

**RESEARCH**

# Body-anchored verbs and argument omission in two sign languages

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Using quantitative methods, we analyze naturalistic corpus data in two sign languages, German Sign Language and Russian Sign Language, to study subject-omission patterns. We find that, in both languages, the interpretation of null subjects depends on the type of the verb. With verbs signed on the signer's body (body-anchored verbs), null subjects are interpreted only as first person. With verbs signed in neutral space in front of the signer (neutral verbs), this restriction does not apply. We argue that this is an effect of iconicity: for body-anchored verbs, the signer's body is a part of the iconic representation of the verbal event, and by default the body is interpreted as referring to the signer, that is, as first person. We develop a formal analysis using a mechanism of mixed agreement, taking inspiration from Matushansky's (2013) account of mixed gender agreement in Russian. Specifically, we argue that body-anchored verbs bear an inherent feature that gives a first-person interpretation to null subjects. When a body-anchored verb is combined with an overt third-person subject, a feature mismatch occurs which is resolved in favor of the third person. Neutral verbs do not come with inherent feature-value specifications, thus allowing all person interpretations. We also explain how our analysis predicts the interpretation of null subjects in the context of role shift. With our account, we demonstrate that iconicity plays an active role in the grammar of sign languages, and we pin down the locus of the iconicity effect. While no iconic or modality-specific syntactic mechanisms are needed to account for the data, iconicity is argued to determine feature specification on a subset of sign language verbs.

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**Keywords:** null subjects; body-anchored verbs; sign languages; iconicity

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## 1 Introduction

It has, by now, been firmly established that sign languages are full-fledged languages displaying complex structure at every level of linguistic analysis, fully on a par with spoken languages (see e.g. Sandler & Lillo-Martin 2006). After several decades of research centering primarily on exposing the similarities between languages of the two modalities, much of the more recent work on sign languages has shifted its focus toward studying those facets of sign languages that seem to be uniquely afforded by the visuo-spatial modality. By thus attempting to determine the limits of cross-modal similarity, this enterprise can only be expected to lead to a deeper understanding of human language (Sandler & Lillo-Martin 2006; Sandler 2010).

In this paper, we look at a phenomenon that is far from modality-specific but which, we argue, nonetheless has a distinct modality-specific flavor. Many languages – both spoken and signed – allow for pro-drop of arguments. However, we show that subject drop in two sign languages, German Sign Language (DGS) and Russian Sign Language (RSL), is partially constrained in an unexpected way, which we argue is an iconicity effect. We propose a theoretical analysis which can account for subject-drop patterns we find in

naturalistic corpus data, and which enables us to pin down the locus of the iconicity effect. We argue that modality-independent syntactic mechanisms are capable of accounting for the observed pattern, but that iconicity, uniquely, influences feature specification of body-anchored verbs.

Before we delve deeper into the matter, we introduce some relevant concepts from sign linguistics in Section 1.1. Section 1.2 presents an outline of the article and states our research questions.

### **1.1 Some sign language basics**

Sign languages may exploit space to express (actual and metaphorical) spatial relations. Indeed, in most sign languages that we know of, locations in the signing space can be used for pronominal reference (see Cormier 2012 for a recent overview of the relevant literature). In this system, referents may, for the duration of a discourse, become associated with particular locations in space (R-loci) (Lillo-Martin & Meier 2011). There are several means to set up such R-loci; the most straightforward strategy is to use a pointing sign to localize a (present or non-present) referent, as in example (1) from DGS (Steinbach & Onea 2016: 413; reproduced with minor adaptations).<sup>1</sup> In the case of non-present referents, R-loci are abstract locations in the signing space. As such, non-first person pronouns do not have a fixed form, given that their place of articulation may differ depending on where their corresponding referents are localized within the context of the discourse. The same holds for present second- and third-person referents, who can in principle be located in just as many possible loci relative to the signer.

- (1)      *DGS*  
 INDEX<sub>1</sub> NEW TEACHER INDEX<sub>a</sub> LIKE  
 ‘I like the new teacher.’

First-person pronouns, on the other hand, are consistently articulated on the signer’s body, typically on the chest.<sup>2</sup> This dichotomy has led some researchers to propose that sign languages only make a first vs. non-first person distinction (e.g. Meier 1990; Hou & Meier 2018). As we discuss in Section 5, we tentatively arrive at the same conclusion.

Now, R-loci can be exploited by some verbs and auxiliaries to express agreement. Without going into too much detail (consult for overviews Lillo-Martin & Meier 2011; Mathur & Rathmann 2012), most sign languages contain a class of so-called agreement verbs (Padden 1988), which may agree with their arguments by starting their articulation at the locus of the subject and ending at the locus of the object. Semantically, such verbs have been said to express concepts of transfer (Meir 1998; 2002); think of verb meanings such as ‘give’, ‘answer’, or ‘help’, which are frequently realized as agreement verbs in sign languages.

However, many verbs in sign languages cannot be modified in this way and as such have been claimed not to express agreement. These have collectively been called “plain verbs” (Padden 1988).<sup>3</sup> We focus on plain verbs in this article, although – inspired by previous work by Meir et al. (2007) and Oomen (2017) (see Section 2.3) – we make an

<sup>1</sup> See Abbreviations for notation conventions.

<sup>2</sup> There are some exceptions. In Japanese Sign Language, for instance, first-person pronouns are articulated on the nose (McBurney 2002). Still, the main point is that the expression of first person is always associated with the signer.

<sup>3</sup> Padden (1988) also identifies a third class of verbs (“spatial verbs”) which agree with locations rather than arguments, and which express concepts of motion or location (e.g. ‘go’; ‘leave’). However, others (e.g. de Quadros & Quer 2008) group agreement verbs and spatial verbs together into a single class of “agreeing verbs”, arguing that there are no morphological reasons for making such a principled distinction. We do not discuss this issue further.

important additional subdivision between verbs that are articulated on the body and verbs that are not.

A final term that merits introduction is role shift, a grammatical means of triggering a context shift that sees the signer conveying the thoughts, words or actions of another referent (Lillo-Martin 2012; Herrmann & Steinbach 2012). Generally, a distinction is made between quotative (constructed dialogue) and non-quotative (constructed action) uses of role shift (Pfau & Quer 2010), although it is not always easy to observe the difference in spontaneous data. In any case, the non-manual markers that are used to indicate context shift are the same: a change in the direction of eye gaze, a body lean toward the reference locus, and facial expressions representing those of the referent can all be employed as markers (Padden 1986; Herrmann & Steinbach 2012). Under quotative role shift, the use of first-person pronominal pointing signs to refer to the quoted referent may also occur (Engberg-Pedersen 1993).

## **1.2 Research aims and outline**

In this paper, we analyze corpus data from RSL and DGS to investigate the conditions under which subject drop in clauses with plain verbs is licensed, and we propose a theoretical analysis to account for the patterns we find. Inspired by Oomen (2017), who claims that (typically body-anchored) psych-verbs in Sign Language of the Netherlands (NGT) only allow null subjects when they are first person (See Section 2.3), we hypothesize that verbs that are articulated on the body do not allow the drop of a non-first person argument. This is due to an iconically motivated association between the body of the signer and first person, yielding a first-person interpretation. In contrast, we predict that verbs that are articulated in neutral space in front of the signer allow all types of null subjects.

In Section 2, we first discuss some previous research on pro-drop in spoken and signed languages, as well as two studies that have previously looked at the role of the body in sign language verbs. Section 3 describes the languages we studied, the data we used, and the annotation procedure and method of analysis we employed. The results are discussed in Section 4; with the exception of a handful of counterexamples, they provide support for our hypothesis. The exceptions will be discussed. We set out our theoretical account in Section 5. In a nutshell, we propose that body-anchored verb forms are first-person forms by default, leading to a first-person interpretation of the null subject. Formally, this translates into an inherent first-person feature on a body-anchored verb.<sup>4</sup> In the case of an overt non-first person subject, a feature clash arises. We argue that this situation has parallels with mixed-agreement phenomena in spoken languages and adopt Matushansky's (2013) solution for gender mismatch in Russian by positing that the clash is resolved through the introduction of an interpretable feature – in this case on the subject. In Section 6, we show that the analysis can also account for constructions with neutral verbs as well as agreeing verbs. We conclude in Section 7.

## **2 Previous research**

### **2.1 Pro-drop in spoken languages**

Although pro-drop in spoken languages is an extremely well-studied phenomenon, researchers have not yet reached a universally accepted analysis for it (see Barbosa 2011a; b for a comprehensive overview). One fact, however, is quite clear: there are different types of pro-drop languages. In canonical pro-drop languages such as Italian, pro-drop has been connected to verbal agreement. Theories of such languages argue in one way or

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<sup>4</sup> In fact, as we will argue in Section 5, we do not think that the relevant grammatical category should be labeled person. However, we continue to use this term up until that section for ease of exposition.

another that agreement itself fulfills the role of the argument or at least transfers some features to the null argument. In radical or discourse pro-drop languages, such as Chinese and Japanese, pro-drop is allowed to an even greater degree – despite the absence of verbal agreement. For such languages, it is usually argued that argument omission is related to discourse/information structure. As we discuss in section 2.2 below, sign languages have been argued to combine both agreement-based and discourse-based licensing of null subjects.

Finally, in so-called partial pro-drop languages, such as Finnish and Marathi, pro-drop is usually restricted to first- and second-person subjects (Holmberg et al. 2009). Holmberg (2005) argues that the differences between consistent and partial pro-drop languages are connected to the feature specification of the T head: only in the former does the T head have a D-feature specification, which means that it can licence a deficient third-person null subject. In partial pro-drop languages, T cannot licence deficient null subjects, so third-person null subjects are prohibited. First- and second-person null subjects, in contrast, are fully specified DPs that are deleted at PF, so they are allowed.

As we will demonstrate, RSL and DGS show some similarity with partial pro-drop languages in that there are person constraints on subject drop. However, RSL and DGS are crucially different from cases like Finnish and Marathi in that the restriction only applies to a subset of verbs. We therefore develop an analysis quite unlike the one proposed by Holmberg (2005): the restrictions on subject drop will be explained by properties of the verb rather than the (null) subject.

## 2.2 Pro-drop in sign languages

Many sign languages allow for null arguments. Over the years, varying descriptions and analyses of this phenomenon in different sign languages have appeared (see Lillo-Martin 1986; 1991; Bahar et al. 2000; Wulf et al. 2002; Koulidobrova 2017 for American Sign Language (ASL); McKee et al. 2011 for Australian Sign Language (Auslan) and New Zealand Sign Language (NZSL); Glück & Pfau 1998 for DGS; Bos 1993 and Oomen 2017 for NGT, among others). Here, we provide a brief overview of this body of work.

Lillo-Martin (1986; 1991) argues that null arguments in constructions with both plain and agreement verbs can be variables bound by an empty topic. Additionally, agreement verbs (only) can license the empty category *pro* through agreement. The analysis is supported by syntactic facts such as that agreement verbs do not require a resumptive pronoun for a left-dislocated subject across a *wh*-island (2a) but plain verbs do (2b) (examples reproduced with minor adaptations from Lillo-Martin 1986: 424–425). Bos (1993) and Glück & Pfau (1998) describe similar patterns for NGT and DGS.

