



# The eyes don't point: Understanding language universals through person marking in American Signed Language

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## Abstract

In American Sign Language (ASL), pronouns are directed to locations in space associated with specific referents to refer to them (e.g., BOB on the left, BILL on the right). Despite the relative lack of ambiguity in identifying referents, Meier (1990) argues that second and third person cannot be distinguished in the ASL grammar, and instead proposes a single category “non-first” (an analysis adopted for many signed languages). If true, signed languages stand in stark contrast to spoken languages, for which three-person systems prevail. Alternatively, signed languages could mark a three-way distinction using eye gaze patterns to grammatically distinguish between second/third person referents (Berenz, 2002), just as eye gaze is known to mark verb agreement (Thompson et al., 2006). Using eye-tracking, we measured gaze occurring with pronouns, considering three different ways in which eye gaze could be used to mark pronouns. Results indicate that ASL does not use eye gaze to mark person, thus providing further support for a lack of a second/third person distinction. However, there is evidence for the use of eye gaze to mark locatives, which look like pronouns, but pick out a locative referent. We discuss possible reasons for the difference in person marking systems between signed and spoken languages, providing insight into what is universal across languages.

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## 1. Introduction

Research has highlighted the ways in which signed languages exhibit the same linguistic principles and conform to the same grammatical constraints as spoken languages (for reviews see Emmorey, 2002; Sandler and Lillo-Martin, 2006). For example, as in spoken languages, there is evidence from phenomena like “tip of the fingers” states (parallel to tip-of-the-tongue states), in which signers experience access to meaning but an inability to retrieve a sign's form, for separate levels of semantic and phonological representation (Thompson et al., 2005).

Nevertheless, some observed universal properties of spoken languages might not be fully mirrored by signed languages. One potential difference between signed and spoken languages is in how the category of ‘person’ is

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grammatically encoded. Spoken languages use a three-person distinction (first, second, and third) while two-person systems are found across signed languages (first and non-first person; see Meier, 1990; Engberg-Pedersen, 1993). This view, however, is not uncontroversial, and several researchers have claimed that three-person systems are also grammatically encoded in signed languages through the use of eye gaze (Bellugi and Fischer, 1972; Baker and Cokely, 1980; Berenz, 2002). Here we present experimental eye gaze data addressing possible differences in person marking between signed and spoken languages.

In Thompson et al. (2006) we examined eye gaze occurring with verbs in American Sign Language (ASL) and found that only verbs showing manual agreement morphology<sup>1</sup> (movement and hand orientation features) are marked with eye gaze agreement. Plain verbs, a subset of ASL verbs which do not mark agreement manually, are not produced with directed eye gaze to mark agreement. The co-occurrence of eye gaze and manual marking in verb agreement and the absence of both manual agreement and eye gaze agreement for plain verbs suggests an integral relationship between the two that may also be present during the production of pronouns: like agreeing verbs, pronouns in ASL are manually directed toward locations in space associated with referents. However, it is unknown if ASL pronouns additionally use eye gaze to mark locations associated with these referents.

The presence or absence of directed eye gaze to mark pronominal referents in a fashion similar to verb agreement marking is predicted by some analyses of ASL pronouns. One such analysis (Liddell, 2000a,b) claims that while the signs are linguistic, the directional component of pointing, both manual and non-manual (e.g., eye gaze), is gestural and *not* grammatical agreement. Under such an analysis, the eye gaze found occurring with verbs would also be considered gestural and is therefore predicted to pattern similarly for both verb agreement and pronouns, assuming that gestures are not constrained by grammatical category. Thus, whether or not pronominal referents are marked with eye gaze can offer clues about the relationship between pronouns and verbal agreement in ASL. These issues are outlined in the following paragraphs.

## 2. Background

### 2.1. Pronominal reference in ASL

Pronominal reference in ASL is accomplished through the use of locations (“referential loci”) in signing space. Discourse referents are associated with spatial locations, and signers can direct pronouns toward these locations in order to directly ‘point out’ specific referents. Thus, pronominal reference in ASL is indexical in that pronouns point to physically present referents (e.g., for the ASL sentence BOY LIKE INDEX-2nd person, “The boy likes you”, the pronoun will be directed toward the physically present addressee), or to locations in space that have already been associated with non-present referents (see Fig. 1). The association between a locus and a referent remains throughout the discourse until changed by the signer.

While pointing behaviors in ASL serve to call attention to particular entities, this fact alone is not sufficient evidence for a linguistic category of pronouns, or evidence for how many formal person distinctions there are. In fact, while the referent of first, second, and third person can be clearly understood within the discourse for both present and non-present referents, some linguistic analyses suggest that there are no grammatical distinctions among first, second and third person, with only gestural pointing occurring (see Ahlgren, 1990 for Swedish Sign Language; Lillo-Martin and Klima, 1990; Todd, 2009 for ASL; see also McBurney, 2002 for arguments that sign language reference does not use grammatical person marking to identify referents in a discourse, but utilizes demonstratives instead). However, in the most widely accepted view to date, Meier (1990) argues that ASL distinguishes between first and non-first person in the grammar. His argument for a first versus non-first person distinction in ASL is based on two sets of facts. First, unlike first person, which is always located near the signer’s body, second and third person forms do not have fixed locations. Second, while first person plural pronouns (WE and OUR; see Fig. 2) have a distinct phonological form, second and third person share the same form—they differ only in a way that cannot be phonologically specified, i.e., in the direction of pointing, which is controlled by the physical location of referents, or the established location of non-present referents. Lillo-Martin and Meier (2011:237) state that since ‘position of the addressee’ cannot be entered into the lexicon as part of the phonological form, second and third person forms cannot be distinguished in the grammar and therefore “gesture must be invoked to explain the actual locations toward which directional signs point.” In contrast, first person pronouns have only, at most, minimal gestural motivation for the place of articulation, i.e., first person plural pronouns are produced on the signer’s chest even when they

