

The role of contrast in anaphoric expressions in ASL

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1. Introduction

This paper proposes a new analysis of anaphoric expressions in American Sign Language (ASL). ASL makes use of a number of anaphoric expressions, including the null argument, the bare noun, as well as different kinds of indexical pointing (IX). IX can be used to point and refer to actual referents, and can also associate abstract locations in the signing space (loci) to refer to referents not present in the speech context. This latter use of IX has received a lot of attention in the formal semantic literature, notably including debates about the (non-)existence of variable in semantics (cf. Jacobson 1999), as loci have been analyzed as the overt instantiation of indices that variables can carry in reference resolution (Lillo-Martin & Klima 1990).

In this work, we present data that suggest that IX with a locus is more restricted in distribution and licensing conditions. This has been previously observed in a number of reference tracking studies (Czubek 2017, Frederiksen & Mayberry 2016), but has not been discussed much in the formal literature. We begin by presenting this disconnect and motivate a more fine-grained investigation of IX in ASL. Based on an investigation on different uses of anaphoric expressions in ASL, we propose an alternative analysis of IX, where a) IX to a neutral position and IX to a locus are semantically distinguished, and b) IX to a locus is analyzed as a modifier that triggers a contrast. We show that the proposed semantic analysis and the general competition mechanism allow us to account for the distribution of the anaphoric expressions in ASL more fully.

1.1 Disconnect in the ASL Literature

American Sign Language (ASL) has received recent attention in the formal semantic literature, especially where it is argued to exhibit distinctions that are invisible or at least less transparent in spoken languages. In the domain of anaphoric elements, the main focus has been on the pointing gesture (indexical; IX) directed to a location in the signing space (locus) (cf. Koulidobrova & Lillo-Martin 2016, Neidle 2000). Since it has been claimed that loci are overt instantiations of indices that variables carry for pronominal reference (Lillo-Martin & Klima 1990), researchers have focused quite exclusively on IX and loci in formal studies of ASL anaphora (cf. Koulidobrova & Lillo-Martin 2016, Irani 2016, Kuhn 2015, Schlenker 2011, MacLaughlin 1997, Neidle 2000, Steinbach 2015).

Less considered in this series of literature is that IX, especially IX to a locus, is neither obligatory nor frequent in anaphora in ASL. Like any other sign or spoken language, ASL makes use of various expressions for nominal reference, including the null argument, pronominal elements, and full noun phrases, in addition to IX. In fact, when we take a look at narrative production studies like Frederiksen

& Mayberry 2016 and Czubek 2017, we can see that IX is actually quite infrequent in natural discourse. Instead, null arguments and other mechanisms such as constructed action (where the signer iconically reproduce the action of the referent) are used more frequently.

The fact that ASL makes use of other anaphoric mechanisms and that IX is infrequent in production studies provides an empirical challenge for these formal semantic studies. For example, the strongest interpretation of the argument that sign language loci are overt instantiations of indices cannot hold, as loci are not obligatory in all anaphoric references. Indices in formal semantics are assumed to be present whenever anaphora takes place. Thus, if ASL instantiates indices with loci, we would expect loci to be used in all anaphoric expressions. But loci are not overtly present in null arguments, bare nouns, or even in some uses of IX that are used anaphorically. Thus, the argument we can maintain would be that indices *can* be overtly instantiated in ASL even though they are also often covert. It would have to be explained why, in a single language, covert and overt forms of indices are both available, and why the overt form is so infrequent.¹ Such discussions have not to our knowledge surfaced yet, which we believe may be partially due to a large disconnect between formal semantic/syntactic literature and referent tracking studies in ASL. In this paper, we evaluate the formal semantic claims about ASL IX against the distributional properties observed in referent tracking studies and our own data collection and suggest an alternative formal analysis that could better account for natural production data.

We first present an overview of anaphoric expressions available in ASL, especially focusing on the claims made about ASL IX in the formal literature as well as the distributional properties observed in narrative production studies. Based on the relative frequency of bare nouns, null arguments, and different forms of IX in the narrative production studies (Frederiksen & Mayberry 2016, Czubek 2017), we then present a new hypothesis where the use of a **locus in ASL is triggered by contrast with competing referents**. Specifically, we argue that loci are licensed in anaphora only when there is a need to distinguish the intended referent from other competing referents. This differs from previous accounts of locus in that the main role of loci is to draw contrast rather than to refer anaphorically.

In order to investigate the distribution and meaning of different forms of IX more closely, we present a set of comprehension data that involved a series of consultation sessions with three ASL informants. We manipulated the number of referents in the discourse as well as the choice of the anaphoric expression and asked the participants to indicate how felicitous the sentence is, and whether the referents of the anaphoric expressions were clear. Based on this set of data, we propose an analysis of anaphoric expressions in ASL. First, we show how the basic denotations of each anaphoric expression in ASL allow for a naturally derived scale. The scale contains the null argument in the lower end of the scale, and is built with expressions that carry more restrictions occupying higher positions in the scale. Second, we propose that the category of IX must be semantically distinguished between IX to a neutral position (IX_{NEUT}) and IX to a locus (IX_{LOC}). This is a novel claim that differs from syntactic accounts of locus vs. neutral position as in Steinbach 2015 or Kuhn 2015 where the difference was suggested to be a syntactic, feature-based difference that does not have semantic consequences. This

¹ Note that this is different from languages allowing covert and overt pronouns. A pronoun is a morphosyntactic element, while indices are formal entities that are assumed to be present in the underlying structure of all anaphoric references. A morphosyntactic element can be covert, but in this argument, it would have to be this formal element that can have both covert and overt instantiations, unlike spoken languages.

claim is also different from accounts of IX such as in Koulidobrova & Lillo-Martin 2016 where the analysis of IX_{NEUT} was assumed to apply to IX with a locus as well. In our analysis, the two forms of IX are shown to have different distributions as well as different meanings. Under our account, IX_{NEUT} carries a *phi*-information that specifies animacy, while IX_{LOC} is a modifier that contributes the property of being signed at the given locus. After proposing the denotations for the null argument and the bare noun, we show that the competition mechanism proposed in the previous chapters allows us to better account for the distributional properties observed in previous studies.

2. Anaphoric expressions in ASL

We start by showing that ASL allows a number of anaphoric expressions in a given context. Consider (1), where the null argument (1a), the bare noun (1b), and a pointing gesture in the neutral signing space (neutral IX; IX_{NEUT}) (1c) can be used to refer to the boy introduced in the first sentence.

