“More is up” pragmatic intuitions are grammaticalized in ASL as overt contextual domain restrictions

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Abstract

This paper serves as an in depth investigation of a phenomenon in American Sign Language (ASL) whereby quantifiers can be signed higher or lower in signing space to signal widening and narrowing, respectively, of their domains. We show that this domain information is provided through a pronoun argument of the quantifier, providing new evidence for the claim that quantifiers can take individual-type arguments using new evidence based on a feature of the sign language mode: simultaneous morphology. The resulting morphosyntactic/semantic/pragmatic picture sheds light on possible theories of contextual domain restriction in spoken languages, and suggests possible counterparts in spoken languages to the overt restriction seen in ASL. We then discuss how the metaphor MORE IS UP has become grammaticalized in ASL via gesture and formalized as a presupposition such that spatial information is contributing in a highly abstract way to truth and felicity conditions. We discuss our findings in terms of both the syntax/semantics/pragmatics interface and the gesture/language interface.
1. Introduction

The topic of our paper is the nature of contextual domain restriction, a subject that has been the subject of considerable research at the semantic/pragmatic interface. To introduce the topic, imagine the following situation: A group of several friends watch a movie together about one of their favorite kinds of fantastical characters: vampires. The next morning, one of these friends is recounting the evening to someone else and says, “Last night I watched a movie with my friends about vampires. Afterwards I went to bed and I dreamt that everyone transformed into vampires.” In saying this, the speaker could mean that they dreamt that everyone who was watching the movie became vampires (1a), or she could also just as easily mean that she dreamt that everyone in the entire world became vampires (something that certainly might be possible in a horror movie scenario!) (1b).

(1) Last night I watched a movie with my friends about vampires. Afterwards I went to bed and I dreamt that everyone transformed into vampires.
   a. Everyone in that story (your friends/the people in the context) became vampires.
   b. Everyone in the entire world became vampires.

In an example like (1), the listener in English is tasked with figuring out who exactly the speaker meant to include by “everyone.” Note that there is no immediately obvious difference in the interpretations in (1a)-(1b) in terms of their logical form, since it is a simple universal statement in both cases (∀x.\(\text{vampire}(x)\)). Rather, the difference seems to lie in what domain the variable in the universal statement ranges over: Is the universal quantification from everyone restricted to people in the story already mentioned or to everyone in the world? Usually this domain resolution happens seamlessly: sometimes later information cues the listener in to how many people should be considered, sometimes it doesn’t matter, and sometimes it’s clear in context who speakers intend. An example of the latter is when a speaker claims that “Everyone came to the party last night!”, since there’s never been a party that literally everyone in the world can have been invited to, so the meaning must be restricted to the usual group invited to such parties. In English, though, the burden for domain resolution happens outside of the structure of the sentence, while the listener makes use of their substantial pragmatic capacities. The resolution of the domain of everyone is thus tightly related to its truth conditions and yet dependent on context, and so sits squarely at the interface of semantics and pragmatics.

In American Sign Language (ASL), in contrast with English, the distinction between the intended interpretations (1a) and (1b) of the sentence in (1) can be made overt through the quantifier itself. Consider (2) below, signed in the same context as (1). The signer can either sign ALL low or high (as shown in the accompanying photo), and this reflects a difference in meaning such that when signed low it has the meaning in (2a) and when signed high it has the interpretation in (2b).

(2) Context: Signer has just said, “Last night I watched a movie with my friends about vampires. Afterwards I went to bed and I dreamt that…”
a. ALL-low TRANSFORM-INTO VAMPIRE

‘All of my friends transformed into vampires’

‘All of the people in the world transformed into vampires’

b. ALL-high TRANSFORM-INTO VAMPIRE

‘All of the people in the world transformed into vampires’

‘All of my friends transformed into vampires’

Figure 1. The quantifier ALL as signed in (2a) and (2b), with possible and impossible interpretations.

In recent years, sign languages have been argued to make visible certain aspects of linguistic structure, especially semantic structure, that are covert in spoken languages (Lillo-Martin and Klima 1990, Wilbur 2003, Schlenker 2011, Quer 2012, Caponigro and Davidson 2011, among many others). In this paper we discuss this new case of visible semantic structure in American Sign Language (ASL), which we show makes use of both three dimensional space in the visual/manual language modality to communicate something that is covert in spoken languages: quantifier domain restriction, and more generally pragmatic contextual restriction of how many individuals should be under consideration. Among other examples of visible semantic structure, we argue that visible domain restriction in ASL is unique in occurring as a presupposition on a gestural use of height in the pronominal system that has become grammaticalized from an existing metaphor in the surrounding culture (MORE IS UP), an analysis that takes advantage of formal syntax and semantics to model what has been a domain traditionally associated only with
cognitive linguistics. In the remainder of Section 1 we will describe in some more detail the problem of quantifier domain restriction in spoken languages. In Section 2 will review important structural properties of ASL and present the basic data on quantifiers. Section 3 will lay out the arguments in favor of our analysis of the domain restriction coming through the pronoun system. Section 4 will discuss the source of height for representing domain sizes, and Section 5 concludes.

1.1. Quantifier domain restriction: background

We have thus far framed the problem as one of the domain of quantifiers over individuals (like the friends or all the world’s humans above), but some of the earliest work on the problem was especially concerned with the domain restriction of events, which show the same contextual dependence (Partee 1989, von Fintel 1994). For example, someone who realizes in the middle of the day that they may have left their stove turned on that day might very reasonably exclaim (3), despite having turned off their stove many times successfully in the past.

(3) I didn’t turn off the stove!

Why does this cause a semanticist to pause? Because for a statement in the simple past tense to be true, it needs to have held true at least once in the past. In other words, any previous occasion when one did not turn off the stove should make (3) true. That’s not usually what one means with a sentence like (3), though: if no context is overtly given, it is usually taken to be restricted to some pragmatically available context (e.g. today, the last time I left my house, etc.) The problem of pragmatic domain restriction thus extends beyond quantifiers over individuals to quantification over events and/or times, both of which are discussed in more detail in von Fintel (1994).

Szabo & Stanley (2000) compare and contrast what they categorize as pragmatic, syntactic, and semantic approaches to quantifier domain restriction, a categorization that we find also useful so we will review each briefly. As they (and many others) have noted, one solution to the problem of contextual domain restriction (e.g. English) is for the pragmatics to take all of the burden (see especially Bach 1999). In this family of solutions, “everyone became vampires” always literally means that everyone one could possibly consider became a vampire. In other words, the semantics is as it appears on the surface, a statement of universal quantification over all individuals in the universe. What looks like contextual domain restriction comes about via pragmatic reasoning based on the unlikelihood that a speaker would want or even know about everyone in the world. Because the literal interpretation is unlikely to be intended by the speaker, the listener must adjust their interpretation of the quantifier’s domain to a more restricted set. In other words, English speakers are constantly adjusting (perhaps in a way ASL signers need not). We purposely picked an example for (1) that could be just as reasonable in a widened or restricted context, but many real life examples, like “Everyone came to the party” are clearly unlikely statements to hold of everyone in the entire universe, so it seems reasonable that a pragmatic story could restrict the contextual domain in such situations.
Unfortunately, the pragmatic story runs into some difficulty with more complex examples of contextual domain restriction. Consider (4): “everyone” who transforms into vampires must still be contextually restricted, since it could just be the relevant “everyone”/your friends, or everyone in the whole world. However, the relevant group can also vary with the first quantifier “Most of the times”, so that perhaps a different group of friends is turning into vampires each time, if they were the people you watched the movie with.

(4) Last night I watched a movie with my friends about vampires. Most of the times I do this, everyone transforms into vampires.

These kinds of examples suggest instead that there must be a place in the logical form containing information about the contextually supplied domain that can participate in a binding relationship with the higher predicate “most”. This makes a purely pragmatic analysis difficult to pursue. One possible solution then would be *syntactic*, such that there is an explicit domain in the structure, which is elided (unpronounced) in most cases (5).

(5) a. Everyone [I watch a movie with] transformed into vampires.
   b. Everyone [in the world] transformed into vampires.