<sup>1</sup> The term manual agreement morphology here is used to refer to morphology for both “agreeing verbs” which mark agreement with the grammatical object and optionally with the subject and “spatial verbs,” which instead mark agreement with a locative. See Padden (1990) for more discussion on the distinction between these two verb types.

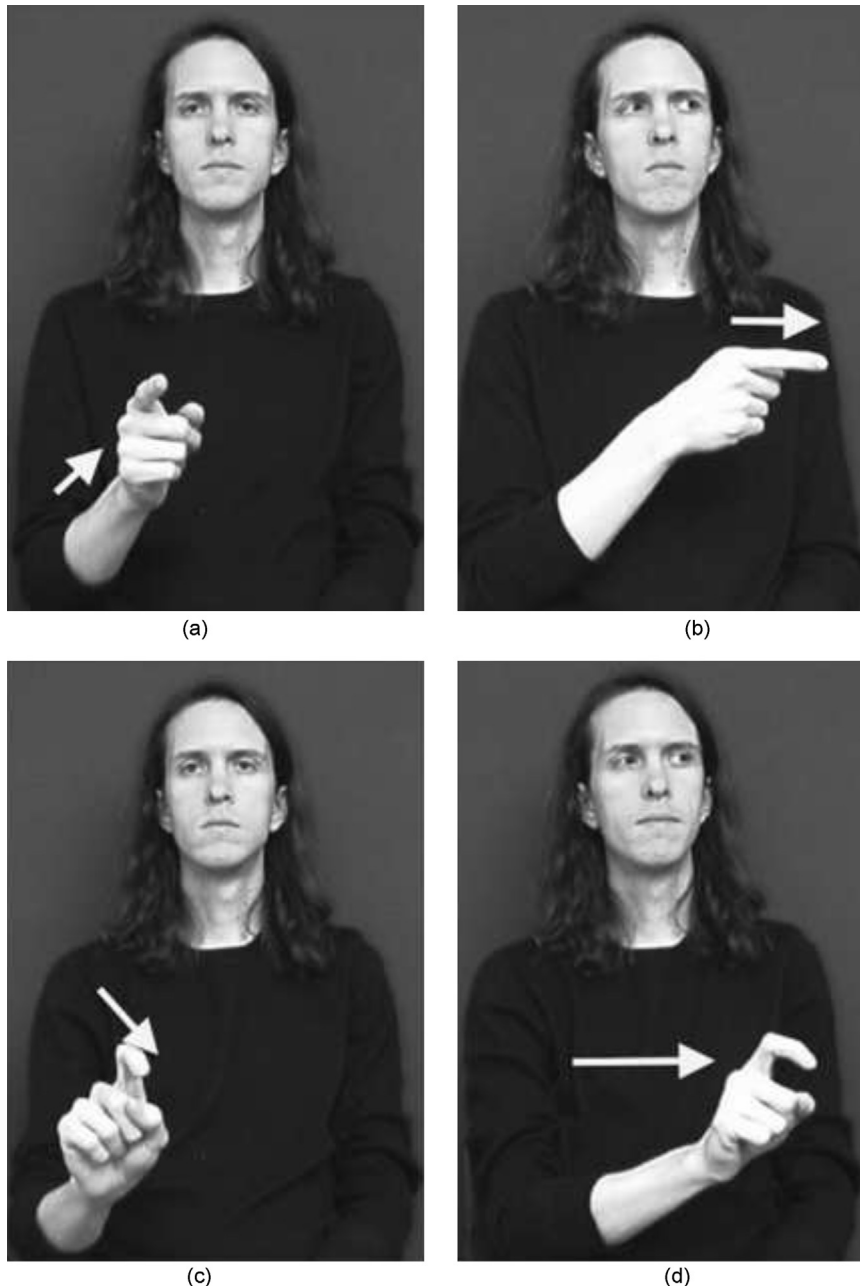


Fig. 1. ASL pronouns and verbs make use of space to refer and mark agreement respectively. Top row: pronouns refer to second-person (a) by pointing directly at the conversational partner, and third-person (b) by pointing to a location that has been assigned to the third person referent (here on the signer's left). Bottom row: the ASL verb *ask* which marks object agreement through the use of referential locations in signing space similarly to pronoun reference for second-person agreement by pointing directly at the conversational partner (a) *ask-you*, and for third-person agreement by pointing to a location that has been assigned to the third person referent (b) *ask-him/her*.

refer to the signer and another participant across the room. Meier (1990) therefore concludes that first person plural forms must be phonologically specified.

