 2000, Pfau 2002, Pfau & Quer 2005, Geraci 2006a,b, Tang 2006), question formation (Lillo-Martin & Fischer 1992, Neidle et al. 2000, Zeshan 2004), and subordinations of various types (Wilbur & Patschke 1999, Cecchetto et al. 2006, and Branchini & Donati 2009), just to mention a few studies on the syntactic role of NMMs (see Sandler & Lillo-Martin 2006 for an overview).

NMMs are considered the sign language counterparts of intonation (cf. Sandler 1999) since, like intonation, they are suprasegmental (NMMs occur simultaneously with the signs articulated by the hands). Furthermore, NMMs and intonation can play similar grammatical roles. For example, yes-no questions in LIS are distinguished from declarative sentences only by the presence of a specific NMM (roughly, raised eyebrows), much as yes-no questions in Italian (and other languages) are distinguished from declarative sentences only by the presence of rising intonation (the fact that in both cases we have a sort of raising seems to be accidental). Unlike the negative NMM in 5 above, the yes/no NMM is not limited to a specific sign, but spreads over the whole sentence, as in 18.

(17) GIANNI ARRIVE
'Gianni arrives.'

(18) _____yes/no
GIANNI ARRIVE
'Does Gianni arrive?'

The exact distribution of the WH-NMM is crucial to capture the syntax of WH-constructions, so we analyze it in detail in the next section.

[8] For neurological differences between emotional and linguistic facial expressions, see Corina et al. 1999.

3. THE RIGHT PERIPHERY OF THE LIS SENTENCE. In this section, we show that, in LIS, three different types of items pattern alike, in that they move to the right periphery of the sentence. These items are WH-phrases, negative quantifiers, and a sign functionally corresponding to a relative pronoun. This fact is important, because it shows that the asymmetry in left-/right-peripheral placement, which differentiates sign languages like LIS from many spoken languages, is not limited to WH-phrases, but is a more general phenomenon that calls for a principled explanation. We now discuss the three categories that occupy a right-peripheral position in turn.

3.1. THE RIGHT-PERIPHERAL POSITION OF LIS WH-PHRASES. LIS has a full set of WH-words including WHO, WHAT, WHEN, WHERE, WHY, WHICH, and HOW-MANY. In general, the WH-determiner can have an overt restrictor or can occur alone. When it occurs alone, the WH-determiner must be placed at the right edge of the sentence, unless it is left in situ. WH-determiners with overt restrictors (i.e. *which book*), if they are not left in situ, always appear at the right periphery, but their restrictors can appear adjacent to them at the right periphery (as in 19a), or they can remain in situ (as in 19b), or they can be doubled (as in 19c, where the in situ noun BOY is doubled at the right periphery). While examples 19a and 19b are judged equally good with a slight preference for 19a, sentences like 19c are judged to be redundant by some of our informants. For this reason, we consider 19c a marked case. (The coindexing in 19 indicates that the categories that are coindexed are articulated in the same region of the signing space.)[9]

(19) a. PAOLO STEAL $\overline{\text{BOOK}_i\ \text{WHICH}_i}^{wh}$
'Which book did Paolo steal?'

b. BOY_i BOOK STEAL $\overline{\text{WHICH}_i}^{wh}$
'Which boy stole the book?'

c. ? BOY_i BOOK STEAL $\overline{\text{BOY}_i\ \text{WHICH}_i}^{wh}$
'Which boy stole the book?'

Another option, as we anticipated, is to leave the whole WH-phrase in situ, as in 19d below. This option, however, is quite restricted, since, as far as we can tell, it only emerges in DISCOURSE-LINKED contexts (see Pesetsky 1987), namely contexts in which the WH-question asks about a set of entities that are contextually salient. As 19d shows, when the whole WH-phrase remains in situ, the WH-NMM must spread over other elements besides the WH-phrase.

(19) d. GIANNI $\overline{\text{BOOK}_i\ \text{WHICH}_i\ \text{STEAL}}^{wh}$

The WH-determiner is never doubled, no matter where the copy is placed.

(20) a. * GIANNI BOOK WHICH STEAL BOOK WHICH
b. * GIANNI BOOK WHICH STEAL WHICH
c. * BOOK WHICH GIANNI BOOK WHICH STEAL
d. * WHICH GIANNI BOOK WHICH STEAL
e. * BOOK WHICH GIANNI STEAL BOOK WHICH

[9] In the case of 19b, the fact that WHICH is signed in the same region of the signing space as BOY forces the object reading of the sentence ('Which book did the boy steal?').

It is worth stressing that our informants never produced an utterance in which a WH-phrase appears at the left periphery of the sentence. When they were explicitly asked, they rated the structure as sharply ungrammatical.

(21) * BOOK WHICH GIANNI STEAL

Duplication, illustrated in 19c, is a frequent phenomenon in sign languages and is not restricted to WH-constructions (see Petronio 1993 for discussion). For this reason, an analysis of duplication goes beyond the scope of this article. Assuming the copy theory of traces of Chomsky (1995:Ch. 3), it is tempting to analyze duplication as a case of multiple spell-out of the different copies. This analysis is even more tempting in the case of WH-duplication, since movement is clearly involved in this construction. Of course, the natural question that arises is why spell-out of multiple copies is permitted only in a restricted set of cases and these cases are mostly (or uniquely) found in sign languages. On this question, we refer the reader to Nunes and Müller de Quadros (2008), who propose an account of this phenomenon in a framework that assumes Kayne's linear correspondence axiom.[10]

We now turn to consider the distribution of LIS WH-NMM in detail. WH-questions are associated with a specific NMM, which is different from the NMM observed in yes-no questions (eyebrow raising). The main feature of WH-NMM is furrowing of the eyebrows. Other nonmanual features may be involved in the articulation of WH-phrases (e.g. a slight and repeated head shake, squinting eyes, etc.), but they are subject to strong individual variation. As for its distribution, WH-NMM is obligatorily coarticulated with the WH-phrase. When WH-phrases are at the right edge, there is a tendency to restrict NMM to the WH-phrase (see 19a,b repeated below as 22a,b), although WH-NMM may also spread over a wider part of the clause, as indicated by the dotted lines in 22c,d.

(22) a. _____wh
PAOLO STEAL $\overline{\text{BOOK}_i\ \text{WHICH}_i}$
'Which book did Paolo steal?'

b. _____wh
BOOK STEAL $\overline{\text{BOY}_i\ \text{WHICH}_i}$
'Which boy stole the book?'

c. _ _ _ _ _ _____wh
PAOLO STEAL $\overline{\text{BOOK}_i\ \text{WHICH}_i}$
'Which book did Paolo steal?'

d. _ _ _ _ _ _ _ _ _ _ _ _____wh
$\overline{\text{BOOK STEAL BOY}_i\ \text{WHICH}_i}$
'Which boy stole the book?'

However, when the WH-phrase remains in situ, spreading of WH-NMM is obligatory, as mentioned above for 19d, repeated below as 22e. In particular, WH-NMM starts from the WH-phrase and spreads rightward.

(22) e. _____wh
PAOLO $\overline{\text{BOOK}_i\ \text{WHICH}_i\ \text{STEAL}}$

f. _____wh
$\overline{\text{BOY}_i\ \text{WHICH}_i\ \text{BOOK STEAL}}$

[10] The fact that only the WH-restrictor can be reduplicated might also be a general property of sign languages. Nunes and Müller de Quadros claim that in Brazilian Sign Language only words (as opposed to phrases) can be reduplicated, and offer an explanation for this fact.

Since the spreading of WH-NMM in LIS plays a crucial role in our proposal, we return to it later on and compare it with the distribution of WH-NMM in ASL.

3.2. THE RIGHT-PERIPHERAL POSITION OF LIS NEGATIVE QUANTIFIERS. In this section, we present some data about the distribution of negative quantifiers in LIS. As becomes clear, there are several similarities between negative quantifiers and WH-phrases concerning both the position of the manual signs and the spreading of NMMs. We claim that these surface similarities reflect a deep similarity that requires a unified explanation. The data about negative quantifiers come from Geraci (2006a,b), who pointed out the analogy between WH-elements and negative quantifiers.

One feature shared by WH-items and negative quantifiers is that, typically, they both occur in postverbal position. Although they are (internal or external) arguments of verbs, negative quantifiers do not appear in the canonical preverbal argument position, as shown by contrast in 23a–c.

(23) a. GIANNI CONTRACT SIGN DONE
'Gianni signed the contract.'

b. GIANNI SIGN $\overline{\text{NOTHING}}^{\text{neg}}$
'Gianni did not sign anything.'

c. CONTRACT SIGN $\overline{\text{NOBODY}}^{\text{neg}}$
'Nobody signed the contract.'

As indicated by the line above them, negative quantifiers are coarticulated with a negative NMM, the same nonmanual marking that cooccurs with negation in 5 above. Geraci analyzes the data in 23 as the result of movement from the canonical preverbal position to the specifier of the negative projection (NegP), which he assumes to be right-branching in LIS.[11]

Despite the fact that negative quantifiers are regularly right-dislocated, some signers do allow them to occur in preverbal position.[12]

(24) a. % $\overline{\text{NOBODY CONTRACT SIGN}}^{\text{neg}}$
'Nobody signed the contract.'

b. % GIANNI $\overline{\text{NOBODY HELP}}^{\text{neg}}$
'Gianni did not help anybody.'

c. * $\overline{\text{NOBODY}}^{\text{neg}}$ CONTRACT SIGN

d. * GIANNI $\overline{\text{NOBODY}}^{\text{neg}}$ HELP

Notice the domain of the spreading of negative NMM in 24a,b: as in the case of the WH-phrases in situ in 22 above, NMM in 24a,b starts being articulated when the negative quantifier is signed (in argument position) and must spread rightward over the manual material that follows it, as indicated by the ungrammaticality of 24c,d.

[11] Pfau and Quer (2005) assume for independent reasons that in German Sign Language and in Catalan Sign Language the specifier of the negative projection has to be on the right.

[12] The symbol % indicates that not all signers accept negative quantifiers in canonical argument position. Some signers, however, think that sentences like 24a,b are fully grammatical in LIS and assign emphatic meaning to the negative quantifier.

The only difference between the spreading of NMMs with WH-phrases and negative quantifiers is that, when the WH-phrase sits in the right periphery, WH-NMM (as we saw) may optionally spread over a wider domain than the WH-phrase. This fact has no counterpart with negative quantifiers that overtly move to the right periphery of the sentence. In this configuration, our informants never produced negative sentences with spreading wider than the negative quantifier. Apart from this (for which we do not have an explanation), the parallelism between WH-phrases and negative quantifiers is striking.

When WH-items and negative quantifiers cooccur in the same sentence, the word order is rigidly the one observed in 25a,b below, where the WH-item follows the negative quantifier, which in turn follows the verb. Word orders in which the negative quantifier follows the WH-item and both are in postverbal position are unacceptable for our informants (no matter where NMM is placed).

(25) a. _____neg _____wh
SIGN NOTHING WHO
'Who signed nothing?'

b. _____neg _____wh
BUY NOBODY WHAT
'What did nobody buy?'

c. * SIGN WHO NOTHING

d. * SIGN WHAT NOBODY

Notice, by the way, that positive quantifiers (SOMEONE, etc.), unlike negative quantifiers, are typically found in argument position, as in 26a below. Geraci reports sporadic occurrences of right-dislocated positive quantifiers with a specific NMM (glossed as emphatic), as in 26b. If the positive quantifier is left in situ with emphatic NMM (head nod), the emphatic NMM spreads rightward, as in 26c.[13]

(26) a. SOMEONE CONTRACT SIGN DONE
'Someone signed the contract.'

b. _____emph
CONTRACT SIGN SOMEONE

c. _____emph
SOMEONE CONTRACT SIGN
'Someone did sign the contract.'

LIS is not the only language in which negative quantifiers must leave their argument position and move elsewhere in the structure (see, for example, Haegeman 1995 for a description of a similar phenomenon in West Flemish). In spoken languages in which negative quantifiers move, however, they move leftward. In LIS, negative quantifiers (and emphatic nonnegative quantifiers), like WH-phrases, target the right periphery of the sentence. Before we try to explain why this should be so, we present yet another case of right dislocation in LIS, which concerns relative elements.

