

Age of acquisition and clausal order effects in temporal constructions: a cross-linguistic study in French Sign Language (LSF) and Italian Sign Language (LIS)

Anastasia Parini (Università degli Studi di Milano – Bicocca)

Juliette Dalle (CNRS, IRIT)

Fabio Del Prete (CNRS, CLLE, Université Toulouse 2)

Beatrice Giustolisi (Università degli Studi di Milano – Bicocca)

Valentina Aristodemo (Université Toulouse 2)

anastasia.parini@unimib.it, jdallecetim@gmail.com,
fabio.del-prete@univ-tlse2.fr, beatrice.giustolisi@unimib.it,
vale.aristodemo@gmail.com

Abstract

It is well established that age of acquisition (AoA) plays a crucial role in linguistic performance, even in adulthood. In addition, clausal order seems to affect sentence processing cost depending on whether the events are mentioned in chronological or counter-chronological order. For this study, a truth-value judgment task measuring accuracy and response times (RTs) was built to investigate both AoA and clausal order effects in temporal constructions expressing anteriority, simultaneity, and posteriority in French Sign Language (LSF) and Italian Sign Language (LIS). Results obtained from 32 LSF deaf adult signers and 25 LIS deaf adult signers show a significant AoA effect in LIS accuracy but not in LSF, whereas sentences with a counter-chronological order of mention had a significant lower accuracy in LSF but not in LIS. Conversely, an AoA effect related to RTs was found in LSF, but not in LIS. Although we need to be cautious in drawing conclusions, due to the small sample size, we propose that these results are related to both sociolinguistic and linguistic factors, the former being an LSF supportive educational system, and the latter being syntactic differences between LSF and LIS temporal constructions.

Keywords: age of acquisition (AoA) effects, clausal order effects, temporal constructions, French Sign Language (LSF), Italian Sign Language (LIS)

1 Introduction

In sign language linguistics, age of acquisition (AoA) effects on linguistic abilities constitute a topic of central interest, since deaf signing adults are a linguistically heterogeneous group, with only a minority of signers exposed to a sign language from birth. Several studies have

shown that adult signers exposed to a sign language from birth have better linguistic performances in their sign language than signers exposed to a sign language at a later time, even when comparing signers exposed from birth to signers exposed during childhood from as early as 3 years old (e.g., Emmorey et al. 1995; Zorzi et al. 2022).

In our study, we focused on AoA effects taking into consideration temporal constructions expressing anteriority (*before*-constructions), simultaneity (*same*-constructions) and posteriority (*after*-constructions) in French Sign Language (LSF) and Italian Sign Language (LIS).

These structures deserve interest as they contain per se a source of difficulty. An aspect that varies across different types of temporal constructions is the order of mention of the (at least) two events, which can follow a chronological order or not. Various studies (e.g., Politzer-Ahles, Xiang, and Almeida 2017) point to a greater processing cost in the comprehension of sentences in which the order of mention of the events within the sentence does not match the chronological order in which the events occurred. In our study, we focused on whether the same effect holds for LSF and LIS, through the analysis of accuracy and response times (RTs).

The article is structured as follows. First, we describe the main features of temporal constructions in LSF and LIS (Section 2). Second, we outline our experiment (Section 3) and we describe the methods in detail (Section 4). Third, we show our results (Section 5). Finally, we discuss them (Section 6), and close with a brief conclusion (Section 7).

2 Temporal constructions in French Sign Language (LSF) and Italian Sign Language (LIS)

In LSF, temporal constructions are analyzed as coordinated clauses with a temporal marker (i.e., the signs BEFORE, SAME-MOMENT, AFTER) in the second conjunct (Aristodemo and Hauser 2021). As for non-manual marking, raised eyebrows occur over the temporal marker. As for the prosodic features, prosodic breaks are not observed.

In LIS, temporal constructions are analyzed as subordinated structures akin to relativization (Aristodemo 2017; Aristodemo and Hauser 2021). The first clause is the temporal subordinate clause, which includes the temporal marker (i.e., the signs BEFORE, SAME-MOMENT, AFTER) whereas the second one is the main clause. As for non-manual marking, raised eyebrows spread over the whole temporal subordinate clause, which is further marked by a cluster of non-manual markers over the temporal marker, namely an emphasized eyebrows raising, a wide eye opening, and a head nod. As for the prosodic features, prosodic breaks occur before and after the temporal marker.