- (2) a. ASL

topic  
MOTHER<sub>a</sub> INDEX<sub>1</sub> DON'T-KNOW WHAT \*(INDEX<sub>a</sub>) LIKE  
'My mother<sub>i</sub>, I don't know what she<sub>i</sub> likes.'

- b. ASL

topic  
MOTHER<sub>a</sub> INDEX<sub>1</sub> DON'T-KNOW WHAT (INDEX<sub>a</sub>) <sub>a</sub>SEND<sub>1</sub>  
'My mother<sub>i</sub>, I don't know what she<sub>i</sub> sent me.'

Bahan et al. (2000) argue against such a hybrid analysis and claim that all null subjects are licensed through agreement, which can manifest itself through non-manual marking (eye gaze or head tilt) in addition to the regular manual strategies.<sup>5</sup> In other words, plain

<sup>5</sup> See, however, Thompson et al. (2006) for experimental evidence against such an analysis.

verbs are said to express agreement exclusively with non-manual means. Koulidobrova (2017), providing some novel data, shows that both *pro* and topic-bound variable analyses fail to account for all the morphosyntactic facts, and proposes instead that null subjects represent cases of ellipsis of a bare NP.

Each of the studies mentioned above are based on elicited or informant data. Wulf et al. (2002) and McKee et al. (2011), in contrast, analyze spontaneous narratives to study patterns of argument drop in ASL and Auslan and NZSL, respectively. Wulf et al. (2002) focus on the behavior of plain verbs and report that just 35% of the examples in their data set include a subject pronoun. Statistical analysis shows that person, number, constructed action/dialogue (role shift), co-reference with the subject in the preceding clause, and several sociolinguistic factors all impact on a signer's choice for an overt or non-overt subject in any given clause. To single out the factors that are relevant in the context of the present study, constructed action or dialogue is reported to correlate with a dispreference for overt pronominal subjects, while first-person singular pronouns are most frequently, and third-person singular pronouns least frequently, expressed overtly. However, it is important to point out that the authors do not quantify how many of the examples with third-person referents not indicated by a pronominal pointing sign involve a null subject, and how many examples include a full NP – which, it transpires, have not been excluded from the data set. As such, the results tell us little about how often a third-person referent is or is not expressed in clauses with plain verbs. This becomes relevant when we discuss our results from RSL and DGS.

McKee et al. (2011) report broadly overlapping results in their study of Auslan and NZSL, which is based on data acquired with the same methods as in Wulf et al.'s (2002) investigation. In addition, McKee et al. (2011) note that what they call "partial agreement verbs" – verbs which agree spatially with an object but have a fixed starting locus on the body – more often co-occur with an overt subject than double agreement verbs in Auslan. Plain verbs are reported to slightly favor subject expression.

In summary, null arguments are a common phenomenon in the signed modality, and their properties have been described and analyzed for various sign languages. With the present study, we add to this body of research by developing a new theoretical approach to account for the subject-drop patterns we attest in naturalistic corpus data from DGS and RSL. A novelty of our analysis is that it takes into consideration the iconic properties of different types of verbs – particularly those articulated on the body – in accounting for the differences in null-subject patterns.

### **2.3 The role of the body**

In the context of this study, it is important to discuss a couple of works that highlight the apparent dual function of the signer's body in plain verbs articulated on the body, hereafter referred to as *body-anchored verbs*.

Firstly, on the basis of data from two sign languages (Al-Sayyid Bedouin Sign Language (ABSL) and Israeli Sign Language (ISL)), Meir et al. (2007) identify a systematic lexicalization pattern that is specific to body-anchored verbs. The systematicity is the result of iconic form-to-meaning mappings. Specifically, Meir et al. (2007) argue that the signer's body corresponds to the subject in body-anchored verbs, while the signer's hands – as with verbs of any type – may represent different facets of the event denoted by the body-anchored verb. Consider the iconic sign EAT, for instance, which happens to be identical in form in both ISL (discussed in Meir et al. 2007), DGS (Figure 1), and RSL.

Meir et al. (2007) decompose this sign into a number of formation elements, four of which they claim iconically map onto components of the verb's semantics. The handshape refers to the holding of an object (food); an "inward movement" (indicated with the arrow



**Figure 1:** The sign EAT; video still from the DGS Corpus (Blanck et al. 2010).

in Figure 1) conveys an action of putting an object into the mouth; an iterated movement indicates a process, and finally, the mouth of the signer corresponds to the mouth of the agent of the action denoted by the verb. The first three components are all properties of the event and are expressed by the hands, while the latter is a property of the agent and is expressed by the body. Following the general mapping principle that the argument with the highest-ranking thematic role maps onto subject (see e.g. Fillmore 1968; Grimshaw 1990), the result becomes what Meir et al. (2007) coin “body as subject”. The authors point out that their proposal forms a partial solution to the object-over-subject-primacy puzzle in sign languages, i.e. the apparent fact that – contra to what can be observed in spoken languages – objects appear to be more frequently marked than subjects. By positing that the subject is marked by the signer’s body, this typologically unexpected conclusion no longer holds.

Meir et al. (2007) consider body as subject to be a basic lexicalization strategy in sign languages. Evidence comes from the fact that ABSL does not have agreement verbs but does have body-anchored verbs, while ISL developed an agreement system from body-anchored verbs over the course of three generations. First generation signers of ISL only use body-anchored verbs to express concepts of transfer, signers in their 30s and 40s modify them to agree with their objects, and younger signers use the full double agreement pattern. According to the authors, these stages thus reflect a gradual “detachment” of the subject from the body. Meir et al. (2007) point out that the pattern of change they describe is not unique to ISL: similar findings have been reported for Danish Sign Language (DTS) by Engberg-Pedersen (1993).

Secondly, Oomen (2017) reports on a corpus-based study on psych-verbs in NGT, noting that such verbs are, almost without exception, body-anchored. Psych-verbs are semantically defined in this study as “verbs that denote an emotional (psychological) state, or the bringing about of a change in emotional state” (Oomen 2017: 56). Pro-drop is found to frequently occur in clauses with body-anchored verbs: of the 133 clauses with a psych-verb analyzed, 72 involve subject drop. This observation in itself is hardly surprising; as discussed in Section 2.2, many sign languages have been reported to allow

for their arguments to be dropped. Interestingly, however, Oomen observes that there appears to be a restriction with respect to the nature of the dropped subject, as just one of the 72 examples involves pro-drop of a third-person subject. In contrast, pro-drop of a first-person subject occurs 27 times in the data.<sup>6</sup> The apparent restriction on third-person drop does not apply to clauses with role shift, where pro-drop of a third-person referent is attested with high regularity ( $N = 27$ ). The findings are tabulated in Table 1, which additionally lists the frequencies of clauses with overt subjects. It can be observed that both first-person and third-person overt subjects, with the optional addition of role shift, are attested.

Oomen (2017) proposes that body-anchoring of psych-verbs yields a default first-person interpretation in the absence of an overt subject argument. This can be construed as an iconicity effect: the articulation of psych-verbs on the body is not random but it is iconically motivated. It reflects either a metaphoric location of an emotion (e.g. ‘loving’ is in the heart), or an external expression of an emotion (e.g. ‘being nervous’ causes shaking legs).<sup>7</sup> At the same time, the body naturally functions as the locus for first person. The concurrence of the two roles of the body – the body as a meaningful part of the body-anchored psych-verb and the body as first person – is argued to lead to the attested subject-drop pattern.<sup>8</sup>

That sign languages exploit iconicity is a platitude; what is interesting about the studies discussed above is the suggestion that iconicity effects reach beyond the lexical realm to factor into the grammar. The intuition that iconicity plays a role in the shaping of (sign) language structure has, by now, gathered a considerable number of supporters. Beyond the studies cited in this section, studies such as Wilbur (2003 and subsequent work); Meir et al. (2013); Schlenker et al. (2013); Schlenker (2014); Davidson (2015), and Aristodemo & Geraci (2017) all subscribe to the same idea. The analysis we propose in Section 5 to account for the data described in the next sections fits within the same research tradition, too.

### 3 Methodology

#### 3.1 RSL and DGS

For this study, we analyzed corpus data from RSL and DGS. The choice of languages is primarily motivated by the availability of corpus data for these languages. The two languages have shared characteristics as well as differences. Both languages can be characterized as Western urban sign languages (Zeshan 2008), which both emerged in the context of deaf education approximately 200 year ago; their transmission is intimately connected with the existence of deaf schools. No fully reliable information on the number

**Table 1:** Properties of subjects in clauses with psych-verbs ( $N = 133$ ) in NGT as reported in Oomen (2017); RS = role shift.

<i>person</i>	<i>OVERT</i>		<i>person</i>	<i>NON-OVERT</i>	
	<b>NO RS</b>	<b>RS</b>		<b>NO RS</b>	<b>RS</b>
<i>first</i>	30	9	<i>first</i>	27	17
<i>third</i>	17	5	<i>third</i>	1	27

<sup>6</sup> There are no examples with non-overt second-person subjects in the data.

<sup>7</sup> Of course, metaphors may be culturally bound, but this is not at issue here. The point is that when metaphor is exploited to denote psychological states, it is likely to lead to body-anchoring of psych-verb forms. It does not matter which part of the body is made reference to.

<sup>8</sup> Oomen (2017) also provides a formal analysis to account for this pattern, which we discuss in Section 5.1.

of signers of either language exists, but it is likely that the signer/non-signer ratio in both countries is comparable.<sup>9</sup> Given that the populations of Russia and Germany tally 144 and 82 million people respectively, we can deduce that the number of RSL signers can be expected to total about double the number of DGS signers. Importantly, the two languages are not historically related and have never been in close contact, which means that any similarities found between them cannot be due to contact or relatedness.<sup>10</sup>

While a convenience sample of two languages (which also share some important socio-linguistic characteristics) is clearly not sufficient for making any universal claims about sign languages, the non-trivial similarities we report on in this paper are expected to hold more widely, creating impetus for further studying the relation between iconicity and syntax using larger typological samples of sign languages.

### **3.2 Corpora used**

The DGS Corpus project is a long-term project carried out by researchers at the Institute for German Sign Language and Communication of the Deaf (IDGS) at Hamburg University. Its aims are to collect DGS data in an annotated corpus and to develop a corpus-based electronic DGS – German dictionary (Blanck et al. 2010). Data collection was completed in 2012 and has yielded a total of 1160 hours of footage with 330 participating deaf signers of DGS from thirteen different regions in Germany (Langer 2012). Annotation of the data is an ongoing process. A subset of dialogues with basic transcriptions and annotations are accessible online via [ling.meine-dgs.de](http://ling.meine-dgs.de). From these recordings, a selection of 58 videos (amounting to approximately 8 hours and 30 minutes of material) with corresponding annotation files make up the data set for the current investigation.

All video clips include dialogues about a variety of news topics such as the death of Princess Diana or the collapse of the Twin Towers, topics related to Deaf culture such as the Deaflympics and other Deaf events, and more personal topics such as the signers' experiences in (a deaf or hearing) school. A total of 104 signers participate in the 58 recordings. Some dialogues feature the same signers, but none of the signer pairs feature in more than two videos.