If Meier's analysis is correct, it raises an important potential difference between ASL and accepted typological universals proposed for spoken languages. As per Greenberg's universals, it is generally accepted that: "all languages have pronominal categories involving at least three persons and two numbers" (1963:96). Greenberg (1993) discussed various phenomena that do not fit into the three-person analysis (such as zero third person forms), but he nonetheless argued for the universality of three-person systems because of their prevalence across the vast majority of the world's



Fig. 2. Illustration of first person pronouns in ASL.  
From Emmorey (2002).

spoken languages. Similarly, in a cross-linguistic typology of person marking in spoken languages, Cysouw (2003) found evidence that some spoken languages share the ASL-type of homophony (i.e., second and third person have the same form in some Papuan languages: e.g., Kombai, Wambon and Awyu), but Cysouw concluded that not only is this type of homophony too rare to show up in the average typological study, but that of all languages included in his study, the second/third person type of homophony is never a characteristic of *all* pronominal paradigms in the language (2003:52). In other words, homophony may exist within the singular pronominal paradigm, the plural paradigm, or the agreement system, but crucially not in all three, as is proposed for the ASL system. If Meier's (1990) analysis of the ASL person system is correct, it suggests a major difference between spoken and signed languages.

When compared to spoken languages, the first and non-first person marking paradigm found in ASL becomes even more surprising considering that it is also attested in many other signed languages (e.g., for Danish Sign Language see Engberg-Pedersen, 1993, for British Sign Language, Cormier, 2007, and for Israeli Sign Language, Meir, 1998). However, it is possible that the key morphological component distinguishing between second and third person in ASL (and other signed languages) is as yet unrecognized. Several researchers have claimed that there is in fact second and third person in ASL, and that eye gaze is the distinguishing factor: for second person, gaze is toward the addressee, while for third person it is toward the location associated with the third-person referent (Bellugi and Fischer, 1972; Baker and Cokely, 1980). These analyses have been criticized for the same reason that analyses of manual pointing using loci in space have been rejected—the direction of both manual points and eye gaze using a potentially infinite number of loci in space cannot be captured phonologically or entered into the lexicon (the so called “listability problem”).

In a related analysis, Berenz and Ferreira-Brito (1990) and Berenz (1996) claim that in Brazilian Sign Language (LSB) the distinction between second and third person reference is determined by the orientation of eye gaze: for second person referents, the signer holds the gaze of the addressee, while for third person referents, the signer shifts gaze from the addressee to the actual location of the present referent or toward the location associated with the non-present referent, and then back to the addressee. While not explicitly stated, one possible interpretation of the analysis in this work is that the phonologically specifiable feature that distinguishes second versus third person is a movement or change in eye gaze. Under this analysis, gaze for second person referents would be steady state gaze toward the addressee (i.e., no movement) whereas gaze for third person referents would be eye movement from the addressee to the third person referent and then back (i.e., a single back and forth movement).

In a later analysis, Berenz (2002) instead claims that the distinction between second and third person reference is determined by the orientation of the chest, head, eye gaze and hands: the Body Coordinates Model. Specifically, for second-person referents, the signer aligns his/her chest, head and eye gaze toward the midline of his/her own body while simultaneously producing a manual point (phonologically determined by hand orientation) in that same direction (toward the second-person referent), while for third-person referents, the chest, head, eye gaze, and hand orientation of the manual pronoun are not in alignment. Under this analysis, second and third person pronouns can be distinguished in the grammar and phonologically determined as a function of the relationship between the different articulators.

To date there is very little empirical data on the nature of eye gaze use with pronouns, and the existing research is based on video tape analyses only (e.g., Metzger, 1998 for ASL; Alibasic Ciciliani and Wilbur, 2006 for Croatian Sign Language; Engberg-Pedersen, 2003 for Danish Sign Language). In Alibasic Ciciliani and Wilbur (2006), the Body Coordinates approach is adopted for Croatian Sign Language. However, in this analysis, the signer's chest alignment is not a reliable predictor, as it is not consistently aligned with the head and hands during production of pronouns with

second-person referents. [Alibasic Ciciliani and Wilbur \(2006\)](#) instead rely on the alignment of the head and eye gaze with hand orientation, concluding that for the most part the Body Coordinates Model is consistent with their data. [Metzger \(1998\)](#) analyzes spontaneous eye gaze for a small number of ASL pronouns (there were 7 usable second-person pronouns and 12 usable third-person pronouns in the data set). The data reveal eye gaze that is consistently directed toward the addressee during the production of both second-person pronouns (100%) and third-person pronouns (91.7%). Gaze for third-person pronouns (i.e., toward the third-person referent) occurred only once, or 8.3% of the time. Thus no distinction was found between second- and third-person gaze alone. However, Metzger's data also support [Berenz's \(2002\)](#) Body Coordinates Model in that eye gaze and hand position were aligned for pronouns with second-person referents but not aligned for pronouns with third-person referents. Nonetheless, given the very small number of tokens, further study is warranted.