- (1) BOY ENTER CLASSROOM.
 a. HAPPY.
 b. BOY HAPPY.
 c. IX HAPPY.
 ‘A boy entered a classroom. He was happy.’

Another way to express the sentence in (1) is to associate the boy referent to a specific location in the signing space (locus) as in (2) and point back to that locus. Associating a boy referent to a location occurs by signing BOY and pointing to a locus, while referring back to that referent is done by pointing to that locus again. As shown in (2), the indexical pointing to a locus A is indicated as IX_A for both the instance of association and the instance of anaphoric reference because they are identical morphologically. Note that this use of IX to a specific locus is different from IX in (1c), where there was no previously established locus.

- (2) BOY IX_A ENTER CLASSROOM. IX_A HAPPY.
 ‘A boy entered a classroom. He was happy.’

That ASL allows more than one type of anaphoric expression in a given context is not surprising given that this is the case for other languages as well. What is also found across languages is that when this kind of variation is available in a language, the choice of an expression out of possible alternatives results in certain implications (cf. Ahn 2019). Thus, in this paper, we examine the distribution of the anaphoric expressions in ASL and discuss a possible analysis of them. Before we go on to discuss the relative distribution found in production studies, I review previous accounts of IX and loci and show some limitations that result from not separating IX_{NEU} from IX_{LOC} and not considering the limited distribution of IX_{LOC}.

2.1 IX

IX has been analyzed as a definite determiner (Neidle 2000, Maclaughlin 1997). However, as discussed in earlier chapters, there are two uses of definite determiners that have been discussed in more recent semantic literature. Schwarz (2009) argues that the uniqueness-denoting definites should be semantically distinguished from the familiarity-denoting definites. The latter carries an anaphoric index and requires that the referent be familiar to conversation participants, while the former simply

requires that the referent be unique in the given context. Cross-linguistic studies show that these two types of definites are morphosyntactically distinguished in a number of languages. Applying this distinction to ASL, Irani (2016) argues that IX should be analyzed as the familiarity-denoting definite (called strong definites following Schwarz 2009), based on examples as in (3). It is shown in (3) that IX to the locus associated with the book (IX_A) is obligatory for the anaphoric use of *the book* in the second sentence.²

- (3) JOHN BUY IX_A BOOK, IX_B MAGAZINE. #(IX_A) BOOK EXPENSIVE.
 ‘John bought a book and a magazine. The book was expensive.’ [Irani 2016]

Koulidobrova & Lillo-Martin (2016) also provide examples against analyzing IX as the uniqueness-denoting (weak) definite, as shown in (4). In (4), what we see is that IX is not licensed just by the fact that the referent (the capital of France) is unique in the given context. IX seems to require the referent to be familiar with conversation participants, which it isn’t in (4).

- (4) FRANCE (*IX) CAPITAL WHAT
 ‘What is the capital of France?’

In fact, Koulidobrova (2012) argue that IX is not the strong definite either, using examples like (5).

- (5) TODAY SUNDAY. DO-DO. GO CHURCH, SEE PRIEST. (*IX) PRIEST NICE
 ‘Today is Sunday. What to do? I’ll go to church, see the priest. The priest is nice.’

The conflicting analyses between Irani 2016 and Koulidobrova & Lillo-Martin 2016 can be resolved when we consider the neutral IX used in (5) separately from IX to locus discussed in Irani 2016. Koulidobrova & Lillo-Martin (2016) purposefully only focuses on IX to the neutral position rather than IX to loci in order to tease apart the effects of loci and the meaning of IX. Instead of generalizing this analysis to IX to loci as well, we restrict the analysis in Koulidobrova & Lillo-Martin 2016 to neutral IX only, and suggest that IX to loci indeed allows anaphoric uses as claimed in Irani 2016. In the present work, the two types of IX will be analyzed as two separate morphemes. In other words, IX to loci is not analyzed as the neutral IX plus a locus. Neutral IX and IX to loci are two separate morphemes that do not have an entailment or a subset relation.

It has been observed that IX behaves like a pronoun rather than a reflexive. For example, it has been observed that IX shows Condition B effects like other pronouns ((6); Sandler 2006) as well as crossover effects (Lillo-Martin 1991, Sandler 2006, Schlenker & Mathur 2013).

- (6) Condition B in ASL:
 a. *JOHN_a LIKES IX-a.
 b. JOHN_a LIKES SELF-a.
 (7) Crossover effect in English:
 a. Which boy_i did he think t_i would win?
 (Unavailable reading: Which boy x is such that x thought that x would win?)
 (8) Crossover effect in ASL:

² The subscript after IX represents the locus variable. IX without a locus in glosses suggests that the pointing sign is in the neutral position rather than at a specific locus.

- a. *WHO-CL-a IX-a THINK MARY LOVE NO-MATTER WHAT?
 ‘Who does he think Mary will love no matter what?’
 Intended: ‘Which person x is such that x thinks that Mary loves x no matter what?’
 [Schlenker & Mathur 2013]

Kuhn (2015) adds semantic similarities such as covariation with the antecedent as shown in (9).

- (9) EACH-TIME LINGUIST_a PSYCHOLOGIST_b THE-THREE-a,b,1 TOGETHER WORK, IX-a HAPPY BUT IX-b HAPPY NOT.
 ‘Whenever I work with a linguist and a psychologist, the linguist is happy but the psychologist is not happy.’

These data points establish that IX is like a pronoun and not like a reflexive. It is crucial to note, however, that the only conclusion we can draw from this set of examples is that IX is not a reflexive. Whether it is necessarily a personal pronoun rather than other types of anaphoric expressions like a strong definite or a demonstrative is not derived from these examples. This is because a strong definite and a demonstrative also show these properties: Condition B in (10), crossover effects in (10a,b).

- (10) John_i likes {him, the boy, that boy}_{*i}.
 a. Which boy_i did {he, the boy, that boy} think t_i would win?
 (Unavailable reading: Which boy x is such that x thought that x would win?)
 b. Whenever I work with a linguist, {he, the linguist, that linguist} is happy.

In fact, Koulidobrova & Lillo-Martin (2016) argue that IX should be analyzed not as a personal pronoun but as a demonstrative. Their argument is based on examples shown below.

- (11) MOTHER_i PERSUADE MARY_j MAKE SANDWICH_k. a-IX_{j,k,*i} GOOD.
 ‘My mother persuaded my sister to make a sandwich. {She/it} is good.’
 (12) SANDWICH_k MOTHER_i PERSUADE MARY_j MAKE. b-IX_{i,j,?k} GOOD.
 ‘Mother is persuading Mary to make a sandwich. {Mother/Mary} is good.’