The on-line corpus of RSL (<http://rsl.nstu.ru/>; Burkova 2015) is the result of a project that was carried out between 2012 and 2015 at the Novosibirsk State Technical University. The corpus contains annotated narratives and a small number of dialogues (> 230 separate video files, total length 5 hours 30 minutes) between 43 signers of RSL, originating mostly from Moscow and Novosibirsk. The full corpus is available on-line on the corpus website; note that (free) registration is required.

The video clips contain a variety of data types including retellings of cartoons (drawings and animations), personal stories on different subjects, and some dialogues on topics related to deafness and sign language.

The two corpora differ from each other in several ways. First, the set of recordings from the DGS corpus has almost twice the length of the data from the RSL corpus, and the videos involve more than twice as many signers. Second, while the RSL corpus mostly contains narrative monologues, the part of DGS corpus analyzed only contains dialogues. As we show, the latter difference affects the frequency of role shift in the examples, see Section 4.

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<sup>9</sup> According to the 2010 census, approximately 120,000 people in Russia use RSL, but this number is very likely to be an underestimation. The estimations of the number of DGS signers vary widely and range from 80,000 to almost 400,000 people: <https://www.ethnologue.com/language/gsg>.

<sup>10</sup> RSL is often said to be related to Old French Sign Language although more research is necessary to verify this claim. DGS is not related to Old French Sign Language, and no claims have ever been made about a historical relationship between RSL and DGS.

### 3.3 The verbs

We searched for verbs that can be classified as body-anchored or neutral based on a list of 80 verb meanings that was previously created in the context of the Valency Patterns Leipzig (ValPaL) project (<http://www.valpal.info/>; Hartmann et al. 2013). The meanings in the ValPaL list have been selected by the creators of the project to be representative of the verbal lexicon and thus display distinct argument structure properties. The list has been compiled based on the outcomes of many years of typological and descriptive research on spoken languages; the results of the project indicate that it serves as a valid tool to study basic argument-structure patterns in languages (Malchukov & Comrie 2015). Recently, it has been used to study basic argument structure in Russian Sign Language (Kimmelman 2016; 2018a), showing that it is suitable for languages in the visual modality, too.

Not all of the 80 verb meanings are realized as body-anchored or neutral verbs in the two sign languages, as verb meanings can also be realized as agreeing verbs or classifier predicates. We excluded all such verb forms for the present study, and only made further annotations for the examples in our data set that contain body-anchored or neutral verbs.

### 3.4 Annotation

The annotation for DGS was conducted by author 1, and the annotation for RSL by author 2. Both authors are hearing L2 learners of the respective sign languages. The procedure for the two languages followed a nearly identical protocol in order to assure comparability.<sup>11</sup>

The first step in the annotation procedure was to find all tokens of body-anchored and neutral verbs in the corpora of DGS and RSL. For DGS, we searched the annotation files using the English meaning labels from the ValPaL list, as well as synonyms, and, in some cases, antonyms or words that are otherwise semantically closely related to the target word. For RSL, we searched the annotation files using Russian translations of the English meaning labels from the ValPaL list, as well as synonyms and other related words. Note that one verb meaning can thus be represented by more than one verbal sign.

The next step was to add the annotations required to perform the analysis. First, the type of verb, i.e. body-anchored or neutral, was annotated for every token. Categorization was based on the place of articulation of the verb, i.e. whether it was signed on or close to the body (body-anchored) or in neutral space in front of the signer (neutral).

We then identified the boundaries of every clause in which a token occurred. The identification of clause boundaries in naturalistic sign language discourse can be quite a complicated task (Crasborn 2007). We used the following simple procedure based on semantic and prosodic cues: the predicate together with its semantic arguments, adjuncts, and function words are analyzed as one clause. Topics that are marked non-manually as such are also analyzed as a part of the clause. In case of ambiguity, prosodic markers indicating a potential boundary (e.g. stops or holds or a marked change in facial markers) were decisive. For instance, in a sequence Verb 1 – Object – Verb 2 – where the object could semantically be an argument of either predicate – the clause boundary needed to be identified based on prosody.

Third, information about person and overtess of the subject was annotated. As for the first factor, we distinguished first person (pointing to the signer), second person (pointing to the addressee), third person (pointing towards a location associated with a non-participant referent, or a full DP), and impersonal reference. The latter concerns cases where the subject is human and non-referential (e.g. in general statements or

<sup>11</sup> The only difference concerned the searching strategy used to identify tokens as the corpora had been transcribed differently; see below.

in referring to unspecified groups of people; Gast & van der Auwera 2013). In both languages impersonal reference is most often expressed by subject omission. Such cases were excluded from further analysis. Secondly, the parameter *overtness* has two possible values: overt (an overt pointing sign or a full DP is used in the same clause as the verb) or non-overt.

In addition, we annotated whether role shift marking was present on the verb. We defined role shift as a visible body and/or head turn or clearly marked emotional facial expressions where the represented emotion can be attributed to the person whose role the signer is taking (see Herrmann & Steinbach 2012 on role shift in DGS and Kimmelman & Khristoforova 2018 on role shift in RSL). This type of role shift should probably be classified as non-quotative, as the signer is not quoting someone's words; instead, someone's actions or emotions are represented while the verbal sign is produced. It is important to note that in the presence of role shift, the reference of non-overt subjects was defined with respect to the global context of the narrative. For instance, in (3) the null subject refers to a cat, whose role the signer takes while producing the verb. We annotate this subject as third person, as in the global context the referent is third person, even though within role shift it can be construed as first person.

(3)     RSL (Supplementary file 1)

rs  
THINK  
‘[The cat] is thinking.’

Finally, we made an annotation when the verbal sign was actually used as a head of an NP or a modifier within an NP via nominalization or adjectivization. Such cases of part-of-speech changing alternations were excluded from further analysis.

We annotated the data on multiple tiers in ELAN (Crasborn & Sloetjes 2008), and then exported the annotations as a .csv file to enable further analysis in R (R Core Team 2016).

### 3.5 Analysis

Extrapolating from Oomen (2017), expanding the scope from psych-verbs to all body-anchored verbs and contrasting these with neutral verbs, we expect the following pattern:

- (4)     a. In clauses with body-anchored verbs, in the absence of role shift, first-person subjects can be non-overt but third-person subjects have to be overt.<sup>12</sup>  
 b. In clauses with role shift, subjects of any person can be non-overt.  
 c. In clauses with neutral verbs, subjects of any person can be non-overt.

We applied a statistical analysis to the data in order to ascertain whether these expectations are borne out. Before we discuss the statistical models, a comment about second person in sign languages is in order.

Some researchers (e.g. Meier 1990; Engberg-Pedersen 1993; Rathmann & Mathur 2002; Hou & Meier 2018) have claimed that sign languages only make a first versus non-first person distinction, as non-first person referents can, in principle, be localized anywhere in the signing space (see discussion in Section 1.1).<sup>13</sup> In our annotations, we simply distinguish second-person subjects based on interpretation, i.e. whether the subject refers to the addressee. We investigated the patterns of behavior of these subjects in relation to verb

<sup>12</sup> We discuss second person below.

<sup>13</sup> See also Alibašić Ciciliani & Wilbur (2006) for an alternative theory.

type and role shift, which are discussed in Section 4. However, since only a small number of examples in our data contain a second-person subject, we excluded these examples from our statistical analysis.<sup>14</sup> In Section 6.3, we discuss our theoretical predictions for second-person subjects.

The theory in Oomen (2017) as well as our analysis (both discussed in Section 5) makes categorical predictions. That is, it is predicted that no examples occur with third-person non-overt subjects with body-anchored verbs (and no role shift). However, naturalistic corpus data almost never present a clear-cut picture of any phenomenon, and other factors may be at play that might lead to a less-than-perfect result (McEnery & Hardie 2012). Therefore, a more realistic expectation is that we will see significant differences between the different verb types in our data. In other words, even if there are some examples of third-person non-overt subjects with body-anchored verbs without role shift, the interaction of verb type and role shift is expected to be a significant factor in predicting the occurrence of such subjects.

To test our prediction, we apply mixed effects linear regression (Bates et al. 2015). Specifically, we would like the model to predict the occurrence of non-overt third person subjects, which we gloss as 3N (as opposed to any other options) based on verb type (body-anchored vs. neutral) and role shift (yes/no), and their interaction as predictors. Individual verbs and signers are added as random intercepts (5).<sup>15</sup>

$$(5) \quad \text{overt-type} * \text{role shift} + (1|\text{verb}) + (1|\text{signer})$$

What we are interested in is the interaction between the predictors (type:role shift), as our prediction is that 3N subjects in clauses with body-anchored verbs without role shift are overall less likely to occur. We thus expect a significant negative effect on frequency of 3N with this combination of factor values.

We use identical models for RSL and for DGS. We could have combined the RSL and DGS data in one model with language as one of the predictors. However, we are not interested in a quantitative comparison between the two languages, e.g. whether DGS and RSL are different with respect to the frequency of 3N subjects, or whether the size of the effect of other factors is different between the languages. We are merely interested in demonstrating that the expected effect exists in both languages.

We conducted the statistical analysis in R (R Core Team 2016) using the *lme4* package for mixed effects binomial linear regression (Bates et al. 2015).

## 4 Results

Our DGS data include 884 clauses with tokens representing 83 verbs produced by 52 signers. 141 examples involve impersonal reference, which are excluded from further analysis. Our RSL data include 530 clauses with tokens representing 45 verbs produced by 36 signers. 75 examples involve impersonal reference, which are excluded from further analysis.

### 4.1 Basic patterns

The DGS results are summarized in Tables 2 and 3. The tables show that non-overt third-person subjects with body-anchored verbs and without role shift are indeed very rare: there are 10 cases, as opposed to 141 examples of overt third-person subjects in clauses with verbs of the same type (Table 2). With neutral verbs but without role shift, overt

<sup>14</sup> Oomen (2017) does not explicitly discuss the behavior of second-person subjects due to a lack of examples in her data set.

<sup>15</sup> It could be informative to also have random slopes for signers (on both factors and the interaction) and verbs (on role shift), but we do not have enough data to explore such a model.

third-person subjects are also preferred over non-overt ones, but not as drastically. When there is role shift, third-person subjects are more frequently non-overt in clauses with body-anchored verbs (Table 3), while for neutral verbs there are too few cases to make any definitive claims – although the results seem to indicate that both overt and non-overt third-person subjects are fine. First-person subjects are often non-overt irrespective of other factors. Second-person subjects are mostly overt, but there are too few examples to draw any reliable conclusions.

In RSL, the general pattern is very similar (Tables 4 and 5). The main difference with DGS is that there are proportionally more examples with role shift (Table 5), which is very likely due to the differences in data type between the two corpora: the RSL corpus includes many narratives – which can be expected to lead to a high occurrence of non-quotative role shift – while the DGS corpus does not. This difference between the two languages is not relevant for our analysis, although it does complicate the statistical analysis somewhat (see Section 4.2).

