

EYEGAZE IN BIMODAL BILINGUAL CHILDREN AND THEIR INTERLOCUTORS

Kadir Gökgöz

Linguistics Department, University of Connecticut, 365 Fairfield Way, Unit 1145, Storrs, CT, 06269-1145
(860) 486-4229
kadirgokgoz@gmail.com

Ronice Müller de Quadros

Universidade Federal de Santa Catarina, Centro de Comunicação e Expressão - Letras Libras
Departamento de Libras, Campus Universitário Reitor João David Ferreira Lima, Trindade
Florianópolis/SC/Brasil
88040-900
ronice.quadros@ufsc.br

Diane Lillo-Martin

Linguistics Department, University of Connecticut, 365 Fairfield Way, Unit 1145, Storrs, CT, 06269-1145
(860) 486-4229
diane.lillo-martin@uconn.edu

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Abstract

We investigate the eyegaze behavior of Bimodal Bilingual children who use a sign language and a spoken language and their interlocutors from a linguistic and developmental perspective. Parallel to previous research (Lillo-Martin & Meier 2011 and Thompson et al. 2013), we found that eyegaze does not differentiate non-first person pronouns in a categorical/morphological manner, contrary to some predictions. Rather, eyegaze has discourse/pragmatic and developmental roles in that its distribution is shaped by the needs of the interlocutors. Eyegaze in adult-to-child interactions is used to establish joint attention (Lieberman et al. 2011, 2014) and to maintain the attention of the child and the adult on the task with very little affordance for looking away, contrasting with eyegaze in an adult-to-adult context where there is more affordance for the adults to look away to keep the conversational floor (cf. Baker 1977).

1. Introduction

Eyegaze is an intentional act of looking at a thing, person or location and it seems to be indispensable for Sign Languages (SLs), which employ the visual-gestural mode of expression for externalization of the abstract human linguistic code (Sandler and Lillo-Martin 2006). SLs employ not only the hands, which are known as the manual articulators, but also the upper body including the torso, the head and finer articulators on the face, which are known as nonmanual markers (see Quer and Pfau 2010 for a recent review). While manual markers express signs which constitute the segmental skeleton, nonmanual markers operate on this segmental component to encode information about clause types, information structure, discourse organization, intonation/prosody and adverbial meaning. In this regard, nonmanual markers are an essential part of the grammar of a SL. Eyegaze is considered among these nonmanual markers and different roles have been ascribed to it. The fact that eyegaze is omnipresent in normally functioning linguistic-communicative contexts of signing has made it gather due attention from sign language researchers of diverse interests.

From a linguistic point of view, some researchers proposed that eyegaze marks person/participant distinctions in collaboration with pronominal pointing signs (Bellugi and Fischer 1972; Baker and Cokely 1980; Berenz and Ferreira-Brito 1990; Berenz 1996, 2002; Alibašić and Wilbur 2006), while others reported that signers' behavior does not support this claim (Thompson et al. 2013). We will discuss this debate and add our contribution to it in section 2.

Eyegaze has also attracted the attention of developmental psychologists. For instance, Brand et al. (2007) found that during infant-directed actions (*motionese*, citing Brand et al. 2002), duration of eyegaze behavior of mothers differed based on the age of their children, i.e. "shorter more frequent gazes and more exchanges characterized demonstrations to older versus younger (*hearing*) infants (p.1)". Furthermore, Lieberman et al. (2011, 2014) found that eyegaze helps to establish joint attention in signing children. Holzrichter & Meier (2000) note, "unlike hearing children acquiring a spoken language, deaf children acquiring a signed language can choose not to attend and thus control when they receive input. Mothers of deaf children must therefore monitor their children's attention more closely than (speaking) mothers of hearing children (p: 27)." One way of checking a child's attention is by means of eyegaze. Therefore, Holzrichter and Meier (2000) were interested in the possible influence of parent-child eye contact on parents' signing, as part of an investigation of child-directed signing in ASL. They investigated the relation between

eyegaze and modifications in the form of signs such as repetition of a sign, duration, location and how big/small a sign was made. Overall, Holzrichter and Meier (2000) found that there is either direct eye-contact between the child and the mother (55% of all times), or in the absence of direct eye-contact the mother makes the signs visibly accessible to the child by signing them on the child's body (13%) or by leaning or signing into the child's visual field (21%). In total, the mothers make sure that their children see the input in 89% of the time. Holzrichter and Meier (2000) note that these findings are "consistent with the view that child-directed signing functions as an attention-getting device ... increasing the amount of input that children receive (p: 37)" and "deaf parents ... are closely attuned to their child's focus of attention and adjust their signing accordingly (p: 37)".

Developmentalists are not alone in proposing that eyegaze is instrumental in the organization of the broader communication, of which joint attention can be regarded a subcomponent. Another aspect of the broader communication has to do with turn-taking strategies. In this sense, Baker (1977) notes for ASL that, among other cues, -GAZE (looking away from the addressee) is a continuation regulator for keeping the conversational turn (citing Wiener and Deveau 1974), used by the speaker during an ASL conversation between adults; while +GAZE (looking at the addressee), among other cues, is a shift regulator helping to yield the conversational turn to the addressee.

Similarly as cited by Wilbur and Petitto (1983), Kendon (1976) reports the role of differential eyegaze behavior in turning the conversational floor to the addressee and the addressee's picking the turn up in spoken conversations. For the former situation, Wilbur and Petitto (1983) cite Kendon (1976) in noting that eyegaze at the addressee is sustained by the speaker while in the latter Kendon (1976) is cited by Wilbur and Petitto (1983) in noting that the addressee looks away as s/he begins their turn. In this respect, the same kind of differentiated eyegaze behaviors to maintain and yield the conversational turn seems to be shared between speech and sign conversations.

This background demonstrates that eyegaze might be functioning on an organizational level broader than a categorically motivated structural level, such as a morphological/featural level. Since eyegaze may be functioning in this broader level of communication, its distribution may be expected to be shaped by the requirements of the discourse-pragmatic context such that differentiated portions of eyegaze behavior types may take place as a factor of discourse organizational needs of interlocutors and the situation they are in. For

instance, a reasonable prediction might be that proportions of eyegaze behavior during pointing are different in child-directed language than adult-directed language. Lastly, it is also possible that eyegaze would have both a categorical/morphological function and a discourse-pragmatic function.

We evaluate linguistic and developmental proposals regarding the function of eyegaze with data from Bimodal Bilingual (Bibi) children, who grow up acquiring a sign language and a spoken language naturally at the same time. The current data has unique differences from previous studies from which it gets its inspirations and motivation. Several comparisons are possible in the current study. First of all, we use data from Bibi children and their interlocutors to contribute to testing proposals regarding eyegaze as a categorical/morphological part of pronominal signs. Furthermore, we can compare children's eyegaze behavior to adults' eyegaze behavior in both sign and speech to detect possible developmental aspects. Lastly, we can compare eyegaze behavior of adult participants in this study, who are interacting with children, to the adults in other studies, who are interacting with other adults. For these reasons, we believe that our study will contribute to our understanding of eyegaze behavior during pointing not only from a linguistic perspective but also from a developmental perspective as well.

In section 2, we will provide detailed background on the issues and put forward our research questions. Section 3 is methodology where we describe participants, data collection and annotation in detail; section 4 is the results & discussion and section 5 is the conclusions.

2. Background

A priori there are three possible roles in a conversation: a speaker (or sender of information); an addressee (or receiver of information); and a non-addressed, non-speaker participant who is involved in a conversation by virtue of being talked about. So far, nothing is said about the actual linguistic forms thanks to which these semantic roles are expressed/externalized. In this sense, when one talks about pronouns, which are linguistic items that may involve person, number, gender or case features, one talks about linguistic forms that map semantic roles to linguistic expressions which in turn obey categorical/linguistic rules of language. One needs to keep this distinction in mind since it is not our intention in this paper to generate the wrong impression in the reader that a sign language does not make those communicative-intentional distinctions as also clearly noted by Meier (1990). We also do not deny the possibility that grammatical person marking distinctions may

independently exist in other linguistic forms such as imperative inflection on verbs independent of the categorial marking (or its absence thereof) of certain person distinctions on pronouns (see Quer 2011 for a discussion).