The problem with this kind of syntactic analysis is that what is elided is radically underdetermined. For example, one could arrive at the right interpretation for (5) with many other options for the elided clause: “everyone who was there during the movie”, “everyone who enjoyed the movie with me”, “everyone I sent an invitation to that day”, etc. Unlike usual cases of ellipsis, there is not necessarily a linguistic antecedent to be copied/reconstructed at the ellipsis site, which doesn’t provide very solid footing to argue that there is overt syntactic material missing in all cases of quantifier domain restriction.

The solution that many have settled on is *semantic* (von Fintel 1994, Szabo and Stanley 2000). Szabo and Stanley 2000 propose that an open variable in the logical form (“C” for context) for the context exists as part of the restrictor of a quantifier. As illustrated in (6) and perhaps even more clearly in (7) with a separate complement, this variable combines with the restrictor of the quantifier (e.g. women in (7)) first. This variable acts as just another modifier, intersecting the restrictor (e.g. people, or women) with the context to return only those in the relevant context. This provides the interpretation that all women (in (7)) or all people (in (6)) in the relevant context turned into vampires. As needed, this context could be just the local context of the speaker’s friends, or the wider context of the whole world (or something else), but under this account C is a semantic placeholder that gets its content via pragmatics.

(6) [Everyone (C)] transformed into vampires.
(7) Every [(C) woman] transformed into vampires.

As we saw earlier, ASL seems to combine information about the contextually restricted domain not just covertly (like English) but overtly pronounced, crucially, at the same time as the quantifier. At first blush, this doesn’t seem to fit with existing accounts of quantifier domain restriction, especially not those like (6)-(7) in which the domain restriction occurs as a modifier
in the restrictor of a quantifier, not directly on the quantifier. However, we make take caution in jumping to conclusions about the underlying syntactic and semantic structure of the ASL construction, which until now has not been described at all. Therefore, we will dedicate the next few parts of this paper toward determining its structure. We will first discuss cross-linguistic work on possible quantified noun phrases in languages other than English (Section 1.2), and then describe our phenomenon in more detail (Section 2). Finally, in Section 3 we will propose an underlying structure for the quantified noun phrases in ASL that we suggest do pose a challenge for the existing theories of contextual domain restriction that we have discussed so far.

1.2. The structure of quantified noun phrases

All of our examples discussed so far have been based on English, a language that can form quantified noun phrases in one of two ways, displayed in (8): a quantifier followed by a partitive phrase (8a) or a quantifier followed by a bare noun (8b)-(8c). (A nonstandard variant also includes the partitive and bare noun, which we note but will not discuss further in this paper (8d).)

(8) a. All of {them/the women} are intelligent. Q(of DP)
b. All {*them/women} are intelligent. Q(NP)
c. Every {*her/woman} is intelligent. Q(NP)
d. %All of them women are intelligent. Q of DP NP

When the quantifier phrase contains a partitive (e.g. “All of the women” or “All of them” in (8a)), the definite DP within the partitive (e.g. “the women”/ “them”) serves as the domain of the quantifier. In this case, quantifier domain restriction can occur by whatever process assigns definite noun phrases their referents in discourse more generally. For example, if a pronoun (e.g. “them”) is used, the usual heuristics for pronoun reference could point to people (more specifically, women) in the immediate context, or the group that the speaker points to while saying them, or any other group as long as the process of pronoun resolution picks out that specific group; for “the women”, we know that “the” requires a single already salient group of women in the context. In other words, because resolving reference for DPs is already known to require complex heuristics that include a significant pragmatic component, the semanticist interested in quantifier domain restriction can offload the work of pragmatic restriction to this definite argument of the partitive.

In contrast to the partitive case, for the QNP case with a bare NP there is no (overt) determiner and in fact a pronoun is ungrammatical outside of the partitive (8b)-(8c). These examples have posed a more significant problem for quantifier domain restriction because there are no components that otherwise engage a process of pragmatic restriction to a definite semantics (like the definite determiner or pronouns). Nevertheless, although potentially differing in how they resolve domain restriction, both types of quantified noun phrases in English share an important property: the complement of the quantifier appears to be a property, semantically of type <e,t>, as in both “of the women” and “women”. It would be convenient, then, to suppose that all quantifiers take only arguments of type <e,t> (again, either a partitive or a bare noun), before
combining with clausal predicate, and indeed this has been proposed as a fundamental property of natural language (Barwise and Cooper 1981).

It may come as a surprise then that the English pattern is not the only one seen across the world’s languages, at least at the descriptive level. In fact, recent work has suggested that the structure of two families of languages could provide unique insight into (covert) structure in English cases. One example described in Jelinek (1995) and Matthewson (2001, 2013) comes from St’át’imcets (Salish), in which a quantifier followed by a bare noun is ungrammatical (9a). Rather than a partitive, St’át’imcets instead uses a quantified noun phrases that consists (overtly) of both a quantifier and a determiner phrase, and nothing else (9b) (both examples from Matthewson 2001, p. 150).

(9) a. *léxlex tákem smelhmúlhats Q(NP)
   intelligent   all   woman(PL)
   `All women are intelligent’

   b. léxlex tákem i=smelhmúlhats=a Q(Det(NP))
   intelligent   all   DET.PL=woman(PL)=EXIS
   `All (of the) women are intelligent’

Matthewson provides a series of arguments suggesting that the semantic type of the complement of the quantifier in St’át’imcets cannot be type <e,t>, but instead must be definite - this is precisely the pattern disallowed in English. She further suggests an analysis of quantified noun phrases in general in which the St’át’imcets case is the underlying pattern for the partitive constructions in English, with of being a semantically insert element provided only for syntactic (case) reasons.

The St’át’imcets pattern, however, is not the only quantifier noun phrase structure that differs significantly from English: Etxeberria (2008) and Etxeberria and Giannakidou (2014) discuss data from Basque, which follows yet a fourth pattern seen in (10) (from Etxeberria 2008, p. 252). In Basque, a determiner is also required, like Salish, but instead of appearing after the quantifier to form a definite noun phrase as a complement of the quantifier, this determiner appears before the quantifier.

(10) a. Ume guzti­ak goiz iritsi ziren. (DetQ)(NP)
    child all-D.PL.ABS early arrive AUX.PL
    `All of the children arrived early.’

   b. * Ume­ak guzti goiz iritsi ziren.
    child-D.PL.ABS all early arrive AUX.PL
    `All of the children arrived early.’

They provide further arguments that in Basque, the Determiner and the Quantifier form a constituent, which takes the subsequent NP as its complement. In this analysis, the generalization suggested based on English can remain essentially intact given that the complement of this
(complex) quantifier is still of type <e,t>.

<table>
<thead>
<tr>
<th>Quantified noun phrases in spoken languages cross-linguistically</th>
<th>Schema</th>
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<tr>
<td><strong>English:</strong></td>
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<td>(11) ‘All of the women are intelligent’</td>
<td>Q(of DetP)</td>
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<tr>
<td>‘All women are intelligent’</td>
<td>Q(NP)</td>
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<td><strong>St'át'imcets (Matthewson 2001):</strong></td>
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<tr>
<td>(12) léxlex tákem i=smelhmúlhat=a</td>
<td>Q(DetNP)</td>
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<tr>
<td>intelligent all DET.PL=woman(PL)=EXIS</td>
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<td>‘All (of the) women are intelligent’</td>
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<td><strong>Basque (Etxeberria 2008):</strong></td>
<td>(DetQ)(NP)</td>
</tr>
<tr>
<td>(13) Ume guzti-ak goiz iritsu ziren.</td>
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Table 1: Quantified noun phrases in English, Salish, and Basque

Table 1 illustrates the four patterns that we have discussed so far. As it stands, two issues have comprised most of the research on quantifier domain restriction until now: first, how domain restriction occurs in the case of quantified noun phrases, and second, whether either of the analyses proposed for Salish or Basque should be extended to account for domain restriction in QNPs in English. In addition, even if the Salish analysis only applies to Salish, this poses a significant departure from the accounts of generalized quantifiers given previously.