**Table 2:** Subjects in DGS without role shift.

<i>person</i>	<b>BODY-ANCHORED</b>		<i>person</i>	<b>NEUTRAL</b>	
	<b>NON-OVERT</b>	<b>OVERT</b>		<b>NON-OVERT</b>	<b>OVERT</b>
<i>first</i>	103	174	<i>first</i>	30	41
<i>second</i>	7	36	<i>second</i>	2	6
<i>third</i>	10	141	<i>third</i>	20	60

**Table 3:** Subjects in DGS with role shift.

<i>person</i>	<b>BODY-ANCHORED</b>		<i>person</i>	<b>NEUTRAL</b>	
	<b>NON-OVERT</b>	<b>OVERT</b>		<b>NON-OVERT</b>	<b>OVERT</b>
<i>first</i>	15	41	<i>first</i>	2	5
<i>second</i>	3	0	<i>second</i>	0	0
<i>third</i>	25	16	<i>third</i>	4	2

**Table 4:** Subjects in RSL without role shift.

<i>person</i>	<b>BODY-ANCHORED</b>		<i>person</i>	<b>NEUTRAL</b>	
	<b>NON-OVERT</b>	<b>OVERT</b>		<b>NON-OVERT</b>	<b>OVERT</b>
<i>first</i>	37	21	<i>first</i>	3	6
<i>second</i>	19	4	<i>second</i>	1	0
<i>third</i>	7	64	<i>third</i>	23	36

**Table 5:** Subjects in RSL with role shift.

<i>person</i>	<b>BODY-ANCHORED</b>		<i>person</i>	<b>NEUTRAL</b>	
	<b>NON-OVERT</b>	<b>OVERT</b>		<b>NON-OVERT</b>	<b>OVERT</b>
<i>first</i>	49	42	<i>first</i>	13	8
<i>second</i>	2	0	<i>second</i>	0	0
<i>third</i>	79	28	<i>third</i>	7	6

Non-overt third-person subjects with body-anchored verbs and without role shift are again very rare: seven cases have been attested, as opposed to 64 examples with overt third-person subjects (Table 4). With neutral verbs without role shift, overt third-person subjects are slightly preferred, although the relative difference is smaller than in DGS. In contrast, in clauses with role shift, third-person subjects are more frequently non-overt (although again for neutral verbs there are too few cases to be sure). First-person subjects are often non-overt irrespective of other factors. Second-person subjects almost exclusively occur in clauses with body-anchored verbs and no role shift, and they are mostly non-overt (see Section 4.3 for an explanation).

To sum up, the general pattern in both sign languages is as expected: although not unattested, third-person null subjects with body-anchored verbs and no role shift are strongly disfavored. In clauses with neutral verbs and/or with role shift, third person subjects are more frequently non-overt. In the next section, we test whether this pattern is statistically significant.

#### **4.2 Statistical analysis**

As described in Section 3.5, we applied mixed effects binomial linear regression to verify whether the chance of occurrence of non-overt third-person subjects is significantly affected by verb type and role shift.<sup>16</sup>

We first look at the results for RSL, as they are easier to interpret. Our model (as specified in (5)) for RSL shows a non-significant negative effect of the body-anchored verb type (estimated odds ratio: 0.55, p-value = 0.16), a significant positive effect of role shift (estimated odds ratio: 2.9, p-value = 0.005), and crucially a significant positive interaction (estimated odds ratio: 23.5, p-value = 0.0002). This means that the odds of occurrence of a non-overt third-person subject are (non-significantly) lower for body-anchored verbs overall and significantly higher when role shift is present, while the effect of verb type is significantly lower when role shift is present. These results thus fully conform to our hypothesis.

For DGS, we find a significant negative effect of the body-anchored verb type (estimated odds ratio: 0.18, p-value = 0.03), a significant positive effect of role shift (estimated odds ratio: 21.8, p-value < 0.0001), and a non-significant positive interaction (estimated odds ratio: 2.23, p-value = 0.5). This means that the odds of occurrence of a non-overt third-person subject are significantly lower for body-anchored verbs and significantly higher when role shift is present, but the effect of verb type is lower when role shift is present, although not significantly. In other words, body-anchored verbs disfavor non-overt third-person subjects, and role shift favors non-overt third-person subjects, but the effect of verb type is not significantly modified by the presence or absence of role shift. This is not entirely consistent with our expectations. However, when inspecting Tables 2 and 3, it becomes clear that the DGS data simply contain relatively few examples with role shift, especially with neutral verbs. It thus appears that we do not have enough data to observe a significant interaction.

Importantly, when we only consider examples without role shift, the pattern is evident: non-overt third-person subjects with body-anchored verbs are strongly disfavored. In fact, when we model only the DGS data without role shift, verb type shows a significant effect on the chance of occurrence of non-overt third-person subjects (odds ratio for body-anchored verbs: 0.14, p-value = 0.01). This is fully consistent with our expectation for cases without role shift.

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<sup>16</sup> For the full summary of the statistical analysis see Supplementary file 2. For the data files and the R code used in the analysis, see Supplementary files 3, 4, and 5.

### 4.3 Exceptions

As discussed above, our data contain some cases of non-overt third-person subjects in clauses with body-anchored verbs without role shift, but our analysis (developed in Section 5) predicts that such cases are ungrammatical. In DGS, we find 10 such exceptions (out of 743 tokens with personal subjects, less than 2%), and in RSL, 7 such exceptions (out of 455 tokens with personal subjects, less than 2%). These numbers are extremely small, but they still warrant explanation. We think several factors are at play.

Firstly, a couple of examples which received an annotation for a third-person non-overt subject might actually be better interpreted as impersonal constructions. For instance, the non-overt subject in (6a) could refer to the adult deaf individuals who were mentioned several sentences previously, but the example may just as well be an impersonal statement with a non-referential subject. Secondly, in some examples, it is not clear from the context whether the non-overt subject is first- or third-person (6b) (the corpus translation implied a third-person subject). Thirdly, in some DGS examples, closer inspection reveals that a pointing sign might actually be present (i.e. the subject is overt), but its articulation is so rapid that it is difficult to observe (6c); see video still in Figure 2. Fourth, in RSL, 4 out of the 7 examples involve the verb *LIVE*. It might be the case that – even though the form is body-anchored – *LIVE* does not involve the body of the signer in its morphophonological representation in the same way as other such verbs do. Indeed, the body-anchored articulation of the sign does not appear to be iconically motivated. We briefly come back to this observation in Section 5.4.

- (6)
  - a. *DGS*  
FEEL / NEED HEAR  
'They [adult deaf individuals fully integrated into the deaf community/some people] still feel like they need to hear.'
  - b. *RSL* (Supplementary file 6)  
KNOW HARM LIKE.THIS OFFEND  
'She understood that she offended us.' or 'We understood that she offended us.'
  - c. *DGS*  
(INDEX<sub>a</sub>) BE-HAPPY WITH  
'They are happy I can play with them.'



**Figure 2:** A video still showing the articulation of the index sign indicated in (6c).

Finally, two examples from RSL involve another interesting phenomenon: the clause with the non-overt third-person pronoun is a center-embedded parenthetical comment on another clause with the same subject referent (7).<sup>17</sup> It is possible that such contexts are extremely strong licensors of pro-drop, overruling any other operative constraints.

(7) *RSL* (Supplementary file 7)

INDEX<sub>a</sub> GIRL TWO DISAPPEAR – SPEAK HEAR WELL – DISAPPEAR.  
 ‘The two girls – they could speak and hear well – disappeared.’

We can now turn to the cases with second-person subjects in our data. As we mentioned in the previous section, we did not formulate clear predictions for these cases because we are not sure about the status of second person in the pronominal system of DGS and RSL. Still, independent of whether we analyze such pronouns as second person or group them together with third person, we may predict that such subjects have to be overt in clauses with body-anchored verbs for the same reason that we think third-person subjects have to be overt: if they are left out, they will be interpreted as first person by default.

If we look at the data in Tables 2–5, we can observe that second-person subjects almost never occur with role shift: signers are unlikely to frequently take on the role of the addressee. We have almost no data for neutral verbs, but for body-anchored verbs in DGS, a vast majority of second-person subjects (36 out of 43 cases) are overt. However, this picture is reversed in RSL: 19 out of 23 second-person subjects are non-overt.

While this pattern seems to contradict our expectations, it is in fact quite easy to explain. 17 out of the 19 examples are questions to the addressee, and those that do not contain the verb KNOW (see below) are clearly non-manually marked as such (8). Of the seven examples with non-overt second person subjects in the DGS data, five are questions, too. It thus appears that the default interpretation of null subjects in direct questions is always second person. We return to this issue in Section 5.

(8) *RSL* (Supplementary file 8)

question  
 HEAR.NEG  
 ‘So you don’t hear?’

Ten out of the 17 questions in RSL (and 4 out of 7 in the DGS data) involve the same verb KNOW (9), which can be characterized as a conventionalized discourse marker; a way of checking that the addressee is following the story. The conventionalization is hallmarked by lack of non-manual marking and general prosodic integration of the sign into adjacent clauses. We would argue that this discourse marker is no longer a verb and hence does not require a subject.

(9) *RSL* (Supplementary file 9)

CHOOSE CLOTHES WHAT EXIST. KNOW? HOCKEY UNIFORM HOCKEY  
 ‘I chose clothes from what I had. You know? A hockey uniform.’

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<sup>17</sup> The verb in the main clause is doubled, which is a common phenomenon in RSL and other sign languages (Nunes & de Quadros 2008).

#### 4.4 Summary

We predicted that body-anchored verbs should disallow non-overt third-person subjects in the absence of role shift. Our analysis of corpus data from RSL and DGS provides confirmation of our expectations (Section 4.1). A small number of counterexamples were attested, most of which can be explained by other factors (Section 4.3). Even if one contends that the pattern is not categorical, statistical analysis shows that the frequency of non-overt third-person subjects with body-anchored verbs is significantly lower than expected if the pattern were random (Section 4.2). We thus conclude that body-anchored verbs license the drop of a first-person subject only. In the next section, we present our theoretical analysis to account for these findings.

### 5 An agreement account of body-anchored verbs

In this section, we develop an analysis to account for the subject-drop patterns described in Section 4. Since a similar restriction on third-person subject drop with psych-verbs – a subset of body-anchored verbs – was reported in Oomen (2017), we start in Section 5.1 with a summary of the account presented there. From Section 5.2 onward, we set out our own analysis for DGS and RSL.

In a nutshell, we propose that body-anchored verbs – like agreement verbs – are in an agreement relation with the subject. Unique to these verbs is that they come equipped with an inherent first-person feature; subjects, on the other hand, bear non-inherent features (Section 5.3).<sup>18</sup> In the case of a null subject, which only has an unvalued feature, an interpretable feature is introduced on the verb as a last-resort strategy to yield a first-person interpretation. A consequence of the proposal is that a feature mismatch arises when there is an overt non-first person subject in the clause – a situation which we argue has parallels with gender mismatch in languages with mixed syntactic and semantic gender agreement. We follow the principle that interpretable features override formal features to resolve this conflict (Matushansky 2013; Section 5.4).

