Argument structure in sign languages

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Abstract:

Although sign languages are crucial for research on the human linguistic capacity, argument structure in these languages is rarely addressed in theoretical and typological studies. This paper provides an overview of existing research on argument structure and argument structure alternations in sign languages. It is demonstrated that there are many fundamental similarities between the two modalities in the domain of argument structure, such as the basic valency patterns and the semantic basis of argument structure. At the same time, modality effects, such as iconicity, simultaneity, and the use of space, play an important role in argument structure realization. Finally, it is discussed how emerging sign languages present an opportunity to observe and study emergence of argument structure.

1. Introduction

1.1 Argument structure

Argument structure is a core topic in linguistics, as it concerns a fundamental component of grammar: how verbs are combined with arguments to form clauses (Levin & Rappaport Hovav 2005). It has been investigated in a variety of frameworks and perspectives, and a large number of questions with wide-reaching theoretical implications are related to it. In formalist frameworks, one of the key topics has been the debate on whether argument structure is part of lexical semantics of verbs, or whether it is constructed in syntax (Borer 2005; Hale & Keyser 1993; Levin & Rappaport Hovav 2005; Marantz 1997; Müller & Wechsler 2014; Ramchand 2008). In functional-typological frameworks, the focus have been on describing the constraints on cross-linguistic variability of argument structure, as well as on explaining the semantic or functional basis for specific argument structure realizations (Hartmann et al. 2013; Haspelmath 1993, 2015; Malchukov & Comrie 2015).

However, all the major theories of argument structure are based on spoken languages, as are most typological studies. This means that a crucial piece of knowledge is missing: that of argument structure in sign languages, which are natural languages existing in the visual-spatial modality and used by deaf communities around the world. In recent decades, sign language linguistics has rapidly developed, and it should by now be common knowledge that, in order to make and test universal claims about human linguistic capacity, we need to take into account sign languages (Sandler & Lillo-Martin 2006). Furthermore, some sign languages are currently emerging, thus giving us a window into the emergence of fundamental linguistic components, including argument structure (Kocab & Senghas 2021).

Despite the clear necessity to understand argument structure in sign languages, relatively little research has been done on this subject. In this paper, I provide an overview of the most important topics related to argument structure, argument structure alternations, and emergence of argument structure in sign languages. I also demonstrate how sign languages

contribute to different theoretical issues of argument structure. Before delving into the topic, it is necessary to introduce some notions from sign language linguistics crucial for further discussion that are likely to be less familiar to spoken language linguists.

1.2 Modality and grammar

Sign languages exist in the visual-spatial modality (Meier 2012; Sandler & Lillo-Martin 2006). This means that, instead of the tongue and the vocal cords employed by spoken languages, speech in sign languages is produced by movements of the hands, the body, the head, and by facial expressions, and perceived visually. The articulators employed by sign languages are visible, they move in space, and, due to being able to move partially independently from each other, they can express several pieces of information simultaneously.

These physiological features of sign language production also have consequences for the linguistic structure of sign languages, which are generally known as modality effects (Meier 2012). One such effect is iconicity: individual signs are often iconic (their shape reflects some aspects of their meaning) (Taub 2001), and some morphological modifications of signs are iconic as well.

Sidebar: Notational conventions

Following standard conventions, sign language examples are represented by glosses in small caps in English. The gloss INDEX stands for a pointing sign; POSS is a possessive pronoun; -REC means a reciprocal marker; PU – a palms up gesture. Subscripts with pointing signs and agreeing verbs indicate points in the signing space (if letters are used), or the signer/addressee (if the numbers 1 and 2 are used); *up* means pointing to a location higher in the signing space. For classifier predicates, the following notation is used: CL stands for classifier, followed by the type of classifier in subscript (WH – whole entity, HL – handling, BP – body-part), followed by a description of the meaning of the classifier between brackets, followed by the gloss for the verbal root, as in CL$_{WE}$('car')-ARRIVE. Since sign languages are visual languages, it is crucial to also represent examples visually. To achieve this, sometimes stills of the signs are provided, and, whenever possible, there is a link to the video recording of the relevant example in the Supplementary Material. Most examples come from the RSL corpus (http://rsl.nstu.ru/) (Burkova 2015), so a link to the location of the example in the corpus is also provided.

Another effect is a large amount of simultaneity at all levels. For example, looking at manual signs, their components such the handshape, the location, and the movement are often combined simultaneously; at the same time, each of these components can encode a separate meaning, and thus simultaneous morphology is manifested (Aronoff et al. 2005). Furthermore, the two hands can partially simultaneously produce two separate signs (Vermeerbergen et al. 2007), and nonmanual marking (linguistic use of articulators other than hands) is superimposed over the stream of signs produced by the hands (Pfau & Quer 2010).

Yet another effect of modality is the fact that sign languages use space for linguistic needs. For example, in many sign languages a referent can be assigned an arbitrary location in the signing space (the space in front of the signer), by either locating the sign itself in this location, or by adding a pointing sign towards this location. For instance, in example 1 from Russian Sign Language (RSL) the sign BOY is preceded by a pointing sign INDEX$_a$, which assigns the

location *a* to the right of the signer to this referent (see also Sidebar "Notational conventions"). In later discourse, the signer can use another pointing sign to this location to point back to or re-activate the same referent.