In the remainder of this paper, we suggest that ASL provides data to bear on each of these points. First, we argue that ASL is another unrelated language that shows the Salish pattern of combining a quantifier directly with a definite noun phrase. In particular, ASL exhibits a particularly strong argument for this combination by means of *simultaneous morphology*, which in the case of quantified noun phrases involves the quantifier combining directly with a pronoun such that they are pronounced together at the same time. This makes use of the strong propensity that sign languages have toward simultaneous morphology thanks to the visual/manual communication modality, which can convey more information simultaneously than the auditory modality, which favors sequentiality (Klima and Bellugi 1979, Padden 1988, Sandler and Lillo-Martin 2006). Moreover, the pronouns that these quantifiers combine with can be spatially modified to indicate how restricted they should be interpreted, a novel finding that makes use of the visual/manual modality to extend a metaphor that we show already exists among English speakers and even occurs in other sign languages and which forms a basis for the grammaticalization of this feature into a presupposition on pronouns more generally in ASL.
2. Quantifiers and sign height in ASL

As we mentioned earlier, the focus of our work in this paper is on American Sign Language (ASL), the language of the Deaf and Hard-of-Hearing communities of the United States and parts of Canada. All of the data we report here are from Deaf adult native signers who learned ASL from birth from their Deaf, signing parents. Our methodology consisted of three parts: first, participants chatted on video with the authors (one of whom, DG, is a hearing native signer) about topics designed to elicit the use of height that we discuss below. Second, we made notes of the examples that were elicited, and asked participants to sign sentences with and without changes to them in front of the camera, or in other words to “play around” with how small changes affect grammaticality. Third, example sentences deemed most natural were recorded in “clean” versions in isolation to the camera, which are the ones that appear in figures here. In the remainder of this section we will first discuss the structure of noun phrases in ASL generally as well as the use of space generally in section 2.1, and then in section 2.2 we will show how the use of space in ASL provides overt information about the size of quantificational domains.

2.1 Background: Noun phrases and loci in ASL

In ASL, a point of the index finger (IX) is the singular pronoun, unmarked for gender (14a). Most full noun phrases (i.e. not pronouns) in ASL are bare noun phrases containing no articles (14b). In this regard they are unlike English, but more like Russian or Mandarin Chinese. Koutlidobrova (2012) has argued that ASL is an NP language in the typology argued for by Boskovic (2005), concluding therefore that all noun phrases in ASL are bare noun phrases, and anything that looks like an article is rather a modifier of some sort. In this sense she differs from MacLaughlin (1997), who argued that a subset of points using the indexical finger are in fact a definite determiner like English the, as in (14c). More recently Barbera (2012a, 2012b) has suggested that the IX in examples like (14c) marks specificity, not definiteness, at least in Catalan Sign Language but also possibly extending to ASL.

(14) a. JOHN LOVE IX.
    “John loves her/him/it.”
 b. JOHN LOVE WOMAN.
    “John loves a/the woman/women”
 c. JOHN LOVE [IX WOMAN]
    “John loves the/that/SPEC woman”

For our purposes it will not be important whether or not an indexical point IX can act as an article when occurring with NPs since we will focus on uses of the indexical point IX instead where it appears on its own as a full NP (a pronoun) as in (14a) and (15). Example (15) illustrates a common sentence structure in ASL: base word order is subject-verb-object, but instead of appearing in its argument position, the subject (FRIENDS) has been topicalized, and a pronominal IX-arc_a appears in its argument position. Because bare arguments are also grammatical in ASL under the right discourse conditions, the subject or object could also be omitted entirely. Because
in (15) the referent of the pronoun is plural, the pronoun IX becomes IX-arc_a, tracing out an arc or circle over an area (commonly considered to be plural number marking) instead of a simple point. The area traced out by IX-arc in (15) is noted as a, since the space chosen (the “locus”) is for our purposes arbitrary but must be distinguished from any others.

(15) (MY) FRIENDS, IX-arc_a REALLY SMART

'(My) friends, they (are) really smart.'

In ASL, discourse referents are tracked through a system of spatial co-occurrence using these “spatial loci.” For example, consider (16) and the accompanying figure to its right. The signer signs the name JOHN (fingerspelled) in one location (the locus “a”) in signing space. Unless otherwise specified, this location is at a “neutral” signing height (approximately mid-torso) and either to the signer’s right or left. She/he signs another name BOB at a different location at neutral signing height, usually the opposite side (left if right) from the first name (here, locus “b”). The establishment of these names in space then allows a pronoun in the next sentence IX to unambiguously refer to one of these referents depending on which location it points to (if a, then John is the referent; if b, it is Bob). We include (16b) to show that association of discourse referents with locations in space is not obligatory, but it is frequently used if the continuing discourse will be making reference to their contents.

(16) a. JOHN-a LIKE BOB-b. IX-a SMART.
   ‘John likes Bob. He (John) is smart.’

   singular with locus

b. JOHN LIKE BOB.
   ‘John likes Bob.’

   singular, no locus

Importantly for the rest of the discussion in this paper, the same properties are seen with plural discourse referents as well, which can be associated with locations in space through IX with plural morphology (IX-arc) immediately following them, which are also not obligatory but frequently used when the contents will be referenced again in subsequent discourse (17).

(17) a. STUDENT IX-arc-a LIKE TEACHER IX-arc-b.
   IX-arc-a SMART.
   ‘The students like the teachers. They (the students) are smart.’

   plural with locus

b. STUDENT LIKE TEACHER.
   ‘Some/the student(s) like some/the teacher(s).’

   plural, no locus
Schlenker, Lamberton, and Santoro (2013) discuss a further property of plural loci, which is that they follow what they call an “iconic geometry.” By this, they mean that the spatial relationship (specifically: the set/subset relationship) of the arc/circles in space should correspond to the same relationship of their referents. So, if a signer establishes a plural locus for a plural referent (for example, a group of students), and then later wants to establish a plural locus for a subset of this group, that second locus should spatially take up a subset of the first locus. Similarly, if one establishes a locus for a group and later wants to establish a locus for a superset of this group, the new locus should be a superset of the first locus (18a). Furthermore, the enforced geometry of the locus system provides access to discourse referents due that are otherwise more difficult to find in non-spatial languages, most notably complement set anaphora: in (18) the signer can assign the large group of students to a large locus (a+b) and assign a subset of that set to a subset locus (a), and then by the enforced mapping can simply point to the remainder of the large locus (b) to refer to the complement (boys) of the smaller set within the large set. Schlenker et al. note that a rough translation with the same meaning is ungrammatical in English, since the only available discourse referents for they in such a translation are the large set and the smaller set (18b).

(18)  
   a. STUDENT IX-arc-a+b SMART. GIRL IX-arc-a HAPPY.  
      IX-arc-b NOT HAPPY.  
      ‘The students are all smart. The girls (a subset of the students) are happy, but the rest (the boys) are not happy.’  
   b. #The students are smart. The girls are happy.  
      They (intended: boys) are not happy.

To this discussion we add a further observation, briefly made in previous work (Davidson and Gagne 2014) that these plural loci need not always be established overtly to make use of the same system including its geometric properties. For example, a signer can establish a locus “a” for a group of students in neutral space. This can be followed with an arc that traces out the remainder of the low/neutral signing space (“Low - a”), and is interpreted as everyone else in the current context besides the students (19a). If instead that same arc was made at a higher level, the interpretation is that the reference is a much larger group, a superset of both the small original locus and also of the lower set (19b)

(19)  
   a. STUDENT IX-arc-a SMART. IX-arc-low-a NOT.  
      ‘The students, they are smart. The rest are not.’  
   b. STUDENT IX-arc-a SMART, IX-arc-high NOT.  
      ‘The students, they are smart.  
      Generally, everyone else is not.’
Put another way, the neutral/low signing space seems to act as the ultimate superset for everything in the pragmatically relevant/restricted context; a higher space seems to allow the signers to make a superset of this set, when he/she has run out of space in the lower space. This vertically informed geometry will be the jumping off point for the discussion in the following section (2.2) on the structure of quantified noun phrases in ASL and the overt expression of quantifier domain restriction through this vertical space.

2.2. The semantic use of height in quantified noun phrases in ASL

Quantified noun phrases in ASL show the same syntactic optionality as non-quantificational noun phrases discussed above in that they may either be signed without using a locus (20) or they can be associated with a locus that functions as the domain of the quantifier (21) (Petronio 1995, Boster 1996, Barberà 2012a,b). The second option (“Spatial QNP”) is common in signed discourse and is the focus of the rest of our paper.