The account captures the idea that certain iconically motivated properties of body-anchored verbs need to be preserved in the syntax. The analysis is also compatible with analyses of role shift (Section 5.5). In addition, it can easily be extended to account for agreeing verbs as well as neutral verbs. We discuss these matters, as well as some thoughts about the way second person subjects should be treated, in Section 6.

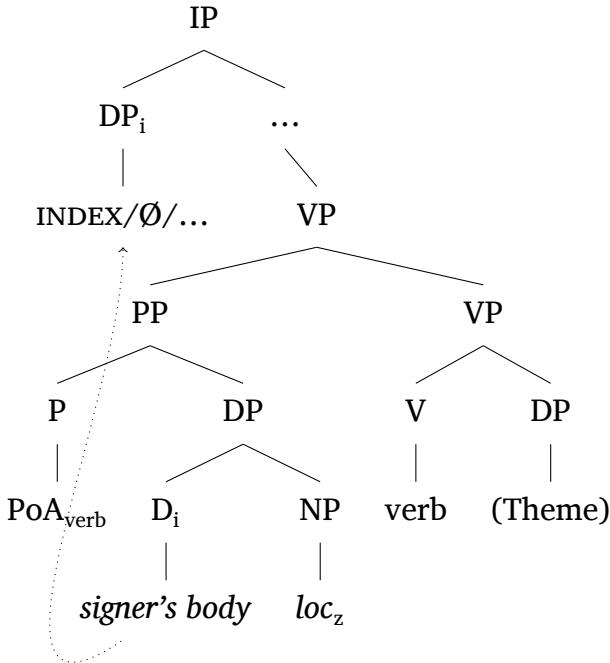
#### 5.1 Oomen (2017)

Oomen (2017) formalizes the body of the signer as part of a locative adjunct, adjoined to the VP, which represents the iconic components of body-anchored psych-verbs. The adjunct contributes the meaning “[psychological state] at location<sub>z</sub> in the signer’s body”, and is projected when a body-anchored psych-verb is articulated. For instance, the verb LOVE – which is articulated on the chest as a reference to the heart as the metaphoric location of love – projects a locative adjunct that can be loosely paraphrased as ‘[love] in the signer’s body’s heart’. Note that ‘the signer’s body’ is an atomic, non-compositional, component.

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<sup>18</sup> Actually, we will propose that verbs and subjects have referent features rather than person features. We present our arguments for introducing this grammatical category in lieu of a person category in Section 5.3. For now, it suffices to make a distinction between first and non-first person.

(10)



The syntactic structure proposed in Oomen (2017) is reproduced with some minor adaptations in (10). The locative adjunct is a prepositional phrase headed by the place of articulation (PoA) of the verb, which functions as a preposition. Note that this element is part of the manual articulation of the sign and is not represented by the body. The DP that is selected as the PP's complement is headed by a possessive determiner represented by the signer's body – the “container” of the psychological state. Finally, the location (*loc<sub>z</sub>*) in or on the body which is singled out by the place of articulation of the psych-verb, e.g. the heart in the case of LOVE, functions as the complement of the DP. Together, the content of the PP thus roughly translates as ‘[psychological state] in the signer's body's heart/head/...’.

Crucially, the possessive determiner – the signer's body – is a variable that is specified for either one or two features. The first feature, *b*, simply indicates that the signer's body is the container of the psychological state, and it ensures that the verb is articulated on the signer's body even if the signer him- or herself is not the experiencer of the psychological state. The second feature is a first-person feature whose selection is dependent on the items present in the numeration. There are three options: the numeration (i) includes a lexical item specified for first person; (ii) includes a lexical item specified for (any) non-first person; or (iii) does not include a lexical item carrying a person feature. In scenarios (i) and (iii), the variable receives a first-person feature. In case (ii) applies, the variable is specified for a *b* feature only.

The first-person feature leads to a first-person interpretation in constructions with a non-overt subject argument because of a co-indexing relation between the variable endowed with this feature and the subject higher up in the structure. Oomen (2017) points out that the analysis compels the experiencer argument to subject position. Indeed, there are no object experiencer psych-verb constructions in NGT (cf. Belletti & Rizzi 1988 and many others).

DGS and RSL show essentially the same pattern as NGT: third-person subject drop is resisted in constructions with body-anchored verbs. Given this observation, Oomen's (2017) analysis would in principle be applicable to DGS and RSL, too. However, we have several reservations about the account.

Firstly, the analysis relies on the idea that variable selection is dependent on other items in the numeration. While technically allowed, the mechanism is a rather artificial solution to the issue it intends to solve. In essence, it introduces circularity: the (un-)availability of person features in the numeration dictates how the variable is specified, which in turn determines whether or not a non-overt subject is permitted in the clause.

Secondly, the analysis stipulates that body-anchored verbs project a locative adjunct that would be entirely absent in the structure of other verb types. At the same time, much emphasis is placed on the fact that the body doubles as the locus for first person in order to account for the attested subject-drop pattern. But agreeing verbs that agree with a first-person subject start their trajectory at the exact same locus – raising the question why body-anchored verbs and agreeing verbs are not analyzed in more comparable terms. Add to that the knowledge that, under certain conditions, body-anchored verbs have the apparent potential to become agreement verbs, as has happened in ISL (Meir et al. 2007) and DTS (Engberg-Pedersen 1993), and we see enough ground to pursue the development of a more universally applicable theory. The next few sections are devoted to this endeavor.

## 5.2 Toward an agreement analysis

First, let us point out that DGS and RSL are not like the partial null-subject languages discussed in Section 2.1. At first glance, it might appear as if DGS and RSL behave in a similar way to spoken languages such as Finnish, given that they, too, disallow third-person subject drop. However, a crucial difference is that the restriction on third-person drop in the two sign languages studied only applies to a specific type of verbs. An analysis à la Holmberg (2005) fails to account for this dichotomy, as it would be far-fetched to claim that DGS and RSL have two different types of the T-head which happen to combine with different verb types.<sup>19</sup> It seems more plausible that the null-subject pattern in DGS and RSL arises as a result of a structural difference related to verb type.<sup>20</sup> Moreover, person marking in sign languages differs from person marking in spoken languages (as explained in Section 1.1), and we will argue that these differences also translate into different feature specifications (Section 5.3).

We do nonetheless feel that the best way to account for the observed pattern is to posit that there is an agreement relation between body-anchored verbs and their subjects. We develop an account in which the interaction between formal and semantic features on the subject and the verb yields the correct interpretation of the subject in all scenarios. Before we discuss which features are involved in which possible configurations, let us first examine the arguments for an analysis in terms of agreement.

Traditionally, body-anchored verbs have been analyzed as non-agreeing plain verbs (see Fischer & Gough 1978; Padden 1988; Lillo-Martin & Meier 2011, among many others). As such, they have been contrasted with agreement verbs, which agree with their arguments through directionality (Fischer & Gough 1978; Lillo-Martin & Meier 2011). Many researchers have remarked that the fact that agreement is limited to a particular, apparently semantically defined, subset of verbs is a non-canonical property of the agreement

<sup>19</sup> Moreover, we are not aware of any independent evidence for the existence of a T-head in DGS or RSL, as tense is not a grammatical category in either of these languages.

<sup>20</sup> Note, however, that our proposal is decidedly different from Lillo-Martin's (1986) analysis of null subjects in ASL. Although she, too, claims that different verb types trigger different subject-drop patterns (as discussed in Section 2.2), she offers that the key difference lies in the presence vs. absence of agreement on the verb: with plain verbs, null subjects cannot be syntactically licensed but must instead be discourse-regulated. We, on the other hand, argue that all verbs in sign languages agree, such that the differences between different verb types with regard to subject-drop patterns reduce to subtle differences in the verbs' feature specifications.

system in sign languages. This peculiar state-of-affairs largely dematerializes when both agreement verbs and body-anchored verbs are analyzed as showing subject agreement.<sup>21,22</sup> What is unique about body-anchored verbs under our analysis is that they are permanently in first-person form due to their articulation on the body. At the same time, this is the exact same locus utilized by agreement verbs when they agree with a first-person referent. Our analysis capitalizes on this observation.

From the attested subject-drop pattern, we derive the implication that signers make an implicit, iconically motivated, connection between body-anchored verbs and first person. This automatic association results in an overtly articulated subject becoming superfluous – if it is first person, that is. An obvious objection to this perspective is that clauses with body-anchored verbs may contain subjects that are *not* first person, in which case there appears to be a mismatch between the (third-person) subject and the (first-person) body-anchored verb. The question, then, becomes, how we can account for sentences with an overt third-person subject and a body-anchored verb. We address this matter in detail in Section 5.4.

A further advantage of an agreement approach is that it goes some way toward solving another puzzling aspect of sign language verb agreement: the apparent primacy of object over subject marking. Remember from Section 2.3 that Meir et al. (2007) attempt to account for this issue by proposing that the body represents the subject in body-anchored verbs, such that there is, in fact, subject marking. The body takes on a different function in agreeing verbs, where it represents first person instead of subject. Verbs that change from body-anchored into agreeing forms, as Meir et al. (2007) report for ISL, also see a change in the function of the body. We similarly argue that the subject is marked in body-anchored verbs, but we do not follow Meir et al. (2007) in asserting that the role of the body needs to change. Rather, it preserves precisely the same function as the locus for first-person agreement – irrespective of verb type.

We conclude that an agreement analysis of body-anchored verbs has appealing benefits and is thus worth pursuing. In the next two sections, we look at the technical side of the story. The main issue that needs to be resolved is that a clash arises between first-person marking on body-anchored verbs and third-person subjects, which we will conceive of formally as a feature clash. We turn to analyses of gender mismatch in spoken languages, in particular Matushansky's (2013) analysis of Russian, for answers.

### **5.3 Inherent and interpretable features**

The key to solving the mismatch problem lies in making the distinction between formal and semantic specifications of features. We follow in the tradition of Pesetsky & Torrego (2007) in assuming that these are distinct concepts. Adopting Matushansky's (2013) terminology, we will say that features can be either inherent or non-inherent (i.e. formally specified, e.g. for gender or number, in the lexicon), and they can be either interpretable or uninterpretable (i.e. make a semantic contribution to interpretation). The uncoupling of these two dimensions presupposes that there are four types of features: (i) uninterpretable, inherent; (ii) uninterpretable, non-inherent; (iii) interpretable, inherent; and (iv) interpretable, non-inherent. This typology diverges from Chomsky's assumption that “uninterpretable features, and only these, enter the derivation without values” (2001: 5). Pesetsky & Torrego (2007) show that this condition is insufficient to account for various syntactic phenomena, such as the relation between the category Tns and the finite verb,

<sup>21</sup> Of course, object agreement may still only occur with regular agreeing verbs.

<sup>22</sup> We are glossing over the matter of neutral verbs here, but – as we explicate in Section 6 – we think that an agreement analysis can also extend to this verb type.

as well as the relation between C and *wh*-phrases. Other researchers have since adopted this approach to account for other phenomena, including Matushansky (2013), who relies on the independence of formal and semantic features in her analysis of gender mismatch in Russian.

