Addressing the Cardinals Puzzle:
New Insights from Non-Manual Markers in Italian Sign Language

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Abstract

This paper aims at investigating the main linguistic properties associated with cardinal numerals in LIS (Italian sign language). Considering this issue from several perspectives (phonology, prosody, semantics and syntax), we discuss some relevant corpus and elicited data with the purpose of shedding light on the distribution of cardinals in LIS. We also explain what triggers the emergence of different word/sign orders in the noun phrase. Non-manual markers are crucial in detecting two particular subcases.

Keywords: cardinal numerals, nonmanuals, Italian sign language, noun phrases, sign order

1. Background

In this paper we focus on cardinal numerals functioning as modifiers in the nominal domain and expressing a certain quantity. The cardinal system in Italian sign language (LIS) uses both hands and is a base-10 system.

In this respect, the distribution of cardinals in LIS reveals a puzzling picture. On the one hand, recent corpus data from 162 LIS signers reveal that in spontaneous narratives the majority of cardinals appears before the noun (Mantovan & Geraci, 2013), as reported in Table 1.

Word order	n	%
Card > N	278/353	79%
N > Card	75/353	21%

Table 1: Distribution of cardinal numerals in corpus data

On the other hand, the existing literature claims that cardinals are consistently or even exclusively postnominal (Bertone, 2007; Branchini, 2007; Cecchetto, Geraci & Zucchi, 2009; Brunelli, 2011). An example from Bertone (2007) is reported below for expository purposes.

[Bertone, 2007:84]

(1)   BOOK NEW TWO DEM MINE
       'These two new books are mine.'

Why do we observe such an important difference between corpus data and elicited data? In what respect is Card>N different from N>Card (and vice versa)? In the remainder of the paper we will offer an explanation for these two newly discovered puzzles. Our working hypothesis is that part of the sign order variability is due to the definite/indefinite character of the noun phrase, that is marked both by prosodic (i.e. non-manual) features and sign order manipulation.

2. Methods

The data for this study mainly come from the LIS corpus (Geraci et al., 2011). The annotated cardinals amount to 353 tokens. Additional data have been collected through picture-based narration tasks and elicitation of grammaticality judgments.

The materials used as stimuli for the picture-based narration tasks are wordless comic strips illustrated by Plauen (2000). Plauen's illustrations are generally self-explanatory and do not give rise to interlinguistic influences since they do not contain any written text.

Figure 1: Extract from "Vater und Sohn" (Plauen 2000)

The story represented in Figure 1 is interesting because it triggers the production of cardinal TWO in two different contexts. In the first panel two children are represented for the very first time. Being first-mentioned referents, they are expected to be introduced in the discourse by an

indefinite noun phrase. On the contrary, the two children represented in the fifth panel are pre-established referents, therefore they are expected to be referred to by using a definite noun phrase.

Data annotation has been conducted by using the annotation software ELAN (Johnston & Crasborn, 2006). Manual and non-manual features have been carefully annotated on separate tiers. The coding scheme associated to the non-manual markers (NMMs) relevant for this study is illustrated in (2). The duration of NMMs has been measured as the time interval intervening between start and end points.

(2) a. NM-Head: left, right, raised, down, forward, back
b. NM-Eyebrows: lowered, raised
d. NM-Body: left, right, down, forward, back
e. NM-Eyes: blink, squint, close, wide, track-hands eye-gaze

To illustrate how ELAN has been used for data annotation, a representative screenshot is shown in Figure 2.
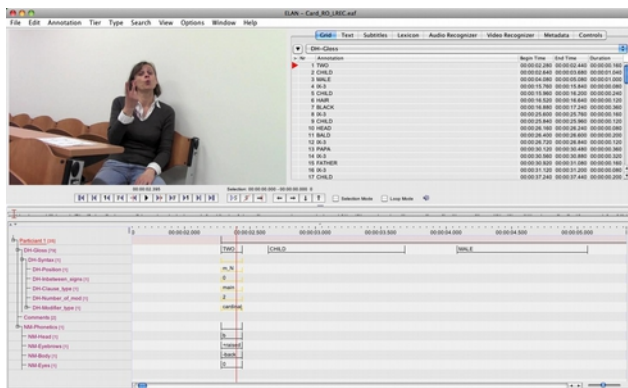

Figure 2: ELAN screenshot

Finally, grammaticality judgments have been elicited from three native signers of LIS (Rosella Ottolini, Gabriele Caia and Mirko Santoro), whom we thank enormously.

3. Results

A deeper investigation of the distribution of cardinals as emerging from the LIS corpus (see Table 1 above) revealed the presence of a confounder, namely the potentially ambiguous status of the sign ONE, and the special behavior of a subclass of cardinals, namely the ones contained in measure phrases. We discuss each of them in turn.

3.1. The sign ONE

Similarly to "uno/una" in Italian, the LIS sign ONE is ambiguous between a cardinal and an indefinite determiner. In our corpus, ONE mainly occurs in prenominal position (almost 90% of the cases) irrespectively of the syntactic/semantic function. The

distribution of determiner ONE and cardinal ONE can be observed in examples (3) and (4), respectively (see also Figure 3 and Figure 4).

Corpus data (middle-aged signer from Rome)
(3) ONE MATE SCHOOL IX-3_POSS IX-3 JEALOUS STRONG
'A schoolmate of mine was extremely jealous.'