Discussions of pronominal signs and person distinctions in SLs go back to the 1970s (Friedman 1975; Klima & Bellugi 1979). To start with, it has not been truly uncontroversial to propose the existence of pronouns in a sign language. For instance, some researchers proposed that pointing signs, which are considered to be pronouns by some other researchers, are gestures, i.e. non-linguistic, perhaps akin to pointing gestures in speech (Liddell 2003). However, there are several pieces of accumulating evidence for the linguistic status of pointing in SLs. This evidence includes the fact that pointing signs are used anaphorically (Meier 1990); that pointing signs are not restricted to functioning as pronominals but they may also play other linguistic roles such as functioning as determiners and adverbial-locatives (MacLaughlin 1997) or demonstratives (Koulidobrova and Lillo-Martin in press); that there are morphological restrictions in the form of pointing signs during plural formation (Cormier 2002); the system-internal role of pointing signs in structural phenomena such as subject pronoun copy (Padden 1983); aspects of the developmental trajectory of pointing signs such as reversal errors (Petitto 1987) and a period of time which is characterized by avoidance of points to self (Petitto 1987; Hatzopoulou 2008, Author 2015, in prep.). Such evidence leaves no doubt in the minds of some researchers that pointing is part of the linguistic system of a sign language.

Following up on the debate about the status of pointing signs, i.e. if gestural or linguistic, Cormier et al. (2013) argue that pointing signs bear both linguistic and gestural characteristics. They use five criteria: referentiality, participant roles, number/plurality, syntactic distribution, and grammaticalization.

With respect to referentiality, Meier (1990) first pointed out the possibility of index shift in ASL as evidence for the grammatical status of pointing signs (i.e. pointing to self can shift its reference from first person to a non-first person). For this aspect, Cormier et al. (2013) note that pointing signs behave the same way as pronouns in speech and pointing gestures in co-speech: they all display index shift.

For the expression of number, Cormier et al. (2013) note that pointing signs are more similar to pronouns in speech than co-speech pointing gestures. They note that while not all SLs have a lexicalized first person plural form, some SLs such as ASL and BSL have a lexicalized form for first person plural. Instead of indicating the referents of a first person plural set by pointing to individual referents in that set in addition to

the speaker's own chest (which is shared by pointing in co-speech gesture but not pronouns in speech), ASL uses pointing to the chest twice (first with contact to the ipsilateral and then to the contralateral side of the chest) as the lexicalized plural form for first person parallel to a lexicalized plural pronoun in speech. (See Figure 1.)

[Figure 1 here]

Meier and Lillo-Martin (2013) cite Frishberg (1975) who traces the historical change in the form of the first person plural sign. They cite the historical form to be: "a series of separate thrusts, sometimes as many as five or six, first pointing at one's own chest, then at three or four other persons (real or imagined) and finally at the chest again" (Frishberg 1975: 50 cited in Meier and Lillo-Martin 2013). In contrast to the historical expression of plurality for first person, the contemporary form of the first person plural pronoun, as we observe in Figure 1, only touches two sides of the chest without pointing to other members in the reference set of *we*. Therefore, Meier and Lillo-Martin (2013) argue that the sign has become "deindexicalized". In other words, it has become grammaticalized. This proposal is also agreed upon by Cormier et al. (2013).

Although Meier and Lillo-Martin (2013) and Cormier et al. (2013) agree upon the proposal that the plural form of the first person pronoun is lexicalized, Cormier et al. (2013) claim that there is no evidence for distinguishing singular forms of pronouns. In this regard, as opposed to Cormier et al. (2013), Meier and Lillo-Martin (2013), following Meier (1990), propose that there is a linguistic difference between the forms of the first person pronoun vs. non-first person pronouns. Meier and Lillo-Martin (2013) note that, phonologically, the three parameters that make up a sign, i.e. handshape, movement and location, are lexically specified for the form of the first person pronoun. Most crucially, the location of the articulation of the first person pronoun sign is the signer's chest, Figure 2a. However, the location of the addressee or non-addressed referents depends on where those participants are located in actual or imagined space, Figure 2b.

[Figure 2 here]

In the case that a third person referent is spatially bound to the left side of the signer and another third person referent is bound to the right side of the signer, pointing to the right vs. to the left makes a non-arbitrary difference in picking up a referent. Likewise, depending on where the addressee is located, pointing to the addressee implements space in a non-arbitrary manner: thus the location (which is one of the three phonological parameters determining the phonological shape of a sign as we noted above) cannot be

phonologically determined for a third person or the second person referent. Following Meier (1990), Meier and Lillo-Martin (2013), thus, conclude that, phonologically, the first person pronoun form in ASL is conventionalized, i.e. show duality of patterning, while non-first person pronouns in ASL use space in a non-arbitrary way.

Syntactically, Cormier et al. (2013) note that pointing signs are more similar to pronouns in speech than pointing in co-speech gesture. In agreement with this proposal, Meier and Lillo-Martin (2013) cite Schlenker and Mathur (2010) who also note that the syntactic distribution of pointing signs is restricted by linguistic principles such as binding (Chomsky 1981) in addition to other well attested syntactic distributions of these signs.

As for grammaticalization, Cormier et al. (2013) note that more evidence is needed to compare grammaticalization of pronouns in speech with grammaticalization of pointing signs. As opposed to Cormier et al. (2013), Meier and Lillo-Martin (2013) cite abundant evidence that grammaticalization of pointing has been attested in several SLs. The summary of those studies is that when a sign language develops over time, younger generations use pointing signs more systematically than older generations; reference to people increases while reference to locations remain stable, i.e. nominal use develops over time while a locative/predicative use is the starting point, and grammatical marking of the first person form develops later than non-first person forms, and is used more systematically by younger generations (Engberg-Pedersen 1993; Pfau and Steinbach 2006; Senghas and Coppola 2010; Meir 2012 as cited in Meier and Lillo-Martin 2013). These findings not only show that pointing signs are grammaticalized over time but also that the grammaticalization occurs in a piecemeal manner wherein nominal use of pronouns as well as first person forms develop later on.

To refute the claim that first person has a special linguistic status, Cormier et al. (2013) propose that the form of the first person pronoun in a SL is akin to pointing to one's chest during co-speech gesture to refer to oneself. This is the case in Western Societies as Cormier et al. (2013) note. In Japan, it is cited by Cormier et al. (2013) that a speaker may point to their nose in their co-speech gesture to refer to oneself (Poyatos, 2002:26 as cited in Cormier et al. 2013). Similarly, in Japanese SL, Smith and Ting (1979) is cited by Cormier et al. (2013) to note that first person can be indicated by pointing to the nose. Thus, Meier's (1990) claim about idiosyncrasy of the first person form, Cormier et al. (2013) suggest, is questionable. We already pointed

out phonological evidence for the special status of first person pronoun above after Meier (1990) and Meier and Lillo-Martin (2013). In further response to Cormier et al.'s (2013) argument, we should point out that it is not unattested for a gesture from the surrounding speech community to become part of the linguistic system of a sign language. For instance, a gesture for expressing negation is a side-to-side headshake in Western Societies and it has been proposed that side-to-side headshake has been grammaticalized into SLs in Western Societies. It has also been noted that when side-to-side headshake is used as a grammatical nonmanual marker, its behavior is different than the similar looking gesture in English (Baker-Shenk 1983). To give an example, negative side-to-side headshake has been observed to cover linguistic constituents to have scope over them in ASL (Baker-Shenk 1983; Neidle et al. 2000; Pfau and Quer 2003; Goodwin 2013) while we are not aware of such behavior in the similar looking co-speech gesture. Also, although several speech communities use side-to-side headshake as a gesture of negation, the syntactic behavior of side-to-side headshake in SLs displays cross-linguistic differences (Author 2011, in prep; Goodwin 2013; Pfau 2016). Only after careful linguistic investigation did researchers prove that the form of side-to-side headshake in sign languages, despite looking similar on the surface to the side-to-side headshake in speech, has become part of the linguistic system of respective sign languages. Therefore, it does not seem to be a conclusive argument to bring up that people point to their chest in Western societies and to their nose in Japan in their co-speech gesture to disprove the special status of first person without documenting if the co-speech pointing gesture has the same kind of behavior with the linguistic form of first person pointing across the relevant spoken languages and sign languages. To the best of our understanding, such evidence is not provided in Cormier et al. (2013) and thus the surface similarity that they note remains to be investigated more deeply.