Pesetsky & Torrego (2007) propose a feature-sharing mechanism, where an unvalued feature F probes within its c-command domain for another instance of F to agree with, in which case it is replaced by the value of the goal. Crucially, under this definition of Agree, it is also possible that two unvalued occurrences of F enter into Agree: the output will be a structure with one occurrence of F with two instances. In other words, in Pesetsky & Torrego's (2007) system, being unvalued is not a precondition for being uninterpretable. Another important aspect of their account is that a link between the two instances is preserved, unlike in classic Agree after feature deletion has taken place (Chomsky 2001).

Matushansky's (2013) conception of Agree is quite different from that of Pesetsky & Torrego, although it preserves the notion that unvalued features do not necessarily need to be uninterpretable. According to Matushansky, all instances of  $\phi$ -features come into the derivation valued.<sup>23</sup> Instances of features that are non-inherent, however, do need to be licensed. This may happen in one of two ways: either a non-inherent instance of a feature is matched to an inherent instance residing in a sister node, or it gets semantically interpreted due to the presence of an interpretable feature. Since we will be building on Matushansky's work, we will adopt her view on Agree rather than Pesetsky and Torrego's. We come back to the details of her account in Section 5.4.

Having made the distinction between formal and semantic feature specifications, let us first determine which features body-anchored verbs and their subjects bear. Up until now, we have talked about *person* being the relevant grammatical category that expresses distinctions between referents. Here, we propose a different term: *referent*. The use of the term *referent* in lieu of *person* is intended to account for the observation, previously discussed in Section 1.1, that non-first person referents become associated with a particular location in the signing space within the context of a discourse. As such, any reference that is subsequently made to such a location picks out a *specific* referent (which may also be plural), rather than the pool of all possible referents available within a particular discourse that a third-person pronoun would pick out in spoken languages. Conversely, the same referent can be associated with different R-loci in different conversations.<sup>24</sup> We believe our proposal for a referent category is in consonance with analyses that argue for a first versus non-first 'person' distinction in sign languages (e.g. Meier 1990; Engberg-Pedersen 1993; Rathmann & Mathur 2002; Hou & Meier 2018). A referent  $\phi$ -feature is also close in spirit to Costello's *identity* feature, "an abstract feature that encodes identity but is not intrinsically related to location" (2015: 252), and it has echoes of Steinbach & Onea's (2016) proposal that non-first person subjects are specified with an abstract feature associated to a particular location in the signing space for the duration of a discourse (see below).

Now, in spoken languages, pronouns and NPs functioning as subjects can be said to possess inherent  $\phi$ -features, while the verbs that agree with them bear non-inherent features. We argue for the opposite scenario in clauses with body-anchored verbs in sign languages. Firstly, body-anchored verbs have an inherent referent-feature specification which we will refer to as *S* for speaker. *S* is inherent because body-anchored verbs are fixed forms that reference the speaker by virtue of their articulation on the body. Thus, whereas Pesetsky & Torrego (2007: 264, fn. 2) remark that they are "... unaware of verbs

<sup>23</sup> We will argue in Section 5.4 that null subjects form an exception: they have an unvalued feature.

<sup>24</sup> In fact, R-loci may even change within a discourse, as in the case of role shift, for example.

that have, for example, only first-person forms ...”, we claim that the equivalent of that does exist in languages in the signed modality.

In contrast, we propose that subjects possess a non-inherent referent feature value as a result of the spatial nature of the pronominal system in sign languages, as discussed above. We follow Steinbach & Onea (2016) in positing an abstract R/L-feature for non-speaker referents. Steinbach & Onea (2016) observe that in most cases where two referents are localized, one referent becomes associated with the right side of the signing space, and the other with the left side. Whenever more referents are introduced in the discourse, these regions can be further subdivided if necessary. For Steinbach and Onea, feature values are thus recursive: you can have an R value, an L value, a RL (left part of the right side) and a RR (right part of the right side) value, etc. In this system, a newly introduced referent in the discourse will always become associated with a region that is maximally contrastive to the previously introduced region.<sup>25</sup>

Semantically, Steinbach & Onea (2016) model this feature within the Discourse Representation Theory framework as a device to track referents. They extend the standard DRT framework with the assumption that the top part of the Discourse Representation Structure boxes are structured and recursive – parallel to the way the R/L feature values can be recursive.

Without going further into the technical details, the crucial aspect of their analysis for us is that non-first person pronouns bear this spatial R/L feature, and that the values of this feature are also interpretable. In addition, Steinbach & Onea (2016) argue that noun phrases receive a value for this feature even when there is no overt marker of localization in the clause, as sometimes a noun phrase is not localized overtly but is later still referred back to with a pointing sign. Steinbach & Onea (2016) do not discuss first-person referents, but we think that their approach is compatible with proposing that first-person pointing signs have a formal value of the same feature that we will indicate with *S*, and which is interpreted as [[SPEAKER]].

Thus, all pronouns have features in our system – unlike what is commonly accepted for the comparable person features in spoken languages, where third person is usually characterized by the absence of features (Harley & Ritter 2002). We would argue that this is an acceptable solution, since (a) we have proposed that a different grammatical category (*referent*) is involved in sign languages, and (b) non-first person pronouns in sign languages (i.e. those with a R/L-feature) have semantic information associated with them (they track referents using a spatial mechanism). As such, they cannot simply be analyzed as bearing no features.

The R/L feature on pronouns is non-inherent because its realization is dependent on which values have been assigned to other referents earlier in the discourse. The S-feature that first-person referents receive is also non-inherent on the assumption that the first-person pronoun INDEX<sub>1</sub> is part of the same paradigm as non-first person pronouns.

For all the features introduced above, we follow Matushansky (2013) by proposing that features – both inherent and non-inherent ones – come into the derivation already valued. Non-inherent features still need to be licensed, except for null subjects: these also bear a non-inherent referent feature, but it is unvalued because there is no phonological content. As such, valuation must come from elsewhere. We return to these issues in Section 5.4.

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<sup>25</sup> Steinbach & Onea (2016) state that pronominal points toward the addressee are typically realized in the central area of the horizontal plane, and thus do not participate in a system of maximal contrast. However, on the presumption that second-person referents can, in principle, be localized at all the same locations as third-person referents, we argue that second-person referents come with a R/L feature, too. We come back to the treatment of second-person subjects in Section 6.3.

With respect to semantic features, first-person subjects bear an interpretable [[SPEAKER]] feature value, while non-first person subjects bear a value which we gloss as [[R/L]] as a shorthand for the reference tracking feature proposed by Steinbach & Onea (2016).<sup>26</sup> Crucially, body-anchored verbs come with a [[SPEAKER]] feature value only when that is required for a proper interpretation of the clause – namely, when it contains a non-overt subject. We explain this mechanism in more detail in the next section. An overview of the feature specifications of subjects and body-anchored verbs is presented in Table 6.

#### 5.4 Feature mismatch

A consequence of introducing an inherent-speaker feature value on the body-anchored verb is that a feature clash arises in the case of a non-first person subject. This situation has parallels, we show, with gender mismatch in spoken languages – a phenomenon that has attracted the attention of linguists for some time, going back to at least the seventies (see Corbett 1979).

Gender can be both semantically and formally assigned to nouns, and languages differ with respect to how they assign it. Some languages have a fully semantic system, while others have a predominantly formal system. Because there are no languages where gender does not have any grounding in semantics, languages that allow syntactic gender often present mixed gender systems. In such languages, the semantic gender of the referent denoted by the noun may differ from its formal gender, giving rise to mixed agreement, i.e. different marking on the noun vis-à-vis its modifiers and/or the verb. There are language-specific restrictions on the possible combinations of semantic and formal gender marking.

Several theoretical analyses have been put forward to account for mixed agreement patterns (e.g. Sauerland 2004; Steriopolo & Wiltschko 2010; Ackema & Neeleman 2013), but the one we focus on here is Matushansky's (2013). Studying mixed agreement in Russian, Matushansky (2013) proposes that agreement markers on verbs with non-inherent feature specifications can be endowed with semantic features as a last-resort strategy. Under the theoretical assumption that interpretable features override inherent grammatical features, this operation results in the (semantically) correct interpretation. (11) presents an example of mixed agreement between the noun with modifiers and the predicate.

- (11) *Russian* (Matushansky 2013)  
 Naš rajonnyj vrač byl-a bol'n-a  
 our.M district.M doctor.M was-F sick-F  
 'Our district doctor was sick.'

The structure Matushansky (2013) proposes is represented in (12). *Vrač* ('doctor') is a noun with formal masculine gender. The determiner and adjective modifying the noun also take masculine gender in this example. However, the predicate is marked for feminine gender. In order to resolve the clash that arises between formal feature specifications, an interpretable feature [[FEMALE]] is inserted as a last resort on the predicative copula.

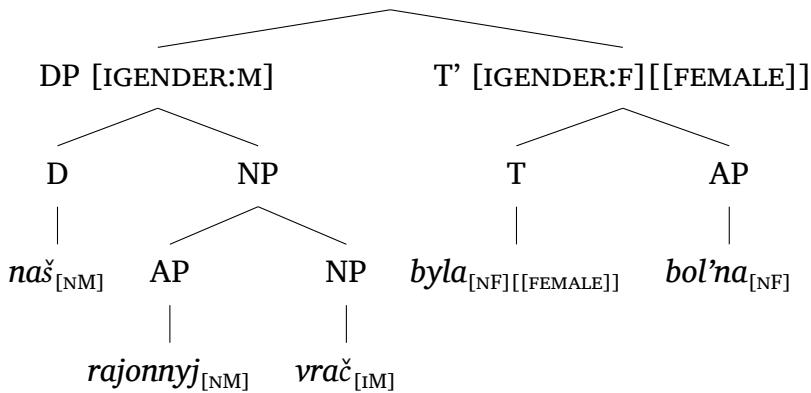
**Table 6:** Feature values specified on subjects and body-anchored verbs.

	<b>subj-1</b>	<b>subj-3</b>	<b>pro</b>	<b>v</b>
<i>formal</i>	[NREF:S]	[NREF:R/L]	[NREF]	[IREF:S]
<i>semantic</i>	[[SPEAKER]]	[[R/L]]	-	- / [[SPEAKER]]

<sup>26</sup> This means that the R/L values are basically interpreted as individual indexes associated with individual referents and used for reference tracking.

Since interpreted features override inherent features, the correct (female) interpretation is derived.

(12) TP [IGENDER:F][[FEMALE]]

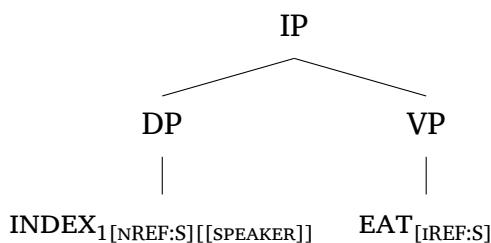


We argue that in DGS and RSL, referent features can be assigned both semantically and formally to subjects as well as to verbs. We can motivate these different feature specifications as follows: body-anchored verbs and subjects have formal referent-feature values because these specify a location, which can be either the body of the signer or some locus in the signing space. This means that a mismatch arises whenever a body-anchored verb – specified formally for speaker referent – is combined with a third-person subject with a corresponding formal (albeit non-inherent) R/L-specification. Remember that body-anchored verbs have an inherent referent-feature specification because their form is fixed and does not change depending on the subject referent. Subjects bear a semantic feature because it provides semantic information, namely reference tracking.