We conducted a semi-naturalistic experiment using eye-tracking technology during two different production tasks in order to monitor the eye gaze patterns of ASL signers. The goal of the research was to investigate the presence or absence of systematic eye gaze used to distinguish between pronouns with second- and third-person referents. Specifically, we considered the following possibilities for eye gaze patterns: (1) eye gaze is directed toward locations associated with pronouns ([Bellugi and Fischer, 1972](#); [Baker and Cokely, 1980](#)); (2) eye gaze movement with second-person referents is steady-state, while for third-person referents, back-and-forth eye gaze movement is used (as suggested in [Berenz and Ferreira-Brito, 1990](#); [Berenz, 1996](#)); (3) eye gaze and hand position of the manual pronoun are aligned for pronouns with second-person referents and are not aligned for pronouns with third-person referents (Body Coordinates Model, [Berenz, 2002](#)); or (4) eye gaze is not a systematic marker of grammatical second- and third-person referents for pronouns. Thus the overall goal was to explore the use of eye gaze in distinguishing second- and third-person pronominal forms. We also secondarily considered the role of eye gaze in distinguishing between these pronominal forms (with nominal referents) and other uses of pointing signs (e.g., determiners), as discussed below.

## 2.2. *The relationship between pronominal reference and verb agreement*

A further goal of this study was to examine the relationship between the eye gaze patterns that occur with verb agreement in ASL and possible eye gaze patterns occurring with pronouns, as there is reason to believe that the behaviors of verbs marking agreement and pronouns are related. In general, both ASL verb agreement and pronominal reference make use of locations in signing space to indicate referents (see [Fig. 1](#)). Specifically, manual verb agreement (which occurs only with a subset of ASL verbs called “agreeing verbs”) and pronominal reference both manifest in ASL as a location in signing space that is assigned to a discourse referent and subsequently “stands in for” or represents that referent. Importantly, for both verb agreement and pronominal reference, signs are directed toward spatial locations associated with discourse referents (which cannot be phonologically specified). This directionality is therefore gestural in nature, but differs from other gestures in one important way: it is not optional. One parallel example in English is the word ‘yea,’ as in the sentence, “It was yea high.” When saying ‘yea’ the speaker *must* include a gesture indicating the actual height of the thing being discussed. In much the same way, a signer cannot produce a pronoun with a second/third-person referent or mark agreement without making use of this gestural directionality determined (at least in part) by the location (actual or assigned) of real world referents. Because directionality for verb agreement and pronominal reference cannot be completely determined via phonological specification, different accounts, all containing some element of required gesture, have been offered to explain how directionality is determined.

[Liddell \(2000b\)](#) identifies a distinction between plain verbs and agreeing verbs as a distinction between fully specified lexical verbs (plain verbs) and partially gestural verbs (agreeing verbs). Specifically, [Liddell \(2000a,b\)](#) claims that instead of a lexically specified direction morpheme proposed by others (see below) the directional component of both pronouns and agreeing verbs (or what he refers to as indicating verbs) is gestural. Therefore the directed movement of signs to locations in space is driven by our general cognitive ability to point at things (either with the eyes or the hands). Under this view, directionality is a function of general cognition and is not constrained by the grammar. Because gesturally encoded directionality should not distinguish between different grammatical categories (i.e., verb agreement and pronouns), Liddell's analysis predicts that the directed eye gaze occurring with verb agreement should also occur with pronouns.

Alternatively, several researchers have adopted a type of dual representation for manual agreement that contains both gestural and grammatical directional elements ([Askins and Perlmutter, 1995](#); [Mathur, 2000](#); [Lillo Martin, 2002](#); [Rathmann and Mathur, 2002](#); [Meier and Lillo-Martin, 2010](#)). Although there are several variations on this theme, it is generally assumed under these analyses that both verbal agreement and pronominal reference involve a lexically specified direction morpheme, but that spatial locations are underspecified in the phonological and morphological representation of these signs and are instead elaborated with a gestural component.

In [Thompson et al. \(2006\)](#) we adopted this hybrid analysis to account for eye gaze behaviors during verb production. Our data argued against the claim that eye gaze marks object agreement across all verb types ([Neidle et al., 2000](#)), and we instead concluded that eye gaze is part of a grammatically specified directional morpheme occurring only alongside

manual features of agreeing verbs. Specifically, we proposed that eye gaze (and manual agreement) mark features of verb arguments according to a noun phrase accessibility hierarchy (Keenan and Comrie, 1977), with eye gaze marking the lowest-ranked argument present in the utterance (subject < object < locative). This use of eye gaze may or may not occur during the production of pronouns, because while both agreeing verbs and pronouns make use of a (shared) gestural component, there is not necessarily a direct relationship between a verbal agreement directional morpheme and a pronominal directional morpheme. Therefore, eye gaze, a feature of a grammatical verbal agreement morpheme, may or may not occur as a feature of a pronominal morpheme.

We used eye-tracking technology to investigate whether eye gaze agreement occurs with ASL pronouns. In addition, we examined (a) whether eye gaze distinguishes between pointing signs that may function as determiners (co-occurring with nouns) and pointing signs that occur in isolation as pronouns, (b) whether eye gaze differs for pointing signs with a locative function versus a pronominal function, and (c) whether eye gaze is sensitive to the grammatical role of pronouns. The results provide insight into ASL-specific issues: the potential use of eye gaze to distinguish between second and third person, the relationship between verb agreement and pronouns, and the basic nature of eye gaze in ASL (e.g., grammatically or gesturally based). More broadly, this investigation bears on issues of universality for person-marking systems in signed and spoken languages alike.