Due to this structural difference, a cross-linguistic comparison of temporal constructions comprehension in LSF and LIS is interesting, as coordinate structures should be less complex than subordinate clauses and therefore easier to understand and process.

Examples of temporal constructions expressing anteriority (*before*-constructions), simultaneity (*same*-constructions), and posteriority (*after*-constructions) are provided below in (1)-(6), with (1)-(2) exemplifying *before*-constructions, (3)-(4) *same*-constructions, and (5)-(6) *after*-constructions.¹ LSF temporal constructions are shown in (1)-(3)-(5), whereas LIS

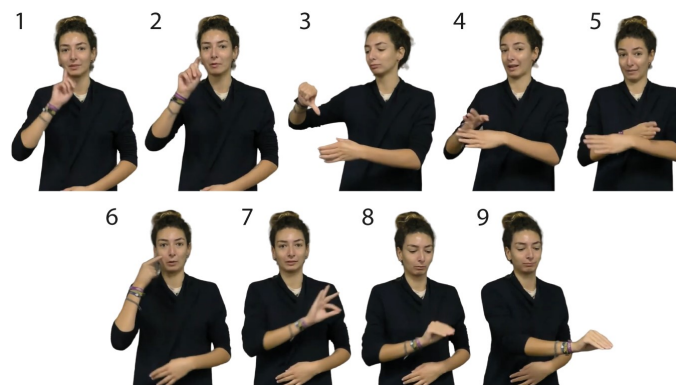
1. Glossing conventions used: lexical signs are transcribed in small capital. As for the non-manual markers, 're' refers to 'raised eyebrows', and its spreading is indicated by the length of the line above the signs glossed; 'nmm' refers to the cluster of other non-manual markers, namely an emphasized eyebrows raising, wide eye opening, and a headnod occurring on the temporal marker in LIS. The overall usage of the signing space is indicated grouping signs into square brackets, specifying 'left' or 'right' (n.b., body-anchored signs within a

temporal constructions are shown in (2)-(4)-(6).

Notice that in (1)-(2), which are *before*-constructions, the first clause refers to the second event on the timeline, whereas the second clause refers to the first event. Therefore, in examples (1) and (2), first the man moves the pen (second clause), then the woman pours water (first clause). On the other hand, in (5)-(6), which are *after*-constructions, the first clause refers to the first event on the timeline, and the second clause to the second event. Thus, in examples (5)-(6), first the woman pours water (first clause), then the man moves the pen (second clause).

Before-constructions

Figure 1: Frames from sentence (1). WOMAN (frame 1); WATER (frame 2); POUR (frame 3); BEFORE (frames 4-5); MAN (frame 6); PEN (frame 7); MOVE (frames 8-9).



- (1) [WOMAN WATER POUR]_{right} $\overline{\text{re}}$ $\overline{\text{BEFORE}}$ [MAN PEN _aMOVE_b]_{left} (LSF)
 'The woman pours water and, before that, the man moves the pen.'

Figure 2: Frames from sentence (2). WOMAN (frame 1); WATER (frame 2); POUR (frame 3); NOT-YET (frame 4); BEFORE (frames 5-6); MAN (frame 7); PEN (frame 8); MOVE (frames 9-10).



- (2) [WOMAN WATER POUR NOT-YET $\overline{\text{nmm}}$ $\overline{\text{BEFORE}}$]_{right}, [MAN PEN _aMOVE_b]_{left} (LIS)
 'Before the woman pours water, the man moves the pen.'

clause are grouped together with the rest of the clause they belong to). Further features, such as verbal spatial agreement and other non-manual markers (e.g., eyegaze direction) are not glossed.

Same-constructions

Figure 3: Frames from sentence (3). WOMAN (frame 1); WATER (frame 2); POUR (frame 3); SAME (frame 4); MOMENT (frames 5-6); MAN (frame 7); PEN (frame 8); MOVE (frames 9-10).



- (3) [WOMAN WATER POUR]_{right} $\overline{\text{MOMENT-SAME}}$ $\overline{\text{re}}$ [MAN PEN _aMOVE_b]_{left} (LSF)
 ‘The woman pours water and, at the same moment, the man moves the pen.’