(20)  A-L-L/NONE/SOMEONE LIKE TEST  `Everyone/No-one/someone likes tests’

(21)  (Context: I just mentioned that a group of my friends recently took the bar exam.)

\[
\begin{align*}
\text{A-L-L-a/NONE-a/ONE-a FAIL.} \\
\text{`All/none/one of them (of the friends) failed.’} \\
\text{IX-a MAD.} \\
\text{`They (my friends) were mad’}
\end{align*}
\]

Recall that in Section 1 we discussed the puzzle of quantifier domain restriction with our example about friends watching a vampire movie ((1), repeated below as (22)). In English, the sentence “Everyone transformed into vampires” is underspecified relative to the size of its domain: did just all of the friends turned into vampires, or everyone in the world? ASL provides a very different picture where the same sentence ALL TRANSFORM-INTO VAMPIRE can be signed in two different ways to signal these two different meanings. The only difference is in the spatial QNPs ((2), repeated below as 23), shown in Figure 1.

(22) Last night I watched a movie with my friends about vampires. Afterwards I went to bed and I dreamt that everyone transformed into vampires.
    c. Everyone in that story (your friends/the people in the context) became vampires
    d. Everyone in the entire world became vampires

(23) Context: Signer has just said, “Last night I watched a movie with my friends about vampires. Afterwards I went to bed and I dreamt that…”
    a. ALL-low TRANSFORM-INTO VAMPIRE
       `All of my friends transformed into vampires’
    b. ALL-high TRANSFORM-INTO VAMPIRE
       `All of the people in the world transformed into vampires’
In (23), when ALL is signed at a low height it is interpreted as having a different domain than when signed at a high height: in particular, the low ALL has a domain that is restricted to a set based on the context, namely whoever is in the group we have been talking about, even if it has not yet been explicitly assigned a locus. When ALL is signed higher (near the signer’s head), it is interpreted as having increasingly wider (or the widest possible) domain. Note, importantly, that the signer’s hands are not actually more spread apart or wider for the high case, and her nonmanual/facial expressions are equally emphatic in both cases. Instead, the difference comes from her eyegaze, which is directed down (for low space) or up (for high space), and from l{x-arc (directed down or up for low and high space respectively), and this is sufficient to convey a very different interpretation.

One of the most interesting things about this use of height is that this pattern holds not just for ALL, but also for a variety of different quantifiers. A second such example is the negative quantifier NONE ‘no one’ (24).

(24) Context: Signer is asked if anyone in her family is Deaf beside herself. She replies:

a. 

"None (of my immediate family), only me’
Note in (24) that even the “large” domain for high NONE is still pragmatically restricted in some sense, since here the high set “no one” can’t apply to everyone in the entire world, since the signer is not the only Deaf person in the entire world. Rather, she means that she is the only Deaf person in her entire family, in a very broad sense, with more people to be included than in the default interpretation of family. Thus, it is not the case that the highest space necessarily means everyone possible, only that it is a contrastively bigger domain than when signed lower. In other words, context still plays some role in pragmatic restriction even of the largest set, but the use of space allows a set/superset distinction that isn’t available in English.

At this point, we’ll also take this opportunity to provide a nice example of binding over quantifier domains using NONE. Recall (4) above (“Most of the times I watch a vampire movie with friends, everyone transforms into vampires.”), which involved quantificational binding over contextual domains, an indication that there is an open contextual variable as part of the syntax/semantics of the utterance. Example (25) shows a similar example in ASL with NONE, which can be signed either low or high. Despite this variation in size of contextual restriction (high or low), nevertheless the adverb TYPICALLY quantifies over these contexts, such that the people in the restricted group (when NONE is signed low) may be different in each case, but still, none of them fail. We can see then that the location of these high and low domains are not just referential and bounding to a particular domain, but must involve a domain variable that can be bound by quantificational adverbs.

(25)  Context: Signer is discussing the numerous tests that he gives out.
TYPICALLY NONE\textsubscript{LOW/\text{HIGH}} \text{FAIL}.
‘Typically/most times none (in the -possibly different- group/at all) fail.’

A third quantifier to show a similar use of height is the existential quantifier SOMEONE ‘someone’/‘something’ (26). Similar to ALL and NONE, SOMEONE is interpreted as ranging over a restricted domain when signed low, but a much wider domain when signed high.

(26) Context: Deciding condiments to put out at a party. Host says:
Example (26) also involves the quantificational adverb TYPICALLY scoping over the situations described in (26a)-(26b) with the result that the domain varies with the adverb. Here, the individual who satisfies (26a) (the “someone” who likes mustard) can vary from party to party - it doesn’t have to be the same person at every party. In addition, there is another specific reading of (26a) in which SOMEONE-low is interpreted with widest scope, such that the same person at each party likes mustard. In fact, Barberà (2012a,b) shows that when the existential quantifier SOMEONE in Catalan Sign Language is signed low, it can receive a specific reading, and she argues that specificity is the key notion separating the lower from higher planes. While it is true that specificity correlates with height, we suggest that at least in ASL that by viewing this as domain restriction, we better capture the similarity with other quantifiers like ALL and NONE. Furthermore, if we follow Schwarzschild (2002) who views specificity as extreme domain restriction, we predict that a low SOMEONE should be able to be interpreted as specific, which is exactly what Barberà (2012a,b) reports for CSL and what we find for ASL.

Given that multiple quantifiers seem to pattern together in a similar use of height to indicate information about the breadth of individuals under consideration, it’s reasonable to ask whether the same is found in some sense in spoken languages, and in particular English. We turn to this topic in the next section.

2.3 Contrast with the use of height in domains in English

Although English doesn’t initially appear to do what ASL does for marking domain sizes, many English speakers with whom we have discussed the above data about ASL quantifier height but
do not otherwise know ASL have remarked that they find this use of height intuitive. In fact, there is existing experimental evidence confirming that they might be right: work within the Embodied Cognition literature has indeed reported that English speakers associate the concept of “more” with “high” in a variety of ways. For example, Langston (2002) reports that while reading English sentences, participants show increased processing difficulties when height and amount fail to correlate, as in (27a). These mismatches were found to be more difficult to read than an example where they do correlate (27b).

(27)  
a. Pepsi has more calories than Coke so we put it below Coke on the shelf. (incongruent)  
b. Pepsi has more calories than Coke so we put it above Coke on the shelf. (congruent)

In addition, Sell and Kaschak (2012) found that when people read sentences that involved discussion of “more” quantities (e.g. “The Yankees scored more runs”) and had to press an “up” button to move to the next sentence they performed the task faster than when height and amount did not correlate, for example if they had to press the “down” button in that same “more” scenario to go on to the next sentence. These kinds of studies provide supporting evidence that English-speaking nonsigners do have some association between the concepts of “more” and “high,” discussed by Lakoff and Johnson (1980) as the metaphor MORE IS UP. They note that this metaphor could be motivated by certain physical examples such as the pouring of liquid into a container, where more liquid reaches a higher level, followed by extrapolation to a wider variety of cases for which this physical relationship no longer exists. Of course, formal semanticists use this same metaphor every time they discuss upward and downward entailment, which refers to abstract superset/subset relationships, and not actual height. It is a natural question to ask, then, whether English speakers use height in precisely this way to represent domain information like ASL does, perhaps concurrently with our speech either in our intonation or with co-speech gestures.

To address this question, we first considered intonation, and found some similarities but ultimately also some important differences between higher intonational pitches in English and higher sign space in ASL. For one thing, high intonation pitch can be used to bring attention to things in English, and sometimes this means “more”/greater domain size under consideration, but sometimes it does not. For example, consider (28), where both sentences in English have high pitch on the capitalized word. In (28a) our intuition is that high pitch does bias the interpretation toward an exceptionally large or unexpected domain. However, this requirement seems to be able to be overridden by surrounding context without a loss of grammaticality (by following with an explanation that it was just one’s friends), while this is impossible in ASL. It is interesting, though, that at least there is the possibility of doing this to quantifiers, as the option of adding high pitch to a pronoun to bias it to be a wider domain is entirely out in English: note that (28b) can never mean that everyone in the world transformed into vampires. In English, the pronoun THEY requires an antecedent, and here the only option is the friends, so the high intonation signals something like surprise or unexpectedness, not a wider domain, whereas this is perfectly grammatical in ASL (see especially (29) below).

(28)  
a. Last night my friends and I watched a movie about vampires and later I dreamed that EVERYONE transformed into vampires!
b. Last night my friends and I watched a movie about vampires and later I dreamt that THEY transformed into vampires!