[13] In 26c, the emphatic reading is provided by rightward spreading of the emphatic NMM, but the subject is also coarticulated with the specific NMM that cooccurs with topicalized elements (raised eyebrows). Thus, the fully specified gloss for 26c is as in (i).

(i) _____emph
_____topic
SOMEONE CONTRACT SIGN
'Someone did sign the contract.'

3.3. THE RIGHT-PERIPHERAL POSITION OF LIS RELATIVE MARKERS. LIS has a productive strategy of relativization, which has been investigated in Cecchetto et al. 2006 and Branchini & Donati 2009. Although these authors present different analyses, they both assume that a relative element, a manual sign glossed as PROREL by Cecchetto and colleagues (2006) (and glossed as PE by Branchini and Donati), moves to the right periphery of the sentence. We briefly sketch the relevant data and summarize our analysis.

Relative constructions like *a boy that called left* are translated in LIS as 27a or 27b (recall that coindexing indicates that categories are articulated in the same region of the signing space). The bracketing reflects our claim that these are biclausal constructions, where a correlative clause (the one that contains PROREL) is left-adjoined to the matrix clause.

(27) a. [BOY_i PROREL_i CALL] [(HE_i) LEAVE DONE]
b. [BOY_i CALL PROREL_i] [(HE_i) LEAVE DONE]
'A boy that called left.'

PROREL is a pronominal element whose manual configuration differs from that of other personal pronouns. When it is not adjacent to the noun, PROREL is still part of the clause containing the noun with which it is construed. Evidence for this claim is provided by the following facts, illustrated by 28 below: (i) PROREL precedes the time adverb that modifies the matrix clause, (ii) the distribution of NMM can cover the entire PROREL clause, but never extends over the matrix clause, and (iii) a prosodic break is introduced after PROREL.[14]

(28) $\overline{\text{[YESTERDAY BOY}_i\text{ LEAVE PROREL}_i\text{]}}^{\text{raising}}$ [TODAY (HE_i) CALL]
'A boy that left yesterday called today.'

If PROREL is not adjacent to the noun with which it is referentially linked, it is always the rightmost element inside its clause. This is indicated (among other things) by its position relative to postverbal elements like negation and time adverbs, as shown in 29.

(29) a. [BOY_i LEAVE NOT PROREL_i] [CALL]
'The boy that did not leave called.'
b. [BOY_i LEAVE IN-TIME PROREL_i] [CALL DONE]
'The boy that left in time called.'

In Cecchetto et al. 2006, it is argued that PROREL clauses are correlatives, syntactically similar to Hindi *jo*-clauses investigated in Dayal 1996. In particular, the distributional facts in 27–29 follow, if PROREL is a relative pronoun that moves to a Spec,CP position on the right (the movement of PROREL is either covert, as in 30b, or overt, as in 30a).

(30) a. [$_{\text{CP}}$ BOY_i t_{PROREL} CALL PROREL_i] [$_{\text{IP}}$ (HE_i) LEAVE DONE]
b. [$_{\text{CP}}$ BOY_i PROREL_i CALL] [$_{\text{IP}}$ (HE_i) LEAVE DONE]

In view of the pattern of WH-phrases presented here, the fact that PROREL moves to the right periphery of the sentence is hardly surprising. In English, Italian, and many other languages, interrogative and relative pronouns move to the left periphery. Similarly, interrogative and relative signs in LIS move to the right periphery. What

[14] From now on, we indicate NMM on the PROREL clause only when needed for the discussion, but the reader should keep in mind that its presence is a mandatory requisite for a PROREL clause to be well formed.

remains to be understood is the origin of this systematic left/right asymmetry, which, as shown in §3.2, extends to negative quantifiers as well.

4. CONSERVATIVE APPROACHES. A legitimate reaction, when confronted with the right-peripheral position of WH-phrases in LIS (and in other sign languages), is to ask whether this pattern can be explained without positing a dedicated structural position for WH-phrases in the right periphery of the clause, an assumption that would set LIS and other sign languages apart from the overwhelming majority of spoken languages. In this section, we consider three different strategies to avoid this assumption. We label these approaches 'conservative', because they try to reduce apparent cases of rightward movement to familiar cases of leftward movement.

4.1. THE BICLAUSAL ANALYSIS. A possible hypothesis to account for the right-peripheral position of WH-phrases in LIS, without assuming that they move to the right, is that LIS WH-questions are biclausal structures. According to this hypothesis, the LIS sentence STUDENT BOOK_i STEAL WHICH_i corresponds to the English discourse *A student stole a book. Which?*. Clearly, in order to account for English discourses of this sort, there is no need to suppose that the WH-phrase *which book* has undergone rightward movement: presumably, the WH-phrase sits in its canonical position in the left periphery and the rest of the sentence has been deleted. A similar account may then be extended to LIS: in this case, the question STUDENT BOOK_i STEAL WHICH_i would be a biclausal discourse consisting of the affirmative sentence STUDENT BOOK_i STEAL ('a student stole a book') and of an interrogative sentence in which the lexical material following the WH-phrase has been deleted, as shown in 31.

(31) STUDENT BOOK_i STEAL. $\overline{\text{WHICH}_i}^{\text{wh}}$ ~~BOOK STUDENT $t_{\text{WHICH BOOK}}$ STEAL~~

'A student stole a book. Which ~~book did the student steal~~?'

We do not deny that biclausal discourses of this sort can be used in LIS (as in other languages) to express the content of WH-questions. There are reasons, however, to hold on to the view that LIS also has genuine monoclausal questions in which the WH-phrase is clause-final. Notice that assuming that all LIS WH-questions can be reduced to biclausal discourses would amount to saying that in LIS (and other sign languages that behave like LIS) there is no grammaticized way to ask fully explicit clausal WH-questions. This would attribute a very impoverished grammatical structure to these sign languages, contrary to what much research has shown.

There are also more direct empirical reasons to reject a general analysis of LIS WH-questions as biclausal discourses: this analysis cannot account for the behavior of WH-NMM. As we saw in the case of PROREL constructions, one indication that the sign PROREL is part of the subordinate clause is that the relevant NMM cannot spread beyond it. This suggests that the edge of the clause is a boundary for the spreading of NMMs. Thus, if WH-questions were analyzed as biclausal, the prediction would be that no spreading should occur across the two clauses. This prediction is not borne out, as 32 below shows. According to the biclausal analysis, 32 consists of the affirmative sentence GIANNI EAT ('Gianni ate (something)') and of the interrogative sentence WHAT ('what?'), in which the verbal complex has been deleted. As can be seen from the gloss ———$^{\text{wh}}$, however, the WH-NMM extends over the verb EAT, something we should not expect if EAT were in a different clause. Notice, moreover, that according to the biclausal analysis of 32, the WH-NMM, a grammatical marker for a question

type, extends to material that is not part of an interrogative sentence, surely a dubious consequence of the analysis.

(32) _____wh
GIANNI EAT WHAT
'What did Gianni eat?'

Finally, notice that the biclausal analysis, even if it could explain the right-peripheral position of LIS WH-phrases without appealing to rightward movement, cannot be used as a general strategy to eliminate appeal to rightward movement in other cases. Indeed, if applied to negative quantifiers, this analysis would predict that 23b, reported below as 33, is formed by the affirmative clause GIANNI SIGN ('Gianni signed (something)') and the negative clause NOTHING ('nothing').

(33) _____neg
GIANNI SIGN NOTHING
'Gianni did not sign anything.'

The problem is that, unlike for WH-questions, where content of the question *What did Gianni eat?* can be conveyed by the biclausal discourse *Gianni ate (something). What?*, the content of negative statements like *Gianni signed nothing* cannot be expressed by a biclausal discourse like *Gianni signed (something). Nothing*. Indeed, it is not clear how a biclausal analysis could yield the correct interpretation for 33. We conclude that the biclausal analysis must be rejected.

4.2. THE REMNANT-MOVEMENT ANALYSIS. Another possibility, consistent with a conservative approach, is that the sentence-final placement of WH-phrases in sign languages results from two applications of leftward movement. First, the WH-phrase moves to a dedicated position in the left periphery (as in spoken languages). Then, the constituent out of which the WH-phrase has moved (the remnant) is moved to its left. The result is that the location of the WH-phrase on the right side is only apparent, because, structurally speaking, the WH-phrase sits in the left periphery. Mutatis mutandis, the same reasoning can be applied to the cases of right placement of negative quantifiers. We refer to this account as the remnant-movement analysis.

Poletto and Pollock (2004) propose a remnant-movement analysis for WH-constructions in some Romance dialects that display instances of in situ WH-phrases. Aboh and Pfau (2009) and Aboh, Pfau, and Zeshan (2006) apply a modified version of the remnant-movement analysis to two sign languages in which WH-signs occur at the right periphery, namely Sign Language of the Netherlands (NGT) and Indo-Pakistani Sign Language (IPSL).[15]

There are at least three problems we see with applying a remnant-movement analysis to LIS. First, the remnant-movement analysis raises a general concern. We began this article by pointing out a macrotypological puzzle: sign languages easily allow WH-phrases at the right periphery of the sentence, while spoken languages do not. If the placement of WH-phrases to the right is derived by systematic movement of the remnant, one can legitimately ask why sign languages involve a massive use of remnant move-

[15] More precisely, Aboh and Pfau (2009) and Aboh, Pfau, and Zeshan (2006) analyze the clause-final WH-sign in IPSL as a complementizer that marks the sentence as a question. This complementizer is assumed to be base-generated in the left periphery of the structure, and its right placement is derived by moving the entire clause to a structural position to its left. In this account, like in the remnant-movement analysis, the WH-phrase does not move rightward, while other constituents move to its left.

ment, which results in displacing WH-phrases at the right periphery, while spoken languages do not. In order to answer this question, it is crucial to understand which features trigger the movement of the remnant. Unless we explain this, the remnant-movement analysis predicts the correct word order but provides no answer to the puzzle we are trying to solve.

The second problem is, again, originated by how WH-NMM spreads. To show where the difficulty lies, we need to describe how complementation works in LIS. Since LIS is an SOV language, one might expect complement clauses to be center-embedded; namely, one might expect them to be in median position between the matrix subject and the matrix verb (this is what happens, for example, in SOV languages like Japanese or Turkish). In fact, a sentence like 'Gianni says that Maria ate the cake' cannot be translated in LIS as in 34, which is ungrammatical.

(34) * GIANNI MARIA CAKE EAT SAY

The possible LIS translations for 'Gianni says that Maria ate a cake' are given in 35.

(35) a. MARIA CAKE EAT GIANNI SAY
b. GIANNI SAY MARIA CAKE EAT
'Gianni said that Maria ate a cake.'

In both cases, the embedded complement clause is displaced, either at the right or at the left edge of the matrix clause. Now consider the sentence in 36, in which the complement clause is left-dislocated.

(36) PAOLO ARRIVE AFTER SAY WHO
wh
'Who said that Paolo arrived later on?'

In 36, WH-NMM occurs over the string SAY WHO. This fact is hard to account for in the remnant-movement analysis. Presumably, according to this analysis, the structure that corresponds to 36 is 36′, where WHO has been moved to the left periphery and then the clause from which WHO has been moved (the remnant) is further moved to the left.

(36′) [PAOLO ARRIVE AFTER t_{WHO} SAY]$_{remnant}$ [WHO $t_{remnant}$]

It is unlikely that the string SAY WHO, over which WH-NMM occurs, can form a prosodic unit under the remnant-movement analysis, at least if some form of mapping exists between the syntactic structure and the phonological one, since the two signs in this string do not form a constituent and there is no obvious way to group them. In §5, we assume that WH-phrases move to a dedicated position in the right periphery, and we make a specific proposal about the spreading of WH-NMM in LIS. We show that, under this proposal, the spreading of WH-NMM in 36 is expected.

The third problem for the remnant-movement analysis is raised by sentences like 37 and 38 (for simplicity, we do not indicate NMMs, since it is not essential to our argument).

