Research Article

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Argument Structure of Classifier Predicates: Canonical and Non-canonical Mappings in Four Sign Languages

Abstract: We analyze argument structure of whole-entity and handling classifier predicates in four sign languages (Russian Sign Language, Sign Language of the Netherlands, German Sign Language, and Kata Kolok) using parallel datasets (retellings of the Canary Row cartoons). We find that all four languages display a systematic, or canonical, mapping between classifier type and argument structure, as previously established for several sign languages: whole-entity classifier predicates are mostly used intransitively, while handling classifier predicates are used transitively. However, our data sets also reveal several non-canonical mappings which we address in turn. First, it appears that whole-entity classifier predicates can be used unergatively, rather than unaccusatively, contrary to expectations. Second, our data contain some transitive uses of whole-entity classifier predicates. Finally, we find that handling classifier predicates can express various complex event structures. We discuss what these findings imply for existing theories of classifier predicates in sign languages.

Keywords: Argument structure; Event structure; Classifier predicates; Handling classifiers; Whole-entity classifiers

1 Introduction

Language is all about predication: all languages use predicates to relate entities (also referred to as arguments) to events and/or properties. Predicates can therefore be said to have an argument structure: the number and types of arguments they require and how these are licensed in syntax.

Argument structure is a relevant area of inquiry for sign languages, i.e. visuo-spatial languages, just as it is for spoken languages – which is not surprising given that sign languages have been shown to display complex grammatical structures on a par with spoken languages. Studies have demonstrated, for instance, that different verb classes must be distinguished and that argument structure alternations occur in both spoken and signed languages (Kegl 1990; De Lint 2018; Kimmelman 2018). Approaching the study of argument structure from the perspective of sign languages, one is quickly confronted with the case of classifier predicates. Classifier predicates are ubiquitous in sign languages, yet their nature is the subject of ongoing debate (see, for instance, Zwitserlood 2003 vs. Schembri 2003). In classifier predicates, sub-lexical

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building blocks of signs – handshape, orientation, location, and movement of a sign – take on a morphemic function through iconic mappings of form onto meaning (Supalla 1986; Emmorey 2003; Zwitserlood 2012). Of interest here is that classifier handshapes have been analyzed as morphemes that determine argument structure (Benedicto & Brentari 2004).

Consider the examples in (1), shown in Figure 1, from Russian Sign Language (RSL).[1] The two examples were signed right after each other. In (1a), the opening of the window is first described with an unaccusative predicate containing a whole-entity classifier:[2] the B-handshape is used to represent the window itself, and the movement of the hand depicts the movement of the window opening. Then, in (1b), with a transitive predicate containing a handling classifier, the S-handshape on both hands is used to represent the hands of the Agent holding the window, and the movement again depicts the opening of the window.

(1)   a.   WINDOW CL_{WE}(B)-OPEN   [RSL, s40:e5]
               'A window opened.'

        b.   GRANNY WINDOW CL_{HL}(SS)-OPEN   [RSL, s40:e5]
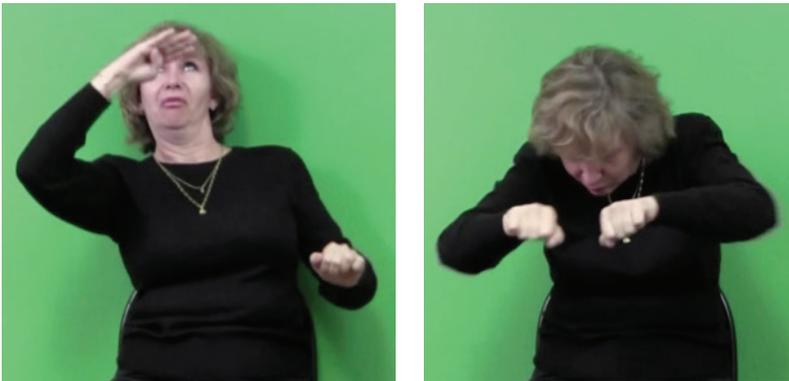   'A granny opened the window.'

Figure 1. RSL predicates CL_{WE}(B)-OPEN (last frame) and CL_{HL}(SS)-OPEN from example (1).

In their influential paper, Benedicto & Brentari (2004) argue that classifier handshapes are instantiations of two functional heads, f1 and f2, whose specifiers host the external and internal argument, respectively. Benedicto & Brentari show that American Sign Language (ASL) has minimal pairs of classifier predicates, in which a change in handshape results in a change in argument structure (similar to what happens in (1)). They distinguish at least three types of classifier handshapes, each displaying properties of a distinct syntactic structure: body-part classifiers exhibit the behavior of unergatives (one, external argument), whole-entity classifiers exhibit the behavior of unaccusatives (one, internal argument), and handling classifiers exhibit the behavior of transitives (one external argument, one internal argument). A simplified version of Benedicto & Brentari's (2004) syntactic analysis, applied to the RSL examples in (1), is depicted in Figure 2.

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1 See Appendix 1 for the glossing conventions and illustrations of the classifier handshapes.

2 From here on, we will use the term "classifier" to refer to the handshape in a classifier predicate, since it is these handshapes that are commonly equated to classifiers in the literature (Emmorey 2003; Sandler & Lillo-Martin 2006; Zwitserlood 2012).
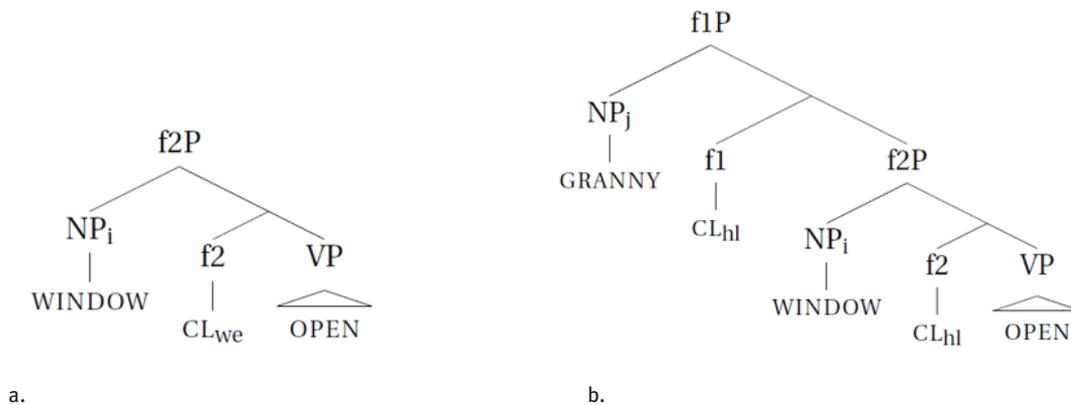
Figure 2. Simplified syntactic structures for classifier predicates in (1a,b) based on the approach proposed in Benedicto & Brentari (2004); (a) unaccusative predicate, (b) transitive predicate.