     RSL
(1)   INDEX$_a$ BOY
      'A boy…'
Video
Corpus link: http://rsl.nstu.ru/data/view/id/27/t/129490/d/130210

Most importantly for this paper, in many sign languages, verbs can be spatially modified in order to express the reference of the subject and object arguments. This is most commonly analyzed as verbal agreement (Lillo-Martin & Meier 2011), although some researchers contest the validity of the parallel between spatial modification in sign languages and verbal agreement in spoken languages (Liddell 2003). In example 2 from RSL the verb HELP moves from location *a* to the left of the signer, which is associated with the referent 'granny' to location *b* to the right of the signer, which is associated with the referent 'canary', see also Figure 1. Thus, the argument structure of this verb is clearly and overtly indicated in its form.

     RSL
(2)   INDEX$_a$ $_a$HELP$_b$ INDEX$_b$
      'She [the granny] helps [the canary].'
Video
Corpus link: http://rsl.nstu.ru/data/view/id/253/t/73730/d/74730

Figure 1 RSL sign $_a$HELP$_b$ from example (2) (initial and final locations).

Importantly, not all verbs in sign languages can show agreement (Padden 1988). Currently, the following morphological classes (in terms of spatial modification) are commonly distinguished (Oomen 2020a):

   (1) body-anchored verbs, which are located in contact with or close with the signer's body, and cannot be spatially modified;

(2) neutral verbs, which do not contain a path movement and thus cannot express both subject and object agreement; however, these verbs can be displaced in space to show agreement with one of the arguments, usually the internal argument;

(3) agreeing verbs, which contain a path movement, and thus associate the initial and final locations with the subject and the object, as in (2) above;

(4) spatial verbs which also contain a path movement, but the initial and final locations refer to places (typically the source and goal of motion), not grammatical subject and objects (e.g. FLY which can move between two locations associated with two cities).

An important sub-class of spatial verbs is commonly referred to as classifier predicates (Zwitserlood 2003, 2012), although again there is a debate about the validity of this term in light of comparison with classifiers in spoken languages (Schembri 2003). In these predicates, the movement of the hand is usually analyzed as the verbal root, and it is used iconically to depict the motion of a referent. The handshape, which is known as the classifier, expresses a separate meaning component, namely it specifies the type of the referent that moves. For instance, in example 3, the movement in the verbal sign depicts the motion of the car, and the handshape specifies that the object of motion is in fact a car. Using the same sign with a different handshape would mean that a different type of object moved; modifying the movement would mean that the motion of the car was different.

RSL
(3) CAR CL_WE('car')-ARRIVE
'A car arrived.'
Video
Corpus link: http://rsl.nstu.ru/data/view/id/372/t/32690/d/33600

Three main classifier types are distinguished (Benedicto & Brentari 2004). Whole-entity classifiers refer to the class of the object that undergoes motion. For example, an upright handshape with the index finger outstretched is used in many sign languages to refer to long thin objects, including humans. Example 3 above illustrate this type of classifiers. Handling classifiers are handshapes depicting the hand of someone holding or manipulating an object. For example, a cup-shaped hand can be used to refer to holding or moving a cup. Finally, body-part classifiers are handshapes referring to body parts, such as the fist referring to the head.

Classifier predicates are often contrasted to lexical verbs, that is, all the other verb types. The basis for this distinction is that classifier predicates are highly flexible signs, whose forms are context-dependent and, for location and movement, depictive. Therefore, in contrast to other verbs, classifier predicates have a limited lexical content.

Note also that classifier predicates manifest all the major modality effects discussed above: they are iconic (the handshape typically resembles the type of objects it refers to, the location and movement are used depictively), they instantiate simultaneous morphology, as the classifier morpheme and the verbal root are combined simultaneously, and they use space in front of the signer to convey linguistic information. As I discuss in Section 3 below, they also have very interesting argument structural properties.

1.3 Structure of the paper

In the rest of the paper, I first discuss basic argument realization in lexical verbs (Section 2), followed by a short overview of argument structure alternations (Section 3). Argument structure in classifier predicates, a topic that has received a lot of attention, is discussed separately in Section 4. In section 5, emergence of argument structure in the context of sign language emergence is reviewed.

2. Basic argument structure

2.1 Valency classes in lexical predicates

Basic argument structure of lexical predicates (that is, all verbs except for classifier predicates) has not been systematically described for most sign languages. The few exceptions are American Sign Language (ASL), RSL, and German Sign Language (DGS) (Kegl 1990; Kimmelman 2018a; Oomen 2020a). The main general conclusion that can be drawn for these three languages is that, at least for lexical predicates, their argument structure is strikingly similar to typologically common patterns of argument structure in spoken languages. This manifests in at least two ways: (1) the same verb classes in terms of transitivity are attested in the sign languages as are in spoken languages and (2) the semantics of the verbs belonging to the different verb classes is largely similar across languages in both modalities.

The first description of basic argument structure in a signed language is Kegl's (1990) article on ASL. This article demonstrates that ASL has transitive predicates (HIT), unergative (RUN) and unaccusative (DIE) intransitive predicates, ditransitive predicates where the indirect object is introduced by preposition FOR (KNIT), ditransitive double object predicates (GIVE.TO), psych verbs (LIKE), and weather verbs (RAIN) (Kegl 1990, p. 155). Kegl was also the first to discuss the causative-inchoative alternation for classifier predicates (see Section 4), and to observe that psych verbs in ASL cannot have inanimate theme subjects (see below).

In Kimmelman (2018a), I described basic argument structure in RSL for 80 verbal meanings using a combination of corpus analysis and elicitation. The verbal meanings were taken from the Valency Classes in World's languages project (Hartmann et al. 2013), which developed and used the list of meanings to study argument structure (valency) across 37 typologically and geographically diverse languages. Using this list allowed me to compare the findings for RSL with the typology of argument structures in spoken languages.

