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Mutual intelligibility among the sign languages of Belgium and the Netherlands

Abstract: In an exploratory study of mutual intelligibility between the sign languages of the northern part of Belgium (Flemish Sign Language, VGT), the southern part of Belgium (French Belgian Sign Language, LSFB), and the Netherlands (Sign Language of the Netherlands, NGT), we tested the comprehension of VGT by signers of LSFB and NGT. In order to measure the influence of iconic structures (classifier constructions and constructed action) that linguistic analyses have shown to be similar across different sign languages, two genres were compared: narrative and informative signing. To investigate the effect of the overlap between the spoken languages surrounding the Dutch and Flemish Deaf communities, videos were presented in two conditions: first without and subsequently with mouthings. As we hypothesized, both LSFB and NGT signers understood narratives better than informative signing, showing for the first time that iconic structures facilitate comprehension of foreign signing. Furthermore, the results at least partially confirm our hypothesis that NGT signers benefit more from mouthings than LSFB signers, uncovering a source of intelligibility that is unique to sign languages.

Keywords: mutual intelligibility, sign language, narrative, mouthing, iconicity

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1 Introduction

1.1 Possible sources of mutual intelligibility in sign languages

Research into mutual intelligibility among spoken languages investigates the extent to which speakers of one language understand another language based on the knowledge of their mother tongue alone. It has been shown that the speakers of closely related languages such as Danish and Swedish may communicate effectively across linguistic boundaries while using their own language (*semicommunication* [Haugen 1966]). The extent of mutual intelligibility between two languages is determined mainly by linguistic distance, language attitudes and language contact (Gooskens 2007).

Whereas mutual intelligibility among spoken languages has been investigated for several languages and language families, there is little research exploring the nature of mutual intelligibility among sign languages. Contrary to the common myth of the universality of sign language, the fact is that there are as many sign languages as deaf communities and often they are not mutually intelligible. But another fact often observed by signers and researchers alike is that signers of different sign languages often communicate with ease (using a communication system usually referred to as "international sign"; see Hiddinga and Crasborn 2011) and certain structures (for example classifier constructions) are often understandable even across sign languages that are not closely related (Meir and Sandler 2008).

Similar to spoken languages, genetic relationships, language contact and the resulting lexical similarities may contribute towards mutual intelligibility among sign languages. However, some aspects of signing lead us to expect additional factors to play a role in understanding foreign signing, such as the exploitation of the iconicity inherent to the visual-spatial modality as well as the use of mouth patterns from the surrounding spoken language.

While crosslinguistic comparisons have uncovered variation among sign languages at all levels of linguistic structure (see, for example, the papers in Perniss et al. 2007a) there seem to be important similarities as well. A number of grammatical structures have been shown to be present in many unrelated sign languages, for instance the use of space in pronominal reference and verb agreement or the grammatical functions of facial expressions (Perniss et al. 2007b). Meir and Sandler (2008: 264) go as far as claiming, "The points of similarity among sign languages are many and are not limited to a single linguistic phenomenon or restricted to a particular level of grammar. In short, sign languages structurally appear to constitute a single linguistic type, though they are neither historically nor geographically related."

An important aspect of the similarities among sign languages concerns certain iconic structures that are extensively used in storytelling. Signers can use classifier constructions – complex predicates composed of iconically motivated handshape and movement morphemes – to describe the size and shape of objects or the location and motion of referents in space. The handshapes used in classifier constructions are conventionalized and differ across sign languages but their use and functions are similar (Perniss et al. 2007b). Another device common to many sign languages is constructed action, which allows the signer to use his own body to depict the actions and represent the thoughts, utterances, and feelings of a character in a narrative (Metzger 1995). These constructions are typical to storytelling and less frequent in other genres, such as informative signing. Sallandre (2003) compared two genres: narratives and explicative signing (recipes) in terms of speed as well as proportion of classifier constructions and constructed action – both analyzed as "highly iconic structures" in her theoretical framework (Cuxac 2000) – and lexical ("frozen") signs. She found that signing in the explicative genre is faster (0.74 seconds for one unit compared to 0.85 for narratives). Furthermore, the proportion of iconic structures is higher (69%) for narratives than for recipes (34%). Throughout this article, we will use the term "iconic structures" to refer to classifier constructions and constructed action.

A further source of similarity among sign languages is that they are almost always used in a minority language community surrounded by a spoken majority language. While sign languages are independent from spoken languages, manual signs are often accompanied by mouth patterns similar to the articulation of spoken words. Similarity in mouthings and manual signs may but do not always coincide, so that two sign languages may be surrounded by the same spoken language without being mutually intelligible, as in the case of American Sign Language and British Sign Language. The linguistic status of mouthings (full or reduced articulation of spoken words) is a subject of debate (see Boyes Braem and Sutton-Spence 2001). According to Bank et al. (2011), the discussion is characterized by two extreme views: on the one hand, that mouthings are fully lexicalized and, on the other hand, that mouthings are instances of code-mixing, not an inherent part of sign language. We do not argue for either position here, but simply observe that mouthings of (parts of) spoken words often accompany manual signs and may contribute to understanding unfamiliar or foreign signs.