Though authors may differ with regard to specific analyses, data from ASL and several other sign languages indicate that there is a relation between classifier type and argument structure (Grose et al. (2007), Mathur & Rathmann (2007), and De Lint (2010) for ASL; Ferrara (2012) for Australian Sign Language; Glück & Pfau (1998) for German Sign Language (DGS); Pavlič (2016) for Slovenian Sign Language (SZJ); Zwitserlood (2003) and De Lint (2018) for Sign Language of The Netherlands (NGT); Kimmelman et al. (2019) for RSL).

In this paper, we limit ourselves to whole-entity and handling classifiers and will leave body-part classifiers out of the discussion. The reason to exclude body-part classifiers is two-fold. First, it appears from the few existing studies that body-part classifier predicates, unlike the other two types, do not have a stable argument structure cross-linguistically. Even for ASL, Grose et al. (2007) argued for a different analysis than Benedicto & Brentari (2004); Kimmelman et al. (2019) show that in RSL these predicates are different from ASL. Second, and probably related to the first reason, most research on argument structure in classifier predicates focused on the whole-entity and handling classifier only. Typological research on body-part classifier predicates in sign languages can clearly yield important results, so we hope that future research on this topic will be conducted.

We will compare four unrelated sign languages on the basis of naturalistic data. The languages in focus are RSL, DGS, NGT and Kata Kolok (KK). While the first three are European, urban sign languages, the last one is an Asian village sign language (see next section for a definition). More details about the languages and the methodology can be found in section 2. In section 3, we describe the results, which confirm the general pattern, but show some unexpected tendencies, too. These will be discussed in section 4. Section 5 concludes the paper.

2 Methodology

We analyzed argument structure of classifier predicates in four sign languages: RSL, DGS, NGT, and KK, using parallel datasets. We annotated and analyzed retellings of the Canary Row cartoons (Freleng 1950) in all four languages.

The Canary Row cartoons have been used in much research on sign language and gesture (e.g. Casey & Emmorey 2009; Brentari & Coppola 2013). The cartoons consist of eight episodes. In each episode, a cat named Sylvester unsuccessfully tries to catch and eat a canary bird named Tweety, who is owned by an old woman, the granny. The episodes thus involve many cases of motion of different types: the protagonists move in both controlled and uncontrolled manners; they also manipulate and move various objects (a bowling ball, an umbrella, a cage, etc.). Such motion events are commonly expressed by classifier predicates in sign languages, which makes these cartoons very well suited to elicit such predicates.

In the next section, we provide basic information about the four sign languages we included and describe the data sets analyzed per language. In section 2.2, we describe the annotation and analysis procedures.

2.1 Languages and datasets

We analyze data from four sign languages. Two of these languages (RSL and NGT) might be historically related, while the other pairs of languages are certainly not. Furthermore, three of the languages are European urban sign languages while KK is an Asian village sign language. This means that while the sample of four languages is by no means sufficient for a comprehensive typological study, some geographical and sociolinguistic variation is present in our sample.

RSL is a sign language used in Russia by at least 120,000 people (according to the 2010 census: http://www.rg.ru/2011/12/16/stat.html). It emerged at the beginning of the 19th century when the first school for the deaf was established. RSL has been claimed to be historically related to French Sign Language, although not all researchers agree with this position (Bickford 2005). Socio-linguistically, RSL is clearly a Western urban sign language (Zeshan 2008), as it is used on a large territory by a large signing community, and its transmission depends on national educational programs for deaf children.

An on-line corpus of RSL has recently become available: http://rsl.nstu.ru/ (Burkova 2015). The corpus contains over 200 video recordings produced by 43 signers, mainly from Moscow and Novosibirsk. It includes various datatypes, one of which is the retellings of the Canary Row cartoons by 12 signers from Moscow. Each of the signers retold 4 out of 8 episodes, which means that we analyzed 6 retellings of the full series of cartoons.

DGS is a sign language used in Germany. The number of signers cannot be stated reliably, as assessments vary from 80,000 to almost 400,000 (https://www.ethnologue.com/language/gsg). The sign language emerged at the end of the 18th century with the introduction of deaf education. Unlike RSL, DGS is not thought to be historically related to French Sign Language. Similar to RSL, however, DGS is a Western urban sign language.

A large DGS corpus is currently being created (Hanke et al. 2010). The currently publicly available sub-corpus (http://ling.meine-dgs.de/, accessed in March 2019) contains retellings of the Canary Row cartoon by three signers.

NGT is a sign language used in the Netherlands. According to the estimation of Wheatley and Pabsch (2012), it is the first or preferred language of approximately 7,500 people. It emerged at the end of the 18th century when the first school for deaf children was established in Groningen (Rietveld-van Wingerden 2003). It is sometimes claimed that NGT, too, is related to French Sign Language.[3] Socio-linguistically, it is a Western urban sign language, similar to RSL and DGS, although the number of signers is considerably smaller.

Corpus NGT is a large corpus containing data from 92 signers from different regions (Crasborn, Zwitserlood & Ros 2008). Among other data types, it includes retellings of Canary Row cartoons by all signers. For the current paper, we selected 10 signers from the Amsterdam region, who took turns in retelling the episodes, which amounts to 5 complete sets of retellings of the cartoons.

KK is a sign language used in the Bengkala village in Bali (De Vos 2012). Genetic and genealogical details indicate that the language emerged up to six generations ago, in response to a sudden rise in the incidence of hereditary deafness (Winata et al. 1995; Hinnant 2000; Lutzenberger p.c.). KK is also different in other socio-linguistic characteristics. Most importantly, it is shared by deaf and hearing people in the community, that is, a considerable number of hearing villagers are proficient in the sign language, and the proportion of deaf signers is actually very small (approximately 4% of the overall signing community).

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3 The influence of French Sign Language, if at all present, should be the most prominent for the Groningen variant of NGT, as the Deaf school in Groningen had connections with France. In this paper, we analyze recordings of signers who use the Amsterdam variant of NGT.