Similarly to Kegl (1990), I found that RSL has predicates with various argument structures: verbs with no arguments (weather verbs such as RAIN), intransitive verbs (including unaccusative predicates such as DIE and unergatives such as RUN), labile verbs that alternate freely between unaccusative and transitive use (DAMAGE, BOIL), transitive verbs (STEAL) which also include psych-verbs (LIKE), and ditransitive verbs (SEND). Some transitive and ditransitive verbs can take nominal complements only (DAMAGE, SEND), while others can take clausal complements (SEE, TELL). Note that clausal complements in sign languages have barely been analyzed so far, see Pfau et al. (2016) for some case studies.

Furthermore, I have demonstrated that there is a clear relation between the meaning of the predicate and its valency, as demonstrated by Table 1, partially reproduced from Kimmelman (2018: 29). It is also clear that the relation between the meaning and valency is very similar

to what has been demonstrated for spoken languages in typological research (Haspelmath 1993, 2015; Malchukov & Comrie 2015).

Table 1 Valency-based verb classes in RSL

Class	Verbal meanings
no arguments	**Weather verbs:** RAIN, SNOW, WIND
intransitive	**States:** DRY, HUNGRY, SAD, COLD
	Non-caused events: DIE, BURN, LAUGH, COUGH, BLINK, SMELL, BOIL
	Activities: RUN, ROLL
labile	**Caused/non-caused events:** DAMAGE, HIDE, BOIL
transitive	**Activities**: PLAY, SING, BLINK, SHAVE, EAT, HELP, HUG, SEARCH, SMELL(TR), BUILD, KILL, STEAL, GRIND, COOK, WASH, FOLLOW, LIGHT.UP
	Verbs of cognition/emotion: THINK, KNOW, LIKE, FEAR, FRIGHTEN, SEE, HEAR
	OTHERS: NAME, LIVE, FULL, LEAVE, SIT
ditransitive	**Spatial transfer:** GIVE, SEND, TRHOW, POUR
	Communication: ASK.FOR, TELL, SAY, SCREAM, TALK

Oomen's (2020a) study of DGS used largely the same methods as Kimmelman (2018): the same list of verbal meanings was analyzed, and naturalistic corpus data was used as the source, although elicitation played a smaller role. The main perspective of Oomen's dissertation was the relation between argument structure, morphological verb type, and iconicity. However, it is also clear from her findings that DGS has the same general argument structure types (no argument verbs, intrasitives, transitives, ditransitives), and also that the meaning distribution across different valency types is similar to the one described for RSL, and thus also typologically common.

2.2 Expressing predicate argument structure
In both modalities, there are various means of expressing argument structure or valency, and the most common ways are word order, case or adpositional marking, and verbal agreement or cross-referencing of arguments on the predicate (Hartmann et al. 2013).

Word order is clearly used to express argument structure in many sign languages. Specifically, a majority of sign languages described so far have a preferred/basic word order, typically SOV or SVO with lexical verbs (Napoli & Sutton-Spence 2014). In almost all sign languages subjects precede both the verb and the object (in absence of additional factors, such as information structure (Kimmelman 2019)), and thus subjects are often clearly identified by word order.

In contrast, case and adpositional marking are relatively rare in signed languages. No case marking on nouns has been described thus far. Some languages, such as Swedish Sign Language, have dedicated object forms of pronouns that are typically only used for human referents (Börstell 2017). Furthermore, adpositions have been described (often in passing) for several sign languages, including ASL (Kegl 1990) and RSL (Kimmelman 2018). Adpositions are often used to introduce non-core arguments, such as beneficiary.

Verbal agreement, in contrast, is attested in many sign languages (Lillo-Martin & Meier 2011), although some sign languages lack it (De Vos & Pfau 2015). Clearly, verbal agreement can be and is used to express argument structure directly, as the verbal form cross-references the

subject and the object (Geraci & Quer 2014). Furthermore, some sign languages, including DGS and Greek Sign Language, have the so-called agreement auxiliaries: functional signs that do not have a lexical meaning and are combined with a lexical verb to show spatial agreement with the subject and the object (ibid: 47-48).

Agreement verbs come in several types (Pfau et al. 2018): some are transitive, and contain a movement from the subject to the object (e.g. HELP in RSL, (1)), some are ditransitive, and contain the movement from the subject to the indirect object (e.g. SEND in RSL, which moves from the subject to the addressee object), and some are the so-called backward agreeing verbs. In this latter category, the movement is from the direct object to the subject (e.g. in INVITE in RSL the hands move from the invitee to the inviter). Note that the roles of subject and object roles for these verbs is determined based on other factors, such as word order (see also Pfau et al. 2018 for a discussion of alternative analyses for these verbs).

However, differently from spoken languages, agreeing verbs in sign languages only constitute a subset of all lexical verbs (Padden 1988). An important question can be asked: do morphological verb classes (body-anchored verbs, neutral verbs, agreeing verbs) correlate with/determine valency and argument structure of the verbs? As it turns out, while there are some (often trivial) correlations, the morphological verb class does not determine argument structure (Kimmelman 2018a; Oomen 2020a).

For example, as Oomen (2020: 263) demonstrated, DGS body-anchored verbs are often intransitive, but also include transitive and ditransitive verbs; neutral verbs can be intransitive, transitive, or ditransitive, or have no arguments (as in weather verbs); and agreeing verbs are either transitive or ditransitive. This latter observation is unsurprising, as agreeing verbs by definition must be at least transitive in order to show agreement with two arguments. Kimmelman (2018: 30) found the same patterns for RSL.