Figure 4: Frames from sentence (4). WOMAN (frame 1); WATER (frame 2); POUR (frame 3); MOMENT (frames 4-5); SAME (frames 6); MAN (frame 7); PEN (frame 8); MOVE (frames 9-10).



- (4) [WOMAN WATER POUR $\overline{\text{MOMENT-SAME}}$ $\overline{\text{nm}}$ $\overline{\text{re}}$]_{right}, [MAN PEN _aMOVE_b]_{left} (LIS)
 ‘When the woman pours water, the man moves the pen.’

After-constructions

- (5) [WOMAN WATER POUR]_{right} $\overline{\text{AFTER}}$ $\overline{\text{re}}$ [MAN PEN _aMOVE_b]_{left} (LSF)
 ‘The woman pours water and, after that, the man moves the pen.’

Figure 5: Frames from sentence (5). WOMAN (frame 1); WATER (frame 2); POUR (frame 3); AFTER (frames 4-5); MAN (frame 6); PEN (frame 7); MOVE (frames 8-9).



Figure 6: Frames from sentence (6). WOMAN (frame 1); WATER (frame 2); POUR (frame 3); AFTER (frames 4-5); MAN (frames 6); PEN (frame 7); MOVE (frames 8-9).



- (6) $\frac{\text{re}}{\text{nmn}}$ [WOMAN WATER POUR AFTER]_{right}, [MAN PEN _aMOVE_b]_{left} (LIS)
 'After the woman pours water, the man moves the pen.'

Crucially, both LSF and LIS temporal constructions display a fixed clausal order for which inverting the order of the two clauses leads to a change of meaning in LSF, and to ungrammaticality in LIS (Aristodemo 2017, 86–87), as shown below in (7)-(8) for *before*-constructions.

- (7) $\frac{\text{re}}{\text{BEFORE}}$ [WOMAN WATER POUR]_{right} [MAN PEN _aMOVE_b]_{left} (LSF)
 'Before (now), the woman pours water and the man moves the pen.'
 [Adapted from Aristodemo and Hauser 2021, 14]

- (8) * $\frac{\text{re}}{\text{nmn}}$ [MAN PEN _aMOVE_b]_{right}, [WOMAN WATER POUR NOT-YET BEFORE]_{left} (LIS)
 [Adapted from [86-87] Aristodemo 2017]

This particular constraint entails that, both in LSF and in LIS, in *before*-constructions the linear order of the clauses does not match the chronological order of the events (counter-

chronological order of mention), whereas in *after*-constructions it matches the chronological order of the events (chronological order of mention).

Furthermore, an interesting feature in the type of *before*-constructions in LIS chosen for this study (see example (2) above) is the presence of the negation NOT-YET, absent in *before*-constructions in LSF. NOT-YET is the negative counterpart of the perfective marker DONE, and it is presuppositional in nature (Branchini and Mantovan 2020, 276), as the negated action or event is expected to occur in the future, as can be seen in example (9).

- (9) G-I-A-N-N-I HOMEWORK NOT-YET (LIS)
 ‘Gianni has not done his homework yet.’
 [Based on Zucchi et al. 2010, 212, as reported in Branchini and Mantovan 2020, 276]

In (9), the implication is that it is expected that Gianni will do his homework at some point in the future: this implication is absent in the negative sentence in (10), that features the truth-functional negation NOT.

- (10) G-I-A-N-N-I HOMEWORK NOT (LIS)
 ‘Gianni did not do his homework.’
 [Adapted from Branchini and Mantovan 2020, 276]

3 The present study

The main goal of the study was to investigate how AoA effects interact with linguistic complexity by comparing the performance of French and Italian adult deaf signers exposed to LSF or LIS from birth or later during childhood (between the age of 3 and 15) in the comprehension of temporal constructions.²

To do so, we designed a truth-value judgment task in which participants had to decide if a linguistic video of a temporal construction matched a previously presented non-linguistic video or not.