There are a number of comparisons of similarity in lexical items across sign languages. For example, in a study investigating two sign languages that are thought to be historically related, Danish and Icelandic Sign Language, Aldersson and McEntee-Atalianis (2008) found that over 60% of the elicited signs were similar. On the other hand, Guerra Currie et al. (2002) compared signs of two unrelated languages, Mexican Sign Language and Japanese Sign Language and

found that 23% of the signs included in a comparison were similarly articulated. The authors quote Greenberg's (1957) claim that a lexical resemblance of over 20% between two spoken languages indicates some kind of a historical relationship between them and conclude that their results support earlier claims of a higher degree of lexical similarity between unrelated sign languages than for spoken languages, probably due to iconicity.

To our knowledge, only two previous studies used an experimental paradigm to investigate intelligibility of foreign signing. Jordan and Battison (1976) used a referential communication task in which participants had to choose a picture from a set based on a description in a foreign sign language. They found that the average percentage of correct choices was 34% (among various pairs of sign languages). Faurot et al. (2000) describe a small experiment (with 4 participants) in which they measured the comprehension of Mexican Sign Language (LSM) by signers of American Sign Language (ASL). They showed participants two videos of LSM and asked 10 comprehension questions. They report that the average understanding of LSM by ASL signers was only 14%. Unfortunately, the authors do not describe their study in detail.

To summarize, in addition to lexical similarities (in manual signs), some possible sources of mutual intelligibility are unique to sign languages, in particular the use of iconic structures that are attested in all sign languages studied so far and mouthings, articulations of spoken words that accompany manual activity. While lexical similarities among sign languages have been studied extensively, experimental investigations of mutual intelligibility are almost nonexistent. Therefore, we decided to conduct an exploratory study of mutual intelligibility among the sign languages of Belgium and the Netherlands that allows for the investigation of the respective contributions of manual components and mouthings.

1.2　Sign languages in Belgium and the Netherlands

The complex sociolinguistic situation of Belgium deserves at least a short explanation here. Belgium is a federal state in which there are three language communities. The Dutch-speaking community is in Flanders, in the north of Belgium. The French-speaking community spreads throughout most of Wallonia. The Brussels region is officially bilingual (even though only 10–15 percent of its inhabitants claim to have Dutch as their first language). Finally, there is a small German-speaking community in eastern Wallonia.

Belgium and the Netherlands together boast three sign languages (see Table 1 below). The sign language of the French-speaking part of Belgium is

Table 1: Sign languages of Belgium and the Netherlands

Region	Wallonia	Flanders	the Netherlands
Signed	Langue des Signes de Belgique Francophone (LSFB)	Vlaamse Gebarentaal (VGT)	Nederlandse Gebarentaal (NGT)
Spoken	French	Dutch	Dutch
Similarity	Manual component		
		Mouthings	

French Belgian Sign Language (LSFB; Langue des Signes de Belgique Franco-phone). Flemish Sign Language (VGT; Vlaamse Gebarentaal) is used in Flanders and the Sign Language of the Netherlands (NGT; Nederlandse Gebarentaal) in the Netherlands. Regional variation is considerable: each of these languages is thought to have at least five regional variants (for further description see Van Herreweghe and Vermeerbergen 2009 for VGT, Haesenne et al. 2008 for LSFB and Schermer 2004 for NGT).

All three sign languages are thought to descend from old French Sign Language (Haesenne et al. 2008, Lewis 2009). This historical relation might partially explain the fact that the vocabularies of LSFB and VGT, the sign languages of the French and Flemish speaking parts of Belgium, seem to show a high degree of similarity. In fact, according to Vermeerbergen et al. (2007) there is not enough evidence to decide whether the differences between LSFB and VGT are large enough to talk about separate languages. Anecdotal evidence suggests that these two sign languages share as much as 70% of their lexical items. This figure is corroborated by a preliminary comparison of lexical signs that we conducted based on the Swadesh list modified for sign languages (Woodward 1978 cited by McKee and Kennedy 2000) as well as judgments of lexical similarity of the signs appearing in our test materials (see Section 2.1. and Table 3 below).

However, this similarity between LSFB and VGT signs is in fact only partial. Due to the different spoken languages surrounding these deaf communities (French in the case of LSFB and Dutch in the case of VGT), the articulations of spoken words (mouthings) that accompany the signs are different. Therefore, we can say that the manual parts of LSFB and VGT signs are often similar, while the mouthings are different (and mutually unintelligible). Non-manual elements other than mouthings may also be similar, but in this study we focus on mouthings and manual activity only.

In the case of VGT and NGT we see the opposite pattern. Deaf signers report that the manual components of signs in these sign languages are different, but

due to the shared spoken language of the communities the mouthings are often similar. Signers from these communities claim to be able to enhance mutual understanding by relying on mouthings of Dutch words. Thus VGT shares similar manual components with LSFB and similar mouthings with NGT, resulting in a sort of natural experimental situation, which may allow us to test the contribution of the different components of signs to mutual intelligibility. Again, we have no information on whether non-manuals other than mouthing are similar between VGT and NGT (as well as possibly LSFB and NGT).

Based on the above considerations, in this study we aim to test three hypotheses related respectively to the intelligibility of iconic structures, the role of lexical similarity in manuals and mouthings:

1. Narratives involving a high number of iconic structures show a higher degree of intelligibility in both groups.
2. Signers of LSFB understand VGT better than signers of NGT.
3. Mouthings of Dutch words are an additional source of intelligibility for NGT signers, but not for LSFB signers.