In the case of a null subject, the body-anchored verb will become semantically active, i.e. interpretable, and will thus be specified with a semantic speaker feature. This is quite unlike any mechanism Matushansky describes, but we think it is necessary to introduce such a feature because it is a representation of the iconicity effect that we have argued occurs in both languages: signers can access a default speaker interpretation of a null subject in clauses with iconically motivated body-anchored verbs.

Translating the above into a structural representation, we propose the trees in (13) to (15). Our analysis of agreement with body-anchored verbs essentially presents the mirror image of Matushansky's structure in (12). In (13), we present a schematic representation of the syntactic structure of a clause with an overt first-person subject and a body-anchored verb. The verb bears an inherent feature for speaker, while the indexical bears a non-inherent speaker-feature as well as an interpretable [[SPEAKER]]-feature. There is no mismatch situation.

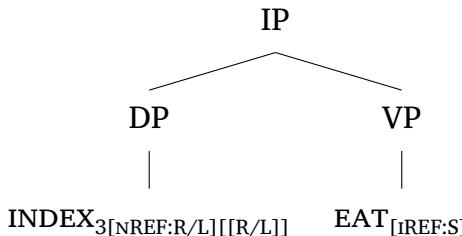
(13)



In (14), the simplified structure for clauses with a third-person referent and a body-anchored verb – the mismatch scenario – is illustrated. The structure is identical to the one with a

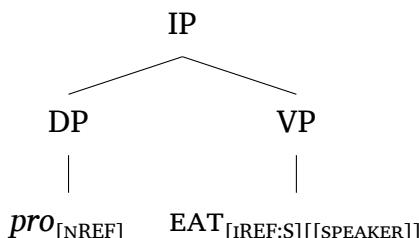
first-person subject with the exception of the features that are specified on the subject. While there is a mismatch between the formal features on the subject and the verb, this is overridden, à la Matushansky, by the interpretable feature on the subject. Nominal subjects are endowed with the same features as (third-person) pronominals; the structure will thus be the same.

(14)



Finally, (15) represents the structure of clauses with a null subject. Since *pro* only bears an unvalued non-inherent feature, an interpretable feature needs to be introduced on the verb as a last resort. Due to the verb's body-anchored form, the specification of this feature is [[SPEAKER]]. The non-inherent feature on *pro* gets valued through checking; the result is a first-person interpretation of the null subject.

(15)



The account we have proposed above rests on the notion that body-anchored verbs are first-person forms. An interesting question worth asking is whether this holds for all body-anchored verbs, or only for those that are iconically motivated.<sup>27</sup> While we can only speculate at this point, given the limited data that we have with non-iconic body-anchored forms, let us reiterate from Section 4.3 that four of the RSL examples with a null third-person subject – exceptions to our hypothesis – involve the verb LIVE. Indeed, this verb is body-anchored but, as far as we can tell, not iconically motivated. These examples thus serve as some indication that only an iconically motivated body-anchored verb activates an association with the speaker. We tentatively conclude that only iconic body-anchored verbs are first-person forms, although it is evident that further testing is needed.

To summarize, we have set out a basic account of subject-drop patterns in clauses with body-anchored verbs. We have argued that body-anchored verbs represent first-person forms – always specified with an inherent speaker-referent feature value – which are in an agreement relation with the subject. However, the verbs' referent feature may be overridden by an interpretable feature specification on the subject. This mechanism ensures that clauses with third-person referents receive the correct semantic interpretation. In the case of a non-overt subject, which has a non-inherent feature that still needs to be valued, an interpretable [[SPEAKER]]-feature value is introduced on the verb as a last-resort strategy, leading to a first-person interpretation of the null subject.

<sup>27</sup> We thank an anonymous reviewer for raising this question.

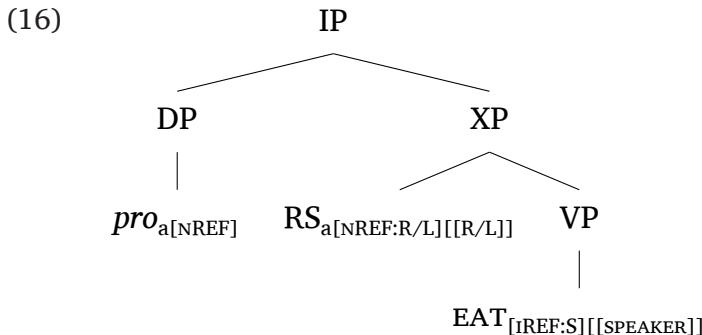
### 5.5 Role shift

In this section, we sketch an analysis of sentences involving role shift. There are various approaches to role shift (Quer 2011; Lillo-Martin 2012; Schlenker 2017), but our analysis is in principle compatible with any approach as long as role shift is a manifestation of or related to context shift.

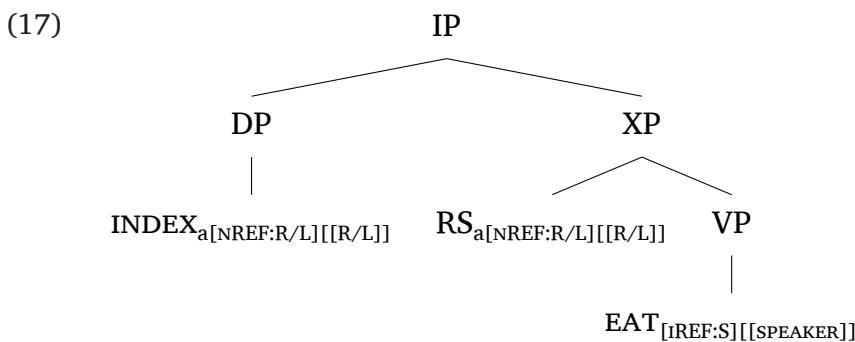
The basic logic is as follows: role shift is an operator expressing context shift; constituents marked with role shift are not interpreted relative to the context of the utterance, but to the shifted context. While this claim is usually made in relation to quotative role shift, we think that the same applies to non-quotative role shift, that is, to constructed action. The effects of context-shifting in non-quotative role shift are less obvious, but since in our approach body-anchored verbs have a speaker-referent feature, there is an effect of context shift on their interpretation.

Specifically, when marked with role shift, the body-anchored verb still has the [IREF:S] and [[SPEAKER]] features so that the referent of the subject has to be first person (the speaker), but only within the shifted context. The null or overt subject is outside the scope of role shift and thus context shift.

A syntactic analysis for the null-subject case is presented in (16). Within the scope of the role shift, we have a body-anchored verb forcing a first-person interpretation, as in (15) above. The role shift is an operator producing context shift so the reference to the speaker in the shifted context corresponds to another referent in the global context (see below for the semantics). Also, in this approach, the operator itself introduces the referent (R/L) values of the subject, which the null subject lacks.



In case of an overt subject, we propose a very similar structure (17) with the exception that the subject also bears the R/L-referent values.



A simplified semantics of the role-shift operator is represented in (18), after Schlenker (2017: 41). What it means is that the [[SPEAKER]]-value under role shift will be interpreted with respect to the modified context  $\langle s(i), w \rangle$ , so the reference of the speaker is now determined by the  $i$  index on the role-shift operator.

- (18) If  $c$  is a context,  $s$  an assignment function and  $w$  a world parameter,  
 $[[RS_i VP]]^{c,s,w} = [[VP]]^{<s(i), w>, s, w}$ .

Thus, we can easily account for the observation that null subjects of body-anchored verbs can be interpreted as third person in clauses with role shift: the solution is that they are actually interpreted as first person, but only within the shifted context.

## 6 Extensions of the analysis

The analysis we laid out in Section 5 provides a way of accounting for subject-drop patterns with body-anchored verbs, but it has also been developed with the intention of making it extendable – with only a minimum of required adaptations – to clauses with verbs of other types. Here, we discuss how this can be done for neutral verbs (Section 6.1) as well as agreeing verbs (Section 6.2). We also devote some space to discussing how subject-drop patterns with second-person referents should be accounted for within the framework we have developed (Section 6.3).

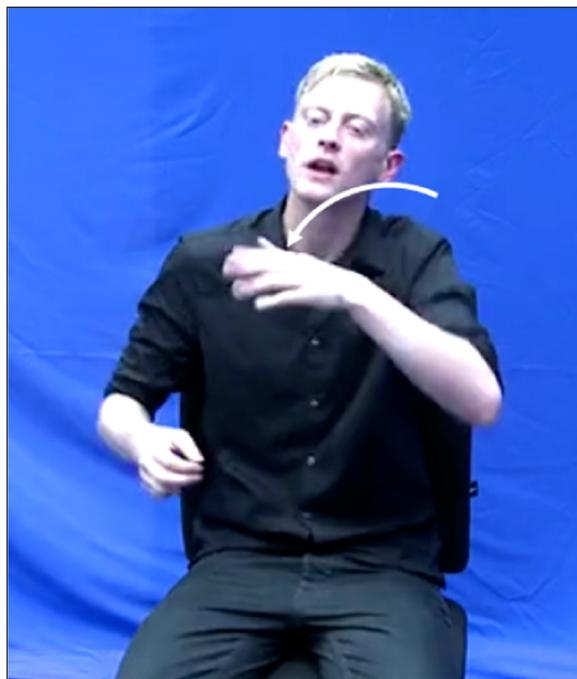
### 6.1 Neutral verbs

The results from DGS and RSL (Section 4.1) indicate that subject drop is permitted across the board in clauses with neutral verbs: no restrictions related to person are attested. Unlike body-anchored verbs, neutral verbs are not obligatorily articulated at a locus that is by default associated with a particular referent feature. This observation motivates positing a non-inherent referent feature for neutral verbs. In the absence of an overt subject, we argue that the value of this feature – which, as we discuss below, has the potential to be expressed overtly – is determined by a default feature assignment mechanism similar to that described by Steinbach & Onea (2016) for pronouns.

Let us first consider what an overt expression of the non-inherent feature on the verb looks like. As in other sign languages (e.g. ISL, Meir 1998; NGT, Zwitserlood & van Gijn 2006; Spanish Sign Language, Costello 2015), it is possible for at least some neutral verbs in DGS and RSL to be articulated at a locus associated with a particular referent (i.e. an R-locus). We treat such localization as agreement. Localization is only possible for non-first person referents; as a phonological restriction, a neutral verb can never be articulated on the body. An example with a localized neutral verb in DGS is provided in (19). Figure 3 shows the articulation of the verb DIE in the example, which is normally articulated at a location more toward the ipsilateral side of the signing space. However, in Figure 3, the verb is localized on the contralateral side. The relevant referent in the example has been localized earlier in the discourse at the same location.

- (19) *DGS*  
INDEX<sub>1</sub> FIRST OBSERVE DIE<sub>a</sub> / INDEX<sub>1</sub> BE-SAD  
‘When I first learned that (she)<sub>a</sub> had died<sub>a</sub>, I was sad.’