There is a descriptive generalization that personal pronouns refer to the most salient referent or the topic, while demonstratives refer to the other referent in English. For example, demonstrative pronouns in German are analyzed as anti-topic or anti-perspective holder in Hinterwimmer 2016, 2018. Showing that IX in neutral position is degraded in referring to the subject in (11) and in referring to the topic in (12), Koulidobrova & Lillo-Martin argue that IX is not a personal pronoun but a demonstrative.

However, note that there are many factors that may be playing a role in this resolution pattern shown in (11) and (12). The first factor is the last-mention bias. For example, pronouns in spoken languages are often observed to refer to the last-mentioned referent (Roberts 2002). This is shown in the example in (13) with the English pronoun *she*.

- (13) A woman entered from stage left. Another woman entered from stage right. She was carrying a basket of flowers.
 [Roberts 2002]

If pronouns are likely to refer to last-mentioned elements, then the tendency of a-IX in (11) and b-IX

in (12) is not referring to the first-mentioned entity (MOTHER and SANDWICH, respectively) follows from an analysis of IX as pronouns.

Another factor is the availability of null arguments in ASL anaphora. This is an important difference between languages like English and ASL because, as discussed in previous chapters, the interpretation of an expression including its markedness is affected by the presence of other expressions in the language. In other words, given two expressions that can refer to the same referent in a given context, the more complex form is marked. This is what we find with overt pronouns and demonstratives in English. In languages that make use of null arguments like Romance, the null argument can compete with the overt pronoun, thus making overt pronouns marked. Since IX to a neutral position is an overt pronominal expression, it may be more marked than the null *pro*, just like in Romance languages. So, it is predictable that the more marked IX would refer to secondary referents due to a competition with the less marked null argument. With this in consideration, the markedness of IX in examples like (11) and (12) remains compatible with analyses of IX as a pronoun.

What we have seen so far is that while there is a number of examples that suggest that IX encodes anaphoricity, it is unclear which kind of anaphoric expression IX should correspond to. There are two issues that complicate the matter in these works. The first is the heavy focus on the comparison between ASL and English. ASL is a bare argument language that makes use of bare nouns as well as null arguments frequently. This is different from languages like English that does not allow either form in argument positions. Thus, trying to give an English-based label to a morpheme in ASL causes us to miss important generalizations about the distribution and interpretation of IX. Second, IX was assumed to be a single category that has a uniform interpretation across all of its uses. There is no distinction between neutral IX and IX to a locus in Kuhn 2015 or Irani 2016. Koulidobrova & Lillo-Martin (2016) focus on IX to a neutral position, but generalize analysis of IX_{NEUT} to all uses of IX, including IX to locus.

I will show later in the chapter that distinguishing the two uses of IX semantically allows us to better account for their interpretation as well as their distributional properties.

2.2 Loci

We now turn to analyses of loci in formal literature. In formal studies, it has been debated whether loci should be analyzed as indices that pronouns carry in semantics, or whether they should be analyzed as grammatical features that check the uninterpretable features carried by verbs in syntax. We discuss both in turn.

The idea of analyzing ASL loci as indices has received a lot of interest since Lillo-Martin 1990. The idea is that loci are like pronouns in English that carry indices, and the loci are overt instantiations of those indices, which are not visible in spoken languages. Sign languages are attractive in that they show both the assignment of loci to a specific referent and the later reference by using that locus. Consider (14) for example.

(14) I SEE DOCTOR IX_A PHILOSOPHER IX_B. IX_B NICE.

‘I saw a doctor_i and a philosopher_j. The philosopher_j was nice.

The locus A is assigned with the doctor, and the locus B is assigned to the philosopher in the first

sentence. Then, later pointing to one of the loci, for example, IX_B picks up the referent previously associated with that locus, so the second sentence is true of the philosopher the signer met is nice.

On the other hand, in more syntactic-based analyses, loci are analyzed as grammatical features that pronouns carry to check the uninterpretable features on verbs. In spoken languages, *phi*-features like gender, number and person on verbs are analyzed to be uninterpretable, and thus must be checked by arguments that carry matching features. For example, the verb *likes* has an uninterpretable singular feature that can be checked by singular NPs like *he*. A parallel analysis is given for ASL by considering different kinds of verbs available in sign languages. ASL, like many other sign languages, make use of what is often called ‘directional’ verbs, where the starting point of the verb matches the locus associated with the subject and the end point matches the locus associated with the object, and is used in contrast to ‘plain’ verbs, which do not show such matching of location (Padden 1983). Kuhn (2015) argues that these directional verbs are lexically specified two uninterpretable features, one associated with the subject, and the other associated with the object (see also Neidle 2000). IX that points to the loci associated with subjects and objects check these features, thus making the sentence grammatical. He further argues that plain verbs, verbs that do not show this directionality, are underspecified in terms of loci, meaning that a verb could appear with no uninterpretable feature that must be checked by a pronoun in that locus.

Note that the definition of ‘feature’ in this account is a syntactic one, that does not assume any semantic meaning. In semantic analyses of pronouns, many of the *phi*-features are assumed to carry meaningful information, like the feminine feature carrying a presupposition that the referent is female. The argument in Kuhn 2015 is a grammatical one, where the only purpose of carrying a feature is to check the matching feature on the verb.

2.3 Distribution

Now that we have looked at the three anaphoric expressions in ASL, we go on to look at their distribution in corpus-based referent tracking studies. We look at Frederiksen & Mayberry 2016, where 12 native signers were presented with a simple, 6-panel picture depicting a story and were asked to retell the story. A number of different anaphoric expressions available in ASL such as the null argument, classifiers, and IX were counted in the collected corpus, focusing on the subject position. In order to determine how referent status affects the choice of the anaphoric expression, they adopt the three-way distinction of referent status in the discourse from Gullbert 2006. The categories are as follows.

(15) Referent status

- a. **Introduced:** First mention of a referent, independent of clause position
- b. **Maintained:** A referent having appeared in any position in the previous clause appearing in the current clause as sentential subject
- c. **Reintroduced:** A referent appearing as sentential subject in the current clause, subsequent to a clause where the referent was not mentioned

Note that the latter two categories, maintained and reintroduced, focuses on the distance between the antecedent and the anaphor. As discussed earlier, the relative distance between the antecedent and the anaphor is not so crucial to the present work. What is important for this work is the presence of competing referents, which is not coded in this set of narrative production studies. Thus, we reanalyze

their categories and call the category that only contains the maintained referents the ‘narrow anaphora’ and the category that contains both maintained and reintroduced referents the ‘broad anaphora’. We will focus mainly on the broad anaphora category to look at wider ranges of anaphora, with the understanding that the presence of contrast remains unspecified in this category.

