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Who's on First? Investigating the referential hierarchy in simple native ASL narratives⋆

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Abstract

Discussions of reference tracking in spoken languages often invoke some version of a referential hierarchy. In this paper, we asked whether this hierarchy applies equally well to reference tracking in a visual language, American Sign Language, or whether modality differences influence its structure. Expanding the results of previous studies, this study looked at ASL referential devices beyond nouns, pronouns, and zero anaphora. We elicited four simple narratives from eight native ASL signers, and examined how the signers tracked reference throughout their stories. We found that ASL signers follow general principles of the referential hierarchy proposed for spoken languages by using nouns for referent introductions, and zero anaphora for referent maintenance. However, we also found significant differences such as the absence of pronouns in the narratives, despite their existence in ASL, and differential use of verbal and constructed action zero anaphora. Moreover, we found that native signers' use of classifiers varied with discourse status in a way that deviated from our expectations derived from the referential hierarchy for spoken languages. On this basis, we propose a tentative hierarchy of referential expressions for ASL that incorporates modality specific referential devices.

Keywords

Sign languages; Referent tracking; Referential hierarchy; Spatial coherence; Discourse; American Sign Language (ASL)

1. Introduction

Sign languages, including American Sign Language, use the visual-manual modality for their production and perception. Since the beginning of sign language research, much work has explored the phonology, morphology, and syntax of visual languages (Klima and Bellugi, 1979; Sandler, 1986, 2003; Padden, 1988; Brentari, 1992; Engberg-Pedersen, 1993; Bahan, 1996; Neidle et al., 2000; Lillo-Martin, 1986, 2005; Johnston and Schembri, 2007; Meir and Sandler, 2007; Perniss, 2007; Lillo-Martin and Meier, 2011; Crasborn et al., 2012). All this work has revealed language structure that in many ways bears a strong resemblance

⋆We owe this phrase to a well-known baseball comedy routine by Abbott & Costello (first aired on the radio in 1938) where the comic elements arise from referent tracking confusion.

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to structures found in spoken languages – evidence that signed languages are natural languages on par with spoken languages. In addition, researchers investigating sign languages have uncovered in these languages a range of more exotic and often modality specific uses of language, such as employing facial expressions for grammatical modifications, and using space for morpho-syntactic processes. Linguistic domains such as semantics and pragmatics, however, have received comparatively little attention (Davidson, 2013, 2014, but see Engberg-Pedersen, 1993 for an exception). This is also the case for the study of discourse, perhaps particularly in ASL where many researchers have focused more on phonological and syntactic topics (although see Wilbur, 2012 for a discussion of work related to the discourse notions of topic and focus). The goal of the present paper is to expand our knowledge of discourse structure in one signed language by investigating the choices of referential expressions used throughout narratives in ASL. Our goal is to understand how ASL signers use the various forms of reference available to them to track reference in simple narratives and what discourse constraints these forms are subject to. Before describing the details of the present study, we first provide a selective overview of what is known about referential expressions in ASL.

2. Referential expressions in ASL

ASL signers use the hands, face and body for articulation and the eyes for perception of their language. Using the visual-manual modality, signers have access to some different linguistic devices than do speakers using the aural-oral modality. All lexical signs are of course articulated in the space surrounding the signer, or on the signer's body, but in addition, many grammatical processes rely on relative locations in this space. For example, locations in sign space can be assigned referential value in connection with predicates as well as nominals throughout the discourse (Klima and Bellugi, 1979; Lillo-Martin, 1995). To understand how signers manipulate spatial locations along with other referring expressions to construct coherent discourse, we must first consider the range of referential expressions available in ASL, starting with nominal reference, i.e. nouns and pronouns, then continuing on to reference implicit in verbs and other predicate-like expressions, i.e. constructed action, and ending with classifiers.

2.1. Nominal reference

ASL makes use of space for nominal referential purposes. This process is perhaps best explained in a description of ASL pronouns. Anaphoric pronouns are points to referential loci, that is, locations in signing space that have previously been associated with a referent. Due to the gradient nature of spatial loci, ASL can in theory distinguish an unlimited number of spatial loci, each with its specific reference (Lillo-Martin and Klima, 1990). In practice though, this process is constrained such that distinguishing more than 2 or 3 loci at once is rare (Lillo-Martin and Meier, 2011).

Spatial loci also come into play in connection with nouns, which are also used for referential purposes. As opposed to English, ASL makes widespread use of bare nouns (Sandler and Lillo-Martin, 2006: 341). With bare nouns, context is used to determine the givenness or accessibility of the referent of the noun in question. Although most nouns are lexical signs,

some nouns are conventionally spelled using the hand alphabet, and other typically signed nouns may be fingerspelled at times. Be they signed or fingerspelled, nouns in ASL may occur with spatial modification. For instance, a signer may produce a point to a location in space either preceding or following a noun. Under some analyses of ASL, a point followed by a noun has been treated as a definite noun phrase, meaning that the point is analyzed as a determiner. In contrast, under the same analysis a point to a location in space occurring after a noun is not considered a determiner, but an adverbial specifying location (Neidle et al., 2000). However, the status of pre- and post nominal points is still under debate (see Meier and Lillo-Martin, 2013 for a brief overview), and the use of points in combination with nouns is possibly entirely optional in ASL, although there has been very little systematic investigation of the matter (but see Swabey, 2002, 2011).

For the purposes of this paper, we also consider as types of nominal reference nouns that are modified by a classifier, either post-nominally as in Fig. 1, or pre-nominally as in Fig. 2. In addition to localizing referents in space with pointing signs, ASL allows for articulating the noun in a specific space, which serves the same purpose. However, because we observed only two instances of this strategy in our data, we will not discuss it further. We turn now to reference implicit in predicates.

2.2. Reference implicit in predicates

Nominal references, such as the nouns and pronouns discussed above, are frequently omitted in ASL. In their place, signers can use null expressions. According to various scholars, signers may use verb agreement to identify subjects and objects (Fischer, 2009; Friedman, 1975; Coulter, 1979). ASL verb agreement takes the form of alternations in orientation or path movement through space by the verb. According to Lillo-Martin (1986), ASL displays properties of a so-called pro-drop language, primarily by allowing verbs to occur with null argument (subject and/or object) expressions. Some have suggested that this possibility is licensed by agreement features of the verb, because these features allow the identification of the covert verb arguments (e.g. Neidle et al., 2000). Thus, in this way, such predicates may carry referential value similar to pronominal expressions, because they essentially incorporate pronouns via the starting and ending points of their path movement (or palm orientation), e.g. Kegl (1986). Not all languages that allow the omission of overt arguments mark agreement on verbs. In the case of ASL there are three classes of verbs, *plain, inflecting* and *spatial* and they do not all take agreement (Padden, 1988). Although an impression is created by previous literature on ASL that agreement verbs always agree (although Janzen, 2004, 2012 shows that this may not always be so), researchers of other signed languages have argued specifically that even agreement verbs do not always inflect (e.g. de Beuzeville et al., 2009 for Auslan). It is, however, widely accepted that ASL plain verbs (e.g. LOVE) cannot agree with their subjects or their objects (Fischer and Gough, 1978; Padden, 1988). One account for why plain verbs in ASL allow pro-drop, despite the lack of agreement shown by path movement to indicate subject/object, was proposed by Lillo-Martin (1986). She argued that there are two kinds of null arguments in ASL. Null reference that occurs with agreement verbs is licensed by features of the verb, whereas the null reference of plain verbs is licensed by topic-hood.