### 3. Method

#### 3.1. Participants

Ten native signers (four men and six women) participated in the study (mean age = 29.6 years). All participants were Deaf from Deaf families and exposed to ASL from birth.

#### 3.2. Tasks

Participants performed two semi-naturalistic language production tasks. In the first task, participants were asked to compare and contrast groups such as men and women, or Deaf and hearing people (compare/contrast task). The Deaf interlocutor also questioned participants further about how and why they thought the groups were different (e.g., nature or nurture). Since the length of discussion for each topic differed from participant to participant, not every participant finished discussing every topic. The Deaf interlocutor would end the task at a natural break occurring after ten minutes of data collection, with participants generally discussing three or four of the possible topics. The second task was for the participant to find out ten things about the Deaf interlocutor that they did not already know (information-seeking task). Previous studies have predominantly used data from two-person conversations and therefore gaze patterns could have been driven by discourse-level demands (i.e., to maintain eye contact during conversations). We therefore used two different task types to ensure that results were not driven by the discourse situation. Using two different tasks also ensured that we could obtain enough pronouns with both first- and second-person referents, with the first task designed to elicit pronouns with third-person referents, and the second task to elicit pronouns with second-person referents (i.e., the Deaf experimenter/addressee). The overall experimental design attempted to elicit personal pronouns; however, possessive and reflexive pronouns were also included in the data when they occurred.

#### 3.3. Procedure

Participants' eye movements were monitored using iView, a head-mounted eye-tracking system (SensoMotoric Instruments, Inc.). The eye-tracking device consists of two miniature cameras: the scene camera filmed the participant's field of view, and the eye camera tracked the participant's eye movements. In the resulting video, a cursor indicating the participant's eye position was superimposed onto the image of the participant's field of view. A video camera was used to record the participant's signing and was time-locked to the eye position video via a digital mixer. The composite video also contained an image of the participant's eye, which was used to identify eye blinks and to corroborate eye gaze direction.

#### 3.4. Analysis

For each task, the full screen videotape of the participant signing was time-coded, and we transcribed sentences containing overt pointing signs (or other pronoun variants such as reflexives with a 'thumbs up' handshape or possessives with an open palm; less than 1% of the data). The transcription was used to determine (a) the exact start and end times for each sign and (b) where participants placed referents in signing space. The videotape with the eye-position cursor was used to determine gaze position.

For both pronouns with a second-person referent and pronouns with a third-person referent we performed four types of coding. First, gaze was categorized as ‘toward the location associated with the referent’ or ‘away from the location associated with the referent’. Second, gaze was categorized as having movement or no movement (i.e., a change in gaze location during the production of a pronoun). Third, gaze was coded as aligned with the manual pronoun (i.e., the hand), or not aligned. Finally, we coded each pronoun for grammatical category (subject, object, or locative) and the pronoun’s relation to the noun (occurring before, after, or instead of a noun).

Approximately 8% of the pronouns collected were not used in the study. Pronoun productions were discarded when the eye gaze data were unclear or uncodable, e.g., when the participant blinked during the production of a pronoun. Also excluded were any pronouns referring to more than one location in space (e.g., a dual pronoun, *those-two*, which referred to nouns located on the left and right in space). Using this coding system, inter-rater reliability for which signs were pronouns, the start and stop times of these pronouns, and gaze position was overall 96% (based on two coders analyzing a subset of the data).

Before analyzing patterns of eye gaze co-occurring with pronouns it was necessary to determine what constituted a pronoun in our data set. Specifically, [Bahar \(1996\)](#) and [MacLaughlin \(1997\)](#) claim that pointing signs that occur in a construction with a noun (either before the noun or after it), function as determiners and not pronouns. We therefore first analyzed pointing signs occurring with or without a noun, focusing on tokens with third-person referents because there were only two tokens of a second-person referent occurring with a noun. A paired sample *t*-test showed no significant difference in the percentage of time eye gaze was directed toward the referent location when we compared pointing signs that co-occurred with a noun (46%) versus pointing signs produced without a noun (55%;  $t(9) = .798, p = .45$  ns). This suggests that gaze patterns are similar for pointing signs whether or not they occur with a noun. Further, in our analyses of eye gaze comparing patterns of gaze for pronouns with second- or third-person referents, we considered both (1) pointing signs in isolation (uncontroverted pronouns) and (2) pointing signs in isolation along with pointing signs occurring with a noun (possibly pronouns or determiners depending on the linguistic account). Importantly, results did not differ between these two types of analyses. For ease of exposition, only results including all pointing signs are reported, and additionally, we refer to both types of pointing signs as pronouns for simplicity (leaving open the question of whether or not some forms function as determiners).

#### 4. Results

Across the two tasks, a total of 148 pronouns with a second-person referent and 480 pronouns with a third-person referent were produced with clear gaze direction. In the compare/contrast task there were 58 pronouns with a second-person referent, and 271 pronouns with a third-person referent, while in the information-seeking task there were 90 and 209 pronouns in these respective categories. Eye gaze across participants toward pronoun locations was quite variable (e.g., ranging from 11% to 100% across participants for second-person referents and from 22% to 70% for third-person referents; see [Fig. 3](#)).