According to Marsaja (2008), at the time of his investigation, 475 out of 1156 (41%) people in the village were fluent signers, most of them (96%) hearing. Moreover, KK is used in a small territory.

The KK corpus contains data collected by De Vos in 2006–2008 (De Vos 2012, 2016). Among other data types, it contains retellings of the Canary Row cartoons. For this study, we selected retellings by 4 deaf signers, each of whom retold all 8 episodes.

Note that in all datasets, the task that the signers were participating in was the same: they were asked to watch cartoons one by one and retell them to another signer. In all cases, the addressee did not have a specific task. The sociolinguistic information about the signers is provided in Appendix 2.

An overview of the data we analyzed (the number of signers and the number of full retellings of the series of cartoons) is provided in Table 1. Note that we do not attempt a direct quantitative comparison between the languages; instead, we focus on describing the possible patterns of argument structure in classifier predicates in all of them.

Table 1: Signers and episodes per sign language

Language	# of signers	# of full retellings
RSL	13	6
NGT	10	5
DGS	3	3
KK	4	4

2.2 Annotation and analysis

We annotated all instances of classifier predicates that we found in the four datasets. For each instance of whole-entity and handling classifier predicate found, we annotated its type (whole-entity vs. handling), and its argument structure (unaccusative vs. unergative vs. transitive).[4]

It is worth noting that our annotation is based on morphology (which classifier handshape is used), overt syntax (which arguments are overtly mentioned in the clause), and in most cases crucially, on the semantics of the described situation. A more traditional approach would have been to describe argument structure based on overt arguments alone (see, however, Perniss (2007) on the crucial role of semantics in determining transitivity in classifier predicates). However, many sign languages, including the ones under investigation in this paper, allow argument omission, and classifier predicates specifically are known to allow argument omission cross-linguistically (Glück & Pfau 1998; Zwitserlood 2003). Therefore, in coherent narratives, we do not expect to find classifier predicates with overt arguments if the referents have been previously mentioned and are known to participants.

Note that we do not want to argue that notions related to argument structure, such as the distinction between unaccusative and unergative predicates, should be reduced to semantics. Instead, our position is that these notions are syntactic with strong semantic correlates. Given the nature of our data, we use the semantic correlates as a tool to investigate syntactic structure. This approach allows us to offer a first approximation of the phenomenon.

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4 Note that classifier predicates being verbs of movement are also associated with such thematic roles as Location, Source, and Goal, which all might be expressed by noun phrases as well, and influence the trajectory of the movement. Some researchers analyze these as arguments (Zwitserlood 2003), which means that even a whole-entity classifier predicate can have up to three arguments (Theme, Source, and Goal). We are agnostic with respect to the argument vs. adjunct status of such potential arguments; we do not further analyze them in this paper. This means that if, for instance, we categorize a certain predicate as intransitive, we claim that it is intransitive once we disregard the potential spatial arguments.

The procedure is as follows: for each use of a classifier predicate, we first look at the surface syntactic form to identify how many arguments are expressed. If more than one argument is overtly expressed, the predicate can only be considered transitive. Morphology also plays a role: the classifier handshape always represents the Theme argument (the entity that moves)[5], so we assume that at least the Theme argument is a part of the argument structure of the predicate, whether overt or not. For handling classifiers, the handshape does not only represent the Theme argument, but also the hand of the Agent, so we additionally assume that the use of this handshape implies that the Agent is present in the semantics of the predicate.

In most cases, the predicate occurs with no argument at all or a single argument only. In order to interpret such utterances, we take into account the semantic characteristics of the situation being described. We pay attention to the participants present in the situation whose movement is described, and their thematic roles: Agent vs. Theme, based on the characteristics of the motion (controlled by the moving object vs. controlled by another participant vs. uncontrolled). We are able to characterize the situations semantically because we have access to the stimuli (the cartoons) which were used to elicit the data. While we cannot be sure that the signers encode the semantics of situations from the stimuli perfectly in their language use, we consider this a good enough way of establishing the semantics of classifier predicates. This procedure has its limitations, which we address throughout sections 3 and 4.

We annotate an instance of a classifier predicate as unaccusative if there is at most one overt argument in the clause, and this argument (whether overt or not) is a Theme of the described situation, that is, it moves and it does not exercise control on the movement.[6] Examples of such situations in the Canary Row cartoons include Sylvester falling out of a window, a bowling ball rolling down a drain, and an anvil falling down. For instance, example (2), shown in Figure 3, depicts a situation in which Sylvester, the cat, falls down. Here Sylvester does not control the movement, and can be characterized as Theme.

(2)   CL$_{WE}$(H)-FALL   [DGS, koe07_CR1]
           'It (the cat) fell down.'

Figure 3. The sign CL$_{WE}$(H)-FALL in DGS from example (2). The passive (left) hand is disregarded.

We annotate an instance of a classifier predicate as unergative if the clause has at most one overt argument, and this argument refers to the participant who moves and controls the movement. Examples of such situations in the Canary Row cartoon include Sylvester walking around, walking up and down the stairs, Tweety running away, and a man (a hotel employee) walking in. For instance, in example (3), shown in Figure 4, a man walks in, so he is in control of his movement.

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5 The hand can also represent an Instrument, see below.

6 Note that, as stated above, we also use a morphological criterion in identifying unaccusative predicates: we never annotate handling classifier predicates as such. With a handling classifier predicate, the handshape does not only represent the shape of the Theme, but also the fact that the object is being handled, so it necessarily implies the presence of an Agent.

(3)   MAN CL_{WE}(1)-COME   [RSL, s44:e5]
        'A man walks in.'

Figure 4: The sign CL_{WE}(1)-COME in RSL from example (3). The passive (left) hand is disregarded.

We annotate an instance of a classifier predicate as transitive if the event semantically involves two participants: the Agent controlling the movement and the Theme that is being moved. Examples of such situations in the Canary Row cartoon include Sylvester carrying a plank, a cage, or a telescope, and others. For instance, in (4), the granny opens the window (that is, she causes the window to move in a particular way so that it ends up open); the signer depicts this event as shown in Figure 5. Note, however, that we found out that it is not always the case that the two participants of an event referred to by a handling classifier can be characterized as Agent and Theme; see section 3.4 for discussion.

(4)   GRANNY WINDOW CL_{HL}(SS)-OPEN   [RSL, s50:e5]
        'The granny opened the window.'