All in all, Cormier et al. (2013) propose some potentially relevant criteria for determining the linguistic status of pointing signs. Our review of their discussion leads us to reject their conclusion that no grammatical distinction is made in the singular forms of pronominal signs.

We adopt here the view that pointing works as a pronominal sign as one of its linguistic functions¹ (irrespective of its gestural characteristics, if any). For part of this study, we are interested in what kind of

¹ But cf. Koulidobrova & Lillo-Martin (in press) for an argument that non-first forms are demonstrative rather than personal pronouns.

finer linguistic distinctions are made in the pronominal use of pointing signs: more specifically for this study, what person/participant categories are linguistically marked in the form of pointing signs. There have been three proposals in the literature about how many person distinctions there are in the pronominal system of a sign language.

The three proposals about person distinctions can be labeled (i) *no person distinctions account*, (ii) *only two persons account* and (iii) *three persons account*. Figure 3 illustrates these proposals on signing space, which is the space in front of the signer that extends to the right and left with a comfortable reach of the hands. Signing space is shown by a semicircle in the figures while the proposed person distinctions are shown by numbers: 1 for first person, 2 for second person and 3 for third person. We will provide more details about each account in turn.

[Figure 3 here]

First we should note that in pedagogical grammars describing ASL (for instance Baker-Shenk and Cokely 1991), all of the three person distinctions are assumed as in Figure 4:

[Figure 4 here]

The real position of the addressee constitutes the locus, i.e. spatial location in space, towards where the so-called second person pronoun is pointed. Likewise, the position of an actual third person constitutes the locus for that referent, towards where the so-called third person pronoun points. However, a third person referent does not need to be on the right or the left of the signing space. They can be directly in front of the signer as well. Similarly, a second person referent does not have to be directly in front of the signer. They can be located on the left or the right as well, as we already represented in Figure 2b above. This observation is the basis for one objection to the view that second and third person are grammatically distinguished in these pointing signs.

Lillo-Martin & Klima (1990) were concerned with the issue that pointing can be directed to a theoretically unbounded number of spatial loci in signing space. The location toward which a pronoun points is determined by a number of factors, potentially including the actual physical locations of the referents. Resisting the possibility that such real-world information is part of the lexical specification of a sign, and furthermore noting that it is impossible to list all spatial loci where a pronominal sign can be directed to, they argued for a single linguistic form of pointing which is accompanied by referential indices assigned to

referents in the discourse, and maintained through establishing them in referential loci (which they called R-loci). Therefore, the single personal pronoun form is anchored to all conceptual person distinctions (Figure 3c) by means of a Discourse Representation mechanism, which combines the single morphological form with R-loci in space to result in an implementation where a pointing sign is pointed to referentially distinct locations.

However, it is difficult to account for the special status of first person forms in an account such as Lillo-Martin and Klima's (1990). There are a number of reasons to recognize first-person as having a distinct form, unlike the other uses of pointing, as first identified by Meier (1990) and further noted by Meier and Lillo-Martin (2013) as we also cited above. Meier (1990) argued that there is a two-way pronominal distinction, which is between first vs. non-first person forms; and he provided additional arguments that no distinction exists between second and third person forms in the pronominal system of American Sign Language (Figure 3b). He finds several pieces of evidence for a grammatical distinction between first person vs. non-first person forms (see also Meier & Lillo-Martin 2013; Lillo-Martin and Meier 2011).

Meier (1990) noted that the locus for first person forms is lexically specified: it is the signer's chest for ASL (and many other sign languages). While the listability problem pointed out by Lillo-Martin & Klima (1990) potentially exists for the non-first person forms, there is no problem putting a lexically-specified form for first-person in the lexicon since, as we already cited above, all the phonological parameters are lexically specified for the first person form (Meier 1990, Meier and Lillo-Martin 2013). As we also noted above, in Japanese SL, there is also the possibility for pointing to one's nose for the first-person pronoun. Touching the nose for indicating person is only possible for first person but it is not found as a grammatical form for other persons in Japanese SL (or in any other sign language attested so far). Such idiosyncratic behavior distinguishes first-person forms from non-first person forms. Lastly, as cited in Meier and Lillo-Martin (2013), Pizzio, Rezende and Quadros (2009) report that Brazilian Sign Language (Libras) has a B-hand-shaped² possessive form that is only used with first-person possessors while there are two more possessive forms which can be used with all persons. Form-wise, these pieces of evidence commonly point to a grammatical distinction between first and non-first persons but crucially not to a distinction between second

² Open handshake with the thumb extended, palm facing up.

and third persons. The two-way distinction between first vs. non-first person forms is also proposed to hold for Danish Sign Language (Engberg-Pedersen 1993) and Taiwan Sign Language (Smith 1990).

So far, we have cited evidence based on the manual forms, i.e. how a pronominal sign is signed on the hands. However, some researchers who claim that there is a three-way distinction among first, second and third person forms in sign languages (Figure 3a), proposed that instead of concentrating on the manual form *per se*, one should also take into consideration the use of nonmanual markers for distinguishing second person from third person. These authors suggested that eyegaze behavior marks the difference between the morphological expression of second person and third person pronouns (Bellugi and Fischer 1972; Baker and Cokely 1980; Berenz and Ferreira-Brito 1990; Berenz 1996, 2002; Alibašić and Wilbur 2006). We will consider possibilities that have been proposed for a variety of sign languages, keeping in mind that different sign languages could use eyegaze with pointing in different ways.

Bellugi and Fischer (1972) and Baker & Cokely (1980) argue for ASL that eyegaze is directed to where the addressee is while pointing to addressee; and eyegaze is directed to where the third person referent is while pointing to a third person referent. Since this distinction requires knowledge of the physical location of referents, using such a difference as definitional would be circular in nature, but we will still consider this possibility in our study. Let's call this view the eyegaze-pointing alignment perspective.

For Brazilian Sign Language (Libras), Berenz and Ferreira-Brito (1990) proposed that, during second person pointing signs, eyegaze to the addressee is steady, while there is back and forth eyegaze movement from a third person to an addressee during pointing to a third person. Let's call this view the steady-state vs. movement cue perspective.

Lastly, Berenz (2002) argues for Libras again that eyegaze aligns with pointing to addressee for second person, while alignment of pointing with eyegaze to that referent is not observed for a third person form. This behavior is also proposed to be operative in Croatian Sign Language (HZJ) by Alibašić and Wilbur (2006). Let's call this view the differential alignment perspective. Figure 5 illustrates the claimed morphological expression of second and third person forms according to this third view.

[Figure 5 here]

According to Figure 5, the second person form is argued to be morphologically, thus categorically, expressed by means of the alignment of pointing to addressee with eyegaze to addressee, whereas such alignment is argued to be not the case for a third person form.

Lillo-Martin and Meier (2011) checked the *differential alignment hypothesis* for ASL with adult-to-adult data. They looked at eyegaze produced during points to self, addressee, and non-addressed referents in a 24-minute sample of signing. They divided referents of pointing signs into three groups: self, addressee and non-addressed referent. They found that during pointing to self, eyegaze is directed to the addressee for 60% of the time (but not 100% of the time as any categorical hypothesis cited above would predict), to the non-addressed referent for 6% of the time and some other location, which is away from the addressee and the non-addressed referent, for 34% of the time. During pointing to the addressee, they found that eyegaze was directed to the addressee for 67% of time and in the remainder of the time (33%), eyegaze was directed to some location away from the addressee or a non-addressed referent. Lastly, Lillo-Martin and Meier (2011) found that during pointing to a non-addressed referent, eyegaze was directed to the addressee for 63% of the time, to a non-addressed referent for 31% of the time and to a location away from the addressee and a non-addressed referent for 6% of the time.