We first considered whether or not eye gaze is directed toward locations associated with pronouns ([Bellugi and Fischer, 1972](#); [Baker and Cokely, 1980](#)). For pronouns with second-person referents, gaze toward the referent (i.e., the addressee) and gaze away from the referent had overall means of 60% and 40% respectively. Using a one-tailed *t*-test, and analyzing gaze toward the referent for pronouns with a second person-referent, gaze toward that referent was not found to be significantly more likely than chance (50%;  $t(9) = .498, p = .63$  ns). For pronouns with third-person referents, gaze toward the location associated with the third-person referent was similarly not more frequent than gaze away from that location (46.8% vs. 53.2%) and not significantly different from what might be expected by chance;  $t(9) = -.753, p = .47$  ns). This pattern of results indicates that for both non-first person pronoun types (i.e., second and third person), gaze was not systematically directed toward the location associated with the referent (see [Fig. 4](#)).

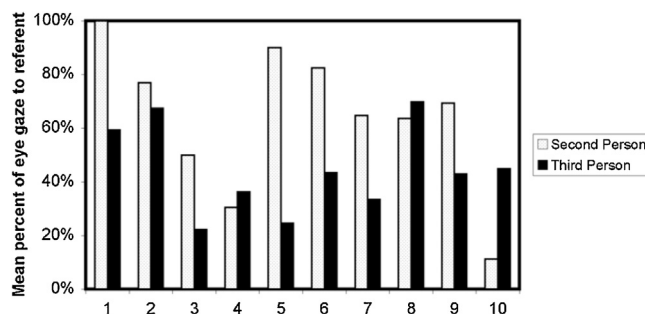


Fig. 3. Variability of gaze directed to the location associated with the pronoun across all ten subjects.

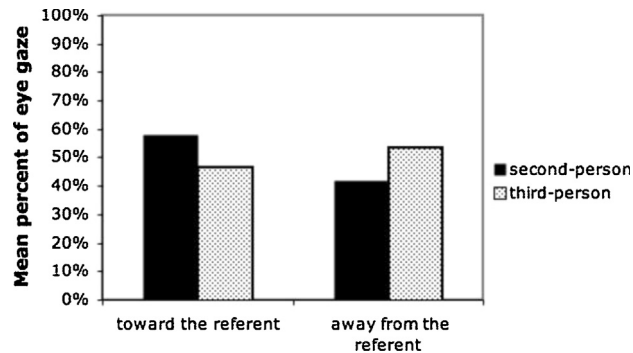


Fig. 4. Mean percentage of eye gaze directed toward referent locations and away from referent locations.

We next considered whether movement, not direction of gaze, could be the key phonological component differentiating second- and third-person pronouns. Specifically, we investigated whether eye gaze movement with second-person referents is steady state, while for third-person referents, back-and-forth eye gaze movement is used (as suggested in [Berenz and Ferreira-Brito, 1990](#); [Berenz, 1996](#)). For this analysis we coded any eye movement (e.g., from the addressee's face to the right of the addressee) regardless of whether the location of gaze coincided with the direction of the pronoun or not (e.g., a look from the addressee's face to the right when the pronoun is directed to the left of the signer). For pronouns with second-person referents, steady-state gaze with no movement was predicted (irrespective of whether this gaze was toward or away from the referent), whereas for pronouns with third-person referents, back-and-forth movement was predicted. Using one-tailed *t*-tests, steady-state gaze for pronouns with second-person referents occurred significantly more often than would be predicted by chance ( $t(9) = 6.98, p < .001$ ; see [Fig. 5](#)). Eye movement for pronouns with third-person referents was also significantly different from chance ( $t(9) = -4.22, p < .006$ ). However, gaze patterned in the opposite direction from that predicted by a movement analysis: signers moved their eyes *less* frequently than expected by chance. This result means that signers prefer not to move their eyes when producing a pronoun with either a second- or a third-person referent. Importantly, the data show no distinction between second- and third-person pronouns in ASL based on eye movement.

We next considered the Body Coordinates Model hypothesis (i.e., eye gaze and hand position of the manual pronoun aligned for pronouns with second-person referents but not aligned for pronouns with third-person referents; [Berenz, 2002](#)). For pronouns with second-person referents eye gaze and the manual point should align more frequently than chance (i.e., be directed in the same direction). Analyzing cases in which the manual point was toward the location of the second-person interlocutor, we used a one-tailed *t*-test and considered gaze toward the second-person referent. Gaze toward that referent was not found to be significantly more likely than chance (50%;  $t(9) = .498, p = .63$  ns). Under the Body Coordinates Model, pronouns with third-person referents should have eye gaze that is not aligned with the manual point. However, gaze away from the location associated with the third-person referent was not more likely than chance (50%;  $t(9) = .493, p = .63$  ns).