Figure 5: The sign CL_{HL}(SS)-OPEN in RSL from example (4).

Finally, we also annotated as transitive classifier predicates used as instrumental predicates (see De Lint (2018) for an analysis). For instance, predicates describing the granny hitting Sylvester with an umbrella were annotated as transitive.

As mentioned above, all arguments of the three types of classifier predicates can be covert. Importantly, in all four sign languages, we also find examples of all these types of predicates with overt arguments, as in the RSL examples (2) to (4) above.

The fact that we annotated every instance of whole-entity and handling classifier predicates in the datasets, further allowed us to analyze the frequency of occurrence of the classifier types and their argument structures in the four languages. In our analysis, we also found several systematic exceptions to the generalization about the argument structure of classifier predicates. Both the overall distribution and these exceptions are discussed in the next two sections.

3 Results

The analysis of the data revealed that, similar to what previous research had indicated for other sign languages, NGT, DGS, RSL and KK mostly use whole-entity classifier predicates intransitively, and handling classifier predicates transitively (if we define transitivity as in section 2.2 above). We discuss these canonical mappings in detail in section 3.1. However, our results also show that some classifier predicates display non-canonical mappings. This holds of all four sign languages investigated in this study. Specifically, we found many instances of whole-entity classifier predicates used unergatively (see section 3.2), some instances of whole-entity classifier predicates used transitively (see section 3.3), and many instances of handling classifier predicates which did not involve an Agent deliberately moving a Theme by hand (see section 3.4).

For NGT and DGS, we basically replicated the results of previous research (e.g. Glück & Pfau 1999; Zwitserlood 2003), while the KK and RSL results are completely novel.

3.1 Confirmation of the general pattern

Our RSL dataset contains 536 instances of classifier predicates; 299 are whole-entity (56%) and 237 (44%) are handling classifier predicates (recall that we did not annotate body-part classifier predicates, which are also attested in all four languages).

If we look at the types of situations described with handling classifier predicates, all of them (100%) involve two entities: an Agent who manipulates an object and the manipulated object. No example can reasonably be analyzed as involving uncontrolled movement of an object, or an object not handled by hand by some other participant. Therefore, Benedicto & Brentari's (2004) prediction for this type of classifiers is strongly supported by the RSL data. However, in section 3.4, we discuss that the event semantics of many of the examples is not fully compatible with their analysis. In fact, out of 237 handling classifier predicates, 171 (72%) can be characterized as referring to regular handling (with an Agent moving a Theme by hand), while the rest (28%) have different semantics.

For whole-entity classifiers, the distribution is also quite clear. Out of 299 cases, there are only 10 examples (3%) where the situation involves an Agent and a Theme and the predicate can be analyzed as transitive. While this unexpected pattern is interesting (see section 3.3 for further discussion), it also has to be noted that the proportion of such examples is very small. Hence, once again we find strong support for the predictions of Benedicto & Brentari (2004). Benedicto & Brentari's theory also predicts that whole-entity classifier predicates are unaccusative. In our RSL data, however, 114 situations (39%) referred to by a whole-entity classifier describe controlled movement. Although this does not immediately disqualify such predicates from being unaccusative, it warrants some further discussion. We discuss this pattern in section 3.2.

The distribution of classifier types in RSL is summarized in Table 2.

Table 2: Argument structure of classifier predicates in Russian Sign Language

	intransitive		transitive		total
Handling	0		237 (100%)		237
			regular	**others**	
			171 (72%)	66 (38%)	
Whole-entity	289 (97%)		10 (3%)		
	unaccusative	unergative			
	175 (58%)	114 (39%)			299

Our KK dataset contains 300 classifier predicates, including 189 handling (63%) and 111 whole-entity (27%) classifier predicates.[7] This distribution is different from what we find in the RSL data, which might indicate that KK has a preference for using handling classifier predicates. However, recall that the KK dataset comes from only four signers, while the RSL dataset contains data from fourteen signers.[8]

Similar to RSL, handling classifier predicates in KK only occur in transitive contexts, again providing syntactic evidence for the analysis in Benedicto & Brentari (2004). However, as we discuss in section 3.4 below, the semantics of these classifier predicates is not always compatible with Benedicto & Brentari's analysis. Out of 189 handling classifier predicates, 157 (83%) can be characterized as referring to regular handling (with an Agent causing a Theme to move), while the rest have a different semantics.

As for whole-entity classifier predicates, they are almost always used in intransitive contexts, though we found 9 examples (8%) in which they are used in transitive contexts (see section 3.3). Furthermore, as in RSL, many contexts (41 out of 111, 40%) in which whole-entity classifier predicates are used can be characterized as unergative rather than unaccusative (using the definitions in section 2.2).

The distribution of classifier types in KK is summarized in Table 3.

Table 3: Argument structure of classifier predicates in Kata Kolok

	intransitive		transitive		total
Handling	0		189 (100%)		189
			regular	**others**	
			157 (83%)	32 (17%)	
Whole-entity	102 (92%)		9 (8%)		111
	unaccusative	unergative			
	61 (60%)	41 (40%)			

Our NGT data contains 306 classifier predicates, including 166 handling (54%) and 140 whole-entity (46%) classifier predicates. This distribution is thus very similar to what we find in the RSL data.

Similar to RSL and KK, handling classifier predicates in NGT only occur in transitive contexts. However, as we discuss in section 3.4 below, their semantics does not always correspond to regular handling. Out of 166 handling classifier predicates, 119 (72%) can be characterized as referring to regular handling (with an Agent causing a Theme to move), while the rest have a somewhat different semantics.

As for whole-entity classifier predicates, they are almost always used in intransitive contexts. However, there are 3 examples (1%) of such classifier predicates used in transitive contexts (see section 3.3). Furthermore, as in RSL, many contexts (69 out of 140, 49%) in which whole-entity classifier predicates are used can be characterized as unergative rather than unaccusative.

The distribution of classifier types in NGT is summarized in Table 4.

Our DGS data contains 250 classifier predicates, including 135 handling (54%) and 115 whole-entity (46%) classifier predicates. This distribution is very similar to what we find in the RSL and NGT data.

Handling classifier predicates in DGS only occur in transitive contexts. However, as we've already suggested previously and will further discuss in section 3.4 below, their semantics does not always imply regular handling. Out of 135 handling classifier predicates, 108 (80%) can be characterized as referring to regular handling (with an Agent causing a Theme to move), while the rest have a different semantics.