AoA, syntactic features, and clausal order were taken into consideration for the formulation of our hypotheses:

- i. **AoA.** Signers exposed to sign language from birth (AoA = 0) are expected to outperform signers exposed to sign language later in life (AoA \geq 3), showing higher accuracy and/or lower response times.
- ii. **Syntactic features and AoA.** Temporal constructions in LIS, which involve subordination, should be more complex to process than temporal constructions in LSF, which involve coordination. This might result in more evident AoA effects in LIS compared to LSF.
- iii. **Clausal order and AoA.** The processing of sentences featuring a counter-chronological order of mention (i.e., *before*-constructions) should be more demanding, resulting in lower accuracy and/or higher response times in both LSF and LIS.
 This might interact with AoA, therefore signers with an AoA \geq 3 might find interpreting sentences with counter-chronological order of mention more difficult to process compared to signers with an AoA = 0.

2. A direct RTs comparison is not possible due to the difference in the stimuli in LIS and LSF. RTs are measured from sentence start and the LIS *before*-constructions contain an additional sign (NOT-YET), which lengthens the sentence duration. The comparison between the results of the quantitative analyses for LSF and LIS is therefore qualitative.

The study was carried out according to the principles of the Declaration of Helsinki and received positive evaluation by the Ethical Committee for Research of the University of Toulouse Jean Jaurès and by the Local Commission for Minimal-risk Studies of the Department of Psychology of the University of Milano-Bicocca.

4 Methods

4.1 Participants

For this study, we considered French LSF deaf adult signers and Italian LIS deaf adult signers exposed to the respective sign language either from birth (AoA = 0) or between age 3 and 15 (AoA \geq 3). Signers who scored lower than 75% in control sentences were excluded from the study regardless of their age of acquisition, which was the case for 2 LSF signers.

We analyzed data from 32 French participants (13 signers exposed to LSF from birth, mean chronological age = 36.5 yrs, sd = 9.4, and 19 signers exposed to LSF between age 3 and 15, mean age = 40.2 yrs, sd = 9.8) and 25 Italian participants (13 signers exposed to LIS from birth, mean age = 36.9 yrs, sd = 13.5 and 12 signers exposed to LIS between age 3 and 10, mean chronological age = 45.1 yrs, sd = 19.9).

Participants signed an informed consent before taking the study and received a 15-Euros gift card for their participation in France, and 10 Euros for their participation in Italy.

4.2 Materials

A truth-value judgment task of a total of 108 experimental items was developed for each language. Each item was composed of a non-linguistic video showing a situation followed by a linguistic video which could describe the situation or not. The participants' task was to decide as fast as possible if the linguistic video matched the situation or not by pressing a key according to their decision.

The non-linguistic videos featured a man and a woman performing two distinct actions at the same or at different times, namely the man before the woman, the woman before the man, or the man and the woman simultaneously. On the other side, the linguistic video contained a temporal construction for a total of 12 *before*-constructions, 12 *same*-constructions, and 12 *after*-constructions (36 linguistic videos in total). Non-linguistic stimuli featured French deaf actors, whereas linguistic stimuli were signed by a native signer of LSF and a native signer of LIS, respectively.

The videos were combined so that each linguistic video was paired with three non-linguistic videos, in order to have one match between the linguistic video and the non-linguistic videos and two mismatches between the linguistic video and the non-linguistic videos. In the "match condition", the sentence in the linguistic video correctly described the content of the non-linguistic video. In the "mismatch condition", the sentence in the linguistic video did not describe the content of the non-linguistic video. In this latter condition, the mismatch was always due to the incongruent order of events.

In addition, 4 control items were created in a similar way where the sentence could match the situation ("match condition") or refer to a totally different situation ("error condition"). While experimental items contained a temporal construction, control items were simpler coordinate structures.³

3. Control items examples:

The items were divided into 3 lists made of 36 experimental items (namely, 4 *before*-constructions, 4 *same*-constructions, 4 *after*-constructions, each appearing in one match condition and two mismatch conditions) and 12 control items (of which 8 in the match condition and 4 in the error condition). Each participant was randomly assigned one list. Furthermore, 5 training items (3 similar to the experimental items and 2 to the control items) were added at the beginning of each experiment.