Next, we considered grammatical role as a possible influence on eye gaze behavior during the production of pronouns. [Senghas and Coppola \(2011\)](#) suggest that in Nicaraguan Sign Language pointing signs that have a locative function (e.g., 'here', 'there') differ from pointing signs with a pronominal function (e.g., 'he,' 'it') in that directed eye gaze occurs with pronouns that refer to locatives but not with pronouns that refer to objects. We therefore additionally compared signs with a

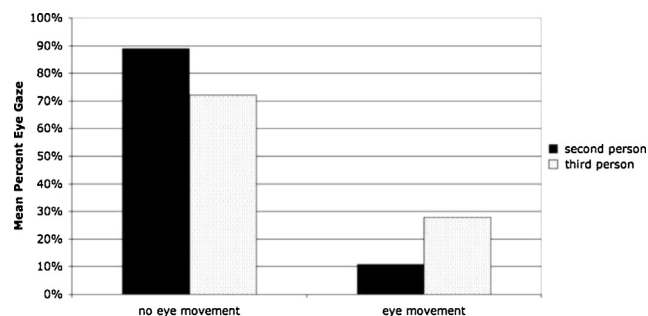


Fig. 5. Mean percentage of eye movement or steady-state gaze for pronouns with second- and third-person referents.



third-person nominal referent to those that referred to locatives. Specifically we looked at instances in which a pointing sign was directed to a location in space associated with a noun with a locative meaning: e.g., ASIA, ME NEVER TOUCH 1X-rt (there), “I have never been to Asia.” Only third-person referents were used since there were no second-person locatives for comparison. Two participants did not produce any locatives at all and were excluded from this analysis. The results indicated a significant difference between these two referent types ( $t(7) = 4.40, p = .003$ ) such that eye gaze with locatives ( $N = 49$ ) was more likely to be toward the spatial location associated with the locative referent (71.4%) compared to personal pronouns (46.6%). In Thompson et al. (2006) we argued that eye gaze agreement is driven by grammatical role. The difference found here for locatives is consistent with this claim. Furthermore, the eye gaze distinction appears to be limited to contrasting locative referents and personal pronouns: we found no differences in eye gaze patterns when we compared gaze patterns for subject versus object pronouns ( $t(9) = 1.148, p = .28$  ns).

## 5. Discussion

Our results provide no evidence that eye gaze marks a grammatical person distinction in ASL. Among the possible eye gaze patterns entertained in the introduction, we found that (1) gaze was not consistently directed toward the location of the referent when signers produced a pronoun with either a second- or a third-person referent, and that (2) there were no differences in movement patterns for eye gaze when comparing pronouns with second-person referents to pronouns with third-person referents. Finally, under the Body Coordinates Model, eye gaze for second-person referents should align with the hand (with both directed toward the addressee) while eye gaze for third-person referents should not be aligned. Thus, gaze toward a second-person referent should be more frequent than chance, while gaze toward a third-person referent should be less frequent than chance. However, we found that (3) gaze toward second-person referents did not occur significantly more than chance and gaze toward third-person referents did not occur significantly less than chance. Thus, with regard to proposals that eye gaze is a potential marker of second and third person, we found (4) no support that such a distinction is grammatically encoded during the production of ASL pronouns.

Instead, our findings support Meier's (1990) analysis of ASL as having only a first and non-first person distinction. Gaze occurring with pronouns was relatively inconsistent, did not vary dramatically across pronoun types, and exhibited a large degree of individual and task-related variation. In contrast, in previous verb production studies, directed gaze occurring with verb agreement was consistent, differed systematically across verb types, and exhibited little individual or task-related variation for both L1 and proficient L2 signers (Thompson et al., 2006, 2009). The difference between directed gaze with agreeing verbs and directed gaze with pronouns has implications for theories claiming that the use of space to indicate referents (either through manual movement or eye gaze) is driven by the same process for both agreeing verbs and pronouns. In particular, analyses that treat both verbal agreement and pronominal reference as forms of gestural pointing would need to account for the difference in gaze patterns between agreeing verbs and pronouns.

We began with a discussion of different analyses of the relationship between verb agreement and pronouns. First, the tenets of Liddell's (2000a,b) analysis predict similar eye gaze behavior during the production of verb agreement and pronouns. This is because, according to Liddell, indicating has the same gestural basis in both verbal agreement (Liddell's indicating verbs) and pronominal reference. If this analysis is correct, then eye gaze behavior for verbs and pronouns should pattern together. In other words, if directed eye gaze is simply another form of pointing, then we should expect to see it during the production of both ASL pronouns and ASL verbs. However, the data from the present study are compatible with analyses claiming both gestural and grammatical components for verbal agreement and pronominal directional morphemes (Askins and Perlmutter, 1995; Mathur, 2000; Lillo Martin, 2002; Rathmann and Mathur, 2002). While the gestural component under these analyses may be the same, there is no necessary relationship between the grammatical components of verbal agreement and pronominal reference.