As mentioned above, ASL verb agreement consists of alternations in orientation or path movement in the verb sign. This process makes use of the spatial loci that are also used for pronominal reference, such that the verb path either moves from locus to locus, as in Fig. 3, or indicates loci by the orientation of the hand (Fischer and Gough, 1978). In Fig. 3, the signer moves the agreeing verb GIVE between two loci in a path through signing space, creating the meaning ‘he gives him’. Because the loci are associated with previously established referents, this process allows the addressee to recover the subject and object referents when either is expressed only by a null argument.

However, ASL signers often choose to use their own body as locus, as either the starting or ending path of the verb. This happens in contexts where the signer has mapped a referent from the narrative onto him or herself, and signals the shifted referent. The referent is shifted because it is now represented at the locus of the signer's body (e.g. Lillo-Martin, 1995). In this paper, the term ‘role-shifting’ refers to a phenomenon observed in many sign languages: by subtle shifts in body posture (that is by shifting the position of the head, shoulders and/or torso and/or by gazing at the locus of the imagined interlocutor in the context), the signer indicates a previously established locus. Some researchers have used the term role-shift to refer to what the present paper calls constructed action (see Lillo-Martin, 2012 for an overview of terminology use). Here, however, we reserve the term role-shift to denote the physical shift that can serve as a marker of a shifted locus. An example is given in Fig. 4, where the signer begins the verb GIVE in front of her chest (panel 1) and ends it at a locus on her right (panel 2). In a non-role-shifted context, the utterance in the figure could be interpreted to mean ‘I give her’. However, due to the signer's role-shift toward a pre-established locus, the first person locus (beginning at the signer's chest) is in fact used to signal a third person referent to indicate “she gave it to her” (Friedman, 1975). This means that agreement verbs without overt arguments indicate which referents are subject and object in role-shifted context as well as in non-role-shifted contexts.

Verbs have been the topic of investigation in many ASL studies. Often, however, such investigations have been concerned with the linguistic status of verb modifications via movement or palm orientation. This means that the focus of these studies has often been on what is possible and the data has often been elicited single sentences. As of yet, for example, we do not know whether there are discourse rules that determine when ASL signers can use agreement verbs with or without role-shift. Although studies have posited the use of spatial loci with agreement verbs is at least one option on equal footing with the role-shifted versions (e.g. Padden, 1988; Neidle et al., 2000; Sandler and Lillo-Martin, 2006), in fact we know little about the function and distribution of these verb modulations in ASL discourse. Finally, agreement verbs may also occur without the spatial indication of verb arguments, that is, neither through the spatial loci of path movement nor though role-shift. Janzen discusses this phenomenon under the heading of mental rotation. He states that signers may ‘mentally rotat[e] their conceptualized space’ and map a third person referent onto their bodies, without any spatial indication of which referent they are acting as (Janzen, 2004: 149). For agreement verbs, this means that the signer signs the verb path, or orientation, between the signer's locus and the canonical second person, even though the referents themselves are two third person referents. Thus, not only has the signer shifted the reference

of their own locus, they have shifted the reference of the canonical second person locus as well.

Unlike the fixed spatial framework, that is, using third person pre-specified loci (as in Fig. 3), or physically role-shifting toward a locus (as in Fig. 4), mentally rotated signing does not provide spatial information about which referents are involved in the action. Rather this is understood via contextual inference. We show an example of this phenomenon from our data in Fig. 5, where the signer moves the sign TAKE inwards toward his body from a position in signing space directly in front of the center of his body.

Constructed action, which we discuss below, can also occur in a mentally rotated framework. In a mentally rotated framework, context and, for constructed action, also the signer's facial expression provide the information about which entities are intended as referents. Janzen (2012) argues that the use of verbs and constructed action with fixed spatial locations appears to be reserved for comparing attributes and actions of referents, and mentally rotated space is used for shifting the perspective on the narrative to align with the perspective of a referent. No studies to date have investigated whether signers differentiate between the two types of space in a referent tracking context.

The choice between the static spatial and the mentally rotated framework is also relevant for the phenomena of constructed action and constructed dialogue, to which we now turn. Constructed action is when a signer enacts actions or emotions attributed to a character or object in their narrative (Padden, 1990; Winston, 1991; Metzger, 1995; Quinto-Pozos, 2007; Cormier et al., 2013b; see Cormier et al., 2015 for an overview). Constructed dialogue is when a signer recreates the speech or signing of a referent in the narrative (Winston, 1991). A signer can indicate the referent of the constructed dialogue or action with a nominal expression, or by role-shifting. This, however, is not necessary as long as the referent is sufficiently salient in the narrative. In such cases, the signer may opt to use constructed dialogue or action in a mentally rotated context. Thus, the possibility in ASL of using zero anaphora as verb arguments, which we described above, extends to constructed dialogue and action as well. However, although these different types of zero anaphora exist in ASL,[1] at present we know little about how signers use each type to track reference.

Last, we turn to classifiers and classifier predicates (Frishberg, 1975; Supalla, 1982). Classifiers are handshapes (or, in the case of tracing SASSes, combinations of handshapes and tracing movements) that represent a referent or how an agent handles a referent.[2] Classifier predicates are combinations of classifier handshapes with movement or with position in signing space, which encode information about the referent, such as motion and location (e.g. Perniss, 2007; Zwitserlood, 2012). Previous studies of classifiers have grouped them into varying types (e.g. Supalla, 1982; Brennan, 1990; Corazza, 1990; Benedicto and Brentari, 2004). Here, we discuss three different types, namely semantic classifiers, handle

[1]Here and in the following, we refer to null arguments from different predicates as different types of zero anaphora, in line with Lillo-Martin (1995) who argued for two kinds of null arguments in ASL due to different types of licensing.

[2]Note that we are grouping both static and tracing SASS together and labeling them as one type of classifiers. As pointed out by an anonymous reviewer, however, there are suggestions in the literature that tracing SASSes should not be treated as classifiers, both for semantic and syntactic reasons. Future work should explore whether static and tracing SASSes behave the same with respect to referent tracking, or not.

classifiers, and size-and-shape specifiers. Classifiers are set apart from other elements of sign languages, because they share a unique way of linking form and meaning. This fact may be relevant for their use in referent tracking. For this reason, we do not subsume different classifier types under other referential categories. Although classifier predicates are verbal in nature and may occur with null arguments like other verbs, there is reason to believe that they may carry a referential saliency that differs from that of other verbs. This is because they represent some aspect (e.g. form or features) of the referent in a visible manner throughout the duration of the predicate. At the same time, it is not clear whether the various classifier types are more closely related to one another, or to other referential expressions. For example, some researchers treat some classifiers as agreement markers (Glück and Pfau, 1998; Benedicto and Brentari, 2004), while other researchers treat classifiers as combinations of roots and affixes (Supalla, 1982, 1986), schematic visual representations (Cogill-Koez, 2000), or as lexically fixed features with gradient form aspects (Liddell, 2003), among others. Treating classifiers as agreement marker would make classifier predicates akin to agreement verbs, but at the same time the similarity of individual classifier types is also under debate, with some researchers maintaining that classifiers are a (somewhat) unified group, and others arguing that some SASSes shouldnot be treated as classifiers at all (see Zwitserlood, 2012 for an overview of different treatments of classifiers). Hence, while we describe classifiers as a separate referential category in the present study, we will also be analyzing the individual properties of the different ASL classifier types.