Oomen (2020, Ch. 7) also showed that, in DGS, verbal semantics is partially predictive of the verb belonging to the specific morphological class. For example, most verbs of effective action (e.g. BUILD) are neutral, and most verbs of interaction (e.g. HELP) are agreeing. Given that there is also a strong relation between a verb's meaning and its valency, as discussed above, it is natural to expect that some relation between morphological class and valency will also be observed. However, such relation would, in my opinion, be an outcome of both morphological class and valency being motivated by the meaning, and not by a direct causal link between argument structure and morphological class.

2.3 Psych verbs

Psych-verbs present an interesting class in sign languages for a number of reasons. First, as mentioned above, Kegl (1990) found out that psych verbs in ASL typically have experiencer as the subject (e.g. FEAR), while no ASL psych verbs have an inanimate theme subject and an experiencer direct object (as in *This worries John*). The same observation has later been made for NGT (Oomen 2017), RSL and DGS (Oomen & Kimmelman 2019). Specifically, and absolute majority of psych-verbs in these languages have experiencer as subject, while experiencer as object verbs are very rare.

Second, a majority of psych-verbs in these languages are body-anchored (Kegl 1990; Oomen 2017; Oomen & Kimmelman 2019). As mentioned above, in general there is a relation between morphological class and verbal meaning (Oomen 2020a), but for psych-verbs this relations is especially strong.

Sidebar: Argument Omission

The topic of argument omission/pro-drop in general has received a lot of attention in sign language literature, and this phenomenon interacts with other grammatical phenomena. For instance, it has been argued that agreeing verbs but not non-agreeing verbs license pro-drop (Lillo-Martin 1986; but see also Koulidobrova 2017) and that classifier predicates license pro-drop, and thus classifiers are agreement markers (Glück & Pfau 1998; Zwitserlood 2003). More recently, pro-drop in psych verbs has been described, see the main text, Section 2.3. Pro-drop with classifier predicates and spatial verbs in general has been connected to demonstration/depiction (Kimmelman 2018c; Oomen 2020b). Finally, subject omission is a very common strategy for agent backgrounding/impersonal reference (Barberà & Cabredo Hofherr 2018), as discussed in Section 3.1.

Sidebar: Second person in sign languages

It is unclear whether second person feature exists in sign languages. Some researchers argue for the lack of the person features in general due to the pointing nature of the pronominal signs (Lillo-Martin & Klima 1990). Others argue that sign languages only distinguish first and non-first person forms (Meier 1990). The argument is based on the fact that the first vs. third person pronouns and verbal forms are formally different, while semantically second and third person forms are formally indistinguishable from each other. Finally, some researchers have argued that second and third person pronouns are distinguished in some sign languages by nonmanual features, namely by the alignment of eye gaze direction and body and head direction (Alibašić Ciciliani & Wilbur 2006; Veiga Busto 2020). For a discussion of second person in the context of psych verbs, see Oomen & Kimmelman (2019: 29).

Third, Oomen (2017) made an intriguing discovery that, in NGT, psych verbs allow subject omission or pro-drop with first person subjects, but not with third person subjects (see the sidebar titled "Argument omission" for a general discussion of pro-drop, and the Sidebar "Second person in sign languages" for a discussion of person features). Note that by definition body-anchored verbs – including psych verbs – are unchangeable and thus at first glance do not express person features of any arguments. Seen from a different perspective, it means that a psych-verb with an omitted subject can be interpreted as a first person form, but not as a third-person form, as in example 4. This observation was also later confirmed for RSL and DGS (Oomen & Kimmelman 2019), and not only for psych verbs, but for body-anchored verbs in general.

> NGT
(4)   ANGRY
> 'I am angry', not 'He/she is angry.'
> (Oomen 2017: 75)

Oomen (2017) and Oomen & Kimmelman (2019) developed a theory that unites the three observations. The analyses developed in Oomen (2017) and Oomen & Kimmelman (2019) are

different in technical implementation; here, however, I only present the general logic of the argument, which is similar between the two papers.

The basic explanation Oomen & Kimmelman (2019) develop for the pattern in (4) is that body-anchored verbs are inherently first person forms (that is, they inherently express the first person feature of the subject). When these forms occur without an overt subject, they can only be interpreted as first person. When they are combined with a third person over subject, a feature mismatch happen, and the person feature on the verb is overridden by the person feature of the subject. The phenomenon of feature mismatch is not unique to sign languages: for instance, in languages that have inherent gender on nouns and grammatical gender marking on adjectives and verbs, gender mismatches can occur (Matushansky 2013).

However, if we accept this argument, it is still necessary to explain why body-anchored are inherently first person forms, and why psych verbs typically only have experiencers as subjects. Here Oomen (2017) and Oomen & Kimmelman (2019) appeal to iconicity. In body-anchored verbs, the body of the signer is typically part of the iconic representation. For instance, consider the DGS sign EAT (Figure 2). The verb iconically depicts putting something (the food) in the signer's mouth. Crucially, the signer's body is part of this depiction, and the body also naturally maps to the first person (that is, refers to the signer).
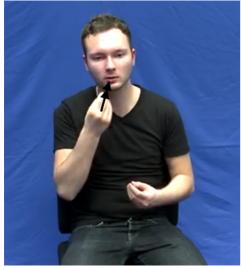

Figure 2 The sign EAT; video still from the DGS Corpus (Konrad et al. 2020), reprinted from Oomen & Kimmelman (2019: 6).

Psych verbs, which typically are verbs of emotions and cognitions, are usually created via an iconic-metaphorical mapping (Taub 2012), where the body or the head is depicted as a metaphorical container of the emotion. For instance, the sign for PITY in RSL is located on the left side of the chest (locating the feeling of pity in the heart), and the sign for THINK is located on the forehead (locating the activity of thinking in the head). This iconic-metaphorical mechanisms explains why these signs are typically body-anchored, and why the experiencer is lexicalized as the subject argument.