(37) GIANNI SIGN NOTHING
'Gianni did not sign anything.'

(38) SIGN NOTHING WHO
'Who signed nothing?'

In order to derive the correct word order in 37 under the remnant-movement analysis, we need to assume that the negative quantifier NOTHING moves leftward and that the remnant moves to its left. A possible derivation for the word order in sentence 38, which contains both a WH-phrase and a negative quantifier in the right periphery, would

then be extremely baroque, since remnant movement would be triggered twice (i.e. by the negative quantifier and by the WH-phrase). Complete derivations for sentences 37 and 38 under a remnant-movement analysis and related technical issues are discussed in Appendix B. The interested reader can verify that, in addition to requiring multiple applications of remnant movement whose only purpose is to predict the correct word order, these derivations require positing two unspecified projections and a movement of a WH-item out of an island.

4.3. PETRONIO AND LILLO-MARTIN'S ANALYSIS. The discussion in the previous section shows that a remnant-movement analysis runs into serious problems. There is another approach, however, that minimizes the differences between sign and spoken languages by denying that there is a dedicated position for WH-phrases in the right periphery. This is the analysis proposed by Petronio and Lillo-Martin (1997) for ASL. We should mention that, among scholars, there is no agreement on the facts about WH-constructions in ASL. There is consensus in the literature (Petronio & Lillo-Martin 1997, Neidle et al. 2000) that ASL is an SVO language and that WH-items may appear sentence-finally, as in 39, or in situ, as in 40.

(39) _____wh
JOHN BUY YESTERDAY WHAT (ASL)

(40) _____wh
JOHN BUY WHAT YESTERDAY (ASL)
'What did John buy yesterday?'

There is disagreement, however, about the conditions allowing the placement of WH-signs at the left periphery. According to Neidle and colleagues, a WH-sign can sit in the left periphery only when this sign is reduplicated at the right periphery, as shown in 41.

(41) _____wh
WHAT JOHN BUY t_{WHAT} YESTERDAY WHAT (ASL)
'What did John buy yesterday?'

Petronio and Lillo-Martin (1997), by contrast, report that sentence 42, with a left-peripheral WH-object and no duplication, is also grammatical (since Neidle and colleagues' informants reject this claim, we mark 42 with %, which indicates disagreement, not marginal status).

(42) _____wh
% WHO JOHN LOVE (ASL)
'Who does John love?'

Assuming that 42 is acceptable, Petronio and Lillo-Martin claim that WH-movement is universally leftward. To explain why WH-phrases naturally appear at the right edge of the sentence (as in 40 above), they argue that, when WH-phrases are right-peripheral, a null WH-element moves to Spec,CP (to the left) and that the sentence-final WH-element is an interrogative complementizer that occupies the COMP position.[16]

Whether or not Petronio and Lillo-Martin's analysis is correct for ASL, it is not adequate for LIS. This is clearly shown by two facts. First, in LIS WH-objects never occur at the left periphery (as shown by the ungrammaticality of 21 above) and our

[16] Clause-final interrogative complementizers are common in SOV languages (see §7.1 below for a description of the Japanese pattern). Since ASL word order is SVO, however, the right placement of the interrogative complementizer is unexpected. One possibility is that sentence-final COMP in ASL is present because ASL was originally SOV (see Fischer 1975 on the transition from SOV to SVO for ASL).

informants unanimously reject this option as ungrammatical. Second, the right-peripheral WH-element can be a phrase, rather than a single word (as shown by 19a and 19c above). Thus, this element cannot be analyzed as a complementizer that occupies the COMP head.[17]

Let's sum up our discussion of conservative approaches. We analyzed three possible ways of explaining the right-peripheral position of WH-phrases in LIS without positing a dedicated position in the right periphery for them. Our conclusion is that these accounts run into problems that are serious enough to warrant a different research strategy: let's concede that WH-phrases, in sign languages like LIS, genuinely move to a dedicated position in the right periphery of the sentence and then let's try to explain why this should be the case.

5. OUR ANALYSIS OF WH-MOVEMENT IN LIS. In this section we propose an explanation for why in LIS WH-phrases are located in the right periphery or (in a restricted set of cases) in situ, but they are never found in the left periphery of the sentence. Although we focus on WH-questions, our reasoning applies to the other cases of right placement that we have discussed in §3.

5.1. SPREADING OF NMM AS A WAY TO MARK DEPENDENCIES. As we have seen, WH-NMM in LIS can either be confined to the WH-phrase or extend to a bigger part of the sentence. Neidle and colleagues observe that in ASL WH-NMM either occurs on the WH-phrase alone or spreads over the entire clause (depending on the occurrence of overt WH-movement). They interpret this pattern as evidence that the spreading domain of WH-NMM in ASL is the c-command domain of COMP. However, the facts are different in LIS. For example, in sentence 43, WH-NMM does not spread over the entire clause, since it is not coarticulated with the subject GIANNI.

(43) $\overline{\text{GIANNI EAT WHAT}}^{\text{wh}}$
'What does Gianni eat?'

GIANNI EAT WHAT

Notice that GIANNI is not topicalized in 43, since topichood is indicated in LIS by a special nonmanual marking,[18] illustrated in 44 below, that is not present in 43. Therefore, it is unlikely that the reason why WH-NMM does not occur on GIANNI in 43 is that GIANNI has vacated the canonical subject position and is outside the c-command domain of COMP.

[17] Actually, Neidle and colleagues discuss some videotaped examples like (i) below showing that WH-phrases can be dislocated to the right. This datum is problematic for Petronio and Lillo-Martin's analysis.

(i) BREAK-DOWN [WHO (POSS) CAR] (ASL)
'Whose car broke down?'

[18] Topicalized material is marked by raised eyebrows and is followed by a pause.

(44) _____topic
GIANNI ARRIVE DONE
'Gianni arrived.'

GIANNI ARRIVE DONE

By contrast, in 45 WH-NMM spreads over the entire sentence.

(45) _____wh
SOMEONE GIANNI SEE DONE. GIANNI SEE WHO
'Someone saw Gianni. Who saw Gianni?'

GIANNI SEE WHO

The generalization suggested by these examples is this: when the WH-phrase is the direct object, WH-NMM may spread over the verb and the object but not over the subject, whereas, when the WH-phrase is the subject, WH-NMM may spread over the entire sentence. This conclusion is also supported by the behavior of WH-NMM in the instances of WH in situ we found. As we have seen, discourse-linked WH-phrases can remain in situ in LIS.[19] For example, 46 below was elicited in a context in which previous discourse had identified a class of relevant dresses among which Maria could choose.

(46) _____wh
MARIA WHICH$_i$ DRESS$_i$ BUY
'Which of those dresses did Maria buy?'

MARIA WHICH DRESS BUY

Other sentences with the WH-phrase in situ that were elicited in a context that favors discourse linking are shown in 47a,b.

(47) a. _____wh
WHO ARRIVE
'Which of them arrived?'

[19] See Pesetsky 1987 for a similar claim about WH-phrases in English.

WHO ARRIVE

b. _____wh
GIANNI WHO KISS
'Which of them did Gianni kiss?'

GIANNI WHO KISS

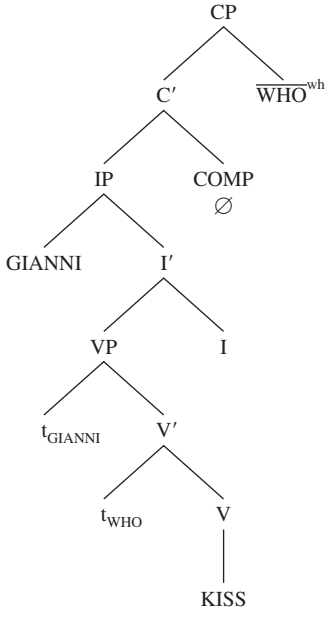
As the glosses in the above examples indicate, the WH-in-situ sentences conform to the generalization we just proposed: WH-NMM excludes the subject when the WH-phrase is the direct object, but spreads over the entire sentence when the WH-phrase is the subject.

The question now is what governs the distribution of WH-NMM in LIS.[20] There is a natural hypothesis concerning how WH-NMM operates in LIS, which is consistent with the data. The generalization we propose may be stated by saying that, when the structure is linearized, the WH-NMM spreads over the lexical material that intervenes between the position of the WH-phrase inside the clause (the subject position if the WH-phrase is a subject, the object position if the WH-phrase is an object, etc.) and the COMP (complementizer) to which the WH-phrase is associated. Capitalizing on this observation, we propose that the function of WH-NMM in LIS is this: the spreading of WH-NMM marks a WH-dependency. Overt displacement (or syntactic movement) is a device natural languages systematically exploit to connect two positions, typically an argument position and some higher position to which the argument is related. According to our view, the spreading of WH-NMM in LIS is just another way to connect these two positions. In more technical terms, and assuming Chomsky's (2001) Probe-Goal theory, we propose that WH-NMM is another way (in addition to movement) to show that a relation holds between the Probe, a WH-feature in the head of COMP in our case, and its Goal, the position of the WH-element that overtly or covertly moves to Spec,CP. The spreading of WH-NMM is thus a modality-specific way to create a WH-dependency: sign languages like LIS can mark WH-dependencies by movement (48a), by WH-NMM (48b), or by both devices at the same time (48c) (the dotted lines in the trees indicate the dependency signaled by the spreading on lexical material).

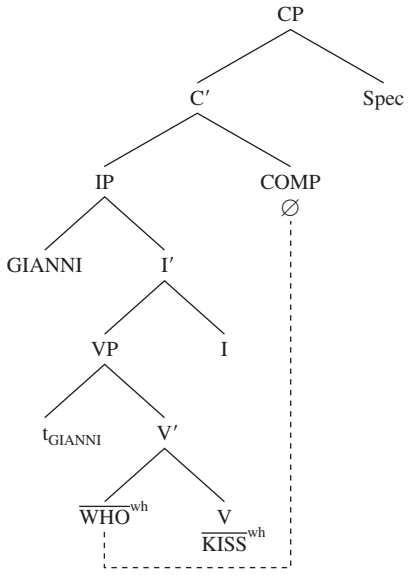
[20] If we restrict our attention to 43 above, we might think that the spreading of WH-NMM expresses Spec-Head agreement between the verb raised to COMP and Spec,CP, where both positions are linearized to the right. However, (i) below shows that the spreading of WH-NMM is not the result of a Spec-Head agreement configuration, since the adverb intervening between the verb and the sentence-final WH-word suggests that the verb does not raise to COMP in LIS.

(i) _____wh
ARRIVE IN-TIME WHO
'Who arrived in time?'

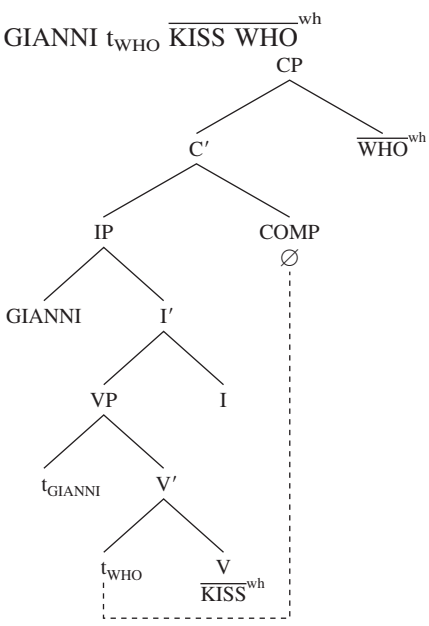
(48) a. GIANNI t_{WHO} KISS $\overline{\text{WHO}}^{wh}$



b. GIANNI $\overline{\text{WHO KISS}}^{wh}$



c.