Johnston (2010) notes for Australian Sign Language (Auslan) that points to addressee usually occur with gaze to addressee – but alignment between point and gaze is also common in points to non-addressed participants. Although it is not as high as gaze to the addressee while pointing to the addressee, the sample from Lillo-Martin and Meier (2011) supports Johnston (2010) in that there is some eyegaze alignment for the non-addressed referents while pointing to them. Thus, Lillo-Martin and Meier (2011) conclude that there is no differential alignment of eyegaze and pointing to differentiate second person from third.

We have just cited discussions about the role of eyegaze in making linguistic distinctions for person marking in pointing signs. In summary, some linguists proposed that eyegaze behavior differentiates second person marking from third person marking (Bellugi and Fischer 1972; Baker and Cokely 1980; Berenz and Ferreira-Brito 1990; Berenz 1996, 2002; Alibašić and Wilbur 2006) while some other researchers didn't observe conclusive evidence to this effect (Meier and Lillo-Martin 2011; Thompson et al. 2013). Following this discussion, our first research question is if eyegaze behavior differentiates second person marking from third person marking in pointing pronouns. Our contribution to this angle is due to the fact that we offer data

from Bibi children and their interlocutors with respect to this question, which, to the best of our knowledge, is lacking in the literature.

Next we will consider discourse-pragmatic and developmental issues that eyegaze behavior is relevant for and accordingly formulate our second research question.

Remember that, based on their results in the 24-minute corpus of ASL, Meier and Lillo-Martin (2011) proposed that eyegaze behavior does not differentiate second person from third person. However, by looking at their results one wonders if the distribution of eyegaze is random or if the distribution is meaningful in the light of consideration of other possible functions.

Wilbur (2013) conducted a chi-square analysis on Lillo-Martin and Meier's (2011) results to find that the entire distribution is not random ($p=.028$ her own analysis). Wilbur further observed that about two-thirds of the time, eyegaze is directed to the addressee in all conditions as also noted by Meier and Lillo-Martin (2011). Then, Wilbur (2013) considers the rest of the distributions. She notes that if there were no difference between pointing to second vs. third person with respect to the distribution of eyegaze, we would expect to find the distribution of eyegaze directed to a non-addressed referent and other to be equal at around 20% each, as would be expected by chance.

However, gaze to a non-addressed referent during pointing to them is 31% and perhaps not distributed by chance. This pattern shows that while pointing to a third person, eyegaze is either to the addressee (63%) or to the third person (31%) with very little looking away (6%). On the other hand, when the speaker points to the addressee, there is no eyegaze to a third person referent. In such a situation, the speaker looks at the addressee 67% of time, and the rest of the eyegaze (33%) is directed to some other place rather than the addressee or a non-addressed referent.

Remember that we cited Baker (1977) in the introduction who discusses the discourse-pragmatic role of eyegaze behavior. According to Baker (1977) looking at the addressee (+GAZE), among other cues, is a shift regulator turning the conversational turn to the addressee, while looking away from the addressee (-GAZE) is a continuation regulator for keeping the conversational turn (citing Wiener and Deveau 1974).

Following Baker (1977), one can think about the distribution of eyegaze in Lillo-Martin and Meier's (2011) results on a discourse-pragmatic level which may address the non-random distribution one observes as duly noted by Wilbur (2013). A signer uses two relevant gaze behaviors while pointing to a non-addressed

referent: gaze either directed to the addressee (63%) or to what is talked about (i.e. non-addressed referent, 31%). These two behaviors may be used to collect and maintain the attention of the addressee while pointing to a third person referent (i.e. a person, thing or location). As for eyegaze behavior during points to addressee, since the direction of eyegaze is not to a third person referent but to another direction for 33% of time, this latter behavior might signal that the speaker is averting her eyegaze away from the addressee for 33% of the time. This latter gaze behavior may then be regarded as a strategy allowing the speaker to keep the turn by avoiding eye-contact with the addressee following what Baker (1977) proposed. Perhaps, there might be a tension between keeping the turn and keeping eyegaze on the addressee. In this respect, it seems to us that two discourse-pragmatic factors might be lying behind the differentiated eyegaze behavior in Lillo-Martin and Meier's (2011) results, namely keeping attention on an object or in the conversation (which is what happens with eyegaze behavior during pointing to a third person referent) vs. not wishing to give the turn to the addressee (which is what happens with eyegaze behavior during pointing to the addressee).

As we noted in the introduction, eyegaze is also considered from a developmental perspective. Lieberman et al. (2011, 2014) studied the use of eyegaze with signs (not restricted to pointing) during book reading and playing with toys by deaf signing children (with deaf parents) versus hearing English monolingual children. The four deaf signing children were between the ages of 1;09 and 3;07. They found that gaze to the addressee (mother) was very common overall in deaf children (33%). They also found that deaf children look at the objects that they are playing with for 62% of the time. The gaze-away behavior was only at the rate of 6% in deaf children. Lieberman et al. (2014) also detected quite a few instances of shifting gaze from addressee to object, or vice versa. Lieberman et al. (2011) compared the 4 deaf signing children to 4 hearing children between ages 1;10 and 3;06. For the hearing group of children, gaze to addressee was almost nonexistent (1%). Hearing children looked at the objects that they played with for 86% of the time and looked away from their mother and the objects that they talk about for 12% of time. Moreover, very few gaze shifts occurred in this group of children. To be more precise about eyegaze shifts, while Deaf children displayed 15 instances of eyegaze shifts per minute, hearing children displayed only 1 instance of eyegaze shift per minute. Lieberman et al. (2014) report that this difference is statistically significant.

Based on the difference between deaf and hearing children, Lieberman et al. (2014) concluded that eyegaze shift is a modality-specific mechanism for joint attention in Deaf signing children: "the current results

expand our understanding of how joint attention adapts to a unique situation in which all language input is perceived visually. While hearing infants perceive auditory language input while visually attending to objects and events, deaf infants achieve a parallel level of coordinated information through meaningful and frequent eyegaze shifts and through careful monitoring of adult cues (p: 33)."

While Lieberman et al. (2011, 2014) worked with monolingual children learning English and others learning ASL, remember that our data come from BiBi children and their interlocutors. In this respect, based on the fact that Bibi children communicate with both their deaf parents and hearing adults, how do their eyegaze patterns develop? Do we observe eyegaze behavior that is similar to what deaf children come to develop or is it similar to what hearing children come to develop? In addition, we were curious about the eyegaze behavior of the adults. As we already noted above, Lillo-Martin and Meier (2011) reported certain eyegaze behavior during adult-to-adult interaction. In this sense, we were also curious if child-directed eyegaze would differ from eyegaze behavior in an adult-to-adult context.

We hypothesize that there might be differential eyegaze behavior in adults between adult-to-adult and adult-to-child conversations since the discourse-pragmatic contexts are different from each other. The adult-to-adult situation is the default situation, i.e. what takes place between adults on a daily basis, whereas the adult-to-child situation is a situation wherein the adult not only needs to converse with the child but also to keep an "eye" on the child to make sure that the child is attending to the speaker and participants in the conversational task. In this sense, it is feasible to predict that off-task eyegaze behaviors, those instances of eyegaze behaviors that are averted from the addressee or a non-addressed participant talked about, will be kept to a minimum in adult-to-child situations. So, our second research question is whether eyegaze behavior differs as a factor of the discourse-pragmatic situation, in this case tied to the developmental fact that the adults are conversing with children. To summarize the research questions in this paper:

- 1) Does eyegaze categorically differentiate second person from third person in the pronominal system?
- 2) Does eyegaze differentiate discourse-pragmatic contexts such that a different role in child-directed language is observed for eyegaze than the attested role of eyegaze in adult-directed language?