With these new categories, the proportion of each expression is listed in Table 1.

Table 1
Proportion of each expression

Anaphora	Nominal	Pronoun	Null Argument	Classifier	Total
Narrow	0.07 (24)	0.01 (4)	0.71 (219)	0.20 (63)	310
Broad	0.10 (34)	0.01 (4)	0.70 (239)	0.19 (63)	340

First note that the null argument is dominant in both categories of anaphoric reference, with around 70% of all anaphoric expressions being null arguments. Nominals can be used in anaphora as well, especially when the definition of anaphora is broadened to include reference to an entity not immediately after it is introduced. Within the nominal category, the bare noun is most frequently found, as the table reproduced from Frederiksen & Mayberry 2016 (Table 4, p.60) shows.

Table 2
Proportion within the nominal category

Anaphora	CL noun	Finger-spell	IX noun	Noun	Noun CL	Noun IX
Narrow	0.00 (0)	0.04 (1)	0.04 (1)	0.88 (21)	0.00 (0)	0.04 (1)
Broad	0.00 (0)	0.04(1)	0.04(1)	0.94 (31)	0.00 (0)	0.00 (0)

Note that IX rarely appears in this kind of production study. The pre-nominal and post-nominal use of IX only occur once each in the whole set of data.

2.4 Summary

What we see from this overview is the following. While the most amount of attention in formal semantics has been given to the use of loci in ASL, the current analyses of loci as features or indices do not take into account the frequency data presented in corpus-based studies. What referent tracking studies like Frederiksen & Mayberry 2016 show is that IX to locus is rarely used in simple narratives. This is problematic for both index-based and feature-based analyses of loci because any formal theory assumes that both indices and features are available for all anaphoric references. Given that loci are not obligatory for all anaphoric expressions in ASL, while indices and features are assumed to be present in all anaphoric reference, the only claim we can really maintain given the distribution is one-way: while loci might be indices or features, it is not the case that these are always instantiated as loci in the language. While it is possible that a language has both overt and covert realizations of a certain semantic concept, the current analysis does not have a story on why there is this divide between overt and covert instantiations, and how this divide is delineated.

Thus, it seems that the relative distribution and licensing condition of IX, as well as how it compares to other expressions available for anaphora in ASL, should be more closely evaluated for a fuller analysis of anaphoric expressions in ASL.

While the production studies such as Czubek 2017 and Frederiksen & Mayberry 2016 have already shown that IX is not so frequent in natural production, these studies did not specifically look for the presence of contrast in the contexts. Also, because they did not distinguish the neutral IX and the IX to locus, the conclusions we can draw from these studies is only preliminary.

In order to investigate the effect of contrast on anaphoric expressions in a more fine-grained manner, a series of grammaticality judgment tasks were designed, where ASL signers were asked to evaluate and comment on the felicitousness of sentences for which we manipulated the presence of contrast and the choice of anaphoric expressions. In section 3, we present the data from three consultation sessions with ASL signers. We show that the results from this study provide some new insights on IX use in ASL. First, we show that IX to loci is indeed not so frequent, and is only licensed in contrastive contexts. IX to the neutral position, however, appears more readily in contexts without contrast in our elicited data set.

3. Novel data: Effects of contrast in ASL anaphora

In our experimental study, short, two-sentence discourses were presented to consultants by a deaf, signing member of our research team, one discourse at a time. Consultants provided acceptability judgments immediately after each one, commenting on whether it is clear who the referent is, and whether they would sign the sentence in that way. This approach allowed us to control factors of interest. The three consultants were all deaf, native signers of ASL.

In the first sentence of each test item, which we call the context sentences, we manipulated the presence of contrast in one hand and the choice of the anaphoric expression on the other hand. For example, in contexts with no contrast, we only had one salient entity introduced in the first sentence as in (16).

- (16) BOY ENTER CLUB. MUSIC ON.
 ‘A boy entered club. Music was on.’

In contexts with a contrast, we added another entity into the context as in (17).

- (17) BOY ENTER CLUB. MUSIC ON. SEE GIRL READ.
 ‘A boy entered a club. Music was on. He saw a girl reading.’

We also looked at contexts where the second entity is an inanimate entity as in (18).

- (18) GIRL BUY BOOK.
 ‘A girl bought a book.’

In the sentences following the first, we manipulated the choice of anaphoric expression. Null arguments, bare nouns, as well as neutral IX and IX to locus were tested. For IX to locus, we also changed the context sentences so that each referent is associated with a referent. An example of each item is shown below with (17) as the context sentence and reference to the boy.

- (19) Sample set of items
 a. BOY ENTER CLUB. MUSIC ON. SEE GIRL READ. DANCE.

- b. BOY ENTER CLUB. MUSIC ON. SEE GIRL READ. BOY DANCE.
 - c. BOY ENTER CLUB. MUSIC ON. SEE GIRL READ. IX_{NEUT} DANCE.
 - d. BOY IX_A ENTER CLUB. MUSIC ON. SEE GIRL IX_B READ. IX_A DANCE.
- Intended: 'A boy_i entered a club. Music was on. He_i saw a girl_j reading. He_i danced.'

For contexts like (17) and (18) where there were two referents, we also tested the reference to the second referent, the girl and the book respectively. The set of items used for the context sentence in (18) is shown below, with (20) showing reference to the girl, and (21) showing reference to the book.

(20) Reference to the girl

- a. GIRL BUY BOOK. HAPPY.
 - b. GIRL BUY BOOK. GIRL HAPPY.
 - c. GIRL BUY BOOK. IX_{NEUT} HAPPY.
 - d. GIRL IX_A BUY BOOK IX_B. IX_A HAPPY.
- Intended: 'A girl_i bought a book_j. She_i was happy.'

(21) Reference to the book

- a. GIRL BUY BOOK. ABOUT PIRATES.
 - b. GIRL BUY BOOK. BOOK ABOUT PIRATES.
 - c. GIRL BUY BOOK. IX_{NEUT} ABOUT PIRATES.
 - d. GIRL IX_A BUY BOOK IX_B. IX_B ABOUT PIRATES.
- Intended: 'A girl_i bought a book_j. It_j was about pirates.'