There are several considerations that make this proposal plausible. First, research on sign languages has made clear that NMM can be the manifestation of grammatical configurations such as agreement, domain of c-command of some functional projection, and so forth (see, for example, Aarons 1994, Bahan 1996, Neidle et al. 2000, Meir 2002, Pfau 2002, Pfau & Quer 2005). Since dependency is a fundamental syntactic configuration, it is only natural that dependencies can also be manifested through NMM. Second, if spreading of NMM is a modality-specific device to mark WH-dependencies, we have a straightforward explanation for why spreading of the WH-NMM is mandatory only when the WH-phrase is in situ (see the sentences in 47 above): if the WH-phrase does not move, WH-NMM obligatorily spreads over the entire extension of the WH-dependency in LIS because NMM is the only way to mark the dependency. If the WH-phrase moves to the right edge, WH-NMM is obligatory on the WH-phrase (plausibly for lexical reasons), but does not have to spread, since the WH-dependency is already indicated by the occurrence of overt movement.[21]

Notice, moreover, that the hypothesis that WH-NMM marks WH-dependencies in LIS accounts for the spreading of WH-NMM in 36 (repeated below), which is problematic for the remnant-movement analysis.

(36) PAOLO ARRIVE AFTER SAY WHO (wh)
'Who said that Paolo arrived later on?'

Let's assume that 36 is obtained in this way: (i) the complement clause PAOLO ARRIVE AFTER is left-dislocated to some extrasentential position higher than CP (Topic Phrase, for example); (ii) the WH-phrase moves to the right-peripheral Spec,CP of the

[21] A further reason for thinking that NMM is a modality-specific manifestation of WH-dependencies emerges in §7, where we find that prosody can mark WH-dependencies in some spoken languages (for example in Japanese; see Deguchi and Kitagawa 2002 and Ishihara 2002). Since NMM is commonly considered the sign language counterpart of intonation, it does not come as a surprise that NMM, like intonation, can mark WH-dependencies.

matrix clause. According to our account, WH-NMM in 36 should mark the WH-dependency by spreading over the lexical material intervening between the WH-trace and the matrix clause COMP. This is exactly what happens in 36.[22]

(36″)
[PAOLO ARRIVE AFTER] [$_{CP}$ t_{WHO} SAY WHO]^{wh}
'Who said that Paolo arrived later on?'

Finally, the hypothesis that NMM can mark dependencies in LIS also explains the behavior of negative NMM with LIS negative quantifiers described by Geraci (2006a,b). As we have seen, negative quantifiers typically occur postverbally, as in examples 23b and 23c above, and, in this case, negative NMM is only coarticulated with the negative quantifier. When negative quantifiers remain in situ, however, negative NMM must spread over other lexical material and the analogy with WH-NMM becomes clear. If the negative quantifier that stays in situ is a subject, as shown in 24a above (repeated here as 49), the negative NMM (headshake) cooccurs with the entire sentence.

(49)
% NOBODY CONTRACT SIGN^{neg}
'Nobody signed the contract.'

If the negative quantifier that stays in situ is an object, negative NMM does spread, but it does not spread over the subject, as shown in 24b above (repeated here as 50), where no headshake cooccurs with the subject GIANNI.

(50)
% GIANNI NOBODY HELP^{neg}
'Gianni did not help anybody.'

The pattern of negative NMM is thus strikingly similar to the pattern of WH-NMM: if the negative quantifier is the direct object, NMM spreads over the verb and the object (excluding the subject), while, if the negative quantifier is the subject, NMM spreads over the entire sentence. In the case of negative NMM, as in the case of WH-NMM, a natural hypothesis is that NMM marks a dependency. In particular, for negative quantifiers, negative NMM marks the dependency between the argument position of the negative quantifier and the head in the right periphery to which the negative quantifier is associated (identified as Neg in the framework we are assuming).[23]

The first step is complete: we have argued that in LIS WH-NMM plays a precise grammatical role; it marks WH-dependencies. Now, we see how this can explain the placement of WH-phrases at the right edge of the sentence.

[22] Notice, by the way, that a similar account of the spreading of WH-NMM in 36 may also be given if we assume that the complement clause in 36 is base-generated, rather than moved, in TopicP: in this case, we still expect WH-NMM to spread on the matrix clause verb SAY. We come back to the structure in 36 in §5.2.

[23] The same line of reasoning also applies to the behavior of nonnegative quantifiers with emphatic readings discussed in §3.2, although in this case some caution is needed, since we could elicit that type of construction only from one of our informants.

A referee asked whether WH-dependencies can be marked by case, agreement, or by other morphological means. As far as we know, this is not the case for the languages we consider, and we are not aware of any account that suggests that WH-dependencies are marked by morphological devices. Notice, by the way, that case would not be a good way of systematically marking WH-dependencies, since not all WH-phrases are case-marked (adjunct WH-phrases, like 'why', 'when', 'how', correspond to PPs and not to NPs and for this reason do not receive case).

5.2. NMM SPREADING FORCES THE PLACEMENT OF WH-PHRASES TO THE RIGHT IN LIS. This article, for obvious reasons, does not aim at offering a comprehensive theory of how hierarchical structure (based on c-command) is mapped onto a linear structure (based on precedence). We assume, however, that any adequate theory should derive two general facts about linear order in natural language: (i) in the overwhelming majority of cases, the specifier of a category XP precedes the lexical material contained in X′, and (ii) the order of head and complement is decided parametrically. Following Chomsky (1995), we assume that linear order is determined at the interface between syntax and phonology, when linearization algorithms (however they are formulated) dictate how a hierarchical structure gets linearized. So, according to this view, linear order is not already specified in the syntactic component, although linearization algorithms do use information about syntactic structure to map it into a specific linear order. Given the fact mentioned in (i) above concerning the position of specifiers, a plausible assumption is then that the linearization algorithm by default linearizes the specifier of a category XP to the left of the lexical material contained in X′.

If the above assumption is correct, a question arises. Consider LIS sentence 32 again, repeated below as 51 (with the trace of the WH-phrase explicitly signaled).

(51) $\underline{\qquad\qquad}^{wh}$
GIANNI t_{WHAT} EAT WHAT
'What does Gianni eat?'

In §4, we argued that in 51 the WH-phrase moves to a dedicated position in the right periphery. In the framework we are assuming, this means that the WH-phrase moves to the specifier of CP that is linearized to the right in LIS. The question is: why is the specifier of CP linearized to the right, given that the linearization algorithm, whatever precise form it has, normally linearizes it on the left?

Recall how we characterized WH-dependencies in §5.1. We identified the lower link of the WH-dependency with the position occupied by the WH-phrase before WH-movement applies, or the position visibly occupied by the WH-phrase when it remains in situ; and we identified the higher link with the position of the complementizer. The higher link of the WH-dependency is standardly identified with the complementizer since it is the complementizer that marks the sentence as interrogative (cf. Cheng 1991). Interrogative complementizers are morphologically realized in WH-questions in many languages (one example being Japanese, discussed in §7.1 below), although in other languages they are not visible in WH-questions (in English, for example, they are morphologically realized only in embedded yes/no questions by *whether*). The fact that the complementizer may assume a specific form, if a WH-phrase is present, clearly shows that there is a dependency linking these two categories. In more technical terms, this means that the fundamental dependency, namely the link required by the process of feature evaluation, is the one between the Probe (in our case COMP) and the Goal, in our case the WH-phrase in its position before WH-movement.

Now, recall that LIS is a head-final language. Thus, although it does not have straightforward examples of complementizers, the null hypothesis is that COMP, as all other heads in the language, is placed to the right by linearization algorithms.[24] Furthermore,

[24] We assume that lexical items are linearized also when they are phonologically null. This assumption is not theoretically costly since, once a linearization algorithm is available, it can freely apply to any category, including empty ones. Empirical evidence for this assumption includes evidence coming from *wanna*-contraction configurations (see Lakoff 1970) and from the fact that, according to several diagnostics, null subjects

see Branchini & Donati 2009 for an explicit proposal that analyzes the sign PE in LIS relative constructions as an overt complementizer located at the right periphery of the sentence. With this in mind, let us consider the counterfactual configuration in which the WH-phrase moves to the left periphery, producing the structure in 52 (which would correspond to an unattested word order in LIS).

(52) * [$_{CP}$ WHAT [$_{IP}$ GIANNI [$_{VP}$ t_{WHAT} EAT] . . .] COMP]

In this structure, there are at least three conceivable ways that the WH-NMM may spread, all starting from the left edge, where the WH-phrase would be the first category to be linearized. One possibility is that WH-NMM spreads over the lexical material intervening between the WH-phrase and its trace, as in 52′.

(52′) * [$_{CP}$ $\overline{\text{WHAT}}^{\text{wh}}$ [$_{IP}$ GIANNI [$_{VP}$ t_{WHAT} EAT] . . .] COMP]

The problem with 52′ is that WH-NMM links the two positions occupied by the WH-phrase but fails to link the trace of the WH-phrase with the COMP position, since it does not spread over the lexical material that intervenes between these positions. Thus, WH-NMM in 52′ fails to mark the WH-dependency.[25]

Another possible way WH-NMM can spread in the counterfactual configuration in which the WH-phrase moves to the left periphery is given in 52″.

(52″) * [$_{CP}$ $\overline{\text{WHAT [}_{IP}\text{ GIANNI [}_{VP}\text{ }t_{WHAT}\text{ EAT]}}^{\text{wh}}$ . . .] COMP]

In 52″ WH-NMM starts at the left edge and spreads over the lexical material that intervenes between the WH-phrase and the sentence-final COMP. The problem with 52″ is, again, that the WH-dependency, as we characterized it, is not properly marked by WH-NMM. Since in 52″ WH-NMM spreads over the whole sentence, it spreads too much to be a reliable indicator of the dependency between the Goal (the position of the trace t_{WHAT}) and the Probe (the position of COMP).

Finally, consider a further way that WH-NMM might spread in the counterfactual configuration in which the WH-phrase moves to the left periphery.

(52‴) * [$_{CP}$ $\overline{\text{WHAT}}^{\text{wh}}$ [$_{IP}$ GIANNI [$_{VP}$ t_{WHAT} $\overline{\text{EAT}}^{\text{wh}}$] . . .] COMP]

In 52‴, WH-NMM spreads over the lexical material that intervenes between the position of the trace t_{WHAT} and the position of COMP; thus it correctly marks the WH-dependency between the Probe and the Goal. However, WH-NMM also occurs on the WH-phrase at the left edge, since WH-phrases are lexically marked for WH-NMM. The problem with 52‴ is phonological, in that 'perseveration' is violated. Perseveration is a common phonological phenomenon of sign languages according to which a handshape or an NMM that is used several times in close proximity remains in place. Examples of perseveration are discussed in Neidle et al. 2000:118–21 and are attested in LIS as

in pro-drop languages like Italian behave like preverbal subjects and unlike postverbal ones (see Cardinaletti 1997 for extensive discussion), suggesting that null subjects are linearized in the preverbal position.

[25] The WH-NMM in configuration 52′ marks another kind of dependency, which in the principles-and-parameters framework is known as the WH-chain. This is one case where the notion of WH-dependency, as we have defined it, diverges from the notion of WH-chain, crucially showing that the former captures the distribution of WH-NMM in LIS.

well.[26] Configuration 52‴, where WH-NMM stops being articulated only to be immediately resumed, is thus excluded for phonological reasons.

We conclude that, if WH-phrases moved to the left periphery, WH-NMM could not properly mark the WH-dependency. Therefore, we assume that in sign languages like LIS, the default value of the linearization algorithm, which linearizes a specifier to the left, is overridden: Spec,CP is linearized to the right because this is the only way for the dependency between the Probe and the Goal to be marked by WH-NMM.

We should stress that our account of the placement of Spec to the right applies only if the relevant Probe-Goal dependency must be marked by some NMM. In particular, our analysis leaves open the possibility that the material in a position higher than Spec,CP is linearized to the left edge of the clause. An example is sentence 36 above, repeated here as 53, which contains a clausal object. Assuming the articulated structure for the COMP area proposed by Rizzi (1997), the left-dislocated complement clause in 53 sits in Spec,TopicP, a functional projection that is higher than the functional projection that hosts WH-phrases (Spec,CP).

(53) _____wh
[$_{\text{TopicP}}$ [PAOLO ARRIVE AFTER] [SAY WHO]]
'Who said that Paolo arrived later on?'