As for whole-entity classifier predicates, they are almost always used in intransitive contexts. However, there are 2 examples (1%) of such classifier predicates used in transitive contexts (see section 3.3).

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7 Vink (2017) also annotated and analyzed 66 cases of body-part classifier predicates in KK.

8 Interestingly, one of the four KK signers only used one whole-entity classifier in the whole dataset, while for the other signers, the numbers were 48 (42% of total), 25 (23%), and 37 (33%) (SD=20.6).

Table 4: Argument structure of classifier predicates in Sign Language of the Netherlands

	intransitive		transitive		total
Handling	0		166 (100%)		166
			regular	**others**	
			119 (72%)	47 (28%)	
Whole-entity	137 (99%)		3 (1%)		140
	unaccusative	**unergative**			
	69 (49%)	68 (49%)			

Furthermore, as in the other sign languages, many contexts (68 out of 115, 59%) in which whole-entity classifier predicates are used can be characterized as unergative rather than unaccusative.

The distribution of classifier types in DGS is summarized in Table 5.

Table 5: Argument structure of classifier predicates in German Sign Language

	intransitive		transitive		total
Handling	0		135 (100%)		135
			regular	**others**	
			108 (80%)	27 (20%)	
Whole-entity	113 (99%)		2 (1%)		115
	unaccusative	**unergative**			
	45 (40%)	68 (59%)			

To sum up, the general pattern found in all four languages is very clear: whole-entity classifier predicates are used in intransitive contexts (with a small number of exceptions), and handling classifier predicates are used in transitive contexts (with no exceptions).

This provides evidence in favor of Benedicto & Brentari's (2004) account, as well as other analyses (e.g. Zwitserlood 2003 for NGT) which propose a mapping between classifier type and argument structure of classifier predicates. However, closer inspection of the semantics of the situations suggests that Benedicto & Brentari's analysis cannot extend to all the relevant cases.

3.2 Unaccusative vs. unergative

As mentioned in the previous section, in both RSL ((3) repeated here as (5a)), and KK (5b), whole-entity classifier predicates are often used in unergative contexts to describe movement of a participant (e.g. the cat, the canary, the canary's owner), where the movement is clearly controlled by the participant him/herself. We also found such examples in both NGT (5c) and DGS (5d).

(5)   a.   MAN CL_{WE}(1)-COME   [RSL, s44:e5]
              'A man walks in.'
        b.   CAT CL_{WE}(B)-MOVE   [KK, Ng:e2]
              'The cat walks.'
        c. CL_{WE}(2b)-MOVE.DOWN[9]   [NGT, 209:s12:e1]
              '[The cat] goes down the stairs.'

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9 We consider this classifier to be whole-entity (rather than body-part) because the fingers do not move, and the movement of the hand describes the movement of the whole referent (the cat). See e.g. Ferrara (2012) for another example of the application of this criterion.

d. THEN CL_{WE}(1)-MOVE [DGS, ber09_CR6]
'Then [the cat] goes away (to fetch the plank).'

This pattern can be characterized as exceptional once we take into account the semantics of the situation being described: it involves movement controlled by the participant in motion. However, with respect to this pattern, the limitation of our method is very clear: while we know that the situation in the cartoons involves controlled motion, we cannot say with certainty whether signers encode this fact in their productions.

Thus, an unaccusative predicate is often semantically compatible with a situation involving causation. For instance, describing a situation in which a cat caused a glass to fall, an English speaker might choose to use an unaccusative predicate and utter "The glass fell" (omitting any mention of the Agent). Similarly, describing a situation in which a boy moves deliberately (e.g. walks towards the window), an English speaker can utter "A boy moved towards the window" without being specific about whether the motion was controlled.

An unaccusative predicate refers to motion of a Theme. It is used to assert that some motion of the object happened, without necessarily asserting that the object was not controlling this movement. To prove that whole-entity classifier predicates like the ones in (5) are indeed unergative, we would need to apply some other tests. For example, we could follow Benedicto & Brentari's (2004) example and test whether such predicates are compatible with agent-oriented adverbs like *deliberately*. Since our data sets do not include clear cases of agent-oriented adverbs, we cannot be sure that these predicates are in fact unergative.

Yet, even if such classifier predicates are in fact unaccusative, the observed pattern is still noteworthy. While all four sign languages have body-part classifier predicates which – according to the predictions of Benedicto & Brentari (2004) – are unergative, some signers do use whole-entity classifier predicates in contexts which would reasonably trigger an unergative predicate.

3.3 Transitive use of whole-entity classifiers

In all four sign languages, we find whole-entity classifier predicates used in transitive situations. These situations involve an Agent moving a Theme by hand, such as Sylvester putting down a plank, Sylvester offering a banana to a monkey, Sylvester opening a door, and the granny hitting Sylvester with an umbrella.

Consider example (6) from RSL. The sentence contains an Agent, GRANNY, and a Theme, WINDOW (modified by a relative clause IX_A DOOR IX_B WINDOW 'the window which was on the top of the door'), but the classifier predicate contains a whole-entity handshape, a B-handshape referring to the window.

(6) IX_A GRANNY, IX_A DOOR IX_B WINDOW, WINDOW CL_{WE}(B)-OPEN [RSL, s47:e4]
'The granny opened the window which was on the top of the door.'

In all four sign languages, signers use a whole-entity classifier predicate to describe the situation of Sylvester putting a plank on a box to make a catapult (7). For instance, in the RSL example (7a), the signer first describes Sylvester bringing a plank (using a non-classifier predicate) and then putting it on the box, this time with a whole-entity classifier predicate. Example (7b) from KK is almost identical; this example is illustrated in Figure 6. Note that the handshape chosen differs between sign languages, but both handshapes refer to the Theme entity, the plank.

(7) a. CARRY PLANK CL_{WE}(H)-PUT [RSL, s43:e6]
'[Sylvester] brings a plank and puts it [on the box].'
b. CARRY CL_{WE}(H)-PUT [KK, Sd:e6]
'[Sylvester] brings a plank and puts it [on the box].'
c. CL_{WE}(B)-PUT [NGT, 1837:s76:e6]
'[Sylvester] puts [the plank on the box].'

d.   CL_{WE}(H)-PUT   [DGS, ber09_CR6]
            '[Sylvester] puts [the plank on the box].'

Figure 6. CL_{WE}(H)-PUT in KK from example (7b). The weak hand (the right hand in this case) is disregarded in the glosses.