3. Methodology

3.1 Participants

The child participants in this study are four Bibi children, two from the USA (Ben and Tom) and two from Brazil (Edu and Igor), who are part of the larger project [Name and references to be added after reviewing]. All child participants have at least one deaf parent and relatively equal exposure to both a sign language and a spoken language. Adult participants in sign-target sessions are the child's deaf parent or a deaf research assistant. Adult participants in speech-target sessions are hearing signers.

3.2 Data

Data for the current study come from longitudinal data collection sessions where the Bibi children play with the adult interlocutors in a familiar setting. Sessions were designated sign- or speech-target based on the primary interlocutor(s). However, contexts were highly bilingual and language mixing was common. Table 1 reports the data used for this study.

[Table 1 here]

For Ben, data with both him and his adult interlocutors have been coded from four speech-target (English) and four sign-target (ASL) sessions. The age range of Ben for these sessions is 2;00-3;00. The total number of pointing signs annotated for Ben is 371 while the total number of pointing signs annotated for the adults in Ben's sessions is 384. The data from adult participants are collapsed for each session type. For instance, if one of Ben's sign-target sessions is with the mother and another one is with a deaf research assistant, we combined the results from those two sessions for reporting in this study.

For Tom, data were coded for the child from two speech-target sessions (English) and three sign-target sessions (ASL). Data from Tom's adult interlocutors were not coded. The age range for Tom for the sessions in this study is 1;11-3;00. The total number of pointing signs annotated for Tom is 96.

For Edu, data with both the child and his adult interlocutors have been coded from three speech-target sessions (Brazilian Portuguese, BP) and three sign-target sessions (Brazilian Sign Language - Libras). The age range for Edu for these sessions is 2;00-3;03. The total number of pointing signs annotated for Edu is 67 while the total number of pointing signs annotated for the adult interlocutors in Edu's sessions is 189.

For Igor, data with both the child and his adult interlocutors have been coded from three speech-target sessions (Brazilian Portuguese, BP) and three sign-target sessions (Brazilian Sign Language - Libras). The age range for Igor for these sessions is 2;02-3;01. The total number of pointing signs annotated for Igor is 395 while the total number of pointing signs annotated for the adult interlocutors in Igor's sessions is 276.

We coded the data in ELAN (Max Planck Institute for Psycholinguistics, Brugman and Russel 2004; Crasborn and Sloetjes 2008). The coding consisted of the following values for the classification of pointing signs:

- (1) Values for the Classification of Pointing Signs
 - IXspeaker: signer/speaker pointing to themselves
 - IXaddressee: signer/speaker pointing to the addressee
 - IXperson: signer/speaker pointing to a non-addressed person
 - IXthing: signer/speaker pointing to an object
 - IXlocation: singer/speaker pointing to a location

Note that the values in (1) are a priori semantic ones. They are based on referential distinctions. Rather than claiming that the forms are distinguished between different persons in morphologically distinct/categorical ways, for instance, the coding simply indicates the referent of the pointing sign. For this reason, a priori semantic terms such as speaker, addressee, person, thing and location are used. The last three kinds of referents are usually subsumed under non-speaker, non-addressee; that is a third person referent.

We also coded eyegaze behavior accompanying each pointing sign. The values for eyegaze behavior are given in (2):

- (2) Values for Eyegaze Behavior
 - Addressee: Eyegaze directed to addressee while pointing to addressee
 - Object/Person/Location: Eyegaze directed to the same location as IXthing, IXperson or IXlocation
 - Shift: Eyegaze movement between a third person (Object/Person/Location) referent and the Addressee

(2) cont. Away: Eyegaze directed to a different location than IXaddressee, IXperson, IXthing or IXlocation

Other: Other eyegaze behavior including searching gaze

Eyegaze behavior is also coded based on a priori semantic distinctions. Addressee is eyegaze to the addressed referent. Object/Person/Location is eyegaze to the referent of a thing/person/location that the pointing sign is referring to. This category excludes the Addressee since Addressee has its own category. Away is used when the speaker/signer is looking away while pointing to the addressee or away from the referent of the pointed Object/Person/Location. Other is all the other eyegaze behavior.

[Figure 6 here]

Figure 6 shows three of the five eyegaze values in the study (Object/Person/Location, Away and Addressee). Furthermore, Figure 6a shows the alignment of eyegaze with pointing to an object; thus the coding is “IXthing” co-temporal with “Object/Person/Location”. Figure 6b shows looking away while pointing to an object; thus coding is “IXthing” co-temporal with “Away”. That is to say, in Figure 6b, the child doesn’t look at the referred object but away/at some other object in front of him. Lastly, Figure 6c shows the alignment of eyegaze to addressee with pointing to addressee; thus coding is “IXaddressee” co-temporal with “Addressee”.

In addition to the simple gaze behaviors in Figure 6, which consist of steady-state simple gaze behaviors, we also coded the data for a complex eyegaze behavior, i.e. gaze movement. Any gaze movement from the addressee to a third person referent or from a third person referent to the addressee is coded as an eyegaze shift following Lieberman et al. (2011, 2014). Figure 7 shows an instance of eyegaze shift from the referent of a location to the addressee; the pointing sign “IXlocation” starts with the eyegaze behavior “Object/Person/Location” and ends with the eyegaze behavior “Addressee”, counted as a shift.

[Figure 7 here]

4 Results and Discussion

4.1 Eyegaze does not mark a pronominal distinction between second and third person

We first report the results for the specific hypotheses about the role of eyegaze to categorically/morphologically mark person distinctions. The question we started with is if eyegaze categorically differentiates between second and third person pronominal forms. We cited three specific

hypotheses to check this research question. The first hypothesis is that eyegaze and the pointing sign align for second and third persons, which, from a categorical/morphological point of view, predicts that eyegaze should always be directed to the addressee while the pointing sign is directed to the addressee; and eyegaze should always be directed to a third person referent while the pointing sign is directed to a third person referent. Again, this requirement is a categorical/morphological one if eyegaze contributes a morphological feature for differentiating linguistic person information. The second hypothesis is that eyegaze is steady-state for marking second person vs. eyegaze moves from a third person referent to the addressee (or from the addressee to a third person) for marking third person. For this hypothesis to hold in a categorical/morphological manner for marking second person, eyegaze should always be directed to the addressee when the pointing sign is directed to the addressee; and eyegaze should always move/shift between the addressee and a third person referent when the pointing sign is directed to a third person referent. The last hypothesis is that there is eyegaze and pointing sign alignment for the second person form but eyegaze is directed to a different direction than the referent while pointing to a third person referent. Similar to the first two hypotheses, this hypothesis predicts for marking the second person form that all pointing signs to the addressee will always be accompanied by eyegaze to the addressee. For marking the third person, this hypothesis predicts that the signer/speaker will always look at some other location but not to the referent while pointing to a third person referent.

Chart 1 shows the results for marking second person with eyegaze. The data is from adults interacting with Ben. The first and third columns show the categorical predictions. That is, looking at the addressee while pointing to the addressee should be at 100%. This prediction is shared by all hypotheses. Thus, we show the prediction and the results only once but for sign and speech separately since the number of pointing signs directed to the addressee is different in each session type. As we observe, In sign-target sessions, points to the addressee are indeed usually accompanied by eyegaze to the addressee, but this is not found in about ten percent of cases. In speech-target sessions, points to the addressee is lower than sign-target sessions although the data are only restricted to three instances of pointing in speech-target sessions.

[Chart 1 here]

Chart 2 shows results from adult interlocutors of Ben for marking third person with eyegaze. For marking third person, the three hypotheses make different predictions due to different behavior in their marking

criteria. Nonetheless, they commonly predict a categorical distribution. As we just noted above, the alignment hypothesis predicts that eyegaze should always be directed to a third person referent while pointing to that third person referent. The steady state vs. movement hypothesis predicts that eyegaze should always shift between the addressee and a third person referent while pointing to a third person referent. Lastly, the differential alignment hypothesis predicts that eyegaze should never be directed to a third person referent while pointing to a third person referent. Thus, the common categorical prediction of these hypotheses is that we should always observe the differentiating eyegaze behavior however it is defined. Accordingly, we show the prediction bars only once for sign-target and speech-target sessions each while giving the results for each hypothesis separately for the two session types.