Semantic classifiers represent referents holistically, that is, their shape denotes some semantic property or form property of the referent (e.g. Supalla, 1982), however, conventionality also plays a role. For example, ASL canonically represents a human with an upright extended index finger, but a vehicle with thumb, index and middle finger extended (the 3-handshape). Semantic classifiers can be incorporated into classifier predicates of motion and location. Handle classifiers serve predicative functions too – their primary use is as handshapes in agreement and locative verbs where they designate the object referent. Lastly, Size and Shape Specifiers (SASSes) are also considered classifiers, although there is some debate regarding the status of certain types of SASSes. SASSes indicate certain physical or geometric characteristics of the referent in question, for example, size, shape and depth. SASSes have been grouped into two different types: static SASSes, where handshapes indicate the shape of a referent, and tracing SASSes, where it is the movement of the hand(s) that indicate(s) properties of the referent by outlining its shape and size (e.g. Supalla, 1982). We show an example of a tracing SASS from the data in Fig. 6.

SASSes in ASL have not received much attention. However, research on other sign languages describe SASSes as both nominal and adjectival (Johnston and Schembri, 2007; Zwitserlood, 2012). As mentioned, these different classifier types are sometimes discussed under the same heading, although, as we have described above, they clearly have different properties. These varying properties may lead to different pragmatic functions in ASL discourse. For example, Zwitserlood (2003, 2012) argues that tracing SASSes do not appear to function anaphorically, unlike static SASSes, handling classifiers and whole entity classifiers (which we refer to as semantic classifiers). This possibility however has not been explored systematically for ASL.

3. The present study

As explained in the previous section, ASL signers have various nominal and predicative reference types at their disposal, including classifiers and constructed dialogue/action. All these expressions could conceivably be used to refer to the same entity. However, it seems logical that signers do not merely choose expressions at random. Thus, a number of questions arise about the potential constraints on using referential expressions. Studies of linguistic properties of referential expressions in ASL do not explain how signers use these reference types to track reference in discourse. Investigating this question is crucial to our understanding of ASL discourse structure and coherence. In a larger perspective, this question is important because the ability to form coherent narratives is an essential part of language acquisition and proficiency. Maintaining discourse coherence requires that the sender establish and uphold reference to the relevant persons and objects in their narrative. From spoken language research, we know that speakers accomplish this feat by employing their linguistic resources systematically. In nominative-accusative languages (as opposed to, for example, ergative-absolutive languages, which may exhibit different patterns of referent tracking, e.g. Nagaua, 2006), speakers show a preference for fuller linguistic referential expressions like nouns (e.g. ‘the horse’) for inaccessible or new discourse entities, and a preference for leaner referential expressions, such as pronouns (e.g. ‘it’) or zero anaphora (Ø) when referring to accessible or given discourse entities (Chafe, 1976; Givón, 1983), e.g. ‘the horse approached the fence and Ø jumped over it’. This has led researchers to propose hierarchies of referring expressions, e.g. the accessibility hierarchy (Ariel, 1988) and the givenness hierarchy (Gundel et al., 1993), to reflect the fact that speakers create coherence between sentences by using less specific, less full referring expressions for the same entity, as they assume higher accessibility of the referent in the mind of the addressee (or their own mind) as the discourse progresses. Signers need to create coherent narrative and discourse just as speakers do. Yet few studies have investigated this question for sign languages (Wulf et al., 2002; Swabey, 2002, 2011; Morgan, 2006; McKee et al., 2011; Perniss and Özyürek, 2015). The first studies to investigate this question have primarily looked at variable subject presence, that is, overt versus null subjects, in Auslan and New Zealand Sign Language (McKee et al., 2011), and American Sign Language (Wulf et al., 2002). These studies found evidence confirming that the use of fuller versus leaner linguistic referential expressions varies as a function of referent accessibility across both the oral-aural and visual-manual modalities. Swabey (2002, 2011) looked in more detail at several referring expressions in ASL, but did not distinguish between different kinds of null arguments. As is evident from the above discussion of referential devices in ASL, the variety of referring expressions in signed languages has not been explained using a discourse framework. Given the many differences between the signed and spoken modalities, we might expect referent tracking in sign language to diverge from the patterns observed in spoken languages.

The purpose of the present study is to systematically investigate ASL discourse organization to discover how referent tracking is constructed in ASL narratives. In order to capture potential language or modality specificities, the present study considers the full range of referential expressions that occurred in the data. This is similar to a recent study by Perniss and Özyürek (2015) who looked at referring expressions in German Sign Language, DGS,

as well as in German speech/gesture. Here we not only investigate the referential function of nouns and pronouns, and zero anaphora, but, as a novel contribution to the ASL literature, we also analyze different classifier and different zero anaphora types, as well as the varying roles of space within the category of zero anaphora. Doing so allows us to uncover their roles in the referential hierarchy in ASL.

4. Methods

4.1. Stimuli

We asked a group of native signers of ASL to retell four short stories. The stimuli used for the experiment were constructed adopting the paradigm advanced by Karmiloff-Smith (1979), the *balloon stories*. The original balloon story consisted of a picture-story comprised of six causally related pictures, showing, essentially, a boy who gets a balloon from a balloon-man, but loses it when walking away. We adapted this paradigm in its essential parts, creating four stimulus items: two picture stories and two video stories; each story consisted of six causally related events. These events were presented as separate pictures in the picture stories and as parts of a dynamic whole in the video stories. The picture stories were black and white drawings, and the video stories were recordings of human actors. An example of a picture story can be found in the Appendix. When designing the stimuli we opted for two different stimulus types (picture vs. video), because we intended to use them across different participant groups. We expected that the picture stories would create more coherence problems than video stories in some of these groups. We had no such expectations for the native signers. An analysis of variance (reference type by discourse status by stimulus type) confirmed that there was no statistical difference between stimulus types in how native signers use referring expressions across statuses ($F(6,42) = 0.93$, $p = 0.48$). Consequently, we collapsed the data across the two stimulus types for the analyses of this paper.

Each story involved a main character (e.g. the boy in the original balloon story), a secondary character (the balloon man), and a featured object (the balloon). The story line was identical across the stimuli; a character walked along somewhere, saw a person selling objects (balloons, popsicles, etc.), obtained one of these objects from the sales person, walked away with the object, lost or damaged the object, and then reacted to what happened to the object. We chose this simple narrative structure because we were interested in basic questions about how characters and objects are referred to throughout narratives in ASL. The simple structure of our stimuli allowed for introduction as well as maintenance and reintroduction of entities, while ensuring similar patterns across stories. Thus we expected to be able to identify basic narrative structure on this basis.

4.2. Subjects

The native signers ranged in age from 19 to 54 years of age (mean age: 30.88; median age 29.5). The amount of ASL input they received from birth varied, due to the fact that some had hearing parents, but all signers had all begun learning ASL from birth from parents and/or older deaf siblings. The native signers were recruited from the San Diego Deaf community. Two signers were hard-of-hearing, the rest were deaf. The participants varied in

their use and knowledge of English, but had an overall preference for communicating in ASL. Six out of 8 participants reported that they currently used ASL 'all the time', and the two remaining participants reported their ASL use as 'daily' and 'every other day'. On a self-assessment scale of ASL production, where 1 is the lowest and 10 the highest, the participants' self-rated proficiency was 9.25 (SD: 1.165).