Corpus data (middle-aged signer from Rome)
(4) REFECTORY EAT FINISHED, REFECTORY ARRANGE TURN, ONE WEEK IX-1, THEN WEEK IX-3
'After we finished eating at the refectory, we took turns arranging things, one week it was my turn, then it was someone else's turn.'

As originally suggested by Bertone (2007), NMMs help distinguish the two functions. Figure 3 shows the facial expressions associated with determiner ONE in sentence (3). The most remarkable features are backward-tilted head and raised eyebrows.
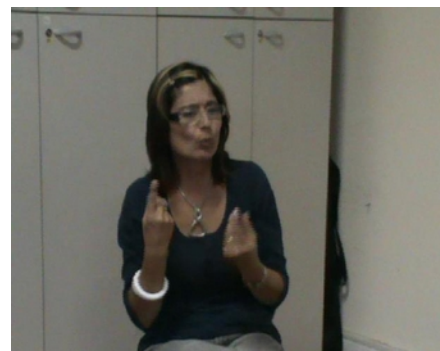

Figure 3: ONE as indefinite determiner

Figure 4 shows the realization of cardinal ONE in sentence (4). In this latter case, eyebrows are in neutral position and the head is not backward tilted.

Figure 4: ONE as cardinal numeral

Once the occurrences of ONE are removed from the counting, we obtain the distribution represented in Table 2.

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Word order	n	%
Card > N	184/252	73%
N > Card	68/252	27%

Table 2: Distribution of cardinal numerals without ONE

3.2. Cardinals within Measure Phrases

Let's now turn to the special case of cardinals included in measure phrases referring to time, capacity, weight, length, temperature, currency (e.g. SIX WEEK, SEVENTY KILOGRAM, THIRTY KILOMETER). According to corpus data, they display a categorical distribution: they always precede the noun, as shown in examples in (5) and (6).

Corpus data (young signer from Lamezia)
  (5)   NOW IX-3_POSS WIFE PREGNANT FIVE
         MONTH
         'Now my wife is five months pregnant.'

Corpus data (old signer from Florence)
  (6)   HOUSE NEAR, FOUR-HUNDRED METER
         IX-3
         'The house is in the neighborhood, about four
         hundred meters away.'

This piece of data has been confirmed by grammaticality judgments, as exemplified in (7).

  (7)   a. IX-1 REPEAT++ TWO-HUNDRED-
         THOUSAND TIME
         'I repeated it two hundred thousand times.'
         b. * IX-1 REPEAT++ TIME TWO-
         HUNDRED-THOUSAND

Without considering these two special cases, the distribution of cardinals, shown in Table 3, looks considerably different from the ones reported in Table 1 and Table 2. As a result, the percentage of postnominal cardinals becomes more prominent and it is now perfectly balanced with prenominal cardinals.

Word Order	n	%
Card > N	67 /135	50%
N > Card	68 /135	50%

Table 3: Distribution of cardinal numerals without ONE and measure phrases

The picture that emerges is even more intricate, showing an apparently uncontrolled variability. We now turn to the narration tasks and grammaticality judgment elicitation in order to address this issue.

3.3. The distribution of cardinals

The data collected during the narration tasks and elicitation reveal that the position of cardinals may be influenced by information structure. New-discourse information (e.g. first-mentioned referents) can be conveyed by both orders (i.e. Card>N and N>Card), whereas old-discourse information (i.e. already-mentioned referents) is compatible with N>Card only. The former is illustrated in the first panel of the comic strip, shown here in Figure 5; the latter in the fifth panel, shown here in Figure 6.

Figure 5: First-mentioned referents (new-discourse information)

Figure 6: Already-mentioned referents (old-discourse information)

When the children are first mentioned we observe both orders Card>N and N>Card, while in further mentioning only the N>Card order is found.

This is further confirmed by the informants' assessment of their own productions. When explicitly asked about the order possibility in the two distinct contexts, only the new-information situation allows for the two sign order options, as exemplified in (8). On the contrary, in the old-discourse context only the N>Card order is possible, as illustrated in (9).

  (8)   New-information context
         a. TWO CHILD
         b. CHILD TWO
         'Two children'

(9) Old-information context
a. * TWO CHILD
b. CHILD TWO
'The two children'

It is worth noting that the relative order of cardinals with respect to the noun is not crucial to distinguish the two discourse functions, as the sequentially identical data in (8)b and (9)b demonstrate. Rather, we found that it is the NMM component that plays a crucial role here. If the signer is dealing with a new referent, the prenominal or postnominal cardinal is usually accompanied by backward-tilted head and raised eyebrows (see Figure 7).

Figure 7: TWO as new-discourse information

If the referent has already been mentioned in the discourse, then the postnominal cardinal is compatible with squinted eyes and/or lowered eyebrows (see Figure 8).

Figure 8: TWO as old-discourse information

We tentatively associate the new/old discourse information with the [±definite] character of the noun phrase. Interestingly, when the noun phrase is new information, it is introduced by the same NMMs as indefinite ONE and the prenominal syntactic position is available for cardinals.

From a syntactic point of view, in the spirit of Cardinaletti and Giusti (2006), the former cardinal functions as a proper quantifier, whereas the latter, being compatible with a definite environment, should be rather considered as a quantity adjective.

4. Conclusions

In this study we combined both quantitative and qualitative data with the purpose of capitalizing on the advantages of each source. When analyzing cardinals in LIS, two special cases (i.e. ONE and cardinals within measure phrases) need to be examined separately. Syntactic positions and, most importantly, NMMs convey crucial information on the definite or indefinite nature of the nominal expression containing cardinal numerals.

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