KK seems to be more prone to use whole-entity classifier predicates in transitive contexts: it also uses this type of predicate in the context of Sylvester offering a banana (8), shown in Figure 7, and the granny hitting Sylvester with an umbrella (9), Figure 8. Importantly, in both contexts, a handling classifier predicate can be used in KK as well. In contrast, the other three sign languages only use handling classifier predicates in these contexts.

(8)   BANANA CL_{WE}(1)-OFFER   [KK, Pu:e5]
            '[Sylvester] offers a banana [to the monkey].'
(9)   CL_{WE}(1)-HIT   [KK, Ng:e5]
            '[The granny] hits [Sylvester with an umbrella].'

Figure 7. CL_{WE}(1)-OFFER in KK from example (8).

Figure 8. CL$_{\text{WE}}$(1)-ʜɪᴛ in KK from example (9); index finger extended in both snapshots.

These examples thus show that a transitive use of whole-entity classifier predicates is indeed possible.

3.4 Event structure of handling classifier predicates

In previous research, handling classifier predicates are usually described as having the following meaning: an Agent moves a Theme (=causes a Theme to move) by hand (=by holding it and moving the hand). This is also the meaning that can be derived from the structure proposed for such classifier predicates by Benedicto & Brentari (2004). We refer to this meaning as *regular handling*. As discussed above, all four sign languages commonly use handling classifier predicates to express this meaning, for example, to describe Tweety lifting a bowling ball, Sylvester lifting and lowering a box or offering a banana, or the grandmother waving an umbrella. This classifier-meaning mapping has been illustrated for RSL by example (4), Figure 4. However, in addition, we found that in all four sign languages, handling classifier predicates can also be used to express three other meanings.[10]

The first meaning that is often expressed by handling classifier predicates is what we call *moving because holding*. This concerns scenarios in which someone holds on to a moving object, and therefore this person also moves. This is illustrated by the KK example (10), shown in Figure 9.[11] Note how this meaning is different from regular handling: in the case of *regular handling*, the movement of the Theme is caused by the Agent (the Agent holds the Theme and moves the hand), while in the case of *moving because holding*, the Agent moves, but his/her movement is actually caused by the movement of the object that s/he holds on to.[12] This use of handling classifier predicates is observed when signers describe Sylvester swinging on a rope, or Tweety swinging on a swing.

> (10)   CL$_{\text{HL}}$(ss)-ꜱᴡɪɴɢ   [KK, Si:e7]
>   '[Sylvester] swings on the rope.' (Sylvester does not move the rope, he swings and moves because the rope moves)

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10 Perniss & Özyürek (2008) and Perniss (2012) report similar patterns in gestures of hearing people.

11 In this section, we do not provide examples of every meaning in every language, as the languages behave identically, and the relevant predicates even contain the same handshapes in all four languages.

12 In this particular case, it is unclear whether the meaning is exactly as we describe it, namely that Sylvester moves because the rope moves. One could argue that they both move because of gravity. Importantly, however, no matter how one interprets this situation, it does not involve regular handling, as Sylvester is not moving the rope by hand. For RSL, Kimmelman et al. (2019) have elicited handling classifier predicates in descriptions of stimuli which were unambiguously *moving because holding* events.

Figure 9. CL_{HL}(SS)-SWING in KK from example (10).

The second meaning, which we call *moving while holding*, concerns scenarios where the Agent does not deliberately move the Theme by hand; instead the Agent moves (e.g. walks) while holding the Theme, and so the Theme also moves. This is illustrated by the NGT example (11), illustrated in Figure 10. Note that here the Agent does (indirectly) cause the Theme to move, as with *regular handling*; the difference with *regular handling* is that in the *moving while holding* case, the Agent moves as a whole, not just the Agent's hand. Signers produce this type of handling classifier predicates when describing Sylvester carrying something, or Sylvester falling through the air while holding Tweety in his paw.

(11)   CL_{HL}(SS)-CARRY   [NGT, 010:S10:e5]
          '[Sylvester] carries [the cage and the suitcase].' (Sylvester walks and carries the cage and the suitcase, he does not move them by moving the hands)

Figure 10. CL_{HL}(SS)-CARRY in NGT from example (11).

Finally, in the third scenario, which we call *no movement*, no movement of the hand is present in the classifier predicate, and the meaning expressed is an Agent holding a Theme (without moving it). This is illustrated by the RSL example (12), Figure 11. Note that this scenario is simpler than the other three: in fact, all three scenarios above include the meaning expressed by the classifier predicate in the *no movement* case (the fact that the Agent holds the Theme), but predicates used in the three previous scenarios also involve movement, which can be interpreted in different ways. The use of handling classifier predicates for *no movement* scenarios occurs when signers describe Sylvester holding a rope or a telescope, or the granny holding an umbrella.

(12)   IX-A GRANNY CAGE CL_{HL}(SS)-HOLD   [RSL, s55:e5]
          'The granny in the cage holds [an umbrella].'

Figure 11. CL~HL~(ss)-HOLD in RSL from example (12). The hands do not move.

The cases discussed in the two previous sections are based on semantic interpretation and thus need verification through syntactic tests. However, the four types of interpretations of the handling classifier predicates discussed in this section are clearly problematic for Benedicto & Brentari's (2004) analysis if we accept the idea that event structure and argument structure are intrinsically connected (Levin & Rappaport-Hovav 2005). On the one hand, all these uses of handling classifier predicates are transitive and therefore, conform to the generalizations with regard to valency. On the other hand, their meanings, or, more specifically, their event structures, are more complex than Benedicto & Brentari's (2004) analysis would predict. We discuss this issue further in the next section.

4 Discussion

The results of our study confirm the canonical mappings between whole-entity classifiers and handling classifiers and intransitive and transitive predicates, respectively. This adds RSL and KK to the list of sign languages studied for this purpose. Moreover, our study provides corpus-based evidence for this phenomenon in NGT and DGS. As for the unexpected sub-patterns we found, several remarks can be made. We will elaborate on each sub-pattern in turn in sections 4.1–4.3.

4.1 Unaccusatives or unergatives?

More research is needed to determine whether the structures in which whole-entity classifiers appear in descriptions of controlled movement are unaccusative or unergative. Clearly, this depends on the criteria one uses for distinguishing unaccusative and unergative predicates. In our annotations, we ground the distinction in semantics (following Perlmutter 1978; Van Valin 1990; Dowty 1991), but we acknowledge the fact that different languages may encode the same meaning differently. For instance, Rosen (1984) argued against the strong version of Perlmutter's Universal Alignment Hypothesis, which grounded unaccusativity in semantics, by showing that examples like *die* and *sweat* have opposite status as unergatives/unaccusatives in Choctaw and Italian.