4.3 Procedure

The experiment was 15-20 minute long and it was administered by a proficient signer. Each participant took the experiment on a laptop in a quiet room. Instructions were shown as signed videos in LSF or LIS by a native deaf signer. During the task, in both the training and experimental items, videos could be seen only once, and responses could not be amended. Both accuracy of the responses and response times (RTs) were recorded.⁴

5 Results

In this section, we present the results for the LSF signers first, and then for the LIS signers. In both cases, we show accuracy results by group (AoA = 0 and AoA ≥ 3), type of sentence (*before*-construction, *same*-construction and *after*-construction), condition (match vs. mismatch), and RTs (calculated at the beginning of the linguistic video) on correct items by group, sentence, and condition (Figure 7 A-B for LSF and Figure 8 A-B for LIS). Accuracy was analyzed by means of mixed model logistic regressions and RTs by means of mixed model linear regressions. The first models we considered had group by condition (“match condition” vs. “mismatch condition”) and group by sentence type (*before*-construction vs. *same*-construction vs. *after*-construction) as fixed factors and subject and item as random factors. The structure of the fixed factors was progressively simplified by removing the effects that did not significantly contribute to the model’s fit.

Considering LSF, as presented in Figure 7, sentence type was the only significant predictor in the analysis of accuracy: accuracy was higher in sentences with *after*- and *same*-constructions compared to sentences with *before*-constructions. As for RTs, the analysis revealed a significant group by condition interaction: signers with an AoA = 0 were faster in the mismatch compared to the match condition, and this was not the same for signers with an AoA ≥ 3.

In LIS, as presented in Figure 8, both the effect of group and of condition were significant: accuracy was higher in signers with an AoA = 0 compared to signers with an AoA ≥ 3 and in the match condition compared to the mismatch condition. The analysis of RTs yielded no significant results.

(11) [MAN NOTE-PAD WRITE]_{right} [WOMAN MOVIE WATCH]_{left} (LSF)
‘The man writes on a note-pad (and) the woman watches a movie.’

(12) [MAN NOTE-PAD WRITE]_{right} [WOMAN MOVIE WATCH]_{left} (LIS)
‘The man writes on a note-pad (and) the woman watches a movie.’

4. Along with this test, other two tests were administered, specifically a test of lexical competence and a test of syntactic competence in the spoken language (French for LSF deaf adult signers, Italian for LIS deaf adult signers). These tests were not included in the analysis for the present study.

Figure 7: Mean Accuracy (A) and mean Response Times (B) for truth-value judgment decisions by LSF signers.

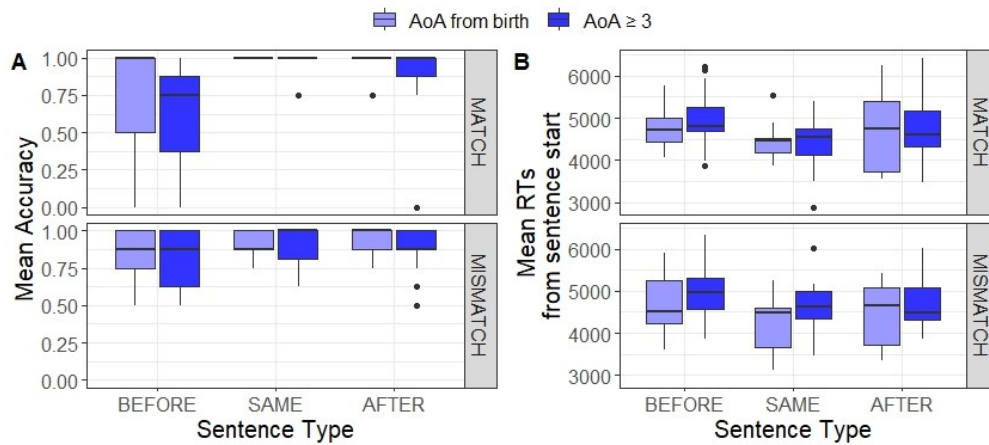
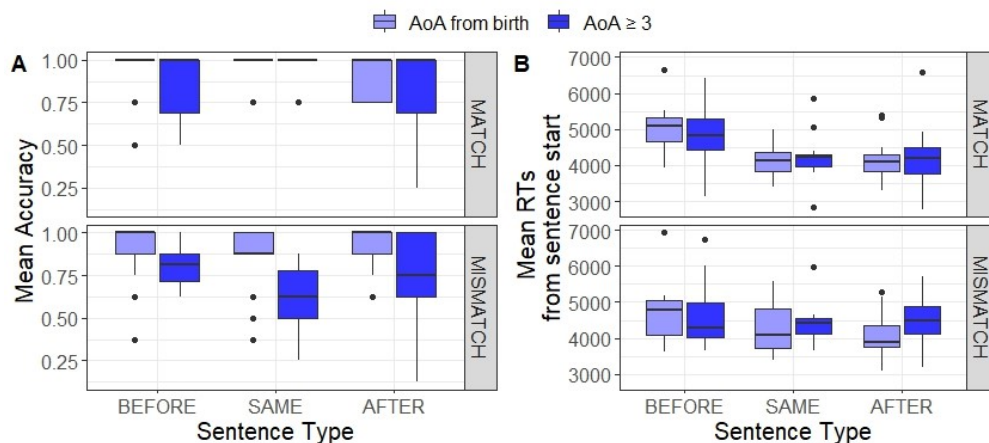