4.3. Procedure

After giving informed consent and filling out a background questionnaire, participants were given instructions in ASL. The participants watched and retold the stories one by one while being video recorded. A hearing signer greeted the participants and took care of practical details, such as consent forms. The instructions for the experiment were then given by a native Deaf signer, either in person or via a video recording. The stimuli were presented on a laptop screen. The video stories lasted 17 s each, from beginning to end; the pictures of the picture stories were shown in sequence, each picture displayed for 5 s. The order of presentation of the stimulus stories was counter-balanced across participants using a Latin squares design in which picture stories and video stories always alternated. Participants either told the stories to a native signer, or to the camera with the instruction that the recording would be shown to a signer who would then be asked to pick out the correct story based on their description.[3]

4.4. Data transcription and coding

After recording, the videos were imported into ELAN (Crasborn and Sloetjes, 2008), an audio/video annotation tool developed at the Max Planck Institute for Psycholinguistics.[4] The retellings were glossed sign by sign using standard sign glossing conventions (Baker-Shenk and Cokely, 1980), with a few modifications concerning the notation of classifier referents and spatial loci. Individual signs are glossed with an English word in capital letters, which approximates the meaning of the sign, as in example 1). Hyphens are used where a sign contains multiple morphemes, as in example 2 and 3).

1) SMALL GIRL WALK

'A/the small girl walks'

2) IX:1(popsicle seller)-GIVE-CL:A(popsicle)-IX:F(boy)

'She gives it to him'

The abbreviations CL and CA are used to refer to classifiers and constructed action respectively. For example, in 3), CL:A indicates that the handshape used in the agreement verb GIVE is a classifier with an A-handshape. The word in parenthesis following the specification of the classifier indicates the entity referred to by the classifier. In example 2,

[3]Half the participants told stories to an addressee and half told them to the camera. This was not intended as an experimental manipulation. Because of time constraints, a native Deaf signer was not always available to be the addressee. Rather than have a hearing non-native signer be the addressee, we opted for having participants tell the story to the camera. An analysis of variance showed that there was no evidence of differences in use of referring expressions across discourse status whether participants told stories to the camera or an addressee ($F(6,36) = 0.11$, $p = 0.99$). We also found that participants used similar proportions of spatial frameworks in agreeing verbs and constructed action regardless of whether they retold the stories to a person (38% rotated ($n = 23$), 62% spatial ($n = 32$)) or to the camera (42% rotated ($n = 24$), 58% spatial ($n = 40$)).

[4]http://tla.mpi.nl/tools/tla-tools/elan/.

this means that *CL:A(popsicle)* is a classifier, with an A-handshape, which designates a/the popsicle. *IX* is used for signs that indicate a spatial locus. The number or letter following the colon specifies the position of the locus in the signing space relative to the signer. In 2) therefore, *IX:1* refers to the locus of the signer, who in this case has mapped another character onto his/her locus, and *IX:F* refers to a locus directly in front of the signer. The word in parenthesis specifies which referent the locus refers to.[5]

All narratives were then divided into clauses and sentences. The guiding principle for clause boundaries was the presence of predicates (e.g. Berman and Slobin, 1994). Thus, we generally annotated boundaries between predicates, even when they expressed the same meaning. This is exemplified in example 3) where a sequence of a lexical predicate immediately following a classifier predicate with the same general meaning is coded as two separate sentences as indicated by the square brackets.

3) [BOY SMALL CL:2-WALK] [WALK][6]

‘A/the small boy walks. He walks’

In most cases, clause boundaries also corresponded to sentence boundaries. However, when signers used overlapping signs or constructed action sequences across multiple predicates, and when there were no prosodic markers (such as eyeblinks, Wilbur, 1994), pauses or lengthened signs (Hansen and Heßmann, 2008) that indicated a boundary, multiple predicates were annotated as belonging to different clauses within the same sentence (indicated by square brackets), as in example 4).

4) [a) WALK b) WALK + CA:WALK.HOLDING-CL:A(popsicle) c) CA:LET.GO.OF-CL:A (popsicle)]

‘While walking with it, he let go of it’

4.5. Annotation of referents, referent status and reference type

We identified each referring expression in the narratives, and we coded which referent the expression denoted. We defined a referring expression as any overt or null reference to animate and inanimate entities.[7] This information was then used in the coding of reference status. Table 1 shows the criteria used for determining referent status. We followed Gullberg (2006) in coding every first mention of a referent as ‘introduced’, and sentence subjects as

[5]Baker-Shenk and Cokely (1980) demark classifier referents with single quotation marks, and transcribe loci with lf/rt, whereas we use parentheses for the former, and transcribe loci with index notation (IX:).

[6]As pointed out to us by an anonymous reviewer, such verb sequences have been analyzed as serial verb constructions, e.g. Supalla (1990). We have chosen not to use this approach in our analysis, in order to maintain consistency in our coding. This is because we have occurrences of subject + classifier, subject + lexical verb, and subject + lexical verb + classifier to express the same proposition of a person walking. This decision only affects a small portion of the data, however, as the data contains only four examples of subject + lexical verb + classifier combinations.

'maintained' if they had been referred to by any referring expression, null or overt, in any position in the previous clause. Referents were coded as 'reintroduced' if they appeared as the subject in a clause following a clause where the referent in question had not been mentioned in any position. Note that this procedure means that all maintained and reintroduced referents are subjects, whereas introduced referents can have any syntactic role.

Only references that received status coding were counted from this point on, although as mentioned in Table 1, we used the presence/absence of non-subject referents to determine the status of the subject referents. We then coded the remaining referential expressions for linguistic type. Based on the principles we discussed above regarding ASL referential expressions, each remaining reference was coded as one of the reference types in Table 2. The reference implied in verbs was only coded when no overt arguments were present. In addition, we noted the reference category (Nominal, Pronominal, Zero Anaphor, Classifier) that each reference belonged to. The reference categories are also shown in Table 2. ASL signers take advantage of the possibility of simultaneous articulation afforded by multiple articulators (hands, body, face), a phenomenon that has been documented for other sign languages as well (e.g. Perniss and Özyürek, 2008). In the present study, we focus on referent tracking, a linguistic phenomenon that proceeds sequentially though the narrative. For this reason, when we encountered simultaneity in the form of null or overt referring expressions occurring with constructed action, which is often sustained across multiple predicates, we opted to count only one of the types. If a lexical (plain or agreeing) or classifier predicate that was not considered quotational co-occurred with constructed action, we counted only the predicate. Consequently, what we have called constructed action in our data corresponds to what Metzger (1995) calls Direct Action, and excludes Indirect and Simultaneous Direct and Indirect Action.

5. Results

Recall that we are interested in how native signers utilize the referential expressions available in ASL, both the cross-linguistically common ones like nouns, pronouns and zero anaphora, and the more modality specific ones like classifier predicates, and constructed action. We also wanted to know if ASL signers use the various zero anaphora types and the various spatial frameworks differentially based on discourse function.

As anticipated, the signers produced short narratives in response to the simple stimulus materials. The average retelling had a duration of 15.03 s and consisted of 12.19 sentences. To get an overview of the structure of the ASL narratives, we first examined the distribution of referential expressions across referential statuses. Across all stimuli, the signers produced a total of 449 referential expressions of the types that we counted. Of these, 24% ($N = 109$) were referent introductions, 69% ($N = 310$) were referent maintenances, and 7% ($N = 30$) were referent reintroductions. The most frequently used status in the present retellings was maintenance. The low proportion of reintroduction statuses compared to introduction and

[7]Note that the inclusion of inanimate entities in the coding departs from the approaches adopted by a number of studies of referent tracking (Clancy, 1980; Marslen-Wilson et al., 1982; Perniss and Özyürek, 2015). Other studies have included inanimate entities as well as non-subject entities in all roles (Gundel et al., 1993; Swabey, 2002, 2011). We followed this latter approach in the present study because we aimed to strike a balance between simple narratives and opportunities to reintroduce referents.

maintenance shows that in these simple narratives the native signers reintroduced referents infrequently.