As for gestures, we have begun research video-recording four English-speaking nonsigners talking about stories that involve “more” groups of people, and they have never used a height gesture to signal more concurrently with speech (e.g. sweeping the hand high in space when saying “everyone”); instead, when trying to be specific they just disambiguate by using more words, like “everyone in the world”, or gesture higher during the domain (during “in the world”). We have also combed through many hours of open access online videos of university instruction for co-speech examples, and have yet to arrive at a clear example of co-speech gesture use unambiguously for quantifier domain restriction (but see Winter et al. 2013 for the use of height for larger numerals in co-speech gesture).

We are left, then with the following conclusion: ASL appears to be more expressive than (what seems like) the equivalent example in English, providing overt information about the size of the group of people under consideration. So, we want to know the source of this difference. How is ASL conveying this information, and what does it say about how domain information is entered in languages that don’t make an overt distinction, such as English? This will be the topic of the next section, Section 3.

3. Syntactic/Semantic Analysis: Height via Incorporated Pronoun

In this section, we will argue that when a signer signs ALL at some height to signal how many people are included, what they are doing is simultaneously pronouncing the quantifier (everyone) and who should be in the domain (IX-arc ‘them’), with the combined meaning “everyone of them.” We think that this is what is going on not just for ALL, but also for all of the quantifiers that can be modified for height to have the interpretation that includes information about the domain size. Evidence comes from showing that the plural pronoun in ASL (IX-arc) can use height even on its own to say how many people are under consideration; the quantifier examples all simply include a pronoun in their pronunciation. Our further arguments for this underlying structure of height-inflecting quantifiers are based on showing that in other places you see pronouns in ASL, you can use height in the same way.

3.1 Evidence #1: IX-arc itself moves for height information

Our first piece of evidence that the domain related contribution of height in quantifiers is coming from a (simultaneous) pronoun is that, even on their own (without a quantifier), pronouns can be modified for height to convey information about the size of the set they pick out. Consider (29): the context is such that the signer unexpected finds herself and her family at a nudist colony. She can use the lowest space to pick out her family, a mid-level height to pick out the people at the nudist colony (a superset of her family) and a further higher level to pick out all of the people in the world. Note that the nudist colony example is natural here because wearing clothes is
something that can be widely said to hold of people in the world, although a small group (e.g. the nudist colony) may be an exception to contrast with at the mid-level height.

(29) Context: Signer is discussing a family visit to a nudist colony.  
[Her family is a subset of people at the nudist colony, who are in turn a subset of people in the world.] She remarks:

a. POSS-1 FAMILY IX-arc-low WEAR CLOTHES.  
‘My family, they all wear clothes.’
b. IX-arc-mid NOT WEAR CLOTHES.  
‘They all (at the nudist colony) don’t wear clothes.’
c. IX-arc-high WEAR CLOTHES.  
‘They all (people generally) wear clothes.’

The reader will probably notice two other important things about this example, besides the fact that it involves a pronoun without a quantifier. First, the signer makes use of three levels in this example, instead of just the two that we have seen so far. This is not specific in any way to the pronoun, but rather it can be seen in other quantifiers too; one other example in this paper is NONE (e.g., below in example 43), so we see here for the first time that height with this meaning is not binary, but rather multi-leveled. If the signer only wanted to contrast two groups, she could use two levels with the lowest space for the local nudist colony instead of her family as in (30). This also illustrates again that the heights are only conveying relative, not absolute, domain size information (we will address precisely how this relative requirement gets implemented in Section 4).

(30) Context: Signer is discussing a family visit to a nudist colony.  
[Her family is a subset of people at the nudist colony, who are in turn a subset of people in the world.] She remarks:

a. IX-arc-low NOT WEAR CLOTHES.  
‘They all (at the nudist colony) don’t wear clothes.’
b. IX-arc-high WEAR CLOTHES.  
‘They all (people generally) wear clothes.’

As we mentioned earlier, there is debate about the syntactic/semantic status of the indexical point IX and its plural IX-arc in general (MacLaughlin 1997, Kouidobrova and Lillo-Martin
forthcoming, a.o.). IX has been noted to require (contextual) familiarity but not referentiality or uniqueness, not unlike the Salish determiner that has been well studied in domain restriction analyses (Matthewson 2001). Importantly, IX is frequently used not as an unsaturated determiner (English ‘the’), but as an argument-saturated pronominal form (14a)(English ‘that’/’it’/’them’), and it is this pronominal form that we are suggesting is pronounced simultaneously with a series of quantifiers in ASL.

3.2. Evidence #2: quantifiers that can’t move for phonological reasons

We’ve shown three different quantifiers in ASL which move for height, which we suggest is because they are combining with a pronoun: ALL, NONE, and SOMEONE (31a). Our second piece of evidence to support this analysis comes from certain quantifiers which cannot be moved in space for phonological reasons. In particular, a separate set of quantifiers (EACH, MOST, FEW, ALL-B) either have a specific location in their phonological form, or an internal movement to the sign, or a dominant hand acting on a non-dominant hand, all of which make moving the quantifier in space phonologically difficult/ill-formed for reasons unrelated to their meaning (e.g. both ALL and ALL-B have the same lexical semantics, as far as we can tell). What is interesting for the current discussion is that all of these quantifiers do allow domain information via height, but do so sequentially with the quantifier followed by a pronoun that uses height (31b).

(31)  
a. A-L-L-high/NONE-high/SOMEONE-high SICK.  
‘All/none/one (of all of the people) were sick.’

b. EACH/MOST/FEW/ALL-B IX-arc-high SICK.  
‘Each/most/all (of all of the people) were sick.’

Consider in more detail the case of FEW (32). The signer begins with the same context ‘My family goes to the beach every year’, without establishing any particular location for the family or the beach (both signed in neutral space). She can continue with (32a), signing FEW followed by IX-arc (one-handed in the figure) located in lower neutral space, with the interpretation that a few of the people already available in the context in a restricted sense (‘my family’) got sick. Alternatively, she could continue the context with (32b), signing FEW followed by IX-arc in higher space, with the interpretation that a few people from among a wider group than one might
have originally guessed (not just her family, but all of the people at the beach) got sick.

(32)  Context: ‘My family goes to the beach every year.’
   a.  FEW IX-arc-low FEEL HIT SICK ‘A few of them (my family) got sick.’
   b.  FEW IX-arc-high FEEL HIT SICK ‘A few of the people at the beach got sick.’

This provides further evidence, then, that spatially modified QNPs are a case of simultaneous morphology - a hallmark of sign languages - here, a simultaneous pronunciation of quantifier and the following IX-arc pronominal. All known cases of simultaneous morphology in sign languages involve constituents (Sandler and Lillo-Martin 2006) and so we take the quantifier Q to form a constituent with IX-arc.

We also note at this point that despite the difference in height modifications for two classes of quantifiers in terms of pronunciation (some simultaneous with the pronoun, some sequential), there is surprising homogeneity among the quantifiers in combining with pronouns that widen and restrict domains with height. We compare this to work on “weak quantifiers” (some, two, many) which gave been argued to not be determiners, but rather noun phrase modifiers (Etzeberria & Giannakidou 2014) that cannot combine with a domain variable, in contrast to “strong quantifiers” (none, every) that undergo contextual domain restriction. Our data from ASL suggest that all spatial QNPs can be modified for domains (33) and generally don’t allow predication (34) suggesting homogeneous structure among spatial QNPs involving a domain argument both for weak and strong quantifiers.

(33)  a.  NONE-high/[EACH IX-arc-high] FAIL.
      ‘None/each (of everyone) failed.’
   b.  ONE-high/TWO-high /[MANY IX-arc-high] FAIL.
      ‘Someone(or other), two (we’re not sure who), many (we’re not sure who) failed’

(34)    #STUDENTS TWO/MANY
      ‘The students are two/many’

The ‘wide domain’ from height in these weak quantifiers often leads naturally to indiscriminate readings (“some of other, doesn’t matter who” Horn 2000). Free choice and/or indiscriminate readings are not traditionally considered domain “restriction” (in fact, they seem to be quite unrestricted, hence the highest height), but in our data they arise through precisely the same

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structural configuration as domain restriction: the use of vertical height for placing loci that provide domain information (see Horn 2000, Kuhn 2014 for why wide domains and indiscriminate readings should be associated). That is, while English uses a morphological alternation some/any for domain widening and a covert variable for domain restriction, spatial QNPs in ASL use the same overt domain process for both whether simultaneous or sequential.