[Chart 2 here]

In Chart 2, we observe that eyegaze behavior for non-addressed referents does not approach the categorical predictions of any of the three hypotheses in either sign-target or speech-target sessions for Adult interlocutors of Ben.

Data for other adults and children follow a similar pattern with the Ben adult data in Charts 1 and 2 but due to space limitations we cannot provide the detailed charts for the rest of the participants for second and third person separately. Instead, we show the overall results for what percentage is successfully predicted based on each specific hypothesis combining results together for second and third person referents in Tables 2 and 3. Table 2 shows that our data do not support any of the hypotheses for a categorical distinction separating second person from third person in Bibi children's eyegaze behavior while they point to referents. Table 3 shows the same overall results for adult interlocutors of the Bibi children in speech-target and sign-target sessions.

[Table 2 here]

[Table 3 here]

Our conclusion for the first research question is that eyegaze does not categorically/morphologically differentiate between second and third person referents in either Bibi children or their adult interlocutors in this study.

Before turning to the next section, we should note that, although the results do not support categorical marking of second and third person referents, there are still a few aspects that we need to note before we proceed to the next section. Those aspects will be relevant while we discuss the results there.

First, it is worth noting that the average values for children's points in sign-target sessions are very similar to adults' points in sign-target sessions while the average values for the children's eyegaze behavior in their speech sessions look different than the average values for the adults' eyegaze behavior during adults' points in speech. This effect might be attributed to the fact that children in this study are native Bimodal Bilinguals and they are different than speaking adults in their looking behavior while pointing. Although speaking adults are bilingual to a certain degree, they are not native signers. It is also worth noting that children's eyegaze behavior in their speech-target sessions is similar to their eyegaze behavior in their sign-target sessions.

We will now turn to the second research question in the next subsection where these similarities and differences will be better understood in the light of different discourse-pragmatic and developmental contexts.

4.2 Eyegaze under different discourse-pragmatic and developmental contexts

The second research question we asked was motivated by the use of eyegaze in joint attention and turn-taking as we cited above (Baker 1977; Lieberman et al. 2011, 2014). We asked if eyegaze differentiates discourse-pragmatic contexts such that a different role in child-directed language is observed than the reported role of eyegaze in adult-directed language. Since this question is independent of the issue regarding morphological person distinctions, in the following tables we report only eyegaze behavior (excluding the referents of pointing signs). Table 4 shows the percentages of eyegaze to different referents from the children in this study.

[Table 4 here]

Overall, on average, looking at the referent of an Object/Person/Location (that is a third person referent) is higher than any other category for children (68%). This result means that children in this study stay concentrated on their tasks. In other words, most of the time, they focus their attention on what they sign/talk about. Furthermore, when the children do not look at a third person referent, they either look at

their addressee (average 13%) to maintain their addressee's attention or children shift their gaze from a third person referent to their addressee and vice versa (average 11%) to get their addressee's attention.

These last two behavior types support the first result that children are keeping on their task while they point; in these cases by engaging with their interlocutors by means of two relevant types of gaze behaviors. In this regard, when the results of looking at the addressee, a third person referent or shifts between the addressee and a third person referent are combined, 92% of looking behavior is obtained. Children are engaged in their task and they are collaborating with their adult interlocutors for 92% of the time. The overall percentage for the rest of eyegaze behavior is only 8%. These are instances when children look away from the addressee or a third person referent (Away) or display any other gaze behavior (Other). This result further supports the claim that overall children tend not to look away from what they talk/sign about.

In order to compare the children's looking behavior in their speech vs. sign target sessions, we conducted 2x4 chi-square tests of independence for Ben and Igor (given the number of points produced by Tom and Edu, the expected frequencies were insufficient to submit their results to this test). Neither test produced significant differences (Ben: $n=371$, $\chi^2=2.96$, $p=0.1136$, Cramer's $V=0.1267$; Igor: $n=395$, $\chi^2=6.95$, $p=0.0735$, Cramer's $V=0.1326$). This means that Bibi children (at least Ben and Igor) display similar eyegaze behavior when they communicate with deaf and hearing adult interlocutors alike.

Table 5 shows the percentages of looking at different referents by the adult participants in this study. Overall, looking at a third person referent (Object/Person/Location) has the largest average value (47%) among the adults, closely followed by looking at their child addressees (36%), which is larger than children's average for looking at their adult addressees as reported above. This behavior is followed in percentage by eyegaze shifts, which is 13% on average. Looking Away and Other eyegaze behavior is only at the rate of 4% in total on average for the adult interlocutors of the children in this study. These results show that adults divide their gaze behavior to make sure that the children are paying attention to them (Addressee, 36%), to get children's attention (Shift %13) and to talk/sign about the Object/Person/Location (47%) that is in the task with even less looking away (Away and Other combined 4%) than what the children display.

[Table 5 here]

For adults interacting with Ben and with Igor, we compared their behavior in sign vs. speech target sessions using 2x4 chi-square tests of independence. In both cases, behavior was significantly different across these session types (Adults-to-Ben: $n=384$, $\chi^2=55.75$, $p < 0.0001$, Cramer's $V=0.381$; Adults-to-Igor: $n=276$, $\chi^2=28.71$, $p < 0.0001$, Cramer's $V=0.3226$). This result shows that deaf and hearing interlocutors of the same Bibi children, Ben and Igor, display different eyegaze behavior. This is predicted given previous results from Lieberman et al. (2011, 2014) and Holzrichter & Meier (2000). Deaf adults need to pay attention to their gaze behavior to make sure that they establish joint attention and make the signing visible to the signing children (deaf in their studies; Bibi in ours) while hearing interlocutors do not arguably have such a requirement.

When children's average results are compared with adults' average results, we observe very little looking away and other behavior in both (8% and 4% respectively) and comparable eyegaze shift behavior (11% and 13% respectively). Interestingly, we found a difference between Ben and Igor when comparing the children and adults interacting with them. For Ben, there is a significant difference between child and adult behavior in sign-target sessions (Ben and Deaf Adults: $n=454$, $\chi^2=77.56$, $p < 0.001$, Cramer's $V=0.4133$), but not in speech-target sessions (Ben and Hearing Adults: $n=301$, $\chi^2=5.69$, $p = 0.1277$, Cramer's $V=0.1375$). For Igor, the pattern is the opposite; no difference in sign-target sessions (Igor and Deaf Adults: $n=344$, $\chi^2=5.21$, $p=0.1571$, Cramer's $V=0.1231$), but a significant difference in speech-target sessions (Igor and Hearing Adults: $n=327$, $\chi^2=27.62$, $p < 0.0001$, Cramer's $V=0.2906$). These results can be understood based on a cultural difference and children's behavior. American and Brazilian speech cultures differ with respect to eye-contact with the addressee. It is considered rude to look at the addressee for a long time in the USA. For this reason, the hearing interlocutors may be looking at Ben less frequently. Similarly, the Bibi child Ben is not looking at his speaking interlocutors as much, perhaps not as much in sign-target sessions as well, although the deaf adult interlocutors need to look at Ben to establish joint attention and provide input. Looking at the addressee for a long time is not considered rude in Brazil. This may explain why speaking adults are looking at their Bibi child interlocutor, Igor, more than the Bibi child looks at them. For sign-target sessions in Brazil, the child and the deaf adult interlocutors are in more coherence.

One visible difference between children's and adults' behavior is in their looking at the addressee vs. their looking at the third person referent that is talked about (Chart 3). Although looking at the third person is

more than looking at the addressee in both children's and adults' eyegaze behavior, for children looking at the third person referent is the more prominent behavior whereas adults look more at the children than children looking at the adults. We can explain this difference by noting that the children are more focused on the task at hand and look at their addressee when needed whereas the adults are more focused on keeping the child's attention alive to provide input.