2 Method

2.1 Materials

We used four video recordings to test the comprehension of VGT by signers of LSFB and NGT (see Table 2 below for details). All videos were recorded for the purpose of this study. A Flemish deaf signer from Antwerp was presented with texts in Dutch and asked to create a signed version that would be understood by most fluent signers of VGT. She used a mix of different VGT variants (which is generally the case when Flemish signers communicate with signers from a different Flemish province). In order to test the effect of mouthings of spoken words in comprehension, we edited the videos to cover the lips of the signer by placing an oval shaped blur on the mouth.

Two of the videos (Fable 1 and 2) are signed narratives based on fables of Aesop ("The lion and the mouse" and "The two friends and the bear"). These videos contain a large number of classifier constructions and constructed action sequences. The two other videos were based on informative texts, one about chocolate, and one about the benefits of the use of pedal machines for exercise at work. The resulting informative videos are characterized by the use of only few classifier constructions and little constructed action. Another difference between the narratives and informative videos is that of speed, as shown by the number of

Table 2: Video recordings used in the comprehension test

Video	Genre	Length (min:sec)	Total units	Number of iconic structures	Speed Unit/Sec
Fable 1	Story	01:46	119	51	1.12
Fable 2	Story	01:40	153	44	1.53
Informative 1	Informative	00:58	100	0	1.72
Informative 2	Informative	01:50	228	5	2.07

units per second. Some of this difference is due to the fact that iconic structures were analyzed as one unit, despite the fact that they contain extensive move-ment repetition (for example, a three second long constructed action sequence describing a mouse running includes six larger movements of the arms and even more smaller movements of the wrists and fingers). Therefore, the difference be-tween genres in terms of actual speed of hand movements may be smaller than suggested by the figures in Table 2. The differences in the use of iconic structures and speed of signing are in line with the findings of Sallandre (2003) quoted above (Section 1.1.).

The videos were glossed by one of the authors and verified by another, who is a native signer of VGT. In order to reveal the degree of lexical similarities be-tween the three languages under investigation in the test materials we used, iden-tical lexical signs were identified by two of the authors, who are native signers of LSFB and NGT, respectively. The percentage of identical items in each video is shown in Table 3. Multiple occurrences of the same sign were excluded from these calculations, as well as instances of pointing, gesture, classifier construc-tions and constructed action sequences. We considered as gestures any manual and non-manual activity that would be used in the hearing community in similar manner, for example expressing fearful shock by raising the two hands, palms facing away from the signer, accompanied by rounded eyes and opening the

Table 3: Similarity of VGT signs used in our test materials to LSFB and NGT (comparing manual components only)

Video	Number of lexical items	Identical to LSFB	Identical to NGT
Fable 1	36	86%	36%
Fable 2	41	88%	21%
Informative 1	45	72%	30%
Informative 2	96	74%	46%

mouth. A few instances of gestures occurred in the two story videos, but none in the informative videos.

2.2 Procedure

Each participant was tested individually by one of the authors and all their answers were recorded on video. Participants volunteered for the study and received remuneration. In the beginning of the experiment, participants were told that they would see videos of Flemish Sign Language and their task was to try to understand as much as possible. The order of presentation of the videos was the same for each participant, starting with a narrative (Fable 1), followed by the two informative videos (Informative 1 and Informative 2) and finally closing with the second narrative (Fable 2). We presented the videos in two conditions: with the lips blurred (without mouthing) and without blur (with mouthing). Videos without mouthing were always shown first in order to enable us to measure the effect of mouthings. In each condition, we showed the videos in short consecutive segments and asked participants to translate it into their own sign language as well as they could. By default, each segment was shown twice before asking participants to explain what they understood, and participants could request to see the segment again. Participants differed in how much detail they included in their answer. In order to get a complete picture of what was understood, experimenters tailored their questions to each participant, sometimes asking for details or the translation of individual signs and phrases. As a result, the instructions were not fixed.

2.3 Participants

2.3.1 Belgium

In total, 13 participants (8 men and 5 women) from the French-speaking part of Belgium (Liège and Brussels) were recruited in a deaf club and through the authors' contacts in the deaf community. However, during testing it seemed that two participants had difficulty understanding and completing the task (instead of answering the questions of the experimenter they merely repeated what they saw in the videos presented to them). One participant was removed during statistical analysis as an outlier, given that her scores were below the mean scores by more than two times the standard deviation on the narratives in both conditions.

The remaining are 6 men and 4 women (mean age 37.2 years, *SD* = 11.7). For one participant, answers about the first informative video have not been recorded (and thus not included in the analysis). Four participants were exposed to LSFB from birth, two between the age of 2–3 years, three between the age of 6−8 years and one at the age of 12 years. During their education, four participants were integrated in mainstream education and instructed in spoken language, while six participants attended schools for the deaf where sign language was used in instruction. Only four participants claim to understand some Dutch. All but one reported to have been in contact with foreign deaf people and to know at least one foreign sign language, most frequently LSF (French Sign Language) or LIS (Italian Sign Language). In addition, seven of them claim to have a basic command of international sign.