Thus, if Oomen & Kimmelman's (2019) analysis is correct, body-anchored verbs (including psych verbs) demonstrate a modality effect. Iconicity plays a role in lexicalization of argument

structure in some predicates, namely for the association between thematic role and grammatical function, and even for the default interpretation for the person of the subject.

3. Alternations

This section provides a brief overview of research on argument structure alternations. Note, however, that no one so far has attempted a comprehensive systematic description of alternations in any specific sign language, comparable to e.g. Levin's (1993) research for English. Instead, specific topics, such as passive constructions, or reflexives and reciprocals have been discussed for a handful of languages. Furthermore, some alternations, such as the unspecified object alternation, are often mentioned in passing, but no detailed research of their properties exists so far.

3.1 Passive and other agent backgrounding constructions

Concerning argument structure alternations in sign languages, most research has been devoted to passive constructions, or, more generally, to agent backgrounding constructions (Barberà & Cabredo Hofherr 2017; Barberà & Quer 2013; Janzen et al. 2001; Kegl 1990; Kimmelman 2018b; Rankin 2013).

Many of these articles discuss the question of whether specific agent backgrounding constructions are passives or something else (e.g. impersonals, middles, etc.). The most insightful discussion is presented by Barberà & Cabredo Hofherr (2017), who discuss the various aspects of the different strategies across sign languages, and specifically for Catalan Sign Language (LSC), and conclude that there is little evidence for the existence of syntactic passive, that is, a syntactic construction where the verb undergoes argument structure reduction (the agent is demoted from argument status) and the patient is promoted to the grammatical subject. However, from the functional point of view, sign languages have a number of strategies that serve the same purpose as syntactic passives.

The construction that most often has been described as passive involves agreeing verbs. Consider the ASL example 5. In this example, the predicate is INJECT-IN-EAR, an agreeing verb, which is inflected for both subject and object agreement. However, the location of the subject/agent, *a*, is not associated with any referent in the context. Furthermore, the object agreement shows first person marking even though the patient is not first person. This is a manifestation of the so-called role shift (Lillo-Martin 2012), when the signer takes on the role of another person/referent, so first person is interpreted as referring to another referent.

ASL
(5)   MEDICINE $_a$INJECT-IN-EAR$_1$
         'He was given medicine.'
         adapted from Janzen et al. (2001: 296)

In this example, it is clear that the agent is backgrounded: it is not mentioned and its reference cannot be recovered from context. At the same time, unlike in prototypical promotional passives, the agent is still present in the morphosyntax, as the verb is transitive and showing both subject and object agreement, and the patient still controls the object agreement slot, so it is not promoted to grammatical subject. Note also that this strategy is by definition restricted to agreeing verbs.

Kegl (2010) described a similar construction in ASL where the agreeing verb is phonologically reduced in such a way that it apparently does not express any agreement with the implicit agent. Thus, this construction resembles syntactic passive familiar from spoken languages most. However, later research reported in Janzen et al. (2001) and Rankin (2013) did not find evidence of this pattern in ASL.

Another very common strategy of agent backgrounding involves various impersonal constructions (Gast & van der Auwera 2013), where the low referentiality of the human agent is marked by dedicated, indefinite or personal pronouns, agreement patterns, or argument omission. An extensive discussion of impersonal constructions in several languages – RSL, LSC, Italian Sign Language, Turkish Sign Language, Hong Kong Sign Language, and French Sign Language – can be found in a special issue of *Sign Language & Linguistics* (Barberà & Cabredo Hofherr 2018).

Very often, to indicate lower referentiality of the agent, sign languages use argument omission or various pronouns. This is illustrated by the following RSL examples: example 6, where the impersonal agent is simply absent (notice also that the verb is non-agreeing, so there is no indication of the agent in morphology either), and example 7, where the indefinite pronoun SOMEONE refers to an impersonal agent.

RSL
(6) BIKE IX PU STEAL
    'They have stolen my bike.'
    (Kimmelman 2018b, p. 212): https://benjamins.com/catalog/sll.00018.kim/video/8
(7) SOMEONE BIKE STEAL
    'They have stolen my bike.'
    (Kimmelman 2018b, p. 216)

Note that for examples like example 6 in RSL it is unclear whether the patient is the subject argument, or whether there is a null subject present and the only overt argument is the object, as the OV order is possible in RSL. Barberà & Cabredo Hofherr (2017), discussing a similar construction in LSC, argue that the patient argument is the subject based on a number of tests. In contrast, Rankin (2013:50ff) discusses similar examples of agent backgrounding with non-agreeing verbs in ASL, and found that most such examples have the patient argument following the verb. Given that subjects in ASL are very strongly pre-verbal, this indicates that the patient argument is not promoted to the subject position.

An interesting modality-specific spatial strategy of marking impersonal reference has been described for LSC (Barberà & Cabredo Hofherr 2017; Barberà & Quer 2013), as well as for some other sign languages (see the papers in Barberà & Cabredo Hofherr 2018 for more examples). The strategy involves using a high locus in the signing space to refer to non-specific or generic referents. For example, non-specific indefinite pronouns in LSC are often performed at a high locus (above the signer's shoulder) (Barberà & Quer 2013, p. 9). Furthermore, agreeing verbs use a high locus for the subject agreement slot when the subject is low in referentiality/impersonal, as in example 8.

LSC
(8)   JOANA, 3$_{up}$-SHOOT-1
         'They shot Joana.'
         (Barberà & Cabredo Hofherr 2017, p. 31)

While the association between high locus and low referentiality has been described for several sign languages, it is not universally attested. For instance, RSL does not have this strategy (Kimmelman 2018c).