[Chart 3 here]

We can compare our results to Lieberman et al.'s (2011, 2014). As cited above, Lieberman et al. (2014) observed that Deaf children looked at the objects more than the Deaf mothers. The Bibi children in this study display a parallel looking behavior. They all looked at the objects more than they looked at their addressee. In Lieberman et al. (2011, 2014), Deaf mothers looked at their children more than they looked at the objects. This pattern is true on average for the Deaf adults in our study except for the Deaf adults in Igor's sessions. In those sessions, adults look at objects more than they look at their child addressee. For speech, we don't have a comparison possibility with Lieberman et al. (2011, 2014) since they didn't code for the eyegaze of hearing adults. Our results show differentiated behavior with this condition. The adults in Edu's speech sessions look more at the child than objects and although the adults in Igor's speech sessions look less at the child than they look at objects, they look at the child much more than the adults looking at the child in Ben's speech sessions. This difference between speaking adults in Brazil and the USA may be due to a cultural difference between these two countries as we mentioned above.

Now compare the eyegaze behavior of adults in this study when they interact with Bibi children to the results obtained in Lillo-Martin and Meier (2011) for adults' eyegaze behavior while interacting with other adults (Chart 4). As we pointed out above, in our study, the adults are keeping an eye on children to sustain children's attention without losing sight of the third person referent (Object/Person/Location) talked about in their interaction with children (dashed line in Chart 4). This seems to be a developmentally helpful role of eyegaze when compared to the adult eyegaze behavior during adults' interaction with other adults (solid line in Chart 4). In adult-to-adult interactions, the adults are looking at their adult addressee most of the time (63%); when the adults are not looking at their addressee, the average ratio of their looking at a third person referent that is talked about is much smaller (12%) than the average ratio obtained from adults

interacting with children (36%) in this study. This gap means that there is more looking away behavior by adult signers in adult-to-adult signing.

[Chart 4 here]

Above, we cited Baker (1977) for noting that -GAZE (looking away from the addressee) is a continuation regulator (keeping the turn) while +GAZE (looking at the addressee), is a shift regulator (turning the floor to the addressee) used by the speaker in ASL conversations between adults. The comparison in Chart 4 seems to support this proposal since the adults look away (-GAZE) more in an adult-to-adult context, which may be because they do not want to give the turn to their addressee whereas adult interlocutors of children are willing to share and give the floor to the children since, essentially, that is why they communicate with them in this context; that's why we observe less looking away behavior in the adult-to-child situation. How exactly does the looking mechanism work, though? We will briefly turn to it in the next subsection before we conclude in Section 5.

4.3 Looking mechanism explained

We will briefly illustrate the components of the looking mechanism which is useful to understand not only how to keep the turn by means of looking away in adult-to-adult conversation but also the developmental requirement that looking away not happen so often while adults are interacting with children.

In a study investigating the contribution of co-speech gesture and eyegaze to communication, Holler et al. (2014) found that in the presence of eyegaze directed to the addressee, an accompanying gesture has no effect on the response time to the content of a message. When eyegaze is not present, an accompanying gesture helps the addressee in response time. This result implies that when you are not looking at your addressee, or your addressee is not looking at you, you look at the hands of your addressee. Observe Figure 8 to understand this behavior:

[Figure 8 here]

The result obtained by Holler et al. (2014) is supported by the impression that there is a tendency for looking at the hand when eyegaze and hand behavior are present together (Figure 8a)³. In contrast, when only eyegaze is present, people tend to look at where the eyes are directing them (Figure 8b).

The tendency to look at the hand when both eyegaze and the hand behavior is present might explain why it is advantageous to look away when someone wishes not to give the turn/floor to their addressee in an ongoing conversation. Consider Figure 9 where the eyegaze and the manual pointing sign are directing to different locations.

[Figure 9 here]

Figure 9 illustrates the looking mechanism when a speaker looks away from the referent of third person pointing. Since the addressee will tend to look at the direction where the hand is pointing to in such a situation, the speaker increases his chance of not “meeting” the gaze of the addressee even if both the speaker and the addressee were to go back to the default eyegaze behavior, namely that of looking at each other. Now observe Figure 10.

[Figure 10 here]

In Figure 10a, the speaker is pointing to a third person while looking at the addressee. In Figure 10b, the speaker is pointing to a third person while looking at the same referent. The chances for the gazes of the speaker and the addressee to meet are more likely in both Figure 10a and 10b than in Figure 9. As the results of our study shows, the kinds of behaviors in Figure 10 are exploited more in the developmental situation of adult to child interaction while the kind of behavior in Figure 9 is used as a strategy to keep the floor in a conversation in an adult-to-adult situation.

It looks like the second research question we asked gets an affirmative answer in a principled manner. Eyegaze has a discourse-pragmatic role in that its distribution is affected by the requirements of the communicative context. In our case, it is exploited in distinct ways in the developmental context of adult-to-child interaction compared to what may be considered the default situation, i.e. adult-to-adult context.

³ Which is perhaps an evolutionary reflex/behavior as the manual gesture is more visible from a distance than eye gesture and therefore, looking at the manual gesture (first) may have become more instrumental in survival.

5. Summary and Conclusions

In this study, we investigated the eyegaze behavior of Bimodal Bilingual children and their interlocutors from a linguistic and developmental perspective. Parallel to previous research such as Lillo-Martin & Meier (2011) and Thompson et al. (2013), we found that eyegaze does not help to differentiate second person from third person in a categorical/morphological manner. The current data shows that eyegaze has a rather discourse/pragmatic role in that its distribution is shaped by the needs of the interlocutors. In such a context as ours, which is a developmental one, eyegaze is used to establish joint attention and to maintain the attention of the child and the adult on the task with very little affordance for looking away – a result which is also supported by previous research showing the overall eyegaze behavior of adults in child-directed signing (Holzrichter & Meier 2000; Lieberman et al. 2011 and 2014).

On the other hand, in an adult-to-adult context, the discourse/pragmatic needs of the interlocutors are different than in child-directed communication. Therefore, eyegaze behavior differs in that there is more affordance for the adults to look away to keep the floor in accordance with Baker (1977), which responds to Wilbur's (2013) concern that the distribution of eyegaze reported in Lillo-Martin & Meier (2011) is not a random distribution.

Our study thus contributes not only to linguistic discussions concerning eyegaze by showing that eyegaze does not contribute a categorical/morphological feature to differentiate second person from third person but it also invites further research into the use of eyegaze in different discourse/pragmatic and developmental contexts. In this sense, follow-up research on eyegaze behavior in a second language learning context where adults learn a sign language as a second language and sign language teachers provide input for adult learners would be interesting to conduct for reasons obvious to the reader by now.

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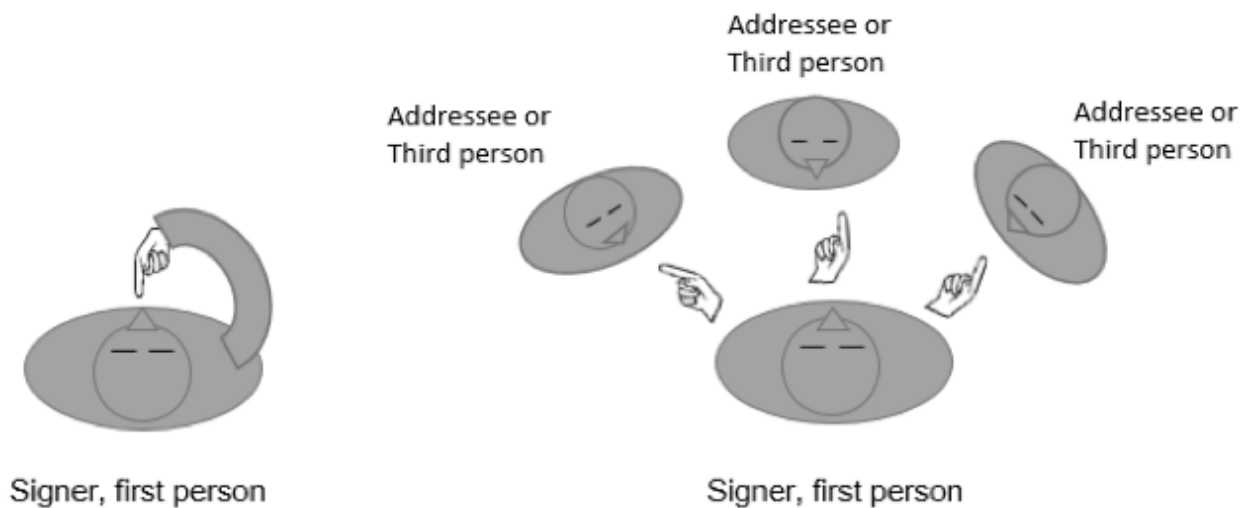
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Figures