2.3.2 The Netherlands

Eleven Dutch signers participated in the study, 4 men and 7 women (mean age 27.4 years, *SD* = 3.4), all recruited through the authors' contacts in the deaf community. All participants live now in the area of Amsterdam, but four have previously resided in the area of Groningen. Three participants were exposed to NGT from birth, five between the age of 1–2 years, and four around the age 4−6 years. Five participants attended schools without any use of sign language in instruction, the others had access to NGT or sign supported Dutch in their schools. Seven participants claimed to have at least some knowledge of English and four of them are familiar with one or two other foreign languages. All participants have some experience in communicating with deaf people from other countries and say they can communicate using international sign. Eight participants claim to have some knowledge of American Sign Language.

2.4 Data analysis

The analysis of participants' answers followed the units of presentation. As we have mentioned earlier, videos were presented in short segments (roughly equivalent to one or two written sentences if translated). Recordings of participants' answers were analyzed to determine how well they understood each segment in each condition (without and with mouthing). Each segment received a score between 0–3 based on the criteria shown in Table 4.

As the videos differed in the number of presentation units, raw comprehension scores were converted to percentages to allow comparison between the four

Table 4: Criteria used in scoring

Score	Criterion
0	segment is not understood
1	some individual signs are understood
2	good global understanding but some details missing
3	sentence is completely understood

videos. For each video, the maximum possible score was calculated, that is, the score obtained if all the units received a score of 3. Participants' results were expressed as the percentage of this total score. Finally, we also recorded each sign that a participant understood with the help of mouthing, based on their self-reflection or if that information was not available, in some cases based on behavioral clues (participants sometimes showed signs of sudden insight while watching the videos with mouthing).

3 Results

A summary of the results is presented in Table 5 below, showing means and standard deviations of the total comprehension score (percentages) for each video in both conditions (without and with mouthing), as well as T-values and significance values from independent samples T-tests comparing the two groups. A third variable, "gain with mouthing" was calculated as the difference between the two conditions. The number of lexical items that were understood through mouthing was also taken into consideration (in the case of this variable figures represent the number of items, not percentages).

Simple inspection of the figures presented in Table 5 (in bold; see Figure 1 and 2 as well) shows that LSFB signers achieved higher comprehension scores on all narratives. On the other hand, NGT signers showed a larger gain between the first (without mouthing) and second (with mouthing) condition as well as higher number of items understood with the help of mouthing.

In accordance with our first hypothesis, the data show a robust difference between the two genres: narrative and informative videos. Figures 1 and 2 show comprehension scores (percentage of total) for each video presented without and with mouthing, respectively. The difference in comprehension of the two genres is clearly visible in both figures as well as in Table 6.

A repeated measures analysis of variance (ANOVA) showed that the interactions between Group (LSFB and NGT) and Genre (narrative and informative)

Table 5: Results of LSFB signers and NGT signers in each condition and the results of independent samples T-tests comparing the two groups.

	LSFB signers		NGT signers		Group differences	
	Mean	**SD**	**Mean**	**SD**	**T-value**	**Sig.**
Condition 1: without mouthing (%)						
Fable 1	**88.89**	13.86	76.77	15.28	1.89	0.07
Fable 2	**91.67**	10.22	85.35	11.46	1.33	0.20
Informative 1	**43.39**	18.96	40.26	15.11	0.41	0.69
Informative 2	**56.15**	16.90	44.06	15.16	1.73	0.10
Condition 2: with mouthing (%)						
Fable 1	**92.78**	12.30	82.32	14.45	1.78	0.09
Fable 2	**93.89**	9.60	93.43	6.49	0.13	0.90
Informative 1	**60.85**	21.92	59.74	22.87	0.11	0.91
Informative 2	**62.56**	17.48	57.58	19.13	0.62	0.54
Gain with mouthing (Condition 2 – Condition 1)						
Fable 1	3.89	8.71	**5.56**	4.97	−0.54	0.59
Fable 2	2.22	3.88	**8.08**	8.00	−2.10	0.05
Informative 1	17.46	15.79	**19.48**	10.74	−0.34	0.73
Informative 2	6.41	6.54	**13.52**	7.70	−2.27	0.04
Lexical items understood through mouthing (number of signs)						
Fable 1	0.30	0.48	**1.09**	0.70	−2.98	0.01
Fable 2	0.40	0.52	**1.09**	1.14	−1.76	0.09
Informative 1	0.67	0.50	**4.27**	1.56	−7.25	0.00
Informative 2	1.30	0.95	**4.64**	1.75	−5.35	0.00

was not significant for any of the scores (comprehension without mouthing as shown in Figure 1 ($F(1,18) = .098$, $p > .1$); comprehension with mouthing as shown in Figure 2 ($F(1,18) = .150$, $p > .1$); performance gain with mouthing as shown in Figure 3 ($F(1,18) = .028$, $p > .1$). This implies that both groups (LSFB and NGT) showed the same pattern of performance differences for the two genres (narrative and informative signing), with the narratives being better understood than the informative videos. The main effects for Genre, thus the comparison between narrative and informative videos (irrespective of the two groups), is significant for all of the scores (comprehension without mouthing ($F(1,18) = 162.41$, $p < .01$); comprehension with mouthing ($F(1,18) = 74.56$, $p < .01$); gain with mouthing ($F(1,18) = 15.43$, $p < .01$).