Figure 8: Mean Accuracy (A) and mean Response Times (B) for truth-value judgment decisions by LIS signers.



6 Discussion

Considering accuracy, we found a significant AoA effect in LIS but not in LSF. The greater syntactic complexity of temporal constructions in LIS, which are subordinate structures compared to LSF ones which are asymmetric coordinate structures, may have a relevant role in lower mean of accuracy in LIS signers in later AoA group. This would align with other studies showing that signers exposed to sign language from birth have an advantage particularly in demanding syntactic structures (Hauser et al. 2021; Aristodemo et al. 2022).

As for clausal order, accuracy was lower in *before*-constructions compared to *same* and *after*-constructions in LSF, which aligns with the hypothesis that sentences with a counter-chronological order of mention require a more demanding processing. Crucially, this was not the case in LIS. This is a puzzling result at first sight. Nonetheless, we speculate that these results might be explained by the presence of the negation sign NOT-YET in LIS: negation might have eased comprehension of LIS *before*-constructions and thus raised their mean

accuracy.

In fact, although several studies have suggested that negative sentences are more difficult to process than positive sentences (Clark and Chase 1972), a growing body of studies is showing that supportive contexts help to mitigate the effect (Albu, Tsaregorodtseva, and Kaup 2021). In addition, recent studies suggest that informativity plays a central role in negation comprehension (Xiang, Kramer, and Nordmeyer 2020). In our experiment, input sentences were preceded by a non-linguistic situation, to some extent comparable to a linguistic context, which should have helped to reduce the processing cost of the negation sign NOT-YET.

In addition, when the participant encounters in the first clause the sign NOT-YET, which is presuppositional in nature (see Section 2), the implicit logical entailment is that the other event in the second clause must have already taken place, given that an event cannot have taken place after an event that still has not occurred. For this reason, when the temporal marker BEFORE is produced in the same clause, not only has the temporal relation between the two events already been, at least partially, processed and established, but also the interpretation of the meaning of the sentence is reinforced. In other words, in LIS the negation NOT-YET “signals” the upcoming discrepancy between the order of mention of the events in the sentence and the chronological order in which they occurred and “lightens” its processing, reason for which LIS *before*-constructions show a higher accuracy. The potential effect on RTs might be shadowed by the slightly longer duration time of *before*-constructions (due to the presence of the additional sign NOT-YET) compared to the one of *same*- and *after*-constructions. As in LSF there is no negation in *before*-constructions, the relation between the two events and the consequent mismatch between the order of mention of the events in the sentence and the chronological order of the events are processed only when the temporal marker is produced.

Finally, these results, and especially those related to the impact of AoA, might also be conditioned by sociolinguistic factors. Differently from LIS signers, LSF signers all attended schools in which sign language was highly supported, with a full-fledged sign language study program from kindergarten to high school: this might have contributed to enhance their LSF linguistic competence.

7 Conclusion

In this study we investigated AoA and clausal order effects on temporal constructions in LSF and LIS by using a truth-value judgment task and measuring accuracy and response times. We found AoA effects and clausal order effects although, in line with previous literature, they seem to intertwine with both sociolinguistic and linguistic factors. Nonetheless, having a small sample size, we should be cautious in drawing conclusions while more research on the topic is welcomed.

Acknowledgments

We deeply thank our participants, Helène Giraudo for our conversations on the test structure, Elodie Cervantes for the LSF sentences, Mirko Santoro for the LIS sentences, and deaf actors Douglas and Nolwenn who enacted the actions in the non-linguistic videos.