3.1 Summary of the sentences

Combining all of the factors above, we came up with five different test conditions, which are organized in the table below. The conditions differed on the number of potential referents ('# Ref'; 1 vs. 2), the intended antecedent (whether it is the first or the second-mentioned entity; intended antecedent indicated with bold text in the sentence), and the animacy of the intended referent as well as the competing referent ('Animacy'; + for animate, - for inanimate). For example, condition A only has one potential referent, while conditions B through E have two referents. Conditions B and C differ in the animacy of the competing referent: B has an animate 'GIRL' as a competing referent, while C has an inanimate 'BOOK'. For each condition, an example context sentence is given. The conditions are labeled from A to E for simplicity.

Table 3
Sentence types:

Condition	# Ref	Animacy		
		Antecedent	Competing	
A	1	+	N/A	BOY ENTER CLUB. MUSIC ON.
B	2	+	+	BOY ENTER CLUB. SEE GIRL READ.
C	2	+	+	GIRL BUY BOOK.
D	2	+	+	BOY ENTER CLUB. SEE GIRL READ.
E	2	-	+	GIRL BUY BOOK .

3.2 Effects of contrast

We report the data on the effect of contrast on the choice of anaphoric expressions. Specifically, we

compared how the judgments on different anaphoric expressions differ between conditions with one or two referents. First, we compared the conditions A and B, where the only difference between the two was the presence of another referent. In the table below, we show the number of consultants out of three who accepted the anaphoric expression as felicitous and clearly referring to the intended referent, the boy.

Note that in the table, the IX_{LOC} means that the loci were established in the previous sentence.

Table 4

A vs. B

Cond.	Sentence	null	IX _{NEUT}	noun	IX _{LOC}
A	BOY _i ENTER CLUB. MUSIC ON. [DP] _i DANCE.	3	3	3	3
B	BOY _i ENTER CLUB. SEE GIRL _j READ. MUSIC ON. [DP] _i DANCE.	1	1	3	3

What we see is that in condition A, where there is only one salient entity introduced in the context sentence, all four anaphoric expressions are accepted by the consultants unanimously. The null argument, the neutral IX, the bare noun, as well as IX to locus (with loci established in the context sentence) unambiguously refer to the boy.

On the other hand, in condition B, the null argument and the neutral IX are not accepted by two out of three consultants. This differs from the bare noun and IX to locus both of which were fully accepted by all three of the consultants. The null argument and the neutral IX were reported to be possible by the third consultant, but what we found from further discussing these sentences was that the consultant was interpreting the story as being told from the perspective of the boy. Thus, what we see is that the use of the null argument and the neutral IX can only refer to the boy if the story is told from the perspective of the boy, so that he is the topic of the narrative.

Thus, in general, we see that the null argument and the neutral IX are only licensed felicitously when there is a unique salient referent. When there is a competing referent in the context, either the noun that teases apart the two referents (BOY vs. GIRL in this context) or the locus information (A vs. B) is necessary.

When asked which sentence they would prefer in Condition A, signers chose neutral IX over IX to locus, suggesting that IX to locus is marked when used without a clear competing referent. The use of a marked form may require signers to accommodate by creating a contrastive setting and thus result in lower felicitousness.

We also compared the conditions B and C, both of which have two referents, but differ in the animacy of the competing referent. In B, the competing referent is animate (GIRL), while in C, the competing referent is inanimate (BOOK). The results are shown below.

Table 5

B vs. C

Cond.	Sentence	null	IX _{NEUT}	noun	IX _{LOC}
B	BOY _i ENTER CLUB. SEE GIRL _j READ. MUSIC ON.	1	1	3	3

	[DP] _i DANCE.				
C	GIRL _i BUY BOOK _j . [DP] _i HAPPY.	2	3	3	3

What we see is that unlike condition B where there was a difference in felicitousness between null arguments and neutral IX on one hand and the bare noun and IX to locus on the other, condition C did not show such effects. Both the null argument and the neutral IX were clear and felicitous to both consultants. The difference may be due to selectional restrictions of the predicate. Because the predicate ‘happy’ cannot take the book as its argument, the book is not a possible antecedent. Thus, the context only has one referent that would meet the presuppositions of the predicate, thus allowing the null argument and the neutral IX. We tested this possibility with condition E, where the same context sentence ‘GIRL BUY BOOK’ was provided but was followed by a sentence that had a predicate that could only apply to the book, and not to the girl. The predicate was ‘ABOUT PIRATES’. In condition E, both the null argument and the neutral IX felicitously referred to the book. This suggests that selectional restriction is also an important predictor in reference resolution and the choice of anaphoric expressions: even if there are more than one referents available, if only one of them can be selected by the predicate and thus be a plausible referent, the simpler forms such as the null argument or the neutral IX are licensed.

3.3 Effects of secondary antecedent

The table in 0 compares conditions C and E, where the test sentence was identical but the intended referent was the girl in the former and the book in the latter.

Table 6
C vs. E

Cond.	Sentence	null	IX _{NEUT}	noun	IX _{LOC}
C	GIRL _i BUY BOOK _j . [DP] _i HAPPY.	2	3	3	3
E	GIRL _i BUY BOOK _j . [DP] _i HAPPY.	2	3	2	0

What we see is that when the intended referent is the girl, all four anaphoric expressions are equally possible. However, when the referent is a book, the null argument and the neutral IX are okay, but the bare noun and IX to locus are not accepted by both signers. The signers commented that creating a separate locus for the book in the test sentence is already degraded because the book is inanimate and it is possessed by the girl. Note that this degradedness of creating locus for the book in a parallel way to the girl poses a challenge for both index-based and feature-based accounts of loci. In formal semantics, indices are assigned to any NP regardless of its animacy. Also, in feature matching, subjects and objects equally carry features that can check matching features in the verb. Neither account predicts the girl and the book to behave differently in the assignment of loci. A contrast-based account that we are proposing in this work, on the other hand, does predict this difference. We are arguing that loci are triggered by contrast. In condition E, however, there is no reason to contrast the girl and the book. This crucially differs from conditions with animate referents like B or D because in those contexts, it is important to draw a contrast between the girl and the boy to determine who out of the two danced. Thus, the difficulty in assigning and using loci for Condition E is explained in terms of the lack of contrast drawn between the girl and her possession.

This would lead us to predict that, if we have two inanimate referents that need to be contrasted, IX to locus would be licensed even for an inanimate referent. We have not tested this, but data from Irani

2016 supports this prediction, where IX to a locus assigned for a magazine is licensed when it is contrasted with a book.