By examining the four reference categories defined above, we next considered the specific means by which ASL signers make reference and how they use these categories within each of the three statuses. The four reference categories we defined for ASL were: nominal, classifier, pronominal and zero anaphor. Our prediction based on previous literature was that the signers would use nouns and some classifiers, SASSes in particular, for referent introduction, as these appear to be the fullest referential expressions in ASL. For referent maintenance, we expected to see classifiers, especially semantic classifiers, pronouns, and zero anaphora. Pronouns and zero anaphora, because these are cross-linguistically lean referential forms, and semantic classifiers because they may serve functions similar to pronouns, as explained above. Last, we expected the signers to use classifiers and pronouns, zero anaphora as well as some nouns for reintroduction. We also expected that pronouns might be more frequent in reintroductions than in maintenances.

Table 3 shows the mean proportion of reference category used by the native signers to introduce, maintain and reintroduce referents. A 3 × 4 ANOVA, reference status by category, performed on arcsine transformed proportions for the native signers' use of reference categories revealed no main effect of reference status, $F(2,14) = 1.24$, $p = 0.32$, but there was a main effect of reference category, $F(3,21) = 25.06$, $p < 0.0001$, and an interaction between category and status, $F(6,42) = 30.46$, $p < 0.0001$. These results indicate, as predicted, that native signers do not use all reference categories equally often, nor do they use the reference categories similarly as a function of discourse status, as Fig. 7 shows. In other words, the native signers differentially use ASL reference devices to track referents as a function of their narrative structure. Post hoc analyses (Student's *t*-tests on the arcsine transformed proportions) were performed on the categories among discourse statuses to tease apart which categories the native signers use differentially. In the following, we report *p* values greater than 0.05 as non-significant. In accordance with our predictions, native signers used nominals to introduce referents more often than to maintain or reintroduce them. However, counter to our predictions, the proportion of classifiers used for introductions was no higher than their use for any other status. Note though, that this result is relevant only in so far as all classifiers can be grouped together. As we will see below, dividing the category of classifiers into semantic classifiers vs. SASSes reveals their differential use in discourse structure.

With respect to maintained contexts, our analyses revealed a preference in the native signers for zero anaphora. The signers used this category more for maintained than introduced reference. However, there was no significant difference between use of zero anaphora for maintained and reintroduced references. We had also expected a large proportion of classifiers in maintained contexts. While the numbers and proportions in Table 3 suggest differential use of classifiers across statuses, the *t*-tests on the arcsine transformed proportions did not reach significance.

Finally, we expected that native signers would use pronouns frequently to maintain reference. This is not what we found. As indicated in Table 3, the number of pronouns was low overall, and proportionally the role of pronouns in maintaining reference was negligible.

As these numbers suggest, the post hoc test revealed no significant differences in the use of pronouns as a function of status.

In reintroduction contexts, we expected to see the native signers use a mixture of lean and fuller forms, that is classifiers and pronouns, but also some zero anaphora and some nouns. In this, our predictions were not borne out in this data set. It should be stressed, however, that the low proportion of referent reintroductions that our stimuli elicited means that the distribution of reference forms could look different in narratives where more reintroductions are required. We will take up this point again in the discussion. The most prominent category in the reintroduced status was zero anaphor. However as reported above, there was no significant difference between use of zero anaphora in maintained and reintroduced references, rather only between introduced and reintroduced references. Similarly, we found no statistically significant differences between maintained and reintroduced references for nouns, indicating that nouns were not used more frequently to reintroduce than to maintain referents.

Last, contrary to our expectation, the signers used no pronouns and no classifiers for referent reintroduction. As mentioned above, the native signers used proportionally more classifiers in maintained than in reintroduced contexts, although the difference was not statistically significant. There was no difference between the use of classifiers in introduced and reintroduced contexts. As for the pronouns, their overall use was small and we found no differences as a function of status.

Summing up, these results suggest that in ASL discourse, nominals are the primary means of introducing new referents, as we predicted. Counter to our predictions, classifiers are used only a little for introductions and not at all for reintroductions. They are, however, a prominent means of maintaining reference. Zero anaphor is the primary means for both maintaining and reintroducing referents. We also observe that, where classifiers are used both to introduce and maintain reference, pronouns are all but absent from the data.

While these results show that native ASL signers vary their referential expressions with discourse context, several questions remain. What, for example, are the discourse properties of the different subtypes of classifiers, nominals and zero anaphora, that is, what does the signer signal about the discourse structure by choosing one subtype over another? What is the role of spatial modulation? To begin answering these questions, we now turn to a more detailed discussion of the subcategories of the various reference categories we have discussed so far.

Recall that ASL uses different kinds of nominal reference in addition to the ubiquitous bare nouns. Table 4 shows the proportion of each of these noun types in the native signers' discourse as a function of reference status. The table shows that native signers use the greatest variety of noun types when introducing referents. All noun types are used for referent introduction, although the proportions of types, other than bare nouns, are relatively small. For maintained reference, the signers only use fingerspelled nouns (FS nouns), IX nouns, bare nouns, and noun IX. When reintroducing referents, they use only bare nouns. This distribution indicates that native signers use nouns types differentially as a function of

reference status, although the difference in proportion is not statistically significant, possibly due to the low number of tokens.

In the main analysis, we found that the signers used classifiers for introduction contexts, as well as in maintained contexts, but not for reintroductions. Recall that we predicted that SASSes might be considered a relatively full form of reference and some might not have anaphoric properties, and classifier predicates might be considered a type of overt yet lean reference, similar in function to that of pronouns in spoken languages. Table 5 shows the native signers' distribution of SASSes, semantic classifiers and handle classifiers over the three statuses across all subjects. An analysis of variance of discourse status (introduced vs. maintained) by classifier type (SASS vs. Semantic CL) was performed by subject on arcsine transformed proportions.

As no classifiers occurred in reintroduction contexts, we excluded this status from the analysis. We also excluded the one occurrence of handle classifier. The results of the analysis revealed a main effect of both discourse status, $F(1,7) = 16.67$, $p < 0.01$, and classifier type, $F(1,7) = 18.53$), $p < 0.01$, as well as an interaction between the factors, $F(1,7) = 57.65$, $p < 0.01$ (Fig. 8).

Post hoc tests revealed no significant difference between native signers' use of SASSes and semantic classifiers in introduction contexts, but there was a significant difference between the two categories in maintained contexts, $p < 0.001$, with semantic classifiers occurring more frequently. In addition, the signers used significantly more semantic classifiers for maintenance than for introduction, $p < 0.001$. These results show that native signers use semantic classifiers primarily for maintained reference, which is in line with our predictions. The general pattern of SASSes being proportionally more frequent in introduced as compared to maintained contexts is also as expected, although it did not reach statistical significance. However, the complete absence of classifiers from reintroduced contexts is unexpected.

Last, we hypothesized that the different types of zero anaphora might serve different referential functions in ASL. Because different verb types and constructed action vary in their referential value, we hypothesized that signers might use the zero anaphora types differentially as a function of discourse status. Although the choice of predicate type is first and foremost a consequence of verb semantics, it is possible that certain verb types are more likely than others to occur with null arguments in certain discourse contexts. This would be reflected as a greater proportion of occurrence in our analysis, as we only considered predicates without overt subjects. We first looked at the distribution of null references. Within the reference category of zero anaphor, we grouped tokens according to whether they were connected to plain verbs, agreeing verbs or constructed action. Table 6 shows the proportion across all subjects of the different zero anaphora types. As shown in the table, zero anaphora from plain verbs predominate in maintained contexts, where they account for just over half of the zero anaphora tokens. In reintroduced contexts, zero anaphora from agreement verbs and constructed action are used to similar extents, and both occur in greater proportion than zero anaphora from plain verbs.