The word order in 53 shows that Spec,TopicP is linearized to the left. This is consistent with our explanation, which implies that the right placement, when it occurs, is triggered by the occurrence of NMM over the relevant dependency. Indeed, if the complement clause in 53 is base-generated in Spec,TopicP, no movement dependency is present that involves this constituent, and thus there is no reason to expect that Spec,TopicP should be linearized to the right. By contrast, if the complement clause in 53 moves to Spec,TopicP from its base (center-embedded) position, there is still no evidence that topic dependencies are marked by a specific NMM.[27] Thus, again, nothing forces the right placement of Spec,TopicP, and the default option (specifiers are linearized to the left) applies.

Finally, notice that, according to our account, the other crucial factor that is responsible for the placement of Spec to the right is the fact that the associated head is also linearized to the right of its complement. Thus, in 52 above, what prevents WH-NMM from marking the WH-dependency is the fact that the null COMP is linearized to the right edge while the WH-phrase is located at the left edge. Thus, our account predicts that other sign languages should behave like LIS in placing the WH-phrase at the right periphery if two concurrent factors are present: (i) the language marks WH-dependencies

[26] An example of hand-shape perseveration in LIS is provided in (i).

(i) _____H2
GIANNI CAR P-A-N-D-A CAN DRIVE
'Gianni can drive a (FIAT) Panda.'

In LIS, the sign for 'car', which is the same as the sign for 'drive', is articulated with the two hands close in a fist as if they were holding the steering wheel. In the case of (i), after the sign CAR is produced, the nondominant hand (i.e. the hand that is not used for one-handed signs) holds the hand-shape, orientation, and location for the sign CAR, while the dominant hand produces the fingerspelled sign PANDA (which is the name of the model of the car) and the modal CAN. When the sign for DRIVE is to be articulated, the nondominant hand is already in place with the appropriate hand-shape and orientation. The phenomenon of perseveration in sign languages can be considered on a par with phonological phenomena in spoken languages such as progressive assimilation or vowel harmony.

[27] Topic phrases are characterized by a specific NMM in LIS ex. 44, but we know of no case in which NMM spreads outside the topicalized element.

by NMM, and (ii) COMP follows its complement.[28] In §6 below, we check this prediction with respect to two other sign languages, IPSL and ASL.

5.3. WHY SPECIFIERS ARE NORMALLY ON THE LEFT. In the previous section, we have shown what would go wrong if WH-phrases were linearized to the left in LIS. To avoid the problem that we have described with the nonmanual marking of WH-dependencies, the default linearization value is overridden, Spec,CP is linearized to the right, and, as a result, WH-phrases are found at the right edge of the clause. If this is correct, however, the question arises: why are WH-phrases (and specifiers in general) by default linearized to the left? The left placement of specifiers may be derived from an account of parsing proposed by Ackema and Neeleman (2002).

Ackema and Neeleman propose that rightward movement is more restricted than leftward movement because of processing difficulties that arise with rightward movement. According to Ackema and Needeman, in sentence processing, the parser must build a syntactic representation on the basis of a linear (left-to-right) input (the incoming sentence). In order to explain why rightward movement has a restricted occurrence, Ackema and Neeleman capitalize on two standard assumptions in the literature on processing. The first assumption is that, in order to reduce the pressure on short-term memory during the analysis of an input string, the parser closes off certain units of already parsed structure and removes them from the short-term memory by treating them as atoms with no discernible internal syntactic structure. The second assumption is that the parser starts searching for a position to insert a gap only when an item is identified as a moved element (on the basis of the grammar of the language in question).[29] These assumptions explain why rightward movement is more restricted than leftward movement. Indeed, if the gap follows its antecedent, in principle the gap can be inserted in any phrase following the antecedent, since for any such phrase the insertion of the trace may occur while the parser is building up the phrase, as illustrated in 54a below. A trace can precede its antecedent, however, only if trace and antecedent are in the same (minimal) unit, as in 54c; otherwise, in order to insert a gap after the moved element has been identified, as in 54b, a 'closed' (fully analyzed) unit would have to be reopened for inspection, something that is not possible since syntactic units that have already been fully analyzed are impenetrable atoms.

(54) a. √ [α . . . [. . . [. . . t_α . . .] . . .] . . .]
b. * [. . . [. . . [. . . t_α . . .] . . .] . . . α]
c. √ [. . . [. . . [. . . t_α . . . α] . . .] . . .]

This account derives Ross's (1967) right roof constraint, according to which rightward movement, like Heavy NP Shift, is clause-bound. If Ackema and Neeleman are right, it is only natural to conjecture that specifiers are normally linearized on the left, because in this way movement would be leftward and therefore easier to process.

Notice that, in the case of LIS, overriding the default linearization value by placing Spec,CP to the right has rather limited consequences for the parser. In LIS, multiple levels of subordination are rarer than in spoken languages: commonly, a sentence of

[28] Arguably, this account also extends to the case of negative quantifiers in LIS.

[29] Ackema and Neeleman motivate this assumption by observing that in a sentence like (i) there is nothing that suggests that it contains a gap. Thus, positing a trace in the string *you think Mary fixed the bike* in (ii) depends on the presence of the fronted interrogative element *how*.

(i) You think Mary fixed the bike.
(ii) How do you think Mary fixed the bike t?

a spoken language that presents multiple subordinate clauses is translated in LIS by using a multisentential discourse. Furthermore, when subordinate clauses occur in LIS, they are never center-embedded, but occur in the peripheral position of the sentence (as shown in the case of (cor)relative clauses and complement clauses discussed above). Due to the reduced level of embeddings and the lack of center embedding, backward localization of a trace in LIS is bound to be a local phenomenon: the syntactic parser has no need to reopen already closed units when it tries to insert a trace after the moved element has been identified. So, the main reason for linearizing WH-phrases to the left may be less compelling in this case.

Notice a consequence of this reasoning. We expect that in spoken languages the fact that a WH-phrase is linearized to the left should allow us to extract it out of subordinate clauses since this does not involve backward localization of the trace. By contrast, in LIS, where WH-phrases are linearized to the right, extraction of a WH-phrase out of a subordinate clause should be barred, because, when the parser reaches the right-peripheral WH-phrase, the unit that contains its trace has already been closed off and the dependency cannot be processed. This prediction seems to be correct for LIS. Indeed, we could not find any counterpart in LIS of long-distance movement of the kind in 55–56.

(55) Chi pensi che hai visto t_{chi}?

(56) Who do you think that you saw t_{who}?

When asked to translate 55 in LIS, our informants produced multisentential structures like the LIS counterpart of 'You think that you saw someone. Who (is it)?'. This suggests that long-distance WH-movement is impossible (or very hard to process) in LIS.

To sum up, specifiers may be normally linearized on the left because of processing constraints. Overriding this default option for LIS does not pose a problem for the parser.

6. EXTENDING THE ANALYSIS TO OTHER SIGN LANGUAGES. As we observed in §1, WH-items occur right-peripherally in several sign languages. WH-NMM is also very common across sign languages. Thus, the question arises of whether the account we proposed of the right-peripheral occurrence of WH-items in LIS can be extended to other sign languages. Unfortunately, the syntax of WH-questions has been systematically investigated for only a few sign languages and, even for these languages, videos or accurate descriptions of the facts are not always available. Since our analysis makes fine-grained predictions about how WH-NMM should spread, this makes the crosslinguistic range of application of our analysis hard to evaluate at the present stage.

There are at least two sign languages, however, for which enough information is currently available to compare them to LIS. One, which we have already mentioned, is Indo-Pakistani Sign Language (IPSL). Interrogatives in IPSL have been discussed in several papers (cf. Pfau 2004, Aboh et al. 2006, and Aboh & Pfau 2009) and show relevant similarities to interrogatives in LIS. Like LIS, IPSL is a head-final language and the WH-sign occupies a sentence-final position. Pfau (2004) and Aboh, Pfau, and Zeshan (2006) also observe that, although WH-NMM can spread over the entire sentence, it does not have to. In particular, Pfau reports cases like 57, in which WH-NMM does not spread over the subject and the subject is not marked for topic.

(57) $\overline{\text{A:DMI: VA:PAS\_A:NA: KYA:}}^{wh}$
man return WH
'Why did the man come back?'

Assuming that the question sign KYA: in 57 is base-generated in a position that does not c-command the subject A:DMI:, the lack of WH-NMM over A:DMI: is expected if, as we propose for LIS, WH-NMM marks the WH-dependency. What remains to be determined are the reasons why WH-NMM spreads over the entire sentence in other IPSL examples discussed by these authors.

Notice, moreover, that IPSL, unlike LIS, has only one question sign covering the whole range of question words. This means that the exact interpretation of the content of a question depends on the context. If the context does not suffice, the interrogative sign can combine with other noninterrogative signs to express a more specific meaning. The presence of a single interrogative sign has led Aboh and Pfau (2009) and Aboh, Pfau, and Zeshan (2006) to analyze it as a complementizer. Consequently, they assume that WH-phrases are always phonologically null in IPSL. Further research is needed to assess whether IPSL is a language that contains no overt WH-items, as they claim, or is a language with right-peripheral WH-phrases and WH-NMM CAN mark a WH-dependency.

A language for which a detailed description and a large amount of videotaped material is available is ASL. As we mentioned above, there is an ongoing debate about the proper analysis of WH-constructions in ASL, and there is no full agreement about what the facts are (this disagreement extends to some data that are relevant to evaluate our hypothesis). In what follows, we compare LIS and ASL as described by the Boston group (the researchers whose work is presented in Neidle et al. 2000), since this group has made available a rich set of videos that we could consult.[30] We are not in a position to judge whether the ASL data described by the Boston group identify a variant of ASL or are more representative.

WH-phrases in ASL can remain in situ, as shown in 58a, move to the right edge, as shown in 58b, or be reduplicated with an occurrence at the left edge and another occurrence at the right edge, as shown in 58c.

(58) a. JOHN BUY WHAT YESTERDAY^{wh} (ASL)

b. JOHN BUY YESTERDAY WHAT^{wh} (ASL)

c. WHAT JOHN BUY YESTERDAY WHAT^{wh} (ASL)

'What did John buy yesterday?'

When no movement occurs, WH-NMM must spread over the entire sentence, as in 58a. When the WH-phrase is at the right edge, as in 58b, WH-NMM may be confined to the WH-phrase, although spreading over the entire sentence is also possible. In case of duplication, shown in 58c, WH-NMM spreads over the entire sentence.

Neidle and colleagues explain this pattern by assuming that WH-NMM must spread over the entire c-command domain of COMP whenever no overt material is locally available to be coarticulated with the +WH feature in COMP (this follows from an independent generalization about the distribution of nonmanual syntactic marking; see Neidle et al. 2000 for details). If WH-material is available in CP, spreading is optional. Notice that the spreading of the WH-NMM in 58c does not follow from this rationale, since the presence of a manual WH-sign in the COMP area would make the spreading of the WH-NMM optional. Indeed, Neidle and colleagues account for the spreading of WH-NMM in 58c in terms of perseveration of the WH-NMM.[31]

[30] See the website http://www.bu.edu/asllrp/book/.

[31] See Neidle et al. 2000:118–21.

Another fact about ASL that is relevant in the present context is that COMP is arguably linearized to the right. Indeed, both Neidle and colleagues and Petronio and Lillo-Martin assume that COMP is to the right in ASL. Moreover, Conlin, Hagstrom, and Neidle (2003) describe an ASL particle that is plausibly analyzed as a complementizer and that occupies the right-peripheral COMP position in ASL. This point is important because our explanation for the placement of Spec,CP to the right in LIS crucially relies on the fact that COMP is linearized to the right.

The ASL sentences in 58 above show that WH-NMM behaves differently in ASL and LIS: in particular, although the WH-phrase moves from object position in 58b, the WH-NMM spreads over the subject, something we do not expect if WH-NMM marks the WH-dependency. One possibility is that WH-NMM plays two different roles in ASL and LIS; namely, in ASL it marks the c-command domain of COMP, while in LIS it marks the extension of the WH-dependency. Our account for the placement of WH-phrases to the right, however, is based on the idea that WH-NMM marks the WH-dependency. So, if WH-NMM does not mark the WH-dependency in ASL, it is not clear why WH-phrases should be to the right in ASL, as the facts in 58 seem to indicate.[32] In what follows, we try to reduce the ASL case to the LIS case by adopting our hypothesis about the role of WH-NNM in marking WH-dependencies.