3.3. Evidence #3: Verbs also allow modification via height

Our third piece of evidence that pronouns are providing contextual domains in ASL comes from verbs that also make use of the same height distinction. To begin, we note that ASL has different morphological classes of verbs, some which change their form depending on their subject and object (call these “inflecting”), and some which do not (call these “plain”) (Padden 1988). When we turn to the issue of height to show set size, plain verbs (e.g. LIKE), which do not change their form for subject and object, also do not for height (36); this contrasts with inflecting verbs (e.g. INFORM) which do inflect for subject and object and also for height (37). Given that inflecting verbs have in fact been analyzed as pronoun incorporation in recent literature (e.g. Nevins 2011, Meier & Lillo-Martin 2011), it is then expected that if inflecting verbs involve pronoun incorporation and if pronouns can make use of height to indicate set size, then inflecting verbs would look like they are using height to indicate set size - and this is exactly what we see.

(36)    a. *IX-1 LIKE-arc-a ‘I like them’ non-inflecting verb LIKE  
        b. *IX-1 LIKE-arc-high (IX-arc) ‘I like everyone’ does not modify for height

(37)    a. 1-INFORM-arc-a ‘I inform them’ inflecting verb INFORM  
        b. 1-INFORM-arc-high ‘I inform everyone’ modifies for height

This use of height in verbs shows the same semantic range as the use of height in pronouns and quantifiers, including the indiscriminate interpretation (35).

(35)    a. 1-PICK-FROM++-arc-high  
        ‘I pick indiscriminately, I could end up with anyone’  
        b. 1-PICK-FROM++-arc-low  
        ‘I pick from among this specified set’

We see then that inflecting verbs can also make use of vertical height to signal domain size of their argument, evidence that the domain variable is contributed via an argument IX-arc pronounced with the verb. We’ll also take this opportunity to note that, just as locations in neutral space are known to make available their locus for later anaphora, the same is true for “high” locations/high space. For example, one verb PICK-FROM was used by one signer in a story about a zombie apocalypse, and he later went back to the same area of space used for the domain to refer to the people who were chosen (38), either from a specified group (38a) or generally from the population (38b).

(38)
a. LET-YOU-KNOW WORLD WILL DESTROYED. IX-high-right(thumb) GOVERNMENT HAVE SPECIAL BOAT READY. UNDERSTAND IX-high-right PICK-FROM-low+++ LIMITED PEOPLE WHO FILE-ON ON BOAT IX-left. UNDERSTAND IX-ARC-right-low RESPONSIBLE WHAT-rq. POSS-low-right CLOTHES BAGS FOOD INCLUDE BRING FILE-ON-BOAT-right-to-left. UNDERSTAND GOVERNMENT PROVIDE BOAT THAT’S-ALL.

“FYI, the world is getting destroyed but the government has a special boat- they’re ready for it- and they choose people (from a previously determined set) who can go on it. The people who are chosen are responsible for bringing their own supplies. The government is just providing the boat.”

b. WORLD HAPPEN DESTROYED WOW. LET-YOU-KNOW GOVERNMENT HAVE SPECIAL BOAT READY FOR. UNDERSTAND IX-high-right PICK-FROM-high+++ PEOPLE WHO CAN FILE-ON-left. UNDERSTAND IX-ARC-right-mid RESPONSIBLE WHAT-rq. POSS-mid-right #OWN-mid-right BAGS CLOTHES FOOD INCLUDE. GOVERNMENT PROVIDE WHAT-rq BOAT THAT’S-ALL.

“The world is getting destroyed! (But) FYI, the government has a special boat- they’re ready for it- and they are choosing people (randomly, from everyone) who can go on it. The people who are chosen (a subset of everyone) are responsible for bringing their own supplies. The government just provides the boat.

3.4. Evidence #4: Only things that take pronominal arguments modify for height.

Our final piece of evidence that contextual domain information is incorporated via pronouns comes from a case that does not allow a change in height to be interpreted as widened or restricted domains: noun phrases. As shown in (39), vertical height cannot combine with bare nouns with a felicitous domain interpretation (39a). Importantly, this is not a phonological restriction on the noun sign itself (as in some quantifiers above): DOG is signed with one hand in neutral space, and can be moved to high space to indicate, for example, a dog that might be literally high (on a roof, for example)(39b). This more iconic use of high space not only has a different interpretation, but involves different eyegaze behavior: it must be directed toward the sign DOG with for the “literally high” interpretation. (This contrasts with the high use of space for existential examples like SOMEONE, which do not allow eyegaze toward the high existential-why this differs from the universal is an open question but perhaps correlates with specificity, as
in Barberà 2012a). Signers all indicate the complete unavailability of a widening domain interpretation for nouns with height. We find this especially interesting because there is a very plausible interpretation, namely the indiscriminate interpretation in (40), which must be signed with a complete quantified noun phrase DOG SOMEONE-high ‘some/any dog’.

(39)  

**Context: Talking about adopting a pet.**

IX-1 WANT DOG-*high.*

a. ‘#I want any/all dog(s).’

b. ‘I want the/a dog that is high (e.g. up on that roof).’ [and only with eyegaze to DOG]

(40) IX-1 WANT DOG SOMEONE-*high.*

‘I want a dog (any kind of dog).’

On our analysis in which height is providing domain information via a pronoun, it should not be surprising that nouns cannot move higher for a widening interpretation, since nouns do not take pronouns as arguments. (Importantly, loci in general cannot be used predicatively in ASL.) Verbs *do* take pronouns as arguments, and they can inflect for height; nouns do not take pronouns as arguments and not surprisingly they cannot inflect for height. This indicates to us, then, that since quantifiers do allow “inflecting” for height, they are also taking a pronoun as an argument, incorporating it via simultaneous morphology just like verbs. Thus, height is a property of pronouns that acts as arguments, and crucially height cannot appear in contexts that only allow modifiers.

**3.5 Interim Conclusions**

We have shown so far that vertical height in ASL is used to signal the set/superset relationship of contextually relevant sets. Quantified noun phrases can incorporate this use via simultaneous pronunciation of demonstrative pronouns for quantifier domain widening and restriction, something that seems to only be covert in spoken languages.

Because the domain information coming via a pronoun, we suggest that it is an argument and not a modifier. Our data thus fail to support accounts of domain restriction in QNPs that combine a context set with the noun phrase via set intersection separately from the quantifier (Stanley and Szabo 2000; see further arguments against this approach in Elbourne 2008). Our data also fails to support an account of domain restriction as a quantifier modifier (Etxeberria & Giannakidou 2014), although we agree with the intuition that the determiner is the location of domain restriction, which is indeed supported by the use of IX in non-spatially inflecting quantifiers and verbs. Allowing quantifiers to take definite DPs (e.g. *them/that*) directly as complements (Matthewson 2013) accounts well for the ASL data, or else a type shifter can be used to maintain Etxeberria & Giannakidou’s (2014) proposal for quantifier domain restriction.

Semantically, a choice function analysis (von Fintel 1994, Matthewson 2001) is especially well suited to the ASL data, given the referential-like properties of the IX-arc domain that nevertheless are able to be quantified over, as in the quantified domains in ((25), repeated below in (41)).
(41) Context: Signer is discussing the numerous tests that he gives out.

Typically none-low/high fail.

‘Typically most times none (in the -possibly different- group/at all) fail.’

In summary, spoken languages are forced to linearize most of their underlying hierarchical structure, but due to the visual/manual modality, sign languages convey much more simultaneous morphology. In the case of quantifier domain restriction, we gain a new view of the morphosyntactic structure of QNPs in which domain restriction is the flip side of domain widening, both implemented through the same use of height in pronouns, and where domain information occurs with any (strong or weak) quantificational determiners as an argument, not as a modifier.