3.2 Causative-inchoative alternations

The causative-inchoative alternation is one of the most studied alternations in spoken languages. In sign languages this alternation has been extensively discussed specifically in the context of classifier predicates. Since such predicates present a number of additional complications, they are discussed separately in Section 4.

As for lexical verbs in sign languages, very little is known about the causative-inchoative alternation. As mentioned above, in RSL, some verbs are labile, which means that the same form is used in transitive and unaccusative clauses, see example 9. Oomen (2020: 175) argued that the lexical predicate BREAK in DGS is also labile.

RSL
(9a)   INDEX$_1$ COMPUTER DAMAGE
         'I broke the computer.' (transitive use)
(9b)   SWING TREE DAMAGE
         'The swing on the tree broke.' (unaccusative use)
[Video](#)
Corpus link: http://rsl.nstu.ru/data/view/id/174/t/141000/d/142620
         (Kimmelman 2018a: 13)

3.3 Unspecified object alternation

In some sign languages, including DGS and RSL (Oomen 2020: 64, Kimmelman 2018a: 18), some transitive verbs can be used without an overt object to refer to the general activity where the patient is unspecific or generic, as in example 10. However, no research studying syntactic or semantic properties of this construction has been done for any sign language so far.

DGS
(10)   INDEX$_2$ CAN COOK
         'You can cook.'
         (Oomen 2020: 175)

3.4 Reciprocals and reflexives

Reflexive and reciprocal constructions exist in many sign languages, including ASL (Koulidobrova 2009), RSL (Kimmelman 2009), DGS (Pfau & Steinbach 2003), and NGT (Klomp 2021). These constructions have been discussed in some detail because they relate to some of the core ideas in generative syntax, namely to Binding Theory (Chomsky 1981).

Without delving into issues of formal analysis, there are three main strategies that are used to express reflexive and reciprocal meanings in sign languages. The first strategy is a dedicated reflexive or reciprocal pronoun, e.g. SELF and EACH.OTHER in RSL, that occurs in an argument position to yield the relevant interpretation. The second strategy that applies to agreeing verbs is to use first person object agreement to yield a reflexive interpretation, as in example 11a, or reciprocal inflection to yield a reciprocal interpretation, as in example 11b. Finally, and especially with non-agreeing verbs, some verbs can be interpreted reflexively or reciprocally when the object is simply omitted, as in example 11c.

RSL

(11a) FATHER POSS$_1$ INDEX SHAVE$_1$
'My father shaved.'

[Video](#)
Corpus link: http://rsl.nstu.ru/data/view/id/178/t/340100/d/342000
(Kimmelman 2018a: 19)

(11b) SEE-REC
'They look at each other.'

[Video](#)
Corpus link: http://rsl.nstu.ru/data/view/id/239/t/26738/d/27404
(Kimmelman 2018a: 20)

(11c) FRIEND INDEX HUG
'The friends hug (each other).'
(adapted from Kimmelman 2018a: 15)

3.5 Polypredicative constructions

A potential strategy to extend argument structure of a clause is to use a polypredicative construction, such as a serial verb construction (Haspelmath 2016), or a resultative construction (Ramchand 2008). Such constructions are quite common in sign languages, and have been attested in ASL and DGS (Loos 2017), RSL (Kimmelman 2018a), and Hong Kong Sign Language (Lau 2012), among others. Example 12 illustrates a typical resultative construction in RSL: the clause contains a transitive predicate THROW referring to the activity and an intransitive predicate FULL referring to the end state. Note that FULL cannot be used transitively on its own and THROW does not entail fullness, so the ditransitive meaning 'to fill X with Y' can only be expressed by a combination of two predicates.

RSL

(12) BOY BASKET APPLE THROW FULL
'The boy filled the basket with apples.'
adapted from Kimmelman (2018a: 22)

4. Classifier predicates

Classifier predicates show an interesting pattern of argument structure depending on the type of classifier used in the predicate. This pattern has been first described for ASL by Kegl (1990). Later generally similar patterns have been found in other sign languages: DGS (Glück & Pfau 1998), NGT (Zwitserlood 2003), Argentinian Sign Language and LSC (Benedicto et al. 2007), Slovenian Sign Language (Pavlič 2016), and even in some emerging sign languages,

including Kata Kolok (Kimmelman et al. 2019a) and Nicaraguan Sign Language, and in homesign and silent gesture (Rissman et al. 2020), which will be discussed in detail in the next section.

The pattern can be summarized as follows: whole-entity classifier predicates are intransitive unaccusative and handling classifier predicates are transitive. For instance, in example 13, the two sentences describe the same event. In the first sentence, a whole-entity classifier predicate is used, and the clause is intransitive, with the patient WINDOW being the subject. In the second sentence, a handling classifier predicate is used, and the clause is transitive, with the agent GRANNY being the subject and the elided patient 'window' being the object.

RSL
(13)   CL_{WE}('flat object')-OPEN WINDOW CL_{WE}('flat object')-OPEN. CL_{HL}('small object')-OPEN GRANNY
        CL_{HL}('small object')-OPEN
        'A window opens. A granny opens it.'
[Video](link)
Corpus link: http://rsl.nstu.ru/data/view/id/247/t/37170/d/41220

In addition, at least in ASL, body-part classifier predicates are intransitive unergative (Benedicto & Brentari 2004), or in an alternative analysis, transitive with an implicit object (Grose et al. 2007). In example 14 the predicate contains a handshape referring to the head of the agent, but note that the head cannot be expressed as an argument noun phrase in the clause.