As we just saw, the main empirical difference between ASL and LIS, as far as the distribution of WH-NNM is concerned, is the fact that, unlike in LIS, WH-NMM in ASL occurs over the subject when the WH-phrase is a direct object.

(59) a. $\overline{\text{SUBJECT VERB (ADVERB) WH OBJECT}}^{\text{wh}}$ (ASL)

b. SUBJECT $\overline{\text{VERB (ADVERB) WH OBJECT}}^{\text{wh}}$ (LIS)

We propose that this difference between ASL and LIS is related to a cluster of properties that set these two languages apart. One difference we already mentioned: in LIS a WH-phrase can never appear at the left periphery, while it can in ASL, on condition that it is duplicated at the right periphery. Another difference has to do with some ASL facts described by Neidle (2002). She shows that WH-movement cannot apply in ASL when the left periphery is filled by a focused category (as in 60a), by an 'if'-clause (as in 60b), or by a relative clause (as in 60c).[33]

(60) a. [context: I know who will eat the rat, but:]
?* MOUSE EAT WHO (ASL)
'Who will eat THE MOUSE?'

b. [context: Sue forgot the umbrellas again]
?? RAIN [BAWL-OUT SUE] WHO (ASL)
'If it rains, who will bawl out Sue?'

c. ?? CAT CHASE DOG [EAT YESTERDAY] 'WHAT' (ASL)
'What did the cat that chased the dog eat yesterday?'

In all of these cases, the structure would be perfectly acceptable if the WH-phrases remained in situ. Neidle's hypothesis is that, in order to move to Spec,CP (to the right), the WH-phrase must pass through a lower position in the COMP area (in the left

[32] Neidle and colleagues (2000) do not discuss why Spec,CP is linearized to the right in ASL, although they extensively argue in favor of this hypothesis.

[33] However, in ASL, as in LIS, WH-phrases can move to the right edge if a topic is present. So, it is important to distinguish focused phrases from topics. See Neidle 2002 for a precise presentation of the data.

periphery), which, in the sentences in 60, is already occupied. This creates an intervention effect analogous to the one observed in English sentences like 61 below. The degraded status of 61 is attributed by a long research tradition (see Huang 1982 and Rizzi 1990, among others) to the fact that the WH-phrase 'who' should pass though the embedded COMP position, but this is not possible, since it is already filled by the WH-phrase 'where'.

(61) ?? Who do you wonder where I met?

Similarly, according to Neidle, the presence of lexical material in the position that the WH-phrase should pass through to reach its final landing site in the right periphery blocks WH-movement in ASL. It is tempting to conclude that the position at the left periphery through which the WH-phrase must pass is the one where the WH-phrase surfaces in duplication cases like 58c.

If Neidle's analysis is correct, this has a consequence for the problem of the distribution of WH-NMM: in ASL the WH-phrase sits in the left periphery before undergoing WH-movement to reach its final landing site in the right periphery. Thus, our hypothesis that WH-NMM marks WH-dependencies (namely, that it spreads over the lexical material that intervenes between the position occupied by the WH-phrase before WH-movement and the WH-complementizer) makes the correct prediction for ASL: WH-NMM should extend over the entire sentence (apart from material that may be dislocated in a position higher than Spec,CP).[34]

Notice that, by this account, the distribution of WH-NMM in LIS should indicate that the WH-phrase does not pass through the left periphery when it moves to the right periphery. This predicts that the WH-phrase should never surface at the left periphery in LIS. As we know, this prediction is correct. Moreover, it predicts that the LIS counterpart of the ASL sentences in 60 should be grammatical, since the presence of the relevant category in the left periphery should not create an intervention effect for WH-movement. For independent reasons it is difficult to provide data on the LIS counterpart of 60a.[35] We know, however, that the LIS counterparts of 60b,c are acceptable, as the LIS sentences in 62 show.

(62) a. $[_{CP}$ BOY$_i$ CALL $\overline{\text{PROREL}_i}]^{\text{raising}}$ $\overline{\text{SEE WHO}}^{\text{wh}}$
'Who saw the boy who called?'

b. $\overline{\text{GIANNI ARRIVE DONE}}^{\text{cond}}$ $\overline{\text{LEAVE WHO}}^{\text{wh}}$
'If Gianni arrived, who left?'

So, there is evidence that our hypothesis about the distribution of WH-NMM may be extended to ASL.

We conclude our discussion with two observations, one about the intensity of the spreading of WH-NMM in ASL and the other about how to test our account further by investigating other sign languages. Neidle and colleagues observe that the intensity of WH-NMM follows this pattern: WH-NMM is most intense on the WH-sign and it decreases

[34] We assume, as is plausible, that the initial displacement of the WH-phrase (the one that places the WH-element to the left-peripheral focus position) does not result from the satisfaction of any WH-feature.

[35] LIS focus constructions have not been investigated yet. It is not obvious how to determine if a phrase is in situ or is focalized in WH-questions. This is due to the fact that in LIS both subject and object are preverbal in simple declarative sentences, so if one sits in the right periphery (being a WH-phrase), the other one will be preverbal, no matter if it is in situ or has been moved to a dedicated focus position in the left periphery.

on signs that are further away from the right edge. For example, YESTERDAY in the ASL sentence in 63 has a less intense WH-NMM than WHO, but a more intense WH-NMM than LIPREAD, which in its turn has a more intense WH-NMM than TEACHER.

(63) $\overline{\text{TEACHER LIPREAD YESTERDAY WHO}}^{\text{wh}}$ (ASL)
'Who did the teacher lipread yesterday?'[36]

Van Gijn (2004), attributing this observation to Josep Quer, notes that this pattern suggests that the intensity of WH-NMM in ASL is determined linearly (intensity decreases as linear distance increases), not hierarchically. As van Gijn notes, if intensity were determined hierarchically, it should be at its peak on WHO, it should decrease on TEACHER, which is in subject position, and it should decrease further on the verb, which, although it is in the middle field from a linear standpoint, is the lexical item most distant from COMP in hierarchical terms. Our proposal is compatible with the pattern of intensity of WH-NMM in ASL, because it amounts to saying that WH-NMM is the manifestation of the WH-dependency when the hierarchical structure is linearized, and we should thus expect that the factors that determine the degree of intensity of WH-NMM could depend on linear, rather than hierarchical, proximity to the COMP.

Finally, we point out a prediction that our hypothesis makes about other sign languages. In our account, as we already mentioned, the default configuration in which Spec,CP is positioned to the left is overridden whenever two conditions obtain: (i) the WH-dependency is marked by a specific NMM, and (ii) COMP is linearized to the right. This means that in sign languages in which one of these two conditions is absent, Spec,CP should be linearized on the left. Thus, a testing ground for our hypothesis would be sign languages that mark WH-dependencies prosodically (by NMM) and have sentence-initial complementizers. In these languages, we predict that Spec,CP should be linearized to the left. Future investigation on sign languages should be able to test whether this prediction is correct or not.

7. MARKING WH-DEPENDENCIES IN SPOKEN LANGUAGES. We began this article by pointing out a macrotypological puzzle: the occurrence of WH-items at the right edge of the sentence, while extremely rare in spoken languages, is quite common in sign languages. We have proposed an account for why LIS and other sign languages that share with LIS some relevant properties should move WH-items to the right edge. But we have not yet explained why spoken languages that behave like LIS with respect to the placement of WH-items are so rare. Since our account of WH-questions in LIS relies crucially on the role of WH-NMM in marking WH-dependencies, one might think that the obvious answer to the puzzle is that only sign languages have nonmanual marking (spoken languages, being vocal, have no facial expressions to mark dependencies); thus, it is only in sign languages that WH-items may need to move to the right. The problem is that the obvious answer is wrong: as we have already pointed out, intonation is arguably the spoken language counterpart of NMM; moreover, as we see in a moment, intonation, like WH-NMM in sign languages, can mark WH-dependencies. So, before we go back to the macrotypological puzzle, we need to discuss how WH-dependencies are marked in spoken languages. We first show that LIS and Japanese have striking similarities in the strategies they use to mark WH-dependencies, and present Richards's

[36] The translation of 63 is from Neidle et al. 2000. The question in 63 can be more formally translated as *Whose language did the teacher understand via lipreading?*.

(2006) typology of spoken languages according to these strategies. We then provide a solution to the macrotypological puzzle raised above. For the purpose of our discussion, following much work on the syntax-prosody interface (see, among others, Selkirk 1984, 1995, Nespor & Vogel 1986, and Wagner 2004), we assume that specific syntactic boundaries are mapped into prosodic representations. We leave open the possibility, however, that some other pragmatic factors may influence the correct placement of prosodic boundaries and the proper placement of prosodic prominence inside the clausal domain, as shown in recent works by German, Pierrehumbert, and Kaufmann (2006) and Féry and Samek-Lodovici (2006).

7.1. PROSODIC MARKING OF WH-DEPENDENCIES IN JAPANESE. As we observed above, NMM is considered the sign language counterpart of intonation. Now, in this article we have argued that WH-NMM spreads over WH-dependencies. If we are right about the role of WH-NMM and, indeed, NMM is the sign language counterpart of intonation, we should expect that intonation could mark WH-dependencies in spoken languages as well. This prediction is borne out. Deguchi and Kitagawa (2002) and Ishihara (2002) show that in Japanese WH-phrases have prosodic prominence, and this creates an intermediate phrase boundary (in the prosodic structure) to their left. After the WH-phrase has been uttered, deaccenting takes place, which reduces the pitch register and suppresses all intermediate phrase boundaries following the WH-phrase. Crucially, deaccenting takes place in a domain that is syntactically determined; namely, it begins immediately after the WH-phrase is uttered and stops when the interrogative particle that fixes the domain of the WH-phrase is uttered (recall that Japanese is an SOV language where the WH-phrases stay in situ and COMP is linearized to the right). For example, in matrix WH-questions like 64 below, deaccenting takes place until the Q-particle *no* in COMP is articulated (intonational prominence is indicated by a box, while deaccenting is indicated by underlining).

(64) Naoya-ga nani-o nomiya-de nonda no?
Noaya-NOM what-ACC bar-LOC drank Q
'What did Naoya drink at the bar?'

In matrix WH-questions with a WH-phrase buried in the embedded clause, as in 65, deaccenting continues until the matrix Q-particle *no* is reached, crossing the embedded-clause boundary.

(65) Naoya-wa [Mari-ga nani-o nomiya-de nonda to] Yumi-ni
Naoya-TOP [Mari-NOM what-ACC bar-LOC drank that] Yumi-DAT
morasita no?
divulged Q
'What did Naoya divulge to Yumi that Mari drank at the bar?'

Finally, in indirect WH-questions like 66 below, deaccenting takes place only between the WH-phrase and the embedded Q-particle *ka*. A full pitch range is regained after *ka*.

(66) Naoya-wa [Mari-ga nani-o nomiya-de nonda ka] Yumi-ni morasita.
Naoya-TOP [Mari-NOM what-ACC bar-LOC drank Q] Yumi-DAT divulged
'Naoya divulged to Yumi what Mari drank at the bar.'

As Ishihara (2002:186–87) points out in commenting on examples like 64–66, 'Japanese exploits deaccenting as the WH-scope marking strategy, which is a counterpart of WH-movement in overt WH-movement languages'. The parallelism with LIS is noticeable. In both languages, a prosodic device (WH-NMM or deaccenting) links the base position of the WH-phrase to the clause-final COMP and spreads rightward. In short,

in LIS as in Japanese, a prosodic device marks the WH-dependency.[37] The relevant difference in this context is that in Japanese WH-elements remain in situ, while in LIS they (typically) move. Apart from that, LIS and Japanese pattern exactly alike. Indeed, our account leads us to claim that, if Japanese displayed WH-movement, it ought to be rightward.