For us, the presence of an Agent (that is, an entity exhibiting control and volition over the motion) was used as the criterion of unergativity. Although volition and control are well-known properties associated with Agents, they are neither sufficient (e.g. the subjects of the English unaccusatives *leave*, *depart* can have both volition and control over their actions) nor necessary (e.g. one can *laugh* or *sneeze* uncontrollably and without volition) criteria for the identification of unergative verbs.

The issue relates to whether one takes a projectionist or constructionalist approach to argument structure: while projectionists see argument structure as determined by the lexical semantics of the verb (Perlmutter 1978; Baker 1988; Levin & Rappaport Hovav 1995), constructionalists argue that the argument structure of a given verb is determined by the syntactic configuration in which it is merged (Borer 1994, 1998; Van Hout 1996; Sorace 2000). In a constructionalist perspective like Benedicto & Brentari's, where

the lexical semantics of a verb can give rise to both unergative and unaccusative alternates, syntactic diagnostics are desirable. Benedicto & Brentari indeed use syntactic tests (in addition to semantic criteria targeting Agents), but the specific tests might not transfer to our languages – and they clearly cannot be applied using corpus data alone.

A first step towards further analysis of the whole-entity classifiers in this case would be to develop language-specific unaccusativity diagnostics. In addition, we should keep in mind that the notion may not be binary, and (some of) our classifier predicates may turn out to fall in between (see, e.g., Levin & Rappaport (1995), Sorace (2000), and Acartürk (2005) for work on the gradience of the unergative/ unaccusative distinction). Clearly, more research on this issue is necessary.

4.2 Transitive use

The second problematic pattern we observed is the use of whole-entity classifiers in seemingly transitive structures. One way to reconcile our findings with the analysis by Benedicto & Brentari is to postulate that a whole-entity classifier predicate, involving one internal argument, can optionally combine with an externally merged agent to form a transitive. This, however, raises a problem of over-generation: what licenses the addition of an Agent? If an Agent can always be added to an otherwise unaccusative structure, we would predict transitive uses of verbs like *fall*, *exist* or *stink*. For classifier predicates, such an analysis would predict that any whole-entity classifier can be used transitively (which seems not to be the case, at least not for RSL, DGS, and NGT). Furthermore, it would predict that the same strategy could also apply to handling classifier predicates producing a meaning like "A man caused the woman to move the cup", which again is not attested.

An alternative explanation is that some of these classifier predicates are in fact lexical signs, or in the process of lexicalization. As is well-known, lexical signs may originate from classifier predicates (e.g. Johnston & Schembri 1999; Zeshan 2003). Unlike in classifier predicates, classifier-like handshapes in lexical signs clearly do not determine argument structure of the predicate, so the fact that a whole-entity classifier handshape is used would not clash with the verb's transitivity. Future research expanding on this topic is necessary to uncover any (ongoing) lexicalization.

4.3 Event structure of handling classifier predicates

The third challenge we want to discuss is not one of unexpected valency or thematic roles, but rather one of incompatible event structure. All four scenarios described for handling classifiers involve two entities (and could thus be expected to trigger transitive structures), of which one controls a holding event, and one undergoes motion; the entities involved could thus be expected to linguistically qualify as Agent and Theme, respectively. However, the causal relationship between the controller of holding and the undergoer of motion differs per scenario. The *regular handling* use of handling classifiers refers to scenarios in which an Agent acts directly and voluntarily upon a Theme, and the Theme moves. In the case of *moving while holding*, the Agent indirectly, and involuntarily, causes a Theme to move. The Agent does act voluntarily and directly upon the Theme, by grabbing/holding it, but the motion of the Theme is not caused by that action. In *moving because holding* uses of handling classifiers, the Agent voluntarily holds on to a Theme, but undergoes movement caused by movement of the Theme. In the *no movement* usage, Agents act upon Themes voluntarily, by grabbing/holding it, but cause no motion of the Theme.

If Benedicto & Brentari's (2004) syntactic structure for handling classifier predicates (recall Figure 1b) is translated into event-structural terms, we expect the following: an Agent causes a Theme to undergo motion. It is clear that such an event structure does not fully cover all the uses of these predicates in the four languages we investigated here.

To address this, Kimmelman et al. (2019) developed an alternative account of handling classifier predicates. Simplifying their proposal somewhat, they argue that handling classifier predicates in fact

involve two separate predicates: one describing the holding event and one describing the motion event. The syntactic structure they propose is depicted for the RSL example (13) in Figure 12. This syntactic structure translates directly into the following event structure: An Agent holds a Theme by hand, and simultaneously the Theme (or the hand) moves. The syntactic and the event structure are thus directly compatible with *regular handling*, *moving while holding*, and *moving because holding* scenarios, as the structure in Figure 12 does not specify any causality between the holding event and the motion event.

(13)   MAN STICK CL$_{HL}$(S)-MOVE   [RSL, constructed example]
                 'A man moves a stick.' OR 'A man moves holding a stick.' OR 'A man holds on to a moving stick.'
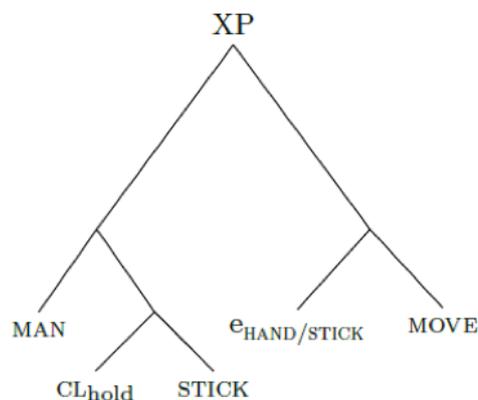

Figure 12. Syntactic structure for example (13) based on Kimmelman et al. (2019).

For the *no movement* scenario, only the left daughter of XP in Figure 12 applies, so the *no movement* scenario involves one event (the holding event), not two. We refer the interested reader to Kimmelman et al. (2019) for a detailed discussion. In the present context, this discussion makes clear that certain handling classifier predicates involve a complex event structure that needs to be accounted for.