ASL
(14)   ROSIE CL_{BP}('head')-BOW
        'Rosie bowed her head.'
        adapted from Benedicto & Brentari (2004: 751)

An influential formal analysis of this pattern in ASL has been put forward by Benedicto & Brentari (2004). They proposed that classifier handshapes introduce functional heads of different types, and these functional heads are responsible for the assignment of thematic roles to the arguments. Thus, a whole-entity classifier handshape is a functional head that hosts an internal argument, a body-part classifier handshape is a functional head that hosts an external argument, and a handling classifier is a combination of the former and the latter functional heads, and thus two arguments can be hosted, creating a transitive clause.

Benedicto & Brentari's (2004) analysis is attractive for two reasons. First, it captures the relation between argument structure and classifier type, which, as mentioned above, is found in many different sign languages. Second, it contributes to the debate on the lexical vs. syntactic nature of argument structure (Levin & Rappaport Hovav 2005; Marantz 1997; Müller & Wechsler 2014; Ramchand 2008). It seems that, at least for classifier predicates in sign languages, a syntactic approach makes more sense because classifier handshapes can be analyzed as dedicated functional heads responsible for argument structure, while the lexical verbal head does not determine it.

However, more recently, both empirical and theoretical challenges for Benedicto & Brentari's analysis have been found, at least if we want to extend the analysis to languages other than ASL. The strongest cross-linguistic generalization that can be partially maintained is that whole-entity classifier predicates are intransitive and handling classifier predicates are transitive. Kimmelman et al. (2019a) using data from four sign languages (RSL, DGS, NGT, and Kata Kolok) qualify this generalization by demonstrating that whole-entity classifier predicates also can be used transitively in all four languages (although the intransitive use is most frequent). For instance, example 15 from Kata Kolok contains a ditransitive clause (with subject and indirect object omitted) with a whole-entity classifier predicate (see Figure 3).

Kata Kolok

(15)   BANANA CL~WE~('long thin object')-OFFER
         '[Sylvester] offers a banana [to the monkey].'
         adapted from Kimmelman et al. (2019: 343)

Figure 3 CL~WE~('long thin object')-OFFER from example (15).

In addition, de Lint (2018) showed that argument structure of classifier predicates in NGT in which the handshape refers to an instrument (e.g. 'to cut with a knife') also diverges from the expected relation between transitivity and classifier type.

Furthermore, Kimmelman et al. (2019b) demonstrated that body-part classifiers in RSL have argument structure that is different from ASL: they can be used in intransitive unaccusative ('The head bowed'), intransitive unergative ('He bowed'), or transitive clauses ('He bowed his head'). Thus, for this type of classifiers, cross-linguistic variation is attested.

Finally, Kimmelman et al. (2019b) discovered that handling classifier predicates in RSL have a very complex event structure which is not compatible with the syntactic analysis proposed by Benedicto & Brentari (2004). Without going into technical details, they proposed that handling classifier predicates are in fact polypredicative signs: the movement and the handshape are separate predicates, the former expressing a motion event, and the latter expressing a holding event. Kimmelman et al. (2019) showed that the same complex event structure is also attested in NGT, DGS, and Kata Kolok. Crucially, this proposal suggests that whole-entity classifier predicates and handling classifier predicates are fundamentally different and therefore do not manifest a marked causative-inchoative alternation. Thus, if

this proposal is correct, these predicates do not provide a clear argument in favor of a syntactic analysis of argument structure.

5. Emergence of argument structure

Sign languages present a unique opportunity to study not just argument structure as a part of language, but also emergence of argument structure. All sign languages are relatively young (Aronoff et al. 2005), with the oldest ones having uninterrupted transmission for less than 300 hundred years. Moreover, some sign languages have emerged very recently, such that linguists are able to document and analyze the very early stages of linguistic emergence (Senghas et al. 2004). For more details on language emergence and the contribution of sign languages to the debate, as well as for more references, see a recent overview in Kocab & Senghas (2021).

Sign languages emerge when a deaf community forms, which often happens in the context of deaf education, or alternatively, it can happen in small isolated communities with high prevalence of deafness (De Vos & Pfau 2015). If a deaf child grows up without access to other signers, the child will typically develop a homesign: a system of gestural communication used with the closest family members (Coppola & Newport 2005). Homesign is influenced by gestures the parents use, but is a much richer system than gestures of hearing non-signers (Abner et al. 2019; Coppola & Newport 2005; Goldin-Meadow et al. 2015). When multiple deaf children are brought together, their different homesign systems converge due communicative needs, and they form the first cohort of users (and creators) of a new language. When later younger children join the group, they can acquire the newly developing system and meld it into a full-fledged language (Horton et al. 2015; Rissman et al. 2020; Senghas & Coppola 2001; Senghas et al. 2004). Therefore, we can trace the development of various parts of language, including argument structure, by comparing gesturers, homesigners, signers from different cohorts of emerging sign languages, and signers of established sign languages.

As summarized in Section 2, the main means of expressing argument structure in sign languages are word order and verbal agreement. Further, in classifier predicates, the choice of classifier handshape is also related to argument structure (Section 4). For all of these grammatical devices, we now have documentation of their emergence.

A surprising discovery has been made that word order spontaneously emerges even in silent gesture of non-signers, and crucially it is independent of the word order in the spoken languages of the participants (Goldin-Meadow et al. 2008). Goldin-Meadon and colleagues asked speakers of Turkish, Chinese, English and Spanish to describe vignettes of simple motion events with different number of participants using only silent gesture. Despite the fact that Turkish is an SOV language, Chinese is a mixed SVO/SOV language, and English and Spanish are both SVO languages, when describing vignettes with an agent and a patient, the participants with all backgrounds overwhelmingly used the SOV (or Agent Patient Action) order. This study shows that the communicative need of expressing argument structure clearly is very pressing, and manifests even in the lack of language as such. Later research has shown that different words orders emerge when the situations described vary in animacy and reversibility of the event participants (Kocab et al. 2018), but the finding that silent gesturers converge on a consistent word order still stands.