A 2 × 2 by subject ANOVA (zero anaphor type by discourse status) of the raw numbers, excluding introduced contexts, showed main effects of discourse status, $F(1,7) = 126.81$, $p < 0.001$, and zero anaphor type, $F(1,7) = 8.86$, $p < 0.01$, as well as an interaction effect, $F(2,14) = 20.39$, $p < 0.001$. Post hoc tests showed significant differences between plain verb zero anaphora vs. agreement verb and constructed action zero anaphora in maintenance contexts. By contrast, there was no difference between zero anaphora types in reintroduction contexts. While it is clear that verbs and constructed action are not necessarily exchangeable, these results suggest that native signers prefer to use the zero anaphora types differentially to maintain and reintroduce referents. This may reflect a preference for overt vs. null arguments for different predicates in different discourse contexts. Plain verbs are preferred in maintenance contexts over reintroduction contexts, while the reverse is true for agreement verbs. This pattern is not surprising if we assume that agreement verbs carry more referential value than plain verbs, due to their indication of subject/object referents. Somewhat counter to intuition however, constructed action zero anaphora are used proportionally more in reintroduction than in maintenance contexts. To explore this result further, we looked at the instances of constructed action in more detail. We examined whether the use of spatial framework, that is whether the signer overtly signals which third person referent is being denoted or not, plays a role in structuring discourse. Recall that both agreement verbs and constructed action can occur in a fixed spatial framework, i.e. with overt spatial marking, or in a mentally rotated framework, i.e. without spatial indication of which referents are involved. Our expectation was that constructed action in reintroduced contexts might be marked spatially, rather than occurring in mentally rotated frameworks. This is because mental rotation might occur primarily when the signer could expect the referent to be highly accessible to the addressee, that is, in maintained contexts as compared to reintroduced contexts. This expectation is similar to the finding that German Sign Language users use more spatial modification of predicates in reintroduction contexts than in maintenance contexts (Perniss and Özyürek, 2015).

Table 7 shows the distribution across all signers of zero anaphora from verbs and constructed action split by framework: fixed spatial versus mentally rotated as a function of discourse status. The table excludes plain verbs ($n = 122$), as these cannot be used differentially in mentally rotated or static frameworks.

Table 7 shows that there is a preference for using agreement verb zero anaphora in fixed spatial frameworks, and a preference for using constructed action in mentally rotated frameworks. This is the case for maintained contexts as well as reintroduced contexts. We asked how the sign interlocutor is then capable of recovering the reference of the constructed action in such reintroduction contexts. However, when looking at the contexts of occurrence we found that in 5 of the 6 instances, the constructed action without spatial marking appeared immediately after a sentence in which the subject was an inanimate entity, and consequently not a possible referent for the constructed action.

One last result should be mentioned here. Within the fixed spatial framework, we only found one instance of a verbal zero anaphor that was used with two fixed loci. All remaining instances occurred in the role-shifted context, where the signer used his/her own locus as the beginning or ending point of an agreement verb.

6. Discussion

We now discuss the patterns of referent tracking displayed by the ASL signers in the data and relate our findings to previous work. In their use of reference categories as function of discourse status, native signers showed a preference for introducing with nouns. This was expected, given the referential hierarchy, since nouns are the fullest form of reference in ASL. This result is also consistent with the findings from Swabey (2002, 2011). Bare nouns were by far the most frequently used referent type. In addition, we found the greatest variety of nominal forms (i.e. modified nouns) in introduction contexts. We also found sporadic use of classifiers for introductions. When signers introduce with classifiers, they tend to use SASSes over other classifier types although the analysis did not reach statistical significance.

Native signers maintained referents primarily with zero anaphora, which was expected and consistent with findings from previous literature (e.g. Swabey, 2002, 2011; Wulf et al., 2002; McKee et al., 2011). They used zero anaphora from plain verbs more than from agreement verbs and constructed action. When we examined the use of spatial frameworks in maintained zero anaphora, we further discovered a differential preference for the spatial vs. mentally rotated frameworks as a function of zero anaphor type. Thus, in these ASL data, spatial marking did not signal discourse status, contrary to what has been found for DGS (Perniss and Özyürek, 2015).[8] Classifiers occurred in maintained contexts as well, and here we found a preference for using semantic classifiers over SASSes.

Zero anaphora were used in reintroductions too, and the preferred zero anaphora types were from agreement verbs and constructed action. Zero anaphor in general was the primary means of reintroducing referents as well as maintaining them. This pattern was reversed for constructed-action zero anaphora. For verbal zero anaphora in reintroduction contexts, the signers showed a preference for the fixed-spatial over the mentally-rotated framework. However, this lack of marking did not obscure the reference of the zero anaphor, demonstrating that ASL signers' choice of referential form is a systematic interaction among the referential hierarchy, sentence structure, and the discourse context.

Although the proportions suggest a greater use of nouns in reintroductions than in maintained contexts, the difference was not statistically significant. When the signers used nouns for reintroductions, they exclusively chose bare nouns. For reintroduction in this study, native signers never used classifiers of any kind. As a broad characterization, these findings suggest that nouns and SASSes are fuller referential expressions whereas semantic classifiers and zero anaphora are leaner expressions in ASL. Given what we know about referent tracking cross-linguistically, this is an expected result. More surprising is what we did not find in the data. First, there was an almost complete absence of pronouns,[9]

[8]However, the types of predicates included in analysis differed in the two studies in that Perniss and Özyürek (2015) included predicates for which the overt subjects were also included in the analysis, whereas the present study did not.

[9]Note that we are only making this claim about the subset of data that we discuss, i.e. introductions and maintained/reintroduced statuses, and only for pronominal points. Other types of pointing signs (i.e. determiners and locatives in connection with NPs) did occur, as we have shown, and also among the signs that did not receive status coding (due to our coding scheme). We found additional points used in the contexts of constructed action (quotational points to signer's locus as subject, $N = 3$, quotational points to non-subject referents, $N = 10$), reference to objects ($N = 2$) and in reference to locations ($N = 9$).

suggesting that pronouns are prominent ways to signal neither maintenance nor reintroduction in these short ASL narratives. It is possible that this could be an artifact of the dataset. Compared to the findings for DGS (Perniss and Özyürek, 2015), where pronouns occurred frequently in both maintained and reintroduced contexts, the proportion of pronouns in the present study is extremely small. As previously mentioned, our stimuli elicited only a very small proportion of referent reintroductions. It is possible that the simple nature of the narratives, and the sequential nature of the episodes, influenced the choice of reference forms. The fact that most actions in the stories are performed by one main protagonist may have allowed the signers to use more null references than they would have in the case of more complex stories with multiple protagonists, as was the case in the work on DGS. However, if we assume that discourse structure follows similar principles whether applied to basic or more complex narratives, and is simply scaled up in the later case, then the small number of pronouns in our data raises some interesting questions about pronouns in ASL (and possibly other sign languages). ASL has pointing signs that appear to be pronouns (e.g. Meier and Lillo-Martin, 2010), and we might thus expect pronouns to play the same important role for referent tracking as they do in English and other spoken languages. However, the results of the present study suggest that anaphoric pronouns do not play the same prominent role in referent tracking in simple ASL narratives as they do in spoken languages. Given previous research suggesting that pronouns could be considered as incorporated into verbs, rendering it unnecessary to always articulate them independently (Kegl, 1986), one might speculate that a potential reason for the absence of pronouns could be that agreement verbs were used in their place. However, in this study we found only one instance of an agreement verb actually moving between two spatial locations. In all other cases, mental rotation or, more often, role-shifting was involved. Thus, if agreement verbs are filling the role of pronouns, they do so partly though shifted reference. Given our present findings, we propose that role-shifting may eliminate the need for anaphoric pronouns in brief narratives with only one main character. This phenomenon may serve as one visual language analog to the spoken language pronoun. An idea that is emerging across various studies is that sign language pointing signs may be partly gestural (e.g. Cormier et al., 2013a) but also pronominal (Meier and Lillo-Martin, 2013). While it could be argued that the absence of pronouns in our findings supports the hypothesis that sign language pronouns are different from spoken language pronouns, the present study provides us with insufficient data to address the status of pronouns directly. At most, our findings allude to the possibility that ASL signers may not need to use anaphoric pronouns in narratives. Given that the present study looked only at short and simple narrative retellings, the general properties of ASL pronouns and their use in other types of discourse merits further investigation.