7.2. PROSODIC MARKING OF WH-DEPENDENCIES AND THE TYPOLOGY OF WH-MOVEMENT IN SPOKEN LANGUAGES. In this section, we discuss a proposal that is close to ours in spirit, namely Richards's (2006) analysis of the language-specific factors that determine whether WH-phrases must remain in situ or move to a dedicated position in the periphery of the sentence (Spec,CP). In a nutshell, Richards's proposal is that, if a language allows the creation of a prosodic domain that includes the WH-phrase at one edge and the interrogative complementizer at the other edge (Japanese being the paradigmatic example), then overt movement is superfluous, and WH-questions can be produced by leaving the WH-phrase in situ. If a prosodic domain with the relevant characteristics cannot be created, the WH-element must move close to the complementizer in order to reduce its 'prosodic distance' from the interrogative COMP. Whether such a prosodic domain can be created or not depends on language-specific rules that Richards discusses for a representative group of languages (prosodic boundaries may be marked by different means in different languages). According to Richards's crosslinguistic examination, there are two crucial factors that allow or prevent the creation of the relevant prosodic domain. The first one is whether language-specific rules introduce a prosodic boundary to the left or to the right of the WH-phrase. The second factor is the location of the interrogative complementizer at the left or right periphery. The interaction of these two factors partitions languages into four types. Richards's typology is reported in 67.

(67)

PROSODIC BOUNDARIES	COMP to the right	COMP to the left
on the right of WH-phrases	?	Chichewa
on the left of WH-phrases	Japanese	Tagalog

The basic idea is that a prosodic domain that marks the WH-dependency can be created only if the prosodic boundary is located on the opposite side of the complementizer. For example, in Japanese COMP is to the right and, as Richards shows, an intermediate phrase boundary occurs to the left of the WH-phrase: this configuration makes it possible to prosodically connect the WH in situ to COMP. The mirror image of Japanese is Chichewa. In this language, the prosodic boundary is to the right of the WH-phrase (due to language-specific rules), but COMP is at the left periphery. So, in Japanese and Chichewa WH-movement does not occur and WH-phrases remain in situ.

There are languages, however, that cannot establish the relevant prosodic domain, since the WH-prosodic boundary and COMP normally occur on the 'same side'.[38] For instance, in Tagalog (and English) the prosodic boundary is normally to the left of the WH-phrase and COMP is also at the left periphery. This prevents the WH-prosody from

[37] As noted by a referee, the object (*nani-o*) has scrambled to the left in 66, since, plausibly, its base position is lower than the position of an adjunct like 'at the bar'. As the referee points out, this means that deaccenting marks the dependency between COMP and the position that the WH-phrase occupies after it has scrambled. This is fully consistent with our proposal, since the scrambled WH-phrase is the Goal, under the assumption that scrambling does not have the purpose of satisfying a WH-feature.

[38] The word 'normally' is important here since otherwise languages like English, which display overt WH-movement but also admit WH in situ under certain circumstances, would be counterexamples to Richards's proposal.

marking the WH-dependency, and forces the WH-phrase to move to the left-linearized Spec,CP in order to reduce the 'prosodic distance' from the interrogative COMP.

As one can see from the table in 67 above, there is an empty slot in Richards's typology: this is the case of a language with a complementizer to the right and with language-specific rules that introduce the prosodic boundary to the right of the WH-phrase. If these two factors cooccurred, a prosodic domain that marks the WH-dependency could not be created. In this language, the WH-phrase would be expected to move rightward to get closer to COMP in order to reduce its prosodic distance from it. Not surprisingly, Richards cannot identify such a language, since it would be a spoken language in which WH-phrases move to the right periphery.[39] If what we have argued so far is correct, LIS is a language where COMP is to the right and WH-phrases move to the right periphery. Although the prosodic properties of LIS have not been studied in any detail yet, we hypothesize that, normally, the WH-prosodic domain cannot be provided if the WH-phrase remains in situ, so WH-movement to a position next to COMP must occur. A dedicated position in the right periphery (Spec,CP linearized to the right) provides the proper location for the moved WH-phrase.

There is, however, one important feature of LIS that is not consistent with Richards's typology, namely the fact that, as we saw, overt WH-movement and spreading of the WH-NMM may optionally cooccur in LIS. According to Richards, there are spoken languages in which WH-dependencies can be marked by WH-movement and by prosodic means. For example, in English, although WH-phrases normally move to the left periphery, they remain in situ in echo questions. Richards suggests that this is due to the fact that in echo questions the non-WH material is destressed and this creates an appropriate prosodic domain (since no prosodic boundary intervenes between COMP and the WH-phrase in situ). Notice, however, that in this case the prosodic marking of the WH-dependency is used as an alternative to movement: indeed, the destressing pattern that allows the creation of the appropriate prosodic domain in echo questions does not occur when the WH-phrase is moved. In LIS, by contrast, the same prosodic marking (WH-NMM) that is used when the WH-phrase stays in situ may also be used to mark the WH-dependency when the WH-phrase moves.[40] This type of redundancy, as far as we know, is not attested in spoken languages.

Technical details of Richards's proposal aside, a plausible reason why this redundancy is acceptable in LIS is that the prosodic strategy to mark dependencies is not costly in sign languages, since they are multidimensional in nature. Multidimensionality here does not simply mean that prosody (NMMs, in our case) always accompanies the manual dimension. By itself, this would not introduce any real difference with spoken languages, since spoken sentences must also be produced with some prosodic contour. Multidimensionality means that manual signs and different types of NMMs are performed by multiple articulators that can operate independently and simultaneously to express different types of grammatical information. This fundamental feature of sign

[39] Richards suggests that Basque might come close to filling the empty slot. In Basque, the interrogative complementizer is to the right and a prosodic boundary also occurs to the right of the WH-phrase. Thus, one might expect the WH-phrase to move close to COMP (possibly to a Spec position linearized to the right). However, something different happens; namely, the lexical material intervening between the in situ WH-phrase and the verb-auxiliary-complementizer complex obligatorily scrambles to the left of the WH-phrase. In this way, the prosodic distance between the WH-phrase and COMP is reduced, although the WH-phrase does not move.

[40] Although, it is important to keep in mind that, when movement occurs, WH-NMM does not need to spread over the entire WH-dependency in LIS, since it can be confined to the moved WH-phrase.

languages is illustrated by the LIS sentences in 68 below. In 68a (reported above as 26c), manual signing is simultaneously coarticulated with two distinct NMMs, one associated with topic and the other associated with the emphatic reading. In 68b, manual and nonmanual devices are used to fulfill the same grammatical function: the antecedent of the 'if'-clause is marked both by the manual sign IF and by the conditional NMM.[41] In these examples, manual signing, topic NMM, emphatic NMM, and conditional NMM are all performed by independent articulators (the hands, the nodding head to indicate topic, the raised eyebrows to indicate a conditional antecedent).

(68) a. _____emph
_____topic
SOMEONE CONTRACT SIGN
'Someone did sign the contract.'

b. _____cond
IF RAIN, UMBRELLA TAKE (LIS; Barattieri 2006)
'If it rains, I will take the umbrella.'

Spoken languages do not display this kind of multidimensionality, since distinct intonational patterns cannot overlap.[42] This difference explains why the role of prosody is much more pervasive in sign languages, as shown by the fact that NMMs are massively used to grammatically mark diverse phenomena like agreement, tense, focus, topic, subordination, questions, negation, and so forth. Since sign languages are intrinsically multidimensional, the fact that manual information about WH-movement may 'redundantly' coexist with the WH-NMM is expected, and it would be strange if things were otherwise.[43]

7.3. SOLVING THE MACROTYPOLOGICAL PUZZLE. We are now ready to address the issue of why sign languages, unlike spoken languages, may naturally place WH-phrases at the right periphery.

In §5, we showed some examples in LIS in which WH-movement cooccurs with prosodic marking of the WH-dependency by WH-NMM. As we just argued, this option is a natural consequence of the fact that sign languages are multidimensional in the sense explained above. However, as we saw in §5, the cooccurrence of WH-movement with NMM marking of the WH-dependency has an important consequence for the direction of the movement: since in LIS, COMP is linearized to the right, the WH-phrase must move to the right in order for the WH-NMM to mark the WH-dependency. As a consequence, the default linearization value that places the canonical landing site for WH-phrases (Spec,CP) to the left is overridden and Spec,CP is linearized to the right in LIS. Since sign languages are multidimensional, we expect that the situation we described for LIS may naturally arise, other things being equal, in any sign language in which WH-NMM marks the WH-dependency and COMP is linearized to the right. This accounts for the typological datum that WH-items can naturally occur at the right edge of the sentence in sign languages.

By contrast, spoken languages are not multidimensional in the way sign languages

[41] 'If'-clauses are most naturally expressed in LIS by marking the antecedent with conditional NMM only. However, Barattieri (2006) reports that for some native signers the presence of the manual sign for 'if' is not a redundant element and plays an important role, for instance, in allowing the consequent to precede the antecedent, a word order that is banned when the antecedent of the 'if'-clause is only marked nonmanually.

[42] One may wonder why in spoken languages pharyngealization, nasalization, and so forth are not used to form overlapping prosodic tiers. This is a fact for which we have no explanation.

[43] See also Aronoff et al. 2005 for a discussion of modality-dependent factors that distinguish sign languages from spoken languages.

are, and thus a principle of economy applies: WH-movement and prosodic marking of WH-dependencies are only used as alternative strategies. Thus, even if COMP is to the right and WH-dependencies can be prosodically marked in a spoken language, the WH-phrase doesn't have to move to the right to allow prosodic marking of the WH-dependency. Thus, other things being equal, the default linearization value applies and Spec,CP is placed to the left. This accounts for the typological datum that WH-items normally occur at the left edge of the sentence in spoken languages.

Ultimately, our account reduces the difference between spoken and sign languages to the fundamental difference in modality between them. Visuo-spatial languages exploit to a full extent the possibility of expressing grammatical information simultaneously by multiple channels, manually and nonmanually (and by multiple NMMs cooccurring over the same signs at the same time). WH-movement, as a way of rearranging the order of manually articulated signs, can be seen as the manual strategy to mark WH-dependencies. WH-NMM is the nonmanual strategy to express the same grammatical information. They can coexist because cooccurrence of manual and nonmanual information is a distinctive mark of sign languages, a property ultimately due to the fact that the visual modality is more prone to express information simultaneously by multiple largely independent articulators (left hand, right hand, head, eyes, eyebrows, shoulders, etc.).

Are there other factors that could play a role in accounting for the difference between spoken and sign languages with respect to the placement of WH-items? Another possible reason was actually mentioned in §5.3. In LIS, as we saw, the move of overriding the default linearization value by placing Spec,CP to the right has rather limited consequences for the parser. Due to the reduced level of embedding and the lack of center embedding, backward localization of a trace in LIS is bound to be a local phenomenon; and thus the pressure for linearizing Spec,CP to the left may be less strong in this case (recall that, according to Ackema and Neeleman (2002), specifiers are normally linearized to the left, because of processing difficulties that arise with rightward movement). In principle, this may suggest an alternative way of accounting for why WH-items are naturally placed to the right in sign languages: if the same reduced level of embedding and lack of center embedding is also found in other sign languages, we might expect that for these languages the reason to place specifiers to the left should be missing and thus movement could be to the right. Notice, however, that, by itself this is not sufficient to account for the difference between spoken and sign languages with respect to the placement of WH-items. If the occurrence of rightward movement of WH-phrases depended only on processing factors, we might expect that in spoken languages where embedding is lacking or reduced (like pidgins, or extended pidgins, or creoles), the placement of the WH-phrase to the right should be a natural option. The rare cases of spoken languages in which WH-phrases naturally occur at the right periphery, however, do not belong to these classes, which suggests that reduced level of embedding and lack of center embedding are not sufficient to explain why spoken and sign languages differ as they do with respect to WH-items. Could factors related to processing play a role in allowing WH-phrases to occur at the right edge, even if they are not sufficient to account for this option? If this were the case, we should expect that sign languages that display WH-phrases at the right edge should be like LIS in avoiding center-embedded structures and in showing a reduced level of embedding. This possibility is compatible with our hypothesis that multidimensionality is ultimately responsible for the fact that WH-phrases commonly occur at the right edge in sign languages but not in spoken languages. Since subordination, however, has not been extensively inves-

tigated for sign languages, the question of whether processing factors play a role must be left as an open issue for now.