Another important study concerns the use of word order for argument structure in homesign. Coppola & Newport (2005) conducted experiments with three isolated homesigners in Nicaragua, and found evidence that they use word order to mark the category of grammatical subject. They provided two crucial pieces of evidence. First, when describing video recordings of events, the homesigners consistently put the subject argument (more specifically, the argument that is the highest in the thematic hierarchy) before the verb, whether it was an agent ('A woman runs') or not ('A woman sees a man'). This demonstrates that the clause-initial position did not encode the thematic role of agent, but the grammatical category of subject. Second, the homesigners put the subject before the verb even if the object was topical. This demonstrates that word order was used to encode the grammatical subject and not a pragmatic topic.

In contrast, it has been shown that in Taurus Sign Language, an emerging sign language used in southern central Turkey, word order as a strategy to mark argument structure is not used by first cohort signers, and only develops in later cohorts (Ergin et al. 2018). Specifically, even in single argument clauses, first cohort signers showed a lot of variation between SV and other orders, while in later cohorts SV strongly dominates the other orders. Similarly, in clauses with two or more arguments, first cohort signers showed extreme variation with no pattern being clearly more frequent than the others, while later cohorts developed a strong preference for the SOV and OSV orders. In Nicaraguan Sign Language, a great deal of word order variation between subject and object is found even in the third cohort, although the language becomes consistently verb-final (Flaherty 2014).

There is also evidence that verbal agreement as a means of expressing argument structure takes time to emerge. First, it has been noticed that many village sign languages, which are typically relatively young, lack verbal agreement, although there are some exception (De Vos & Pfau 2015). Senghas & Coppola (2001) described how spatial modification as a grammatical device developed in the second but not in the first cohort of signers of Nicaraguan Sign Language (see also Flaherty 2014). In Taurus Sign Language, verbal agreement was found only in the third, but not second or first cohorts (Ergin et al. 2018). However, this might be attributable to contact with an established sign language, namely Turkish Sign Language, which the members of the third cohort also learned.

An interesting contrast can be drawn between Nicaraguan Sign Language and Al-Sayyid Bedouin Sign Language, both emerging sign languages (Kocab & Senghas 2021). In the former, word order is quite variable even in the third cohort of signers, but spatial grammar, including verb agreement, can be used to express argument structure. In the latter, spatial modification is not employed, but word order is quite rigidly SOV. This indicates that emergence of some means of expressing argument structure happens quickly, but different languages can take different paths in this development.

The connection between classifier type and argument structure has also been investigated in homesign and emerging sign languages (Ergin & Brentari 2017; Goldin-Meadow et al. 2015; Kimmelman et al. 2019a). For example, Goldin-Meadow et al. (2015) studied language production by homesigners, signers from the first and second cohorts of Nicaraguan Sign Language, and ASL signers. The participants were asked to describe vignettes in agent and no-

agent contexts (e.g. a person putting a book on the table vs. a book falling). The handshapes in the predicates describing these vignettes were analyzed. All the groups showed a strikingly similar pattern: in no-agent contexts, almost exclusively whole-entity classifier handshapes were used, while in agent contexts, there were approximately equal proportions of whole-entity and classifier handshapes (Goldin-Meadow et al. 2015, p. 388).

Finally, as discussed in Section 3.1, many sign languages employ a variety of strategies to express agent backgrounding. In an ingenious recent study, Rissman et al. (2020) demonstrate how agent backgrounding strategy develops by comparing hearing gesturers, homesigners and three cohorts of signers of Nicaraguan Sign Language. They used a similar elicitation technique with vignettes as e.g. Goldin-Meadow et al. (2015), but in addition to agent and no-agent vignettes, they added hand-agent vignettes, in which an object is manipulated by a person, but only the hand of the person is visible. Such vignettes are expected to elicit agentive descriptions, but with the agent backgrounded. Rissman et al. (2020) found that gesturers, homesigners and first cohort signers used the same handshapes in the agent and hand-agent conditions, while second and third cohort signers used both handling and non-handling handshapes in the hand-agent condition, but predominantly handling only handshapes in the agent condition. Thus, second and third cohort signers, but not gesturers, first cohort signers or homesigners used variation in classifier handshape to encode agent backgrounding. Rissman et al. (2020) conclude that, while the necessity to express agentivity (distinguish agentive and non-agentive events) is so fundamental that it emerges even in gesture and homesign, agent backgrounding is of less communicative importance, and thus takes longer to emerge.

Summary points

1. Basic argument structure of lexical verbs in sign languages is largely similar to argument structure in spoken languages. The same valency classes are attested, and the relation between argument structure and verbal meaning is similar across modalities.
2. The main means of expressing argument structure in lexical verbs in sign languages are word order and verbal agreement.
3. Sign languages employ a variety of agent-backgrounding strategies; however, whether any sign language has a syntactic passive construction is still an open question.
4. In classifier predicates in sign languages, argument structure of the predicate is related to the type of classifier. However, the relation is not a one-to-one mapping.
5. Modality effects, namely iconicity, simultaneity, and the use of space, play an important role in some features of argument structure in sign languages.
6. Sign languages provide a window on the emergence of argument structure. Some means of expressing basic argument structure appear very early in the process of language emergence in the visual modality.

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