Given the high degree of similarity of manual signs between VGT and LSFB, we expected LSFB signers to perform better on the comprehension test than NGT
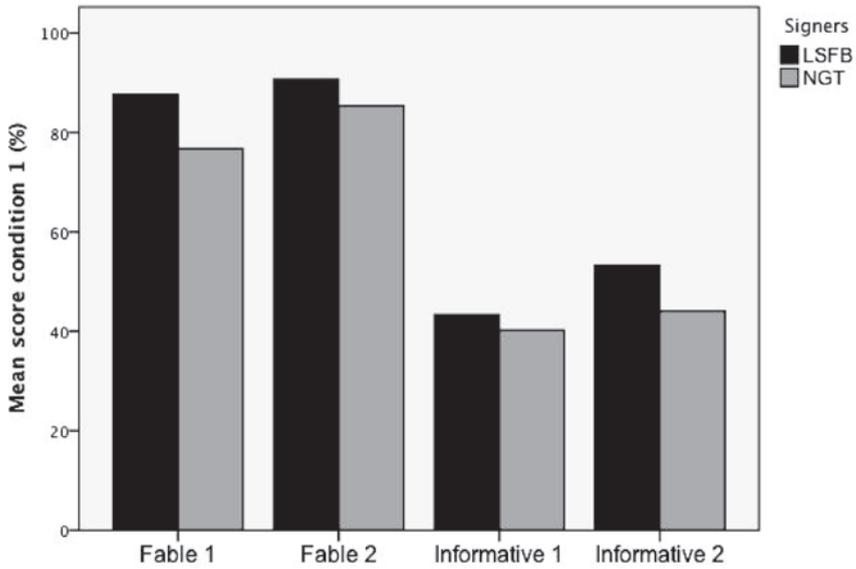
Fig. 1: Comprehension scores in Condition 1: without mouthing (percentage of total possible score)
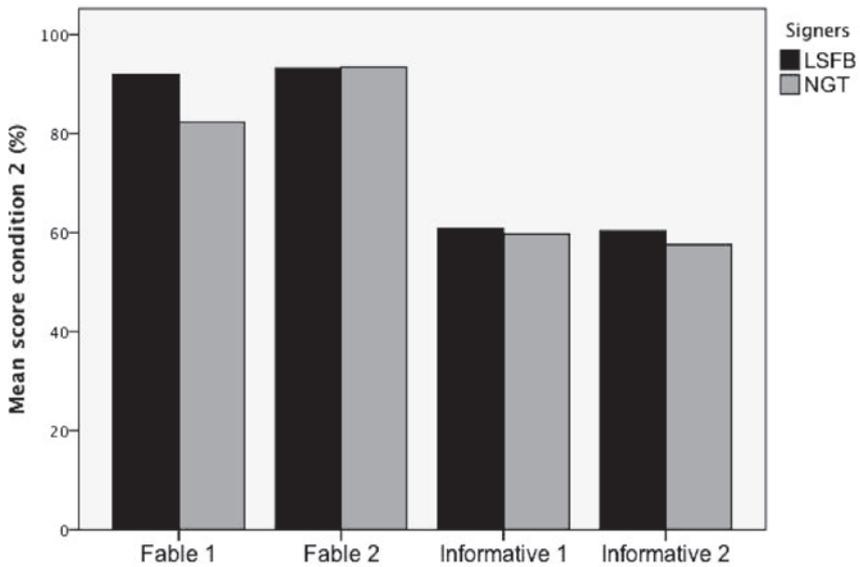

Fig. 2: Comprehension scores in Condition 2: with mouthing (percentage of total possible score)

Table 6: Mean scores (%) for the two genres (narrative and informative) and differences between them

		Narrative	Informative	Difference
LSFB	Without mouthing	89.20	48.33	40.87
	With mouthing	92.59	60.62	31.97
	Gain	3.40	12.29	8.89
NGT	Without mouthing	81.06	42.16	38.90
	With mouthing	87.88	58.66	29.22
	Gain	6.82	16.50	9.68

signers. As we have also mentioned above, this is indeed the case: LSFB signers perform slightly better in all the tests, although the difference is more pronounced in the case of the videos without mouthing (shown in Figure 1). However, none of these group differences reach statistical significance in the condition without mouthing as well as the condition with mouthing, as measured in the independent samples T-tests, probably due to small sample sizes.

However, a repeated measures ANOVA showed that the interaction between Group (LSFB vs. NGT) and Mouthing (comprehension score without mouthing vs. with mouthing) was significant for Informative 2 ($F(1,19) = 5.15$, $p < .05$) and for Fable 2 ($F(1,19) = 4.41$, $p < .05$). This indicates that the differences between the conditions were significantly dissimilar between the two groups. The difference between the with- and without-mouthing conditions was larger for NGT signers, who showed more improvement in the mouthing condition. The main effect for mouthing (thus irrespective of the two groups) for Informative 2 was also significant ($F(1,19) = 40.44$, $p < .001$). Similarly, the main effect for mouthing in Fable 2 was significant ($F(1,19) = 13.62$, $p < .01$), showing the increased performance in the conditions with mouthing.