DIE in (19) agrees with a subject (of an embedded clause), but it is also possible for some neutral verbs that denote transitive concepts to agree with an object, as shown in example (20) (with a left-dislocated object). The three signs that make up the clause are displayed in succession in Figure 4. The generalization appears to be that neutral verbs may agree with an internal argument, which surfaces in subject position in intransitive constructions, but in object position in transitive constructions (Meir 1998; Costello 2015). We do not explore this issue in more detail here; the relevant point is that agreement with the surface subject may, at least under some circumstances, be expressed overtly through localization of the neutral verb.



**Figure 3:** DIE; localized to agree with the subject.



**Figure 4:** A clause with a neutral verb (BOIL) displaying object agreement.

(20) *DGS*

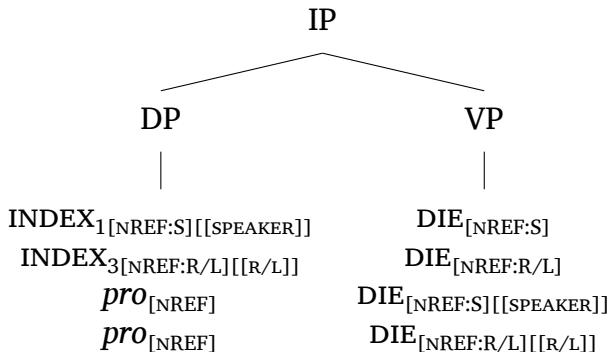
$\text{BIG}_a / \text{INDEX}_1 \text{ BOIL}_a$   
'I cooked<sub>a</sub> [a big pot (of pasta)]<sub>a</sub>.'

In (21), we schematically represent the structure of constructions with neutral verbs and different realizations of arguments in subject position (after potential movement operations). When a clause contains an overt subject, it is the subject's interpretable feature that leads to the intended person interpretation of the subject, as in clauses with body-anchored verbs. In the case of a null subject, the verb's features determine interpretation. A non-inherent feature is assigned by means of a default mechanism and is optionally expressed through localization (though only in the case of non-first referents), which enables the introduction of a semantic [[SPEAKER]] or [[R/L]] feature as a last-resort strategy to yield the intended interpretation.

Thus, given that neutral verbs do not have a fixed form, they may be endowed with different referent features depending on their association with a particular R-locus – and as

such they do not force a first-person interpretation. As a result, subjects of all persons may be dropped. This thus sets them apart from body-anchored verbs.

(21)



## 6.2 Agreeing verbs

Although we did not systematically investigate subject-drop patterns with agreeing verbs, we expect that, as with neutral verbs, there are no person restrictions. Since the form of an agreeing verb is flexible, we argue that verbs of this type also possess a non-inherent referent feature. Again, this feature is specified covertly through default feature assignment, and may be expressed overtly through alignment of the starting location of the verb's trajectory with the locus of the subject.

In essence, this means that the schematic representation in (21) in the previous section also applies to agreeing verbs – with the obvious caveat that verbs of this type may additionally display object agreement. We do not discuss object agreement any further, as it falls outside the scope of this paper, but it has no impact on the analysis proposed here. The same applies to backward agreeing verbs. Our overall prediction for agreeing verbs remains that the arguments targeted by agreement when omitted should show no person restrictions. Future research is needed to verify this hypothesis.

As a final note, several researchers (e.g. Meir 1998; Costello 2015) have previously described “defective” agreeing verbs, which begin their trajectory at a fixed place of articulation on the body but may end at an R-locus to express object agreement (or if it is a defective backward agreeing verb, it will begin its trajectory at an R-locus and end at the body). An example is the verb SEE in DGS (Figure 5). Our analysis predicts that the restriction on third-person subject drop that applies to body-anchored verbs should also hold for defective agreeing verbs. For defective backward agreeing verbs, the person restriction would also apply to subject drop (i.e. the second marked argument).<sup>28</sup>

<sup>28</sup> Before moving on, we would like to briefly discuss how our account relates to previous research connecting pro-drop and agreement in ASL (Lillo-Martin 1986). As we discussed in section 2.2, Lillo-Martin demonstrated that null arguments can be licensed by verbal agreement in certain contexts where they cannot be licensed by discourse topics, such as in embedded clauses with a subject of a main clause intervening between *pro* and the topic. However, this observation is orthogonal to our observation that in RSL and DGS, the third-person subject of a body-anchored verb cannot be dropped, even in simple clauses. In other words, while Lillo-Martin argues that agreement can *license* argument omission in ASL, we argue that agreement *constrains* which subjects can be dropped. Furthermore, the connection between agreement and pro-drop as argued by Lillo-Martin’s model has recently been questioned for ASL (Koulidobrova 2017), while Kimmelman (2018b) has shown that agreeing verbs in RSL do not license pro-drop in embedded clauses. Our hypothesis is that argument omission in embedded clauses is regulated by some mechanisms at least partially independent of agreement, e.g. as argued for by Koulidobrova (2017) for ASL, and thus we do not at present have explicit predictions about subject-drop patterns in these constructions for RSL and DGS. Further research is necessary.



**Figure 5:** An instance of the verb SEE in DGS, starting from the body and ending at the locus of a third-person referent.

### 6.3 Second person

With our analysis, we predict that null subjects should not be able to get a second-person interpretation with body-anchored verbs. Regardless of whether second person is present in the grammar of RSL and DGS as a separate category or is simply part of a non-first person category, our prediction remains that null subjects have only unvalued referent features – and the only feature that can be interpreted in such contexts is the inherent speaker-referent feature on the verb. However, as discussed in section 4.3, we do find examples of second-person subject drop in both languages.

A tentative explanation for these counterexamples, as we discussed in 4.3, is that null second-person subjects tend to occur in questions to the addressee. Crucially, such questions are marked by (a combination of) non-manuals such as body leans, eyebrow raise, or eye gaze toward the addressee (8).<sup>29</sup> We hypothesize that this non-manual marking is in fact syntactically and semantically active in that it can introduce the feature that determines the reference of the subject (be it a dedicated second-person feature or an R/L-feature, depending on whichever analysis one pursues).<sup>30</sup>

A concrete formal implementation of this hypothesis is left for future research. Still, irrespective of the technical details, such an account requires a syntactic (rather than prosodic) analysis of non-manual markers for questions (see Wilbur & Patschke 1999; Sandler & Lillo-Martin 2006 for a discussion of the syntax vs. prosody debate).

<sup>29</sup> In a typological study of interrogative constructions in 35 sign languages, Zeshan (2004) reports that all sign languages in her sample – which includes both DGS and RSL – employ nonmanual marking for questions. Coerts (1992), analyzing NGT data, shows that the large majority of interrogative constructions in her data set are marked by nonmanuals. Indeed, Zeshan (2004) notes that there are few differences across sign languages with respect to status and scope of nonmanual markers in interrogative constructions, in contrast to other domains where nonmanual marking often occurs, such as negative constructions. Given this, we have reason to expect that questions in DGS and RSL are also consistently non-manually marked.

<sup>30</sup> For the examples with questions involving the verb KNOW (10 in RSL and 4 in DGS), we propose that KNOW has simply developed into a discourse marker and thus does not require a subject.

## 7 Conclusions

In this paper, we have demonstrated that iconicity plays a role in constraining subject omission in two sign languages: RSL and DGS. We performed a quantitative analysis of naturalistic corpus data from both languages to draw generalizations about subject-drop patterns. We showed that, with body-anchored verbs, null subjects can only be interpreted as first person, whereas a third-person interpretation of null subjects with neutral verbs is entirely acceptable. We attributed this asymmetry to iconicity: body-anchored verbs use the body of the signer as a place of articulation, and the signer's body is interpreted by default as referring to the signer, that is, as a first-person expression. Neutral verbs do not contain the body as a meaningful part of the sign, and thus no such constraints on reference of a null subject apply.

We developed a formal account in which we drew a comparison to mixed gender agreement as attested in spoken languages such as Russian. Specifically, we argued that body-anchored verbs bear an inherent speaker-referent feature, and, in the absence of an overt subject, this leads to a first-person interpretation. When a third-person overt subject is combined with a body-anchored verb, a feature mismatch occurs. However, this clash does not lead to a derivation crash due to an interpretable feature on subject that overrides formal features. Neutral verbs, on the other hand, do not have a fixed inherent referent feature, such that the interpretation of the null subjects is not constrained.

We also demonstrated that our analysis readily explains why the constraint on interpretation of null subjects is lifted in the presence of role shift, and discussed a possible explanation for the behavior of second-person subjects. Finally, we discussed how the analysis can be extended to agreeing verbs.

Thus, in this paper we clearly distinguish modality-general linguistic principles and modality effects. The formal analysis that we developed uses modality-independent mechanisms of feature checking and mixed agreement. At the same time, the features themselves are modality-specific, as the reference-tracking system in sign languages is fundamentally different from the system used in spoken languages (Steinbach & Onea 2016). Another modality effect – or rather, iconicity effect – is that body-anchored verbs bear an *inherent* speaker-referent feature. While we do not appeal to iconicity in the grammatical analysis itself, it serves as a background for motivating specific grammatical properties of verbal signs.

## Abbreviations

Sign language abbreviations:

DGS = German Sign Language, RSL = Russian Sign Language, ASL = American Sign Language, Auslan = Australian Sign Language, NZSL = New Zealand Sign Language, NGT = Sign Language of the Netherlands, ABSL = Al-Sayyid Bedouin Sign Language, ISL = Israeli Sign Language, DTS = Danish Sign Language.

Glossing conventions:

SIGNS are glossed in small capitals with an approximation of their meaning in English, following common convention in the field. Pointing signs are indicated with INDEX followed by a subscript 1 for first person or a letter (a) for a region in the signing space associated with a particular referent. (The function of) relevant non-manual markers are indicated with a line above the glosses over which they scope; rs is shorthand for role-shift markers.

## Additional Files

The additional files for this article can be found as follows:

- **Supplementary file 1.** RSL video for example (3). <http://rsl.nstu.ru/data/view/id/239/t/50721/d/51183>
- **Supplementary file 2.** Statistical analysis. DOI: <https://doi.org/10.5334/gjgl.741.s1>
- **Supplementary file 3.** Statistical analysis – code. DOI: <https://doi.org/10.21942/uva.7588919>
- **Supplementary file 4.** Annotations DGS data. DOI: <https://doi.org/10.21942/uva.7588847>
- **Supplementary file 5.** Annotations RSL data. DOI: <https://doi.org/10.21942/uva.758886>
- **Supplementary file 6.** RSL video for example (6b). <http://rsl.nstu.ru/data/view/id/208/t/105425/d/107760>
- **Supplementary file 7.** RSL video for example (7). <http://rsl.nstu.ru/data/view/id/56/t/37712/d/40352>
- **Supplementary file 8.** RSL video for example (8). <http://rsl.nstu.ru/data/view/id/228/t/74640/d/75320>
- **Supplementary file 9.** RSL video for example (9). <http://rsl.nstu.ru/data/view/id/278/t/62037/d/65577>

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## Competing Interests

The authors have no competing interests to declare.

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