(22) JOHN BUY IX_A BOOK, IX_B MAGAZINE. # (IX_A) BOOK EXPENSIVE.

‘John bought a book and a magazine. The book was expensive.’

[Irani 2016]

Moving onto the bare noun in referring to the book in condition E, one of the two consultants responded that repeating the word *book* is repetitive and non-native-sounding. This is in line with the fact that both of the simpler expressions (the null argument and the neutral IX) were accepted by both signers, and again suggests that the consultants are not drawing a contrast between the girl and the book. The property of being a book is not necessary to resolve the referent, and thus repeating the noun is taken to be redundant. Note that this is what we find commonly in spoken languages too: when the information carried by the noun is redundant, simpler forms of anaphoric expressions are preferred. This is in line with what we found with bare argument languages as well as languages like English in previous chapters.

We also compared conditions D and E, which both referred to the second-mentioned, but differed in the animacy of that referent. The counts are given in 0.

Table 7

D vs. E

Cond.	Sentence	null	IX _{NEUT}	noun	IX _{LOC}
D	BOY _i ENTER CLUB. SEE GIRL _j READ. MUSIC ON. [DP] _j DANCE.	0	0	1	3
E	GIRL _i BUY BOOK _j . [DP] _j HAPPY.	2	3	2	0

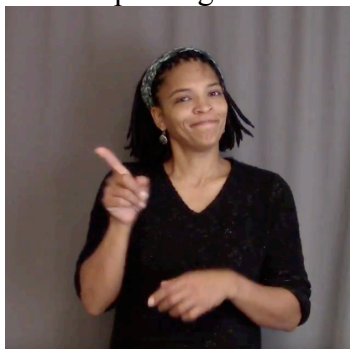
The difference we see between the felicitousness of the null argument and the neutral IX is due to selectional restrictions of the predicate again. It is equally possible for both the boy and the girl in condition D to be the agent of the predicate ‘READ’, while it is only possible for the book in condition E to be ‘ABOUT PIRATES’. Thus, in condition D, there are two competing referents, and the simpler expressions cannot disambiguate between the two. The use of loci for the boy and the girl in condition D is fully acceptable, unlike the use of loci for the book in condition E, as we saw earlier. The reason could be that the two referents in condition D are contrasted, while the girl and the book are not in condition E. Lastly, the bare noun was not accepted by two out of three consultants in condition D. It was later revealed, however, that the low acceptability was caused by pragmatic plausibility, where a girl who was just reading was not expected to be dancing in the next sentence. In other words, if we add an additional sentence to highlight that the two events are not happening at the same time, we expect all consultants to accept the anaphoric use of the bare noun. We have only followed up on this with one of the two consultants who rejected this sentence and confirmed this.

3.3 Effects of animacy

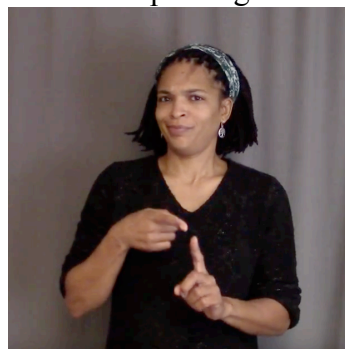
We now look closely at the use of the neutral IX for inanimate referents. In an earlier elicitation session separate from this current study, we noticed that two native signers of ASL distinguish between animate and inanimate referents when they refer to them with the neutral IX. For referring to animate entities, signers used what we call the ‘forward’ pointing, where the index finger is parallel to the ground, as shown in (30a). For inanimate entities, signers used what we call the ‘downward’

pointing, where the tip of the index finger is pointed downward, either with or without the non-dominant index finger as the target of pointing. The picture in (30b) shows a downward pointing to the non-dominant index finger.

(23) a. Forward pointing



b. Downward pointing



In consultation, one of the consultants rejected a test sentence where the book was referred to with a forward IX by overtly mentioning that ‘[the experimenter] was pointing to the wrong place’ and accepted the downward IX for the same test condition.

Thus, the preliminary data on neutral IX suggests that neutral IX may specify the animacy feature of the antecedent. This would not be surprising given that many languages including English mark animacy in their pronouns. While English marks animacy in addition to gender and number, Thai pronouns only mark animacy, just like ASL neutral IX.

3.4 Summary of the data

By manipulating the number of referents, animacy, and plausibility, we were able to confirm some hypotheses formed from looking at referent tracking studies. The findings are summarized in this section.

First, we confirmed that **null arguments and bare nouns readily allow anaphoric uses in ASL**. While it was already clear from referent tracking studies that null arguments are very frequent, we were able to further show that bare nouns are as readily available. That bare nouns are as readily available is not something that can be directly tested in natural production studies, because, as discussed throughout this work, the choice of anaphoric expressions is affected by economy-based principles that choose the least redundant in a given context. Thus, unless there was a reason to use the bare noun over simpler forms like the null argument, the bare noun would not appear in natural production as easily. By explicitly using them anaphorically in test sentences and receiving feedback from consultants, we were able to verify that anaphoric uses of bare nouns is readily possible in ASL.

Second, we showed that **neutral IX and IX to locus have different distributions and licensing conditions**. While neutral IX is only licensed when there is a clear, unique referent available in the context, IX to locus was possible even in contexts with competing referents. This motivates semantically distinguishing the two uses of IX rather than analyzing the two uses with a single denotation. In natural production data from referent tracking studies (Frederiksen & Mayberry 2016, Czubek 2017), we saw that IX was not as frequently used in comparison to null arguments or bare nouns. We suggested that the lack of contrasting contexts may be a reason behind the low

frequency of IX. However, it was unclear from these studies which form of IX was counted, and whether competing referents were present in the contexts that triggered the use of IX. What we have shown in the current study is that neutral IX is not licensed in contexts with a competing referent, while IX with locus is. IX with locus is not the preferred choice when there is no competing referent, suggesting that IX with locus does carry markedness properties.

Third, we have shown that **neutral IX specifies animacy by its pointing direction**. Forward pointing indicates an animate referent, while downward pointing indicates an inanimate referent. This is what we argue is the difference between null arguments and neutral IX. While null arguments do not carry any restriction on the referent, neutral IX does specify whether the referent is animate or not. This would explain why neutral IX (specifically forward pointing) was not licensed when there were two animate referents available, but licensed when there was only one animate referent with a competing inanimate referent. We would need to further test whether neutral IX is licensed when there are two inanimate referents. The prediction we can make based on our analysis is that neutral IX would not be licensed in contexts with two inanimate referents because the animacy specification would not help in resolving the referent if both potential referents are inanimate.