Another notable absence was that of classifiers in reintroduction contexts. On a general level, if classifiers in ASL were to function similarly to spoken language pronouns, we would expect to observe them in a considerable proportion of the reintroduced references. For example, for German narratives Debreslioska et al. (2013) found that pronouns were used more frequently in reintroductions than in maintenances. Our findings, however, were that native signers used classifiers for referent introduction and for maintenance, but never for reintroduction. We should emphasize that our data contained only few reintroductions in general. Consequently, it is possible that this finding does not reflect a principle of native

ASL discourse, but rather the simple structure of our elicited narratives. However, in other work, we have compared the native signer narratives with those of second language ASL learners (Frederiksen and Mayberry, 2015). This work suggests that more frequent reintroductions are possible with these stimuli, and in fact, L2 learners do not show a dispreference for using classifiers for reintroductions. The fact that native signers did not use this referring expression in reintroduction contexts suggests that the discourse function of classifiers is less similar to that of pronouns than we anticipated. This raises the question of how to quantify the material contained in classifiers and requires further investigation, perhaps in the context of more complex narratives that might necessitate more referent reintroductions. On a more specific level, we ask why SASSes are not used in reintroduction contexts. As previously discussed, research on Auslan has suggested that SASSes are often nominal in nature. As such, we might expect them to play a role in reintroduction contexts where, as we know from spoken languages, nominal expressions tend to be relatively frequent (Debreslioska et al., 2013). However, some researchers have argued that SASSes are incorrectly described as classifiers, that only static SASSes belong to this category whereas, tracing SASSes have been argued to be adjectival and to lack anaphoric properties (Zwitserlood, 2012). The fact that they played no role in referent reintroduction in the present study supports the hypothesis that these expressions are adjectival in nature. Clearly more research is need on the function of SASSes in ASL discourse.

To summarize, we found that, on the surface, native ASL signers use nouns primarily and SASSes secondarily to introduce referents. They use zero anaphora primarily and semantic classifiers secondarily to maintain referents. For reintroductions, the signers also use zero anaphora. The main difference between the two discourse statuses is the preference for plain verb zero anaphora over agreement verb and constructed action zero anaphora in maintained contexts, while no differences were found in reintroduction contexts. In addition, no differences were found between the maintained and reintroduced contexts regarding native signers' use of nouns and pronouns. Recent research of spoken language reference in reintroduced and maintained contexts suggests that speakers prefer fuller forms, i.e. they use a larger proportion of nouns and a smaller proportion of zero anaphora, for reintroduced reference than for maintained reference (Debreslioska et al., 2013). Similarly, recent results from German sign language suggests that overt referring expressions are leaner, specifically pronouns, in maintained contexts, and fuller, specifically nouns, in reintroduced contexts (Perniss and Özyürek, 2015). The present ASL results do not align with this finding. This may indicate that the distinction between the two statuses, maintained and reintroduced, is not particularly important in ASL. On the other hand, our narrative stimulus was relatively simple by design so that a replication and extension of this study with a more complex narrative structure is needed to confirm this hypothesis.

Taken together, the findings of the present study lead us to propose a hierarchy of referential expressions for ASL shown in Fig. 9. The upper part of the figure shows the referring expressions used when the referent is less accessible to the interlocutor in the discourse context, and the lower part shows the referring expressions used for the most accessible referents. Note that the form distribution proposed here looks somewhat different from the hierarchy generally proposed for spoken language referent tracking. The absence of pronouns and the distinction between different types of zero anaphora, as well as the

similarity in markings in maintained and reintroduced contexts, suggest that referent tracking in simple ASL narratives may rely on devices than other than those used in spoken languages, even when the same forms are available. Because the visual modality offers the opportunity to conventionalize the use of space, devices such as role-shift may carry the referential functions reserved for pronouns in many spoken languages. Future research will determine if our proposed referent hierarchy for ASL predicts the referential pattern in more complex stories and discourse genres and in ASL signers other than native deaf learners.

7. Conclusion

We investigated referent tracking in ASL. We asked whether the referential hierarchy in a visual language conforms to the cross-linguistic patterns observed in spoken languages, or whether the different affordances of the visual modality might influence its structure. As a novel contribution to the ASL literature, this study looked at a considerable range of referential devices in ASL, in addition to nouns, pronouns and zero anaphora. This led to the discovery of the differential referential functions played by types of classifier and zero anaphora in ASL. Although signers appear to follow some of the general principles of the referential hierarchy as they appear in spoken languages, there are clear differences as well. The similarities we found were reliance on nouns for referent introductions, and on zero anaphora for referent maintenance. As for the differences, the deaf native signers in our study largely refrained from using pronouns for referential purposes, despite the fact that ASL has this referential device. In addition, we found differences in the how native signers use various types of zero anaphora, and we showed that that the use of spatial frameworks in this category seems to depend on the particular type of zero anaphor, rather than on referent accessibility. Our results further revealed that deaf native signers' use of semantic classifiers was not predictable from the referential hierarchy for spoken language. In addition, rather than showing evidence of a unified function, different discourse functions favored different classifier types. Finally, we proposed a hierarchy of referential expressions for ASL that provides a testable framework for future studies of sign language discourse.

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Appendix. Example of stimulus story

Fig. 10.

Fig. 10.
Picture story. Read from left to right.

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Fig. 1.
Noun CL example: TABLE CL:SURFACE-OF-TABLE.

Fig. 2.
CL noun example: CL:SHAPE-OF-BALLOON BALLOON.

Fig. 3.
The agreeing verb GIVE with two loci in signing space.

Fig. 4.
The agreeing verb GIVE with use of spatial loci and in a role-shifted context.

Fig. 5.
The mentally rotated agreeing verb TAKE with no spatial loci.

Fig. 6.
SASS example: CL:SHAPE-OF-VASE.