An additional repeated measures ANOVA whereby the two conditions in Informative 2 were compared for each of the two groups separately showed a significant difference between the two conditions in both the LSFB group ($F(1,9) = 9.62$, $p < .05$) and the NGT group ($F(1,10) = 33.91$, $p < .001$). This indicates that both groups perform better in the mouthing condition, but more so in the case of NGT signers than for LSFB signers. An additional repeated measures ANOVA analysis was also done for the comparison between the two conditions in Fable 2 for each of the two groups separately. Here we find no significant effect of mouthing for the LSFB signers ($F(1,9) = 3.27$, $p > .1$) but we do find a significant effect of mouthing for the NGT signers ($F(1,10) = 11.23$, $p < .01$). This indicates that the LSFB signers do not benefit significantly from the mouthing in Fable 2, in contrast to the NGT signers.

On the other hand, for Informative 1 ($F(1,18) = .12$, $p > .1$) and for Fable 1 ($F(1,19) = .30$, $p > .1$), the interactions between Mouthing and Group were not significant. The main effect for mouthing in Informative 1 was significant ($F(1,18) = 38.6$, $p < .01$) and the main effect for mouthing in Fable 1 was also significant ($F(1,19) = 9.56$, $p < .01$), which is thus similar for LSFB signers and for NGT signers (i.e., all showing improved performance for the conditions with mouthing), as shown by the lack of significant interaction effects.

Regarding the effect of the mouthing condition on comprehension, the overall picture is that NGT signers benefit more from the mouthing in the VGT videos. As it can be seen in the gain in comprehension scores displayed in Figure 3, the benefit from uncovering the mouthings is larger for the NGT signers for all videos, confirming hypothesis 3. Gain with mouthing is significantly different between the two groups for Fable 2 and Informative 2, as shown in Table 5 and confirmed by the interaction effects.

The difference between LSFB and NGT signers was observed even more clearly for the number of lexical items that were detected correctly with the help of mouthing. This effect is significant for Fable 1 and Informative 1 and 2.

While NGT signers show a higher performance gain for all videos than LSFB signers, there is an unexpected difference between the two informative videos. The difference between the two groups is significant in the case of the second but
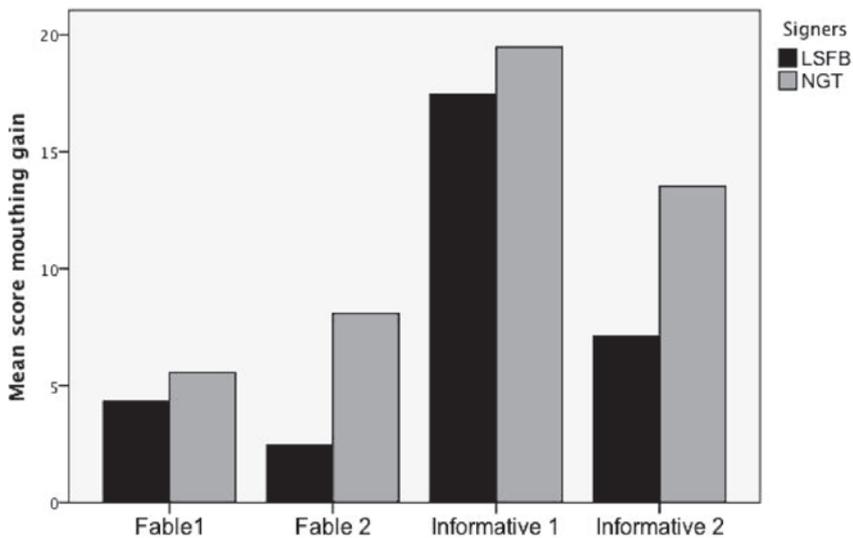

Fig. 3: Performance gain between comprehension without mouthing and subsequent comprehension with mouthing
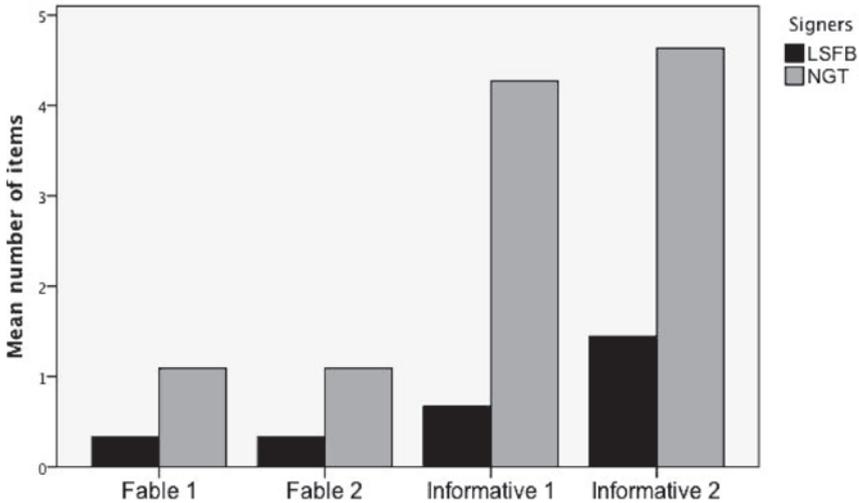
Fig. 4: Number of lexical items understood with the help of mouthing