Finally, we have shown that **analyzing loci as indicating contrast better accounts for its low frequency in natural production and the data collected in the current work**. What we saw in natural production data and confirmed in the current study is that many other anaphoric expressions are possible in ASL and that IX to locus does not often appear in natural production. This already is a challenge for the strong version of index-based analyses where loci are analyzed as overt instantiations of indices. Moreover, we presented the incompatibility between the inanimate book and the assignment of a locus from our consultation data. Recall that in sentences like ‘GIRL BUY BOOK’ it is deemed odd to create two different loci, one for the girl and another for the book. The animacy difference should not affect the assignment of an index to an NP, or the grammatical feature that is carried by the pronouns. This again suggests that while it’s possible that a locus is an overt instantiation of indices in ASL, it’s not the case that indices are implemented as loci in ASL. The effect of animacy and contrast on loci suggest that IX to locus is more related to contrastive topic or topichood in general. If we assume that loci are used for drawing contrasts between potential referents, we can readily explain why it would be odd to create separate loci for the girl and the book. There is no reason to draw a contrast between the two referents, unlike in contexts where there are two competing animate referents.

Given these data points, we propose an analysis of anaphoric expressions in ASL. We argue that the expressions in ASL are organized into a scale, just like other languages that have been looked at in this work. We will specifically argue that the locus information is similar to the contrastive *R* property carried by demonstratives in English. This analysis allows us to derive the distributional properties we saw in natural production data as well as the licensing conditions we identified in the consultation data.

4 Analysis

In order to analyze the anaphoric expressions in ASL, we adopt a competition-based mechanism for anaphoric expressions, as those discussed in Ahn 2019 and, at a more specific-level, Patel-Grosz & Grosz 2017. The main idea of these works is that expressions with similar meaning compete with each other in terms of semantic content or syntactic structure. When more is added, it suggests that the

presupposition of the simpler form was not met.

For concreteness, we assume the following from Ahn 2019. Anaphoric expressions are assumed to share one underlying structure that contain an anaphoric index that links to the intended antecedent, and a set of restrictions (such as *phi*-features or the NP property) that uniquely identify the referent. For instance, the anaphoric expressions *she*₇ and *the linguist*₇ refer to the maximal female entity ($\sup [\lambda x. \text{entity}(x) \ \& \ \text{female}(x)]$) and the maximal linguist ($\sup [\lambda x. \text{entity}(x) \ \& \ \text{linguist}(x)]$), respectively. The index information is part of the presupposed material, such that *she*₇ and *the linguist*₇ are undefined if the maximal female entity or the maximal linguist in the given context is not identical to the discourse referent assigned at the seventh coordinate of an assignment function.

Given these structures, she argues that given multiple anaphoric expressions that can successfully refer to the intended antecedent, an economy principle requires that the least complex form be used. In other words, because *she* only carries *phi*-features while *the linguist* additionally carries an NP property, *she* is used in a context where there is only one female referent who is a linguist. The use of the more complex form *the linguist* suggests to the addressee that the simpler form *she* could not successfully resolve the referent, i.e. there are two or more female possible referents in the context. A use of a more complex form thus requires an accommodation process where alternatives to the intended referent are triggered.

We propose the following denotations for anaphoric expressions in ASL. For all of these denotations she assumes that there is a presuppositional anaphoric index *n* that checks whether the returned individual is identical to the individual at *g*(*n*). In this section, we only show the denotation consisting of the maximality operator that takes a set of restrictions and return an individual that meets all of the restrictions. We argue that the null argument in ASL is analyzed as in (24). It does not carry any additional restriction for the referent and thus returns the maximal entity in the given context.

$$(24) \llbracket [\text{null}] \rrbracket = \sup [\lambda x. \text{entity}(x)]$$

The neutral IX carries one additional restriction than the null argument, which is the animacy restriction. Indicated by *phi*(*x*) as in (25), the neutral IX morphologically distinguishes between animate and inanimate referents and returns the maximal animate or inanimate entity in the given context.

$$(25) \llbracket [\text{IX}_{\text{NEUT}}] \rrbracket = \sup [\lambda x \text{ entity}(x) \ \& \ \text{phi}(x)]$$

The bare noun in ASL is analyzed in parallel to other anaphoric bare nouns in bare argument languages, where it carries the property denoted by the NP, and returns the maximal entity that satisfies the property of being that NP.

$$(26) \llbracket [\text{NP}] \rrbracket = \sup [\lambda x. \text{entity}(x) \ \& \ \text{NP}(x)]$$

We now move on to the analysis of IX to locus. We will argue that IX to locus as a whole carries the *R* property like demonstratives in English as in (27).

$$(27) \llbracket [\text{IX}_{\text{LOC}}] \rrbracket = \sup [\lambda x \text{ entity}(x) \ \& \ \text{R}(x)]$$

However, we follow Ahn 2019 in arguing that **the anaphoric function in IX_{LOC} is contributed fully by the null argument that is not overtly visible**. What we see overtly, namely the pointing to a locus, is a modifier that further modifies this null anaphor with an additional locative property as in (28).

$$(28) [[IX_A]] = [[\rightarrow a]] = \lambda x. x \text{ is at } a$$

Thus, in this analysis, IX to a locus is not on its own an anaphoric expression. It is simply a modifier that adds some information about the referent's location. This location can be both physical and abstract. If IX carries information about the physical location of the referent, then it would be identical to an exophoric use of demonstratives in spoken languages (Ahn 2019; chapter 4). This is what we see with exophoric IX in ASL, where the signer can directly point to an actual entity present in the context. For example, IX to a boy at a location *c* in ASL is identical to the exophoric pointing to *c* in spoken languages as in (29).

(29) BOY IX_C HAPPY.

‘That_{→C} boy is happy.’

[ASL]

IX can also carry an abstract location. In anaphoric uses of loci, the locus does not refer to an actual location in the given context but an abstract one that the signer establishes.

The main reason for analyzing IX to a locus as a modifier rather than an anaphoric expression comes from the difference between neutral IX and IX to locus. The crucial difference between the two is that while neutral IX is used out of the blue to refer anaphorically to a salient entity, IX to locus requires that locus to be established prior to the anaphoric use. For example, in (30) for IX_A to refer to the boy assigned at locus A, it is crucial to assign that boy to that locus prior to using IX_A anaphorically.

(30) BOY IX_A ENTER CLUB. MUSIC ON. IX_A DANCE.