4. The source of height: presuppositions and the grammaticalization of metaphorical gesture

4.1 More is up as an existing metaphor

So far, this paper has focused on the morpho-syntactic structure of quantified noun phrases in ASL that include height, with the goal of shedding light on quantified noun phrases more generally, and how and where they might be include covert information in spoken languages about contextually restricted domains in their structures. We have concluded that in ASL, the height comes via a plural demonstrative pronoun iX-arc in ASL, which can in some cases be pronounced simultaneously and/or incorporated into both quantifiers and inflecting verbs. One thing we have not yet addressed, however, is the relationship of height and the pronoun: why and how does increased height signal a widened contextual domain for pronouns?

As mentioned in the introduction, we have not yet found any examples of non-signers using height to indicate a larger set in their co-speech gestures when pronouncing English quantified noun phrases. While this was true, our initial report of the state of affairs is in a way partially misleading, because non-signers do have some intuitions about possible gestural means for communicating domain size. However, these intuitions only became apparent when we asked in a different gestural situation. In particular, if asked to pantomime (e.g. to tell a story without using any words, like the game Charades!), English speaking non-signers in fact do use increased height for increasingly big sets, tracing out circles at a neutral torso height for pragmatically restricted sets but higher circles (even above their heads) for increasingly larger sets in a story such as (42).

(42) There’s a zombie attack at Yale. First everyone in your suite becomes zombies. Then everyone in your college becomes a zombie. Then you hear that everyone at Yale has become a zombie. Then everyone in New Haven becomes a zombie. Then everyone in the US becomes a zombie. Suddenly, everyone in the world has become a zombie. Except for you.
One English speaking non-signer even *jumped* to reach an ever higher circle to described everyone in the world in (42), once she had used her existing high space for everyone in the U.S. Despite the clear similarity then with ASL, all of these pantomimes by non-signers occurred in referential contexts, where the group traced out was akin to the pronoun IX-arc. We have not encountered an equivalent (at least, so far) of a quantified noun phrase, although this is part of an ongoing gestural investigation. What we can say so far is that this element of ASL does seem like it could have arisen from gestures, and we suspect that these have become increasingly grammaticalized such that signers of ASL have very clear interpretations for them (perhaps more so than non-signers’ gestures) and they can be extended in ASL to be used in much more abstract contexts and in complex morpho-syntactic such as in inflecting verbs and quantified noun phrases. We are not the first to propose this type of grammaticalization of gestures (e.g., Coppola 2007, Hendriks 2008, Wilcox 2004, a.o.), though most previous studies that we are aware of focus on lexical, rather than morphosyntactic, areas that undergo grammatization.

A second intriguing piece of data suggesting that there is an existing conceptual relationship/metaphor which ASL is drawing on for this use of height comes from cross-linguistic data. Not only do English speaking nonsigners use height in a related way in English, but signers of Japanese Sign Language may as well (43). A native signer of JSL used the following set of three contrastive sentences, starting low (reported as “@chest”) for his class, moving to a mid level (reported as “@cheek”) for his school, and a high level (reported as “@forehead”) for the entire prefecture. We note also that this example involves a quantifier (NONE), indicating the complexity in another sign language that is also found in ASL but not (at least to our knowledge) found in nonsigners’ gestures.

(43)

a. CLASSMATE DEAF-FAMILY NONE(@chest) SELF FINISH
   'There is/was nobody from a deaf family in my class. Just me.'

b. SCHOOL DEAF-FAMILY NONE(@cheek) SELF FINISH
   'There is/was nobody from a deaf family in my school. Just me.'

C. WAKAYAMA DEAF-FAMILY NONE(@forehead) SELF FINISH
   'There is/was nobody from a deaf family in (the prefecture of) Wakayama. Just me.'

*Glosses from Japanese Sign Language*

Given that signers have access to a widespread conceptual representation/metaphor that ties together height and amount, it seems intuitive that plural pronouns higher in space are interpreted as a larger set. However, we want to know how this is cashed out in the underlying logic of these quantified noun phrases and all uses of the pronominal system.

**4.2 Semantic implementation of MORE IS UP**

We have shown that (a) height signals domain size through an incorporated pronoun in quantifiers and in verbs in ASL, and also that (b) there is an existing metaphor in a number of cultures that MORE IS UP. However, we still have not discussed precisely how this metaphor
influences the meaning of the pronoun.

To begin, we note that we already know that the meaning of referential pronouns is highly contextually dependent. For example, consider (44a): in context, the pronoun *they* is easily understood to be the man and the woman who are being watched, even though this hasn’t been made explicit in preceding discourse. Sentence (44b) has various interpretations in which either *they* could refer to a number of other things (e.g. attendees at a meeting waiting for the man and woman), but in context is most easily resolved to the couple in view. In (44c), masculine gender marking on the subject pronoun resolves the referent of the pronoun to the man, not the woman. In (44d), one can simultaneously point to the man while pronouncing *he* in order to make sure that the listener is picking out the intended reference. The point here is that pronouns are known to be highly dependent on context for their reference while also marking features that help distinguish from among possible referents (e.g. gender marking, deixis/pointing).

(44) Context: Two friends are sitting inside, looking outside through a window, where they watch a man and woman who appear to be lost.
   a. They must be from out of town.
   b. Do you think they know where they are?
   c. He looks very lost.
   d. He(pointing to the man) should watch out.

In American Sign Language, pronouns are unmarked for gender; nevertheless, they have been suggested to encode features for similar purposes of pronoun disambiguation. It has long been known that while pronouns can use an arbitrary locus system (discussed earlier in Section 2.1), they can also make use of a gestural system such that pointing with IX or IX-arc to a present individual or group (respectively) picks out whoever has been pointing to. In other words, the pronoun is conveniently also a gestural point, so pronoun resolution can occur gesturally just like in English. More recently, Schlenker et al. (2013) discuss the case of iconic height, in which IX can be used to point to high or low signing space to indicate actually high or low referents, such as people up on a house or tall basketball players (high) or people low on the ground or short people (low)(45) (Schlenker et al.’s example (26)). This same use of height can also be used to indicate an honorific hierarchy, in which honorable entities (e.g. gods, bosses) are placed high in space and inferiors (e.g. subordinates at a job) are place low in space (46).

(45) **Actual height:**
   POSS-1 YOUNG BROTHER WANT IX-1 REST. IX-1 UNDERSTAND IX-a-high.
   ‘My younger brother wants me to rest. I understand him.’
   Interlocutor infers: the speaker’s younger brother is tall
   (This is unlikely to receive honorific reading because the brother is younger.)

(46) **Honorific height:**
   POSS-1 BROTHER WANT IX-1 REST. IX-1 UNDERSTAND IX-a-high.
   ‘My brother wants me to rest. I understand him.’
   Interlocutor infers: the speaker’s brother is older and/or more venerable
(This can also receive the “tall” reading, but the point is that it need not be actual height)

Semantically, Schlenker et al. analogize both uses of height to gender marking in English by incorporating this information via a presupposition, since in contexts like negation (47)-(48) and in the antecedent of conditionals, both gender marking (English) and iconic and honorable height (ASL) are still interpreted - so-called presuppositional “holes”.

(47)  a. I don’t understand him.
Inference: the person referred to is male.

(48)  b. Negation with actual height:
POSS-1 YOUNG BROTHER WANT IX-1 REST. IX-1 NOT UNDERSTAND IX-a-high.
‘My younger brother wants me to rest. I don’t understand him.’
Interlocutor infers: the speaker’s younger brother is tall
(Unlikely to receive honorific reading because the brother is younger)

c. Negation with honorific height:
POSS-1 BROTHER WANT IX-1 REST. IX-1 NOT UNDERSTAND IX-a-high.
‘My brother wants me to rest. I don’t understand him.’
Interlocutor infers: the speaker’s brother is older and/or more venerable
(This can also receive the “tall” reading, but the point is that it need not be actual height)

We want to be clear that the use of height we have been discussing in the rest of this paper is not simply an extension or space case of these uses of height that Schlenker et al. (2013). For one thing, big groups mentioned in our high space need not be in any way made of tall referents or in a high location. We have, in fact, given many examples in which the low versions are proper subsets of the high versions, so it is clear that there is no difference in literal height or in honorability of the referents. Nevertheless, the information is incorporated in the semantics analogously, as a presupposition described by the following generalization:

(49) Generalization: The height of a quantifier in ASL indicates the relative size of its domain

Let \( H_n \) be loci in signing space, and \(<\) a “vertical” ordering relation among loci: for any \( H_j \) and \( H_k \), if \( H_k \) is physically higher in signing space in the vertical plane (toward the signer’s head) than \( H_j \), then \( H_j < H_k \). In our transcriptions in the examples in this paper, we often use “HIGH” and “LOW” to stand for two heights \( H \) where \( H_{\text{LOW}} < H_{\text{HIGH}} \). The ordering corresponds to the subset relation:
Let \( S \subseteq U \) be a set signed in locus \( H_j \), and \( S' \subseteq U \) be a set signed in locus \( H_k \). If \( H_j < H_k \), then \( S \subseteq S' \).
This generalization is captured in terms of subsets and supersets, which we argue is the correct relationship expressed by height. We saw earlier (“No one in my family is deaf”) (24) that high space can be used even if not everyone in the universe is included in the domain. Contrastively, even if something is contextually numerous but is not a particular superset of the contextually supplied domain, then it cannot be place in high space. For example, seven spouses might be considered an unusually high number of spouses for an individual to have, but nevertheless one would not use high space in this sense to discuss this relatively small group (high space could instead have an honorific or tall interpretation, but not a “wide set” interpretation), since it is not an indiscriminately larger superset of a specific set.