not the first video. Looking at the scores (Table 5 and Figure 3) we observe that while both groups show a higher gain for the first informative video, this gain is much higher in the case of LSFB signers compared to their performance gain for the second informative video. Thus, the difference between the two groups in gain on the second video is not present for the first video due to the unexpectedly high gain score of LSFB signers. Paired samples T-tests show that the performance gain on the first and second informative video is significantly different in the case of LSFB signers ($t = 2.50$, $p < .05$) but not in the case of NGT signers ($t = 1.65$, $p < .13$). It is unexpected that LSFB signers show higher comprehension gain with mouthing for the first informative video than for the second, whereas this is not the case for NGT signers. This difference between the two videos is not evident in the number of items understood through mouthing.

4 Discussion

As we have shown above, the results largely conform to our expectations. As our first hypothesis predicted, there is a clear difference between the understanding of the two genres, with up to 40% difference in comprehension scores. Concerning differences between the LSFB and NGT signers, as anticipated in Hypothesis 2, LSFB signers attained higher comprehension scores for all videos and conditions, although these differences were not significant, possibly due to small

sample size and large standard deviations. Regarding our third hypothesis concerning the use of mouthings, again we find that NGT signers benefited more from watching the videos with mouthings. They show higher scores for both the performance gain in the mouthing condition and the number of lexical items identified with help of mouthings. These group differences reach statistical significance in the case of Fable 2 and Informative 2 for performance gain and in the case of Fable 1 and Informative 1 and 2 for lexical items understood through mouthing. Unexpectedly, compared to their own performance on Informative 2, LSFB signers showed greater improvement in comprehension after seeing the video with mouthing for Informative 1.

4.1 Iconic structures

The most robust finding of this study then is the difference in the degree of comprehension of the two different genres. Our results show for the first time that the similarities of classifier constructions and constructed action between sign languages that have been extensively described in the literature are not only underlying similarities of linguistic structure but contribute to the actual understanding of foreign signing (at least in the case of related sign languages).

This effect is evident not only in comprehension levels but also from the comments from participants during testing, both in their reflection on how they understood what was signed and also in the amount of information they utilized from these structures. For example, Fable 2 tells the story of two friends who are attacked by a bear. The VGT sign used in the video is different from the sign used in LSFB, both in the manual aspects and the mouthing. However, several signers explained that they deduced that it was a bear because they understood from the characteristics of constructed action and classifier handshapes used to describe the creature that it was a large predatory animal walking upright.

Nevertheless, one caveat is necessary when interpreting the differences between the two genres. As it can be seen in Table 2, the frequency of iconic structures (classifier constructions and constructed action) is not the only difference between the two genres. Informative signing appears to be faster, the Informative 2 video being twice as fast in terms of number of units per second as Fable 1 (as already discussed in Section 2.1.). There also seems to be more repetition in the narratives than in informative signing. While these differences are important, and probably also contribute to better understanding of the narratives, we believe that these factors do not eclipse the effect of iconic structures. This conclusion is based on our experiences during testing: although signers sometimes commented on the relatively higher speed of the informative videos compared

to narratives, they did not claim that this seriously hindered their understanding. We also allowed participants to view videos repeatedly and while it is true that they asked for more repetitions in the case of informative videos, they were able to perceive and repeat most of the signs.

4.2 Lexical similarity and mouthing

The overall level of understanding of VGT in both groups was above 60%. Although due to the different methodologies it is difficult to compare our results to those of Jordan and Battison (1976) or Faurot et al. (2000), the comprehension levels found in those studies were considerably lower (34% and 14%). This is not surprising, since the languages in our investigation are closely related.

However, in the light of the lower lexical similarity between VGT and NGT than between VGT and LSFB, it is surprising that we do not find larger differences between the two groups of signers. We suggest that this points to the contribution of mouthings to intelligibility: NGT signers may not be able to rely on lexical similarity in manuals to the same extent as LSFB signers, but they can compensate for this disadvantage by using information from the mouthings. Thus although ultimate understanding is similar in the two groups, it is arrived at by different means. If this is the case, we would expect any difference between the two groups to be larger in the without mouthing condition, where LSFB signers have the advantage of a larger number of similar signs, but it should even out once information from the mouthings is available. Indeed this is the pattern we see for each video, with the effect being most pronounced for Informative 2, where the difference between the comprehension scores of the two groups is 12% in the without mouthing condition but only 5% in the with mouthing condition. This also indicates that the increase in comprehension – at least for NGT signers – is not due to repeated presentation only, since both groups should benefit equally from repetition and thus group differences should more or less stay constant if nothing else contributes to the gain in comprehension.

Regarding the differences observed in the comprehension of the two informative videos, particularly the differing levels of performance gain after the mouthing condition, we believe we might be able to explain these unexpected results by the actual lexical items appearing in the two videos. Understanding the first informative video depends largely on the comprehension of a "key" sign, CHOCO-LATE. Without understanding this sign, signers had little chance of correctly translating sentences, especially given that this sign appears at least once in each of the seven segments of the video. Furthermore, even if they correctly understood everything else in the video, they would not be awarded full scores based

on our scoring criteria. In comparison, the second informative video is longer and does not have a similar key sign.