While it may seem intuitive that signers will look toward real or imagined referents in signing space while pointing at them, the data do not bear this out. Instead, directed eye gaze appears determined by grammatical environment: marking agreement with verbs and for locative referents, but not for pronouns that refer to nouns (he, she, it). During verb production, eye gaze is reliably directed at locations in space associated with the arguments of agreeing verbs about 70% of the time across individual signers, tasks, and proficient L1 and L2 populations (Thompson et al., 2006, 2009; see Thompson et al., 2006 for possible reasons why this does not occur 100% of the time) and conforms to the noun phrase accessibility hierarchy (Keenan and Comrie, 1977) in marking the lowest-ranked argument in the utterance based on grammatical function. In line with this, proficient signers consistently direct their gaze at locations associated with locatives about 70% of the time across a variety of tasks, both in the present and in previous studies (Thompson et al., 2006, 2009). Eye gaze directed at spatial loci associated with personal pronouns, however, diverges markedly from this pattern: it never differs significantly from chance, and there is no detectable difference in eye gaze directed at subject vs. object pronouns. Thus directed eye gaze does not occur under all circumstances in which it might be expected if it were simply gestural (contra Liddell, 2000a,b). Overall the findings support previous claims that gaze behavior during verb production is in fact a grammatically specified element of ASL.

Our results differ from previous studies using video data that found evidence for the Body Coordinates Model (Berenz, 2002; Alibasic Ciciliani and Wilbur, 2006). Aside from the more reliable, fine-grained nature of the data available from head-mounted eye-tracking, differences between the current study and previous studies may arise from the difference in the tasks that were used. In both Berenz and Alibasic Ciciliani and Wilbur, participants were engaged in face-to-face discourse. In this environment, it may be important to maintain eye gaze with one's conversational partner. A discourse strategy of this type would result in a pattern of eye gaze that is predicted by the Body Coordinates Model: gaze toward the addressee and aligned with the manual point when producing a pronoun with a second-person referent, and gaze again toward the addressee, and therefore not aligned with the manual point, when producing pronouns with third-person referents. Interestingly, when we considered in a follow-up analysis whether discourse topic/task played a role in our observed eye gaze patterns, we found a difference between the two tasks. Across the two tasks (compare/contrast and information seeking), a similar pattern of eye gaze was observed for pronouns with a second-person referent (compare/contrast = 59.1% toward the referent; information seeking = 54.1% toward the referent). However, eye gaze directed toward the location of the referent with third-person pronouns was significantly more frequent in the compare/contrast task (54.2%) than in the information-seeking task (41%) ( $t(9) = 2.43, p = .026$ ). Thus, the interrogative nature of the information-seeking task appears to reduce gaze toward referent locations for third-person pronouns. That gaze toward the addressee occurred more frequently during the information-seeking task (primarily a dialogue) than during the compare/contrast task (primarily a monologue) for pronouns with both second- and third-person referents suggests that previous observations could have been driven by a signers' preference to maintain eye gaze with the interlocutor during face-to-face conversations.

While the data presented here bear most directly on issues surrounding ASL pronoun marking, there are strong typological similarities across all signed languages studied to date in the use of space to mark reference. Thus, while some caution is in order, from a broader viewpoint the findings reinforce a basic difference between signed and spoken languages. Namely, many sign languages appear to grammatically encode a two-person system, while spoken languages appear to universally encode a three-person system in the grammar.

One possible explanation for the difference in person marking lies in the relative amount of ambiguity that exists within the two language types (signed vs. spoken) with regard to person marking. For signed languages, a two-person distinction may be sufficient because communication proceeds clearly with respect to the actual referent. The gesture that occurs with pronouns and verb agreement in signed languages serves to uniquely identify the intended discourse referent, allowing signed languages to distinguish, not just between second- and third-person referents, but among each individual referent in the discourse. For example, the pronoun *she* in English picks out a class of referents (third person females), while a non-first person pronoun in ASL picks out a specific individual (e.g., *Mary*) (Lillo-Martin and Klima, 1990). The end result is that there is no loss of clarity because of the absence of a grammatical second and third person. Conversely, for spoken languages, more grammatical distinctions may arise as a way of more clearly disambiguating referents.

In support of this hypothesis, not only do spoken languages encode a three-person system, but other disambiguating information as well (e.g., in addition to number, gender, case, proximity to the speaker, etc.) that is rare or non-existent in signed languages (gender marking for example is found in only a handful of related signed languages and appears to be used in more ambiguous classifier constructions: Nihon Shuwa [Japanese Sign Language], Korean Sign Language and Taiwanese Sign Language – Fischer, personal communication; see also Fischer and Osugi, 2000).

Importantly, in a case in which ambiguity does arise, our data suggest that signers make use of eye gaze. Note that pronominal reference in ASL is not always unambiguous. For example, a locative referent (e.g., New York) and a nominal referent (e.g., Bob) can be assigned the same location in space ('Bob lives in New York'). In this case a pronoun directed at this location could refer to either to the locative or the nominal (Emmorey and Falgier, 2004). Importantly, in such a case, our data suggest that signers make use of eye gaze to mark locatives, but not pronouns. Eye gaze, therefore, appears to help to distinguish between two potential meanings and reduce ambiguity when it exists. This is a potential area for further exploration across different signed languages.

To conclude, the eye-tracking data clearly show that eye gaze does not serve to mark the grammatical distinction between second and third person pronouns. However, we provide preliminary evidence that eye gaze serves as a marker for locative pronouns as has been claimed for other signed languages. We suggest that this function of eye gaze may arise to reduce possible ambiguity.

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