By definition, anaphoric expressions require the referent to be familiar to conversation participants. This holds for the second use of IX_A in (30) because it refers to the familiar boy introduced in the first sentence. However, in the first use of IX_A, there is nothing familiar about the boy that was just introduced. This is why IX_A itself should not be analyzed as something that requires familiarity. Instead, we argue that IX_A is a modifier that can apply to newly introduced and familiar referents equally.

In the introductory use, IX_{LOC} is used as an appositive relative clause that does not restrict the reference. For example, JOHN IX_A in an introductory use would mean ‘John, who is signed at A’. In the anaphoric use, the relative clause composes with the null anaphor restrictively, just like the relative clauses used with demonstratives in English.

By analyzing IX_{LOC} as a modifier, we are able to account for the introductory and the anaphoric use of IX_{LOC} in a uniform way.

4.1 Competition

We have argued in this section that IX_{LOC} is a modifier that further restricts the anaphoric reference of

a null anaphor. How would this fit into the anaphoric scale and the competition mechanism?

Let's consider the denotations proposed and repeated below. These denotations can be organized into scales based on meaning.

(31) Denotations of anaphoric expressions in ASL

- a. $[[\text{null}]]$ = $\sup [\lambda x. \text{entity}(x)]$
- b. $[[\text{IX}_{\text{NEUT}}]]$ = $\sup [\lambda x \text{ entity}(x) \ \& \ \text{phi}(x)]$
- c. $[[\text{NP}]]$ = $\sup [\lambda x. \text{entity}(x) \ \& \ \text{NP}(x)]$
- d. $[[\text{IX}_{\text{LOC}}]]$ = $\sup [\lambda x \text{ entity}(x) \ \& \ \text{R}(x)]$

Note that IX can appear with or without a noun. This means that based on the presence of the noun, IX will either carry or not carry the restriction NP(x). These denotations derive two scales, one that involves the pronominal forms, and the other that involves the adnominal forms.

In the pronominal scale, IX_{LOC} competes with the IX_{NEUT} .

(32) Pronominal scale: $\{ \text{IX}_{\text{NEUT}}, \text{IX}_{\text{LOC}} \}$

In the adnominal scale, IX_{LOC} competes with the bare noun.

(33) Adnominal scale: $\{ \text{NOUN}, \text{IX}_{\text{LOC}} \text{ NOUN} \}$

Because the economy principle requires that the lowest element compatible with the context be used, the use of the additional locational property in IX_{LOC} suggests that that locational information was necessary to successfully resolve the referent. This would mean that the pronominal IX_{LOC} would suggest that the animacy information of IX_{NEUT} was not sufficient, and that the adnominal IX_{LOC} would suggest that the property denoted by the noun was not sufficient.

Let's consider the pronominal context first. If there are two referents in a given context that differ in their animacy, IX_{NEUT} with forward or downward pointing would successfully identify the unique referent. IX to locus then suggests that there are at least more than one animate or more than one inanimate referents in the context. The fact that in our consultation data, IX to locus was degraded for the context where there was only a girl and a book is compatible with this prediction. In this context, IX_{NEUT} would have been sufficient. The use of loci in this context would suggest that there were more potential antecedents, which is misleading.

In the adnominal context, the bare noun would successfully resolve the referent as long as there is only one entity that matches the denotation of the noun. Thus, the use of the adnominal IX_{LOC} would suggest that there are more than one entities that match the NP property.

These predictions are in line with the data we presented in Section 3. We found that null arguments, bare nouns, and neutral IX are licensed only when there is a uniquely identifiable referent. IX to locus, however, was possible with competing referents. In fact, IX to locus was the preferred anaphoric expressions only when there was a competing referent. Similar kind of markedness was already discussed in Koulidobrova & Lillo-Martin 2016. Thus, our competition-based analysis of IX_{LOC} allows us to derive this marked property without additional stipulations.

5 Conclusion

We have presented a close investigation of anaphoric expressions in ASL. Because there has been a large disconnect between formal studies of each expression in isolation and referent tracking studies that looked at relative frequencies of these expressions, there was no analysis that allowed us to link the two fields. By looking at both natural production data and felicity judgments, we have made the following claims that diverge from previous analyses. First, we argue that the category of IX should be semantically distinguished between neutral IX and IX to locus. While neutral IX is like a pronoun, IX to locus is analyzed as a modifier that can be used in both introducing and anaphorically referring to an entity. This semantic distinction allows us to account for the distributional differences between the two expressions as well as the fact that only IX to locus must be previously established. Second, we present a new set of data that suggest that neutral IX marks animacy by the direction of its pointing. Forward pointing refers to animate entities while downward pointing refers to inanimate entities. Third, we propose that the anaphoric expressions in ASL are organized in a scale with respect to the amount of information they carry, and that the competition mechanism correctly derives both the licensing conditions and predicts the patterns we find in natural production studies.

We conclude by going back to the traditional discussion of ASL pronouns in Lillo-Martin 1990. In Lillo-Martin 1990, IX is analyzed as a pronoun. Given this analysis, three non-canonical aspects of ASL pronominal systems were pointed out in Lillo-Martin & Klima 1990. The first is the ‘infinite pronominal forms’ given that there is an infinite number of loci that can be pointed to by IX. The second is that the pronoun is unambiguous in that it points to the specific locus associated with an individual, rather than just giving some features like male or singular. The third is the potential for shift.

Given our new data and analysis, we focus on the first two aspects. First, if IX to some locus is a modifier similar to the exophoric gesture in spoken languages, the infinite number of loci is no longer surprising. Exophoric demonstratives in spoken languages can also make use of the infinite range of spatial locations to point and refer. The abstract use of space for anaphoric reference in ASL also has a spoken language correlate, where letters or numbers are used to keep track of multiple referents.

If neutral IX is analyzed as a pronoun as proposed in this work, then the second aspect is no longer relevant. Note that the fact that IX to locus unambiguously refers to one specific referent is not surprising because exophoric demonstratives also unambiguously refer to the specific referent in that location. Neutral IX, on the other hand, does not in fact have this property. As we showed in Section 4, neutral IX may at most specify animacy as a feature. Thus, if we analyze neutral IX and not IX to locus as parallel to English pronouns, they start to look much more similar, and there is nothing non-canonical about ASL pronouns. The third non-canonical property, which is the potential for shift, is not something we discuss directly in this chapter, but we do point out that many languages do in fact allow a perspective-shift for their pronouns. Thus, given the new analysis presented in this work, we are able to resolve many puzzles that have been associated with pronouns in ASL.

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