5 Conclusions

In this paper, we present novel data on argument and event structure of whole-entity and handling classifier predicates in four sign languages: RSL, NGT, DGS, and KK. We use parallel datasets (involving retellings of a cartoon) to identify all instances of classifier predicates of these two types and annotate and analyze their argument structures.

Despite historical and socio-linguistic differences between these languages, we find very similar patterns in the domain of classifier predicates, which are in general agreement with previous findings for other sign languages. This suggests, among other things, that KK, despite being a village sign language, is similar to European urban sign languages in this respect. Village sign languages are often different from urban sign languages not only socially, but also grammatically (De Vos & Pfau 2015). However, our research shows that they need not necessarily be "exotic" in all respects.

In all four languages, we find canonical mappings between classifier type and argument structure. Whole-entity classifier predicates are mostly intransitive, while handling classifier predicates are always transitive. The former are mostly used to describe motion of a Theme, while the latter are used to describe an Agent causing a Theme to move. These mappings are in line with previous accounts of classifiers and their relation to argument structure in ASL (e.g. by Benedicto & Brentari 2004).

However, we also identify some non-canonical mappings. We find that whole-entity classifiers are often used to describe controlled motion (that is, motion of a participant who also controls this motion).

While these classifier predicates have previously been described as unaccusative, theoretically this event type is more compatible with unergative predicates. Note that this discrepancy can be explained both by our methodological constraints and by the definitions/analyses of the unaccusative/unergative distinction.

We also find transitive uses of whole-entity classifier predicates. Similar methodological constraints apply to these cases, so further research is needed to confirm this pattern. If confirmed, however, the transitive use of whole-entity classifier predicates presents a problem for existing formal accounts of this type of classifiers.

Finally, we find that, while handling classifiers are always transitive, they can express at least four different types of complex events: regular handling, holding while moving, holding because moving, and holding without movement. If we accept an intrinsic connection between argument and event structures, which has been established for spoken languages (Levin & Rappoport-Hovav 2005), this finding is problematic for Benedicto & Brentari's (2004) analysis of handling classifier predicates.

As discussed in detail in sections 2 and 4, our study has limitations, the most important one being that we only use corpus data. This means that we do not have negative evidence, and, given the small size of the dataset, we can never predict with certainty that some unattested pattern is really ungrammatical. Moreover, using corpus data means that we had to describe argument structure based mainly on semantic grounds. Further research using other data collection techniques is clearly necessary to confirm our findings.

Acknowledgments

Appendix 1: Glossing conventions

Signs are glossed in SMALL CAPS. IX stands for index (a pointing sign), which can be further specified by a subscript to refer to a specific location. Classifier predicates are glossed in the following way: CL, followed by the type in subscript (WE – whole-entity, HL – handling), followed by the handshape between brackets (1 – outstretched index finger, 2b – bent index and middle fingers, H – outstretched index and middle fingers, B – flat hand, S – fist; see Table A1 below for illustrations of these handshapes), followed by an approximate meaning of the movement. Each example from our dataset is accompanied by the acronym for the sign language (RSL, DGS, NGT, and KK, respectively), followed by a code referring to the signer and the number of the episode of the Canary Row cartoon (e.g.: RSL, s39:e1 stands for RSL, signer 39, episode 1). For the NGT data, the acronym is also followed by the name of the file in the Corpus NGT (e.g.: NGT, 209:s12:e1 stands for NGT, recording 209, signer 12, episode 1).

Table A1: Handshapes (and their labels) relevant in this study; note that in the actual productions, the positions of the fingers (e.g. degree of bending, position of the thumb) may be slightly different.

| 1 | 2b | H | B | S |
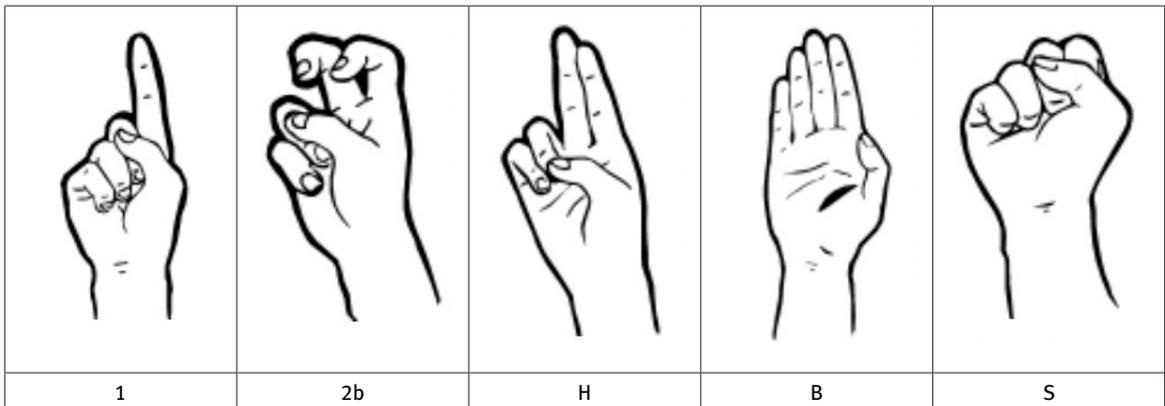
Appendix 2: Socio-linguistic information

For the DGS signers, information about age is not available, only about age group. Information about the deaf vs. hard of hearing (HoH) status is also not available for the DGS signers.

Language	Signer ID	Sex	Age	Deaf/HoH
KK	NG	M	37	deaf
KK	PU	F	37	deaf
KK	SD	M	34	deaf
KK	SI	F	37	deaf
RSL	s39	F	31	deaf
RSL	s40	F	51	deaf
RSL	s41	F	30	deaf
RSL	s42	M	59	deaf
RSL	s43	M	56	deaf
RSL	s44	F	57	deaf
RSL	s54	F	47	deaf
RSL	s55	F	35	deaf
RSL	s56	M	36	deaf
RSL	s57	M	44	HoH
RSL	s58	M	57	deaf
RSL	s59	M	48	HoH
NGT	s003	F	62	deaf
NGT	s004	F	77	deaf
NGT	s009	F	30	deaf
NGT	s010	F	35	deaf
NGT	s011	M	39	deaf
NGT	s012	M	39	deaf
NGT	s071	M	45	deaf
NGT	s072	F	66	deaf
NGT	s075	M	41	deaf
NGT	s076	M	23	deaf
DGS	ber-14	F	18-30	
DGS	koe-07	M	61+	
DGS	stu-23	M	31-60	

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