There seem to be some important differences in the two videos then, but to explain the unexpected pattern shown in the results we also have to examine the properties of the sign CHOCOLATE. The sign used in the video is different from the signs used in both LSFB and NGT (although there is some similarity with one variant of the LSFB sign, which was commented on by some participants), but the spoken word articulated with it is a cognate in French and Dutch and its pronunciation is similar in the two languages. So even though articulations of Dutch words usually do not help LSFB signers to understand the meaning of a sign, in the case of this sign they also could benefit from the mouthing in the second condition. Because of the centrality of this sign to the understanding of the video, the use of this "mouth cognate" and the lack of manual overlap between LSFB and VGT might have had an effect on the overall results, regardless of the much larger numbers of manual overlap between LSFB and VGT than between NGT and VGT in each of the narratives.

When designing the study we assumed that Dutch mouthings would be used by NGT signers, and possibly some LSFB signers who know some Dutch words, but we did not consider the possible effect of similarly articulated words in French and Dutch. However, this discovery that "mouth cognates", signs that do not share manual features but are accompanied by similar articulations, appear to have facilitated comprehension in Informative 1 supports our claim that mouthings are an additional source of mutual intelligibility between sign languages.

4.3 Limitations

Our study has several important limitations, leading to recommendations for further studies. First of all, the samples are small and rather heterogeneous. Concerning the test materials, we found that certain characteristics of some videos might have had an effect on the results, as described above. Furthermore, due to the nature of the task it is not easy to tease apart the different factors that contribute to understanding – besides iconic structures and mouthings, the aspects we were interested in, also reliance on context and repeated viewings contribute to ultimate understanding.

Further studies are needed to explore the effect of different types of cognates on comprehension performance: manual and mouth cognates as well as false friends (signs with similar form but different meaning). It would be worthwhile, for example, to test whether signers recognize cognates out of context and compare this to the understanding of the same cognates in context. Some LSFB par-

ticipants reflected on recognizing mouth cognates (such as the above-mentioned CHOCOLATE or CALORIE), saying that while they made use of the mouthing, the context also helped them, especially when they had difficulty in interpreting reduced mouthings.

An issue we have not addressed in this study is the question of regional variants. As we have described above, all three sign languages included in this study show considerable regional variation. Therefore, it will be important to investigate whether there are differences between signers from different regions in their degree of comprehension, as well as whether certain variants of VGT are easier to understand than others. So for example, we would expect higher intelligibility between variants in neighboring regions, such as the VGT variant of Flemish-Brabant for LSFB signers from the Berchem-Woluwe region, as well as the VGT variants used in Limburg for signers of NGT.

4.4 Implications and perspectives

The research presented here only begins to explore some aspects of mutual intelligibility among sign languages. While they have to be confirmed by subsequent studies, our results may have some important implications and suggest new directions for sign language research in general and the study of the sign languages of Belgium in particular.

The contribution of similar iconic structures, as well as iconic motivation in signs, to the mutual intelligibility of foreign sign languages may pave the way to a better understanding of the processes that make communication through international sign possible. This communication system involves mutual adaptation on the part of interlocutors. However, this adaptation builds on properties of their own sign languages, capitalizing on its iconic structures and features (iconic motivation in signs). Investigating how these contribute to the understanding of signing that involves no adaptation to the partner would reveal what signers can build on to communicate across language boundaries. A first step towards exploring this adaptation process could be looking at how signers of the three sign languages in our study would accommodate each other during communication. Furthermore, studies exploring the mutual intelligibility of iconic structures across unrelated sign languages that show more differences in their classifier systems could add a new dimension to research on crosslinguistic variation in classifier constructions.

As we have mentioned in the introduction (Section 1.2.) there is not sufficient linguistic evidence as to whether LSFB and VGT can be considered different languages. Our study is far from being sufficiently comprehensive to provide any

sort of answer to this question. However, it does provide some evidence that they are almost as different – in terms of mutual intelligibility – as VGT and NGT. This result should of course be confirmed by further research, but we suggest that similar investigations could inform the discussion about the status of these languages.

Another area of sign linguistics that may profit from our results and further studies on the subject is research on mouthings in sign languages. Our results suggest that just like similarity in manual components, similarity in mouthings also contributes to understanding foreign signing. Further research into the role of mouthings in comprehension may inform the debate about the status of mouthings in sign language.

As we have mentioned above, future investigations should analyze the role of different types of cognates, as well as the degree of intelligibility between various regional variants in the two countries in our study. It seems likely that geographically closer variants would show a higher degree of mutual intelligibility. Gooskens (2005) has shown that travelling times from 1900 (before the creation of the modern road system) between different regions of Norway still has an effect on the dialects spoken in those areas and that more easily accessible areas show greater linguistic similarities. This phenomenon could be even more pronounced in the case of sign languages, since until very recently deaf people had little access to communication over distances using sign language or be exposed to other variants of the language in mass media (for example television broadcasts).

Thus, we hypothesize a geographical dialect continuum among regional variants within Belgium, but also across three countries, extending from France through Belgium to the Netherlands, comprising four sign languages: LSF, LSFB, VGT, and NGT. Further research is needed to investigate similarities and mutual intelligibility across these sign languages.

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