For Italian Sign Language data, we thank in particular ENS Milano, ENS Bergamo, ENS

Brescia, ENS Torino, VEDO VOICI – Associazione Genitori Bambini Sordi ODV for the recruitment of participants and for hosting a part of our data collection process.

This study was funded by Research Grant Marica De Vincenzi 2020 for LSF, and University of Milano-Bicocca Competitive Grant 2021 and University of Milano-Bicocca Research Grant “Contemplis” for LIS.

References

- Albu, Elena, Oksana Tsaregorodtseva, and Barbara Kaup. 2021. “Contrary to expectations: does context influence the processing cost associated with negation?” *Journal of Psycholinguistic Research* 50:1215–1242. <https://doi.org/10.1007/s10936-021-09799-8>.
- Aristodemo, Valentina. 2017. “Gradable constructions in Italian Sign Language.” PhD diss., École des Hautes Études en Sciences Sociales – École Doctorale Art et Langages, Institut Jean-Nicod.
- Aristodemo, Valentina, Beatrice Giustolisi, Giorgia Zorzi, Doriane Gras, Charlotte Hauser, Rita Sala, Jordina Sánchez Amat, Caterina Donati, and Carlo Cecchetto. 2022. “On the nature of role shift. Insights from a comprehension study in different populations of LIS, LSC and LSF signers.” *Natural Language and Linguistic Theory* 41:459–500. <https://doi.org/10.1007/s11049-022-09539-0>.
- Aristodemo, Valentina, and Charlotte Hauser. 2021. “Similar but different: investigating temporal constructions in sign language.” *Glossa: a journal of general linguistics* 6(1) (2). <https://doi.org/10.5334/gjgl.999>.
- Branchini, Chiara, and Lara Mantovan. 2020. *A Grammar of Italian Sign Language (LIS)*. Edizioni Ca’ Foscari. <https://doi.org/10.30687/978-88-6969-474-5>.
- Clark, Herbert H., and William G. Chase. 1972. “On the process of comparing sentences against pictures.” *Cognitive Psychology* 3:472–517. [https://doi.org/10.1016/0010-0285\(72\)90019-9](https://doi.org/10.1016/0010-0285(72)90019-9).
- Emmorey, Karen, Ursula Bellugi, Angela Friederici, and Petra Horn. 1995. “Effects of age of acquisition on grammatical sensitivity: Evidence from on-line and off-line tasks.” *Applied Psycholinguistics* 16 (1): 1–23. <https://doi.org/10.1017/S0142716400006391>.
- Hauser, Charlotte, Giorgia Zorzi, Valentina Aristodemo, Beatrice Giustolisi, Doriane Gras, Rita Sala, Jordina Sánchez Amat, Carlo Cecchetto, and Caterina Donati. 2021. “Asymmetries in relative clause comprehension in three European sign languages.” *Glossa: a journal of general linguistics* 6(1) (72): 1–23. <https://doi.org/10.5334/gjgl.1454>.
- Politzer-Ahles, Stephen, Ming Xiang, and Diogo Almeida. 2017. ““Before” and “after”: Investigating the relationship between temporal connectives and chronological ordering using event-related potentials.” *PLoS One*, <https://doi.org/10.1371/journal.pone.0175199>.
- Xiang, Ming, Alex Kramer, and Ann E. Nordmeyer. 2020. “An informativity-based account of negation complexity.” *Journal of Experimental Psychology: Learning, Memory, and Cognition* 46 (10): 1857–1867. <https://doi.org/10.1037/xlm0000851>.

Zorzi, Giorgia, Beatrice Giustolisi, Valentina Aristodemo, Carlo Cecchetto, Charlotte Hauser, Josep Quer, Jordina Sánchez Amat, and Caterina Donati. 2022. "On the Reliability of the Notion of Native Signer and Its Risks." *Frontiers in Psychology* 13:716554. <https://doi.org/10.3389/fpsyg.2022.716554>.

Zucchi, Sandro, Carol Neidle, Carlo Geraci, Quinn Duffy, and Carlo Cecchetto. 2010. "Functional Markers in Sign Languages." In *Sign Languages*, edited by Brentari Diane, 197–224. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511712203.011>.