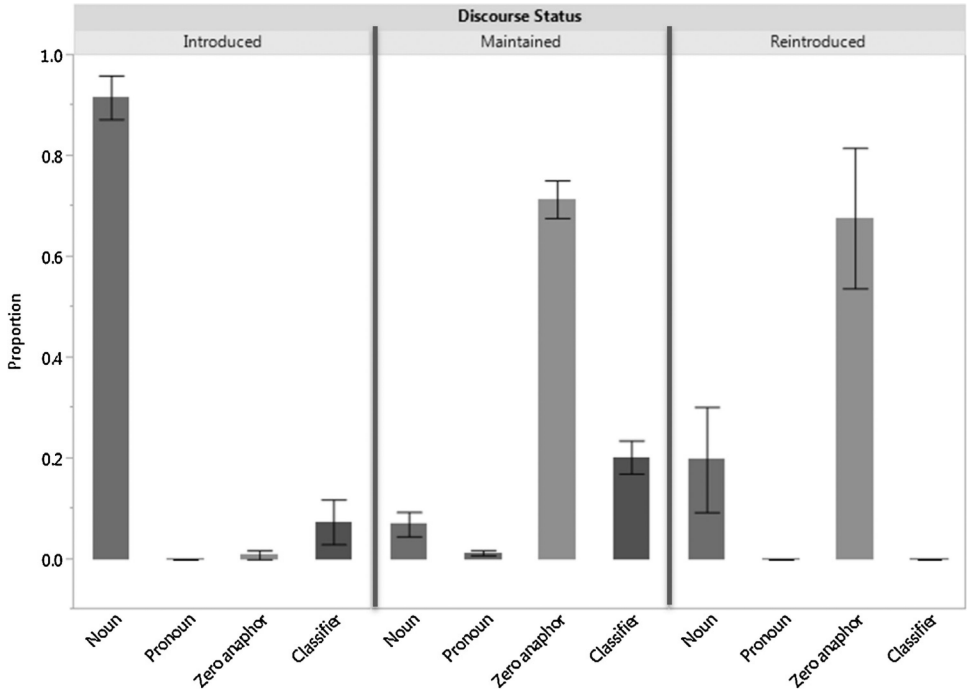

Fig. 7.
Mean proportion of reference category by status (introduced, maintained, and reintroduced).

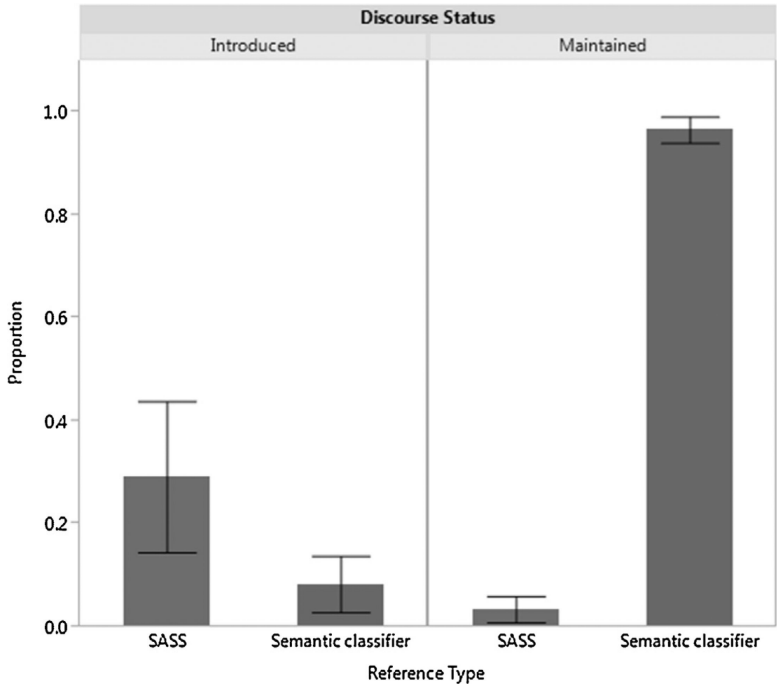

Fig. 8.
Classifier type as a function of discourse status (introduced, maintained).

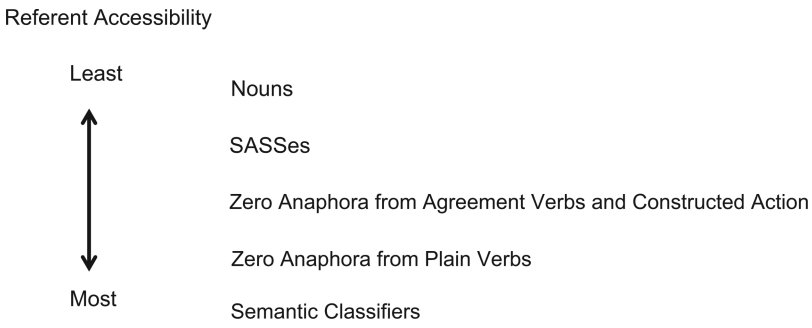

Fig. 9.
Preferred ASL referring expressions as a function of referent accessibility.

Table 1

Referent status definitions.

Discourse status	Definition
Introduced	First mention of a referent, independent of clause position
Maintained	A referent having appeared in any position in the previous clause appearing in the current clause as sentential subject
Reintroduced	A referent appearing as sentential subject in the current clause, subsequent to a clause where the referent was not mentioned

Adapted from Gullberg (2006: 170).

Table 2

Reference categories and reference types.

Reference category	Reference type
Nominal	Bare noun
	Fingerspelled (FS) noun[a]
	Modified noun (IX noun; noun IX; noun CL; CL noun)
Pronominal	Pronoun
Zero Anaphor	Constructed action/dialogue (fixed spatial marking; mental rotation)
	Plain verb
	Agreement verb (fixed spatial marking; mental rotation)
Classifier	SASS[b]
	Semantic classifier
	Handle classifier

[a]Although there is no semantically based reason to distinguish between fingerspelled nouns and signed nouns, we expected that signers may avoid using fingerspelled nouns in maintained and reintroduced contexts simply because of the relatively greater effort required for fingerspelling compared to signing a noun.

[b]In this category, we only counted SASSes that occurred independently of nouns, and that, though they were used to refer to entities, were not lexicalized.

Table 3

Mean proportion (number) of references by status and category.

	Nominal	Pronominal	Zero Anaphor	Classifier	Total
Introduced	0.91 (101)	0 (0)	0.01 (1)	0.07 (7)	109
Maintained	0.07 (24)	0.01 (4)	0.71 (219)	0.20 (63)	310
Reintroduced	0.20 (10)	0 (0)	0.68 (20)	0 (0)	30

Table 4

Proportion (number) of noun types by discourse status.

	CL noun	FS noun	IX noun	Noun	Noun CL	Noun IX
Introduced	0.04 (4)	0.04 (4)	0.07 (7)	0.72 (73)	0.07 (7)	0.06 (6)
Maintained	0.00 (0)	0.04 (1)	0.04 (1)	0.88 (21)	0.00 (0)	0.04 (1)
Reintroduced	0.00 (0)	0.00 (0)	0.00 (0)	1.00 (10)	0.00 (0)	0.00 (0)

Table 5

Proportion (number) of classifier types by discourse status.

	SASS	Semantic CL	Handle CL
Introduced	0.71 (5)	0.29 (2)	0.00 (0)
Maintained	0.03 (2) *	0.95 (60)	0.02 (1)
Reintroduced	0.00 (0)	0.00 (0)	0.00 (0)

* One maintained SASS was a tracing SASS, the other one was a static SASS.

Table 6

Proportion (number) of zero anaphora type as a function of discourse status.

	Plain verb	Agreement verb	Constructed action	Total
Introduced	0 (0)	0 (0)	1.0 (1)	1
Maintained	0.54 (119)	0.23 (50)	0.23 (50)	219
Reintroduced	0.15 (3)	0.4 (8)	0.45 (9)	20

Table 7

Proportion (number) of zero anaphora from agreement verbs versus constructed action, as a function of spatial framework and discourse status.

Status	AGREEMENT VERB framework			CONSTRUCTED ACTION framework		
	Fixed spatial	**Rotated**	***N***	**Fixed spatial**	**Rotated**	***N***
Introduced	0 (0)	0 (0)	(0)	0 (0)	1.0 (1)	(1)
Maintained	0.94 (47)	0.06 (3)	(50)	0.28 (14)	0.72 (36)	(50)
Reintroduced	0.88 (7)	0.13 (1)	(8)	0.33 (3)	0.67 (6)	(9)