8. SUMMARY. In this article, we accomplished three tasks. We proposed an account of why WH-phrases occur at the right periphery in LIS. Then, we showed how this account can be extended to other sign languages. Finally, we proposed an account of why placing WH-phrases at the right periphery should be a natural option in sign languages, but not in spoken languages.

As we observed at the start, although data on sign languages showing typological differences like the one we investigated here have been accumulating in recent years, the sign languages that have been described in detail are still few, and some caution is needed in drawing conclusions based on the available data. The need to extend the database by providing detailed descriptions is obviously crucial for an account, like ours, that tries to explain typological differences between signed and spoken languages by appealing to the workings of nonmanual components. As new data come in, our hypotheses may be confirmed, revised, or refuted. As we see it, this prospect should not stop one from making precise hypotheses about the root of typological differences: while bringing important issues to the foreground, they also serve the function of telling us, when we collect new data, what to look for.

APPENDIX A: EXPLANATION OF THE GLOSSES

LIS, like other sign languages discussed in the literature, has a rich set of morphological devices to vehicle linguistic information. For reasons of clarity, the glosses we provided in the text do not reflect all the morphological complexity of the real utterances. Only those aspects crucial for our discussion have been included in the glosses. The interested reader may access a representative sample of videotaped data at the following URL: http://www.filosofia.unimi.it/~zucchi/ricerca.html. Here we summarize the conventions we adopted in order to gloss sign language sentences.

We use capitalized English words to gloss single signs. For example, LIS sentence 1 above, repeated here as A1, includes three independent signs.

(A1) GIANNI MARIA LOVE
'Gianni loves Maria.'

When more than a word is needed to identify a single sign, a hyphen separates the glosses in capital letters. For example, in LIS sentence 7, repeated here as A2, the gloss IN-TIME stands for a single sign corresponding to the English adverbial phrase *in time*.

(A2) GIANNI ARRIVE IN-TIME
'Gianni arrived in time.'

One way that sign languages mark coreference is by means of the signing space. Signs that are articulated in the same region of the signing space are coreferential or are construed with one another. In the glosses, we indicate that two signs are signed in the same region of the signing space by assigning the same index to them. For example, in LIS sentence 19b, repeated here as A3, the index i indicates that the sign BOY and the sign WHICH are articulated in the same area of the signing space.

(A3)
BOY_i BOOK STEAL $\overline{\text{WHICH}_i}^{wh}$
'Which boy stole the book?'

In A3, the fact that BOY and WHICH are articulated in the same position avoids a potential ambiguity, since it indicates that WHICH must be construed with BOOK and not with BOY (thus, the sentence means the same as 'which boy stole the book?', and cannot be understood as asking 'which book did the boy steal?').

In LIS, like in other sign languages, several grammatical functions are expressed by nonmanual material (i.e. position of the eyebrow, body posture, shaking or nodding of the head, etc.), which is coarticulated with manual material in the sentence. A line above the signs indicates that they are coarticulated with a nonmanual marking (NMM). The kind of nonmanual marking is indicated by an English gloss at the end of the line. Thus, for example, in LIS sentence 22f, repeated here as A4a, the WH-NMM (furrowed eyebrows) spreads over the whole sentence.

(A4) a. _____wh
BOY$_i$ WHICH$_i$ BOOK STEAL
'Which boy stole the book?'

When two NMMs cooccur with the same manual material, two lines are placed one above the other, as in LIS sentence 68a, repeated here as A4b. In this sentence, the topic-NMM (raised eyebrows) cooccurs with the emphatic-NMM (head nod) when the sign SOMEONE is articulated. The emphatic-NMM then spreads through the rest of the sentence, as indicated by the extension of the line, while the topic-NMM stops right after the sign SOMEONE is uttered.

(A4) b. _____emph
_____topic
SOMEONE CONTRACT SIGN
'Someone did sign the contract.'

It is also possible for two NMMs to be articulated in sequence, one after the other. When this happens, two separate lines in the same row are used to identify the two NMMs, as in LIS sentence 25b, repeated here as A4c, where the negative NMM is articulated before the WH-NMM.

(A4) c. _____neg _____wh
BUY NOBODY WHAT
'What did nobody buy?'

When the spreading of a particular NMM is optional, a dotted line is used to indicate the portion of the sentence where the spreading may occur. In LIS sentence 22d, repeated here as A4d, the WH-NMM must cooccur with the WH-phrase and may optionally spread over the direct object and the verb.

(A4) d. - - - - - - - - - - _____wh
BOOK STEAL BOY$_i$ WHICH$_i$
'Which boy stole the book?'

The glosses used to indicate different NMMs and their main features are provided in Table A1.

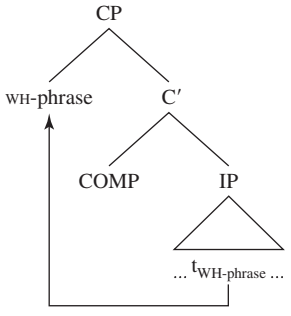
NMM GLOSS	DESCRIPTION	MAIN FEATURES
_____raising	eyebrow raising	raised eyebrows
_____neg	negative	headshake
_____wh	WH-question	furrowed eyebrows
_____y/n	yes/no question	raised eyebrows and body forward
_____topic	topic phrase	raised eyebrows followed by pause
_____emph	emphatic phrase	head nod
_____cond	conditional	raised eyebrows and eye widening

TABLE A1. NMMs and their main features.

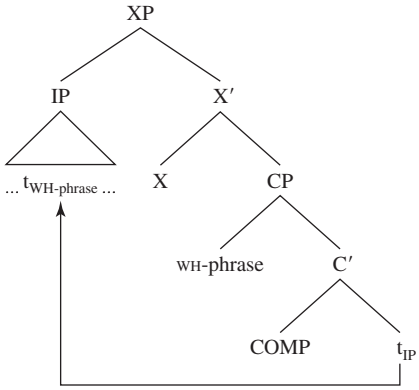
APPENDIX B: WHY THE REMNANT-MOVEMENT ANALYSIS DOES NOT WORK

In §4.2, we explored the possibility that the sentence-final position of WH-items in LIS is not derived by rightward movement but emerges from two subsequent movements to the left periphery of the clause. The first movement places the WH-item to the left in Spec,CP (the canonic landing site for WH-items in spoken languages); the second movement places the IP out of which the WH-item was moved (the remnant) into a higher position at the left periphery of the sentence. The derivation is illustrated in B1a,b.

(B1) a. movement of the WH-phrase to the left-peripheral Spec,CP position



b. remnant movement of the IP node to a higher projection

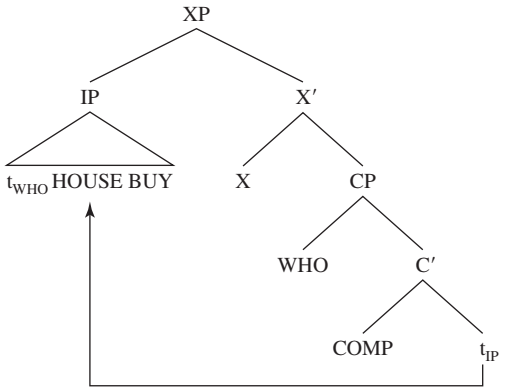


This analysis has been proposed by Poletto and Pollock (2004) to account for right-peripheral occurrences of WH-phrases in some spoken languages. Applied to LIS, it predicts that example 9 above, repeated here as B2a, should have the structure in B2b.

(B2)

a. HOUSE BUY $\overline{\text{WHO}}^{\text{wh}}$
'Who bought a house?'

b.



A modified version of the remnant-movement analysis has been proposed by Aboh and Pfau (2009) and Aboh, Pfau, and Zeshan (2006) to account for the right-peripheral position of WH-items in the Sign Language of the Netherlands (NGT) and in Indo-Pakistani Sign Language (IPSL). According to this modified version, the WH-item would be base-generated in COMP rather than moved to Spec,CP.

In §4.2, we raised three problems for the remnant-movement analysis: one concerning its explanatory character and the other two concerning specific predictions the analysis makes for LIS. Here, we spell out one problematic prediction in detail. The prediction concerns examples 37 and 38 above, repeated here as B3 and B4.

(B3) GIANNI SIGN NOTHING
'Gianni did not sign anything.'

(B4) SIGN NOTHING WHO
'Who signed nothing?'

In order to derive B3 under the remnant-movement analysis, we need to assume that the negative quantifier NOTHING moves to Spec,NegP to the left and that the remnant (the IP containing the trace of NOTHING) moves to a higher position on the left.[44]

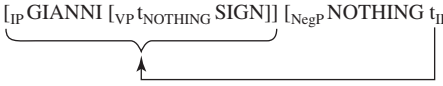
[44] In the derivation, we gloss over various details that are not crucial for the evaluation of the remnant-movement analysis. These include movement of the subject to Spec,IP and possibly verb movement out of the VP.

(B5) a. $[_{NegP}\,[_{IP}$ GIANNI $[_{VP}$ NOTHING SIGN]]]
(underlying SOV word order)

b. $[_{NegP}$ NOTHING $[_{IP}$ GIANNI $[_{VP}\,t_{NOTHING}$ SIGN]]]

(movement of the quantifier to Spec,NegP)

c. $[_{XP}\,[_{IP}$ GIANNI $[_{VP}\,t_{NOTHING}$ SIGN]] $[_{NegP}$ NOTHING $t_{IP}]]$

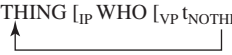


(remnant movement of the IP to a higher projection)

From a technical standpoint, the derivation in B5 does not raise particular problems. Several problems, however, arise if we try to extend a remnant-movement analysis to sentence B4, which contains both a WH-phrase and a negative quantifier in displaced positions. A possible derivation for B4 is considered in B6.

(B6) a. $[_{NegP}\,[_{IP}$ WHO $[_{VP}$ NOTHING SIGN]]]
(underlying SOV word order)

b. $[_{NegP}$ NOTHING $[_{IP}$ WHO $[_{VP}\,t_{NOTHING}$ SIGN]]]

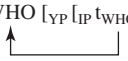


(movement of the quantifier to Spec,NegP)

c. $[_{YP}\,[_{IP}$ WHO $[_{VP}\,t_{NOTHING}$ SIGN]] $[_{NegP}$ NOTHING $t_{IP}]]$

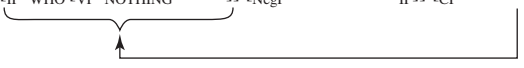
(remnant movement of the IP to a higher projection)

d. $[_{CP}$ WHO $[_{YP}\,[_{IP}\,t_{WHO}\,[_{VP}\,t_{NOTHING}$ SIGN]] $[_{NegP}$ NOTHING $t_{IP}]]]$



(WH-extraction out of a specifier island)

e. $[_{XP}\,[_{YP}\,[_{IP}\,t_{WHO}\,[_{VP}\,t_{NOTHING}$ SIGN]] $[_{NegP}$ NOTHING $t_{IP}]]\,[_{CP}$ WHO $t_{YP}]]$



(remnant movement of the YP to a higher XP projection)

The derivation just sketched for B4 requires positing two unspecified projections (XP and YP) as landing sites for the movements of the remnants, the movement of a WH-item out of a specifier island, and two applications of remnant movement whose only purpose is to get the word order right. The reader can verify that the alternative derivation in which the WH-phrase is extracted before the negative quantifier runs into a similar problem; namely, it requires extraction of the negative quantifier out of a specifier island and two applications of remnant movement.

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Cecchetto
Dipartimento di Psicologia
Università degli Studi di Milano–Bicocca
Piazza dell'Ateneo Nuovo 1
20126 Milano
Italy
[carlo.cecchetto@unimib.it]

[carlo.geraci@unimib.it]
[alessandro.zucchi@unimi.it]

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