Furthermore, most of the examples so far in this paper have involved a single height ordering, but it is also possible to use separate height orderings based on different loci. Recall from (16)-(17) that left and right sides of the signers’ sign space can be associated with separate discourse loci. Now consider example (50), in which two countries (France and England) are associated with the left and right side of the signer’s space, respectively.

(50) WAR-left-right, FRANCE-right, ENGLAND-left, GENERAL-IX-left-low, SOMEONE-right-high

SHOOT-right-high-toward-left-low

‘In a war between France and England, an English general was shot by an unknown French assassin.’

In this example, the general (a specific member of the group in the left space, England) is placed in low left space, while the shooter (a nonspecific individual, thus chosen from the widest group in the right space, France) is place in high right space. Here, too, the directional verb SHOOT is oriented from the right high space of the subject (the shooter) toward the left low space (of the general), as we saw with other directional verbs in Section 3.3. This example further illustrates that the ordering of domain sizes need not be absolute, but is simply relative for any two loci ordered by height (even differently in the left and right sides of space).

We have suggested that our generalization is implemented in the grammar in the form of a presupposition, triggered by the use of a non-default height by a pronoun, either a stand-alone
pronoun or a pronoun incorporated into a quantifier or a verb. We think that this also has an advantage not only in correctly predicting the sustained interpretation of height as “more” in standard presuppositional holes, but also signers’ intuitions about height. Just as it is pragmatically inappropriate to use “he” when pointing to someone who should typically be described as female gendered in English, or high space with a singular IX when the referent is short, it is similarly pragmatically inappropriate to use high space for a set that is a subset of a set that was referenced in a lower signing space.

4.3. Metaphorical restrictions

Although throughout this paper we have been focused on the subset/superset relationship among sets of individuals, recall that we begin the paper with discussion of quantifier domain restriction among other things, such as times and/or situations (“I forgot to turn off the stove!”). Given that the problem of quantifier domain restriction is just as relevant for times and situations (so called A(dverbial)-quantifiers) as for individuals (D(eterminer)-quantifiers), it is natural to want to extend our findings for quantifiers over individuals here to quantifiers over times and/or situations in ASL. When we look to the data, however, we find a somewhat different pattern for times and situations than for individuals. At first blush, we see that in some cases both ALWAYS and NEVER can be signed bigger and higher when intended to apply to even more situations (50)-(51).

(50)  a. IX-1 ALWAYS-low+small HUNGRY.
      I’m always hungry (in the usual situations).

   b. IX-1 ALWAYS-high+big HUNGRY.
      I’m always hungry, all of the time!

(51)  a. IX-1 NEVER-low+small HUNGRY.
      I’m never hungry (in the usual situations).

   b. IX-1 NEVER-high+big HUNGRY.
      I’m never hungry, ever!

However, in each case height cannot be used alone to signal domain size, but rather is accompanied by a wider sign in general (e.g. ALWAYS can’t be signed high and small, like EVERYONE). We hypothesize that this use of height in (50)-(51) is merely emphatic: in general in ASL, signing outside of the expected low/neutral space is taken to be emphatic similar to increased intonational contour in English, and typically goes with bigger movements in general (like those in (50)-(51)). The effect is similar to focusing the adverbs always or never in the English translations of (50)-(51), in which focus would likely mean an unexpectedly larger set of situations, but could also be emphatic for some other reasons (e.g. contrastive focus with a previous utterance). A further dissimilarity between height in (50)-(51) and height in the D-quantifiers in the rest of the paper is that there are no cases of adverbs followed by IX-arc, and seemingly no use of IX-arc signed high to mean that something happens in a lot of situations (or, conversely, low to mean occurring in restricted contexts). There are also no plural pronouns that
seem to be able to be used for situations, as there are for individuals. Thus, the system of grammaticalized height via pronouns found in D-quantifiers is absent in A-quantifiers.

We suggest that one motivated reason that the use of height seen in individuals does not extend in the same way to times or situations is that there is a reliance on the metaphor MORE IS UP that is more generally restricted to individuals, which then restricts its usage in this way, too. For example, consider even in English: we do not use height as a metaphor for increased time passing, instead using a left-to-right configuration, or back-to-front, to mark the passage of time (Cooperrider and Núñez 2009, Núñez and Cooperrider 2013). It seems that “more” time, then, is not metaphorically represented as “up”, and Meir (2010) has shown in a separate set of phenomena that metaphors do constrain some lexicalizations in ASL. Thus, although this is certainly an area that deserves more space than we can devote to it in the current paper, we think that it could be a fruitful area for investigating the relationship between sign and gesture further given the dissociation we see so far between individuals and times and/or situations.

5. Conclusions

We have argued that the use of height in quantified noun phrases in ASL sheds unique light on the structure of QNPs across languages and on the gesture/language interface in sign and spoken languages. First, by looking at height in ASL, we used evidence from four separate structural tests to show that height in fact conveys information about relative domain size via pronominal arguments, sometimes through stand-alone pronouns but sometimes through pronouns that are incorporated into the quantifier or the verb. Incorporated pronouns conveying domain information are a crucial piece of evidence that language allows quantifiers to combine directly with pronouns, since the two are in fact pronounced simultaneously and carry separate information. In this argument, we made use of the general strategy of sign languages for frequently allowing multiple morphemes to be pronounced at the same time (a preponderance of “simultaneous morphology”, an effect of the visual language mode).

Second, the study of height conveying domain size illuminates a further point about the language/gesture interface: it is another example of a gesture becoming grammaticalized to take on more specific meaning in sign languages. Non-signers do have some access to the metaphor MORE IS UP both in spoken English psycholinguistics experiments and in pantomime. However, it seems that non-signers do not use height in the complex way shown in sign languages, to convey simultaneous quantification: they only use it in the pronoun sense, and not (as far as we know) in co-speech gesture. In contrast to non-signers, in a fully fledged language like Japanese Sign Language we found pieces of evidence for precisely the same kind of complex multi-morphemic use of height as in ASL. Work on the precise relationship in this area between gesture and sign is ongoing, but it suggests that while the basic intuition and metaphor is shared by non-signers and signers alike, signers can co-opt this information to be further grammaticalized into a presupposition concerning the relative height of plural pronouns.

Overall, this project brings together unique data from American Sign Language to provide new information about quantificational noun phrases, as well as the relationship between language
and gesture. We’ve also presented a formal morphosyntactic/semantic/pragmatic analysis of this use of height to represent quantifier domains, while at the same time tying it to cognitive linguistic work on metaphor, which we think provides a unique insight into the evolutionary origins of this use of height in sign languages. We hope that this spurs new work not just on quantificational domains in sign languages, but also the relationship between sign and gesture and how the semantic and pragmatic components should divide the work of each, an area that we were only able to touch upon briefly but we think is especially promising given the potential insight to inform even classic problems in semantics/pragmatics such as quantifier domain restriction.

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References


Bedeutung 18, 110-127.


Núñez, Rafael, and Kensy Cooperrider. 2013. The tangle of space and time in human cognition.
Petronio, Karen. 1995. Bare noun phrases, verbs and quantification in ASL. In Bach, Jelinek, Kratzer, and Partee, Quantification in Natural Languages, Springer Netherlands, 603-618.