Figure 1: The ASL lexicalized sign “WE”



Figure 2: Phonological difference between first person vs. non-first person (addressee or third person)



a. Location of first person pronoun is signer's chest

b. Location of addressee or third person is variable

Figure 3: Proposed person distinctions in the pronominal system of a sign language

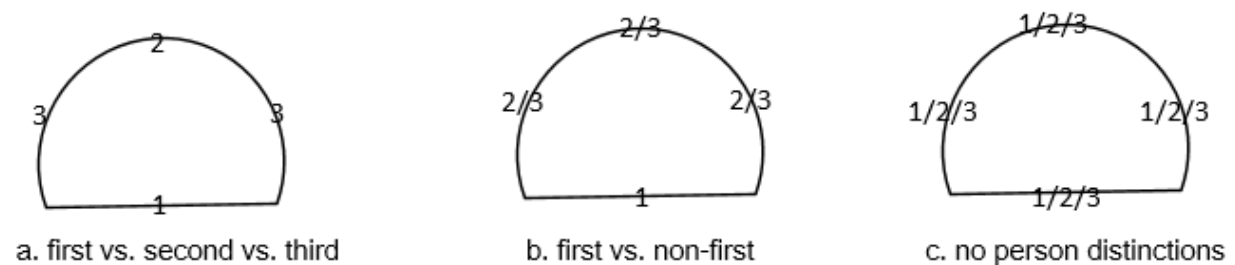


Figure 4: All three person distinctions shown for expository reasons



"I, me"

"you"

"s/he, her, him"

Figure 5: Differential alignment perspective

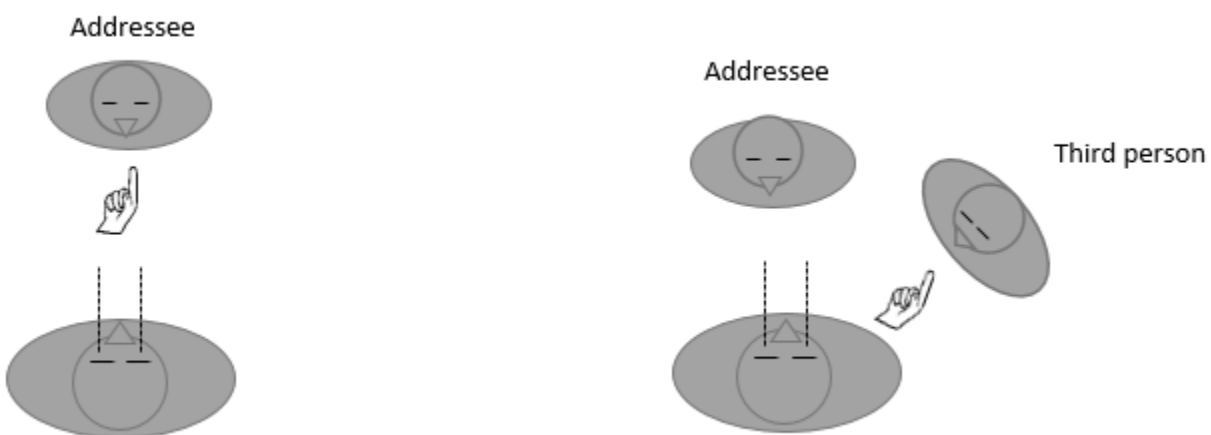


Figure 6: Some of the eyegaze values



a. Object/Person/Location



b. Away



c. Addressee

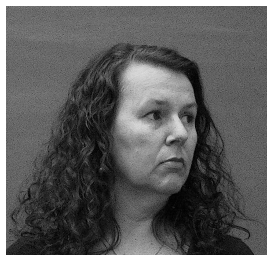
Figure 7: Eyegaze shift from a location to the addressee



Figure 8: Eyegaze accompanied by hand behavior vs. eyegaze alone



a. eyegaze + hand behavior



b. eyegaze alone

Figure 9: Looking away mechanism



Figure 10: Mechanisms for looking at the addressee and third person while pointing to a third person



a. Mechanism of looking at the addressee



b. Mechanism of looking at a third person

Tables

Table 1: Ages, sessions and the number of points coded for children and their adult interlocutors

Country	Child	Age Range	#Sign Sessions	#Pointing by Child in Sign Sessions	#Pointing by Adult in Sign Sessions	#Speech Sessions	#Pointing by Child in Speech Sessions	#Pointing by Adult in Speech Sessions
US	Ben	2;00-3;00	4	196	258	4	175	126
	Tom	2;00-3;00	3	72	NA	2	24	NA
BR	Edu	2;00-3;03	3	45	125	3	22	64
	Igor	2;02-3;01	3	206	138	3	189	138

Table 2: Results for the children of the percentages of predicted eyegaze behavior according to each hypothesis

	Sign			Speech		
	Alignment	Steady State vs. Movement	Differential Alignment	Alignment	Steady State vs. Movement	Differential Alignment
Ben	0.65	0.18	0.37	0.70	0.14	0.30
Tom	0.50	0.29	0.50	0.78	0.13	0.22
Edu	0.84	0.11	0.24	0.82	0.14	0.27
Igor	0.84	0.04	0.17	0.83	0.14	0.22
Average	0.71	0.16	0.32	0.78	0.14	0.25

Table 3: Results for the adults of the percentages of predicted eyegaze behavior according to each hypothesis

	Sign			Speech		
	Alignment	Steady State vs. Movement	Differential Alignment	Alignment	Steady State vs. Movement	Differential Alignment
Adults-to-Ben	0.47	0.43	0.68	0.64	0.25	0.37
Adults-to-Edu	0.75	0.39	0.57	0.43	0.27	0.71
Adults-to-Igor	0.79	0.05	0.19	0.58	0.22	0.49
Average	0.67	0.29	0.48	0.55	0.25	0.52

Table 4: Percentages of looking at different referents for child participants in this study

		Addressee	Object/Person/Location	Away	Other	Shift
Edu	Libras	0.267	0.622	0.022	0.067	0.022
Igor	Libras	0.083	0.817	0.009	0.060	0.032
Ben	ASL	0.117	0.597	0.061	0.077	0.148
Tom	ASL	0.167	0.500	0.000	0.042	0.292
	Average	0.159	0.634	0.023	0.062	0.124
Edu	BP	0.182	0.727	0.000	0.045	0.045
Igor	BP	0.124	0.712	0.056	0.034	0.073
Ben	Eng	0.063	0.703	0.046	0.051	0.137
Tom	Eng	0.083	0.750	0.000	0.042	0.125
	Average	0.113	0.723	0.026	0.043	0.095

Table 5: Percentages of looking at different referents for adult participants in this study

		Addressee	Object/Person/Location	Away	Other	Shift
Adults-to-Edu	Libras	0.528	0.408	0.016	0	0.048
Adults-to-Igor	Libras	0.127	0.802	0.000	0.024	0.048
Adults-to-Ben	ASL	0.422	0.275	0.012	0.043	0.248
	Average	0.359	0.495	0.009	0.022	0.115
Adults-to-Edu	BP	0.609	0.250	0.000	0.031	0.109
Adults-to-Igor	BP	0.367	0.493	0.020	0.040	0.080
Adults-to-Ben	Eng	0.087	0.611	0.016	0.056	0.230
	Average	0.354	0.451	0.013	0.042	0.140

Charts

Chart 1: Eyegaze Results for 2nd Person from Adult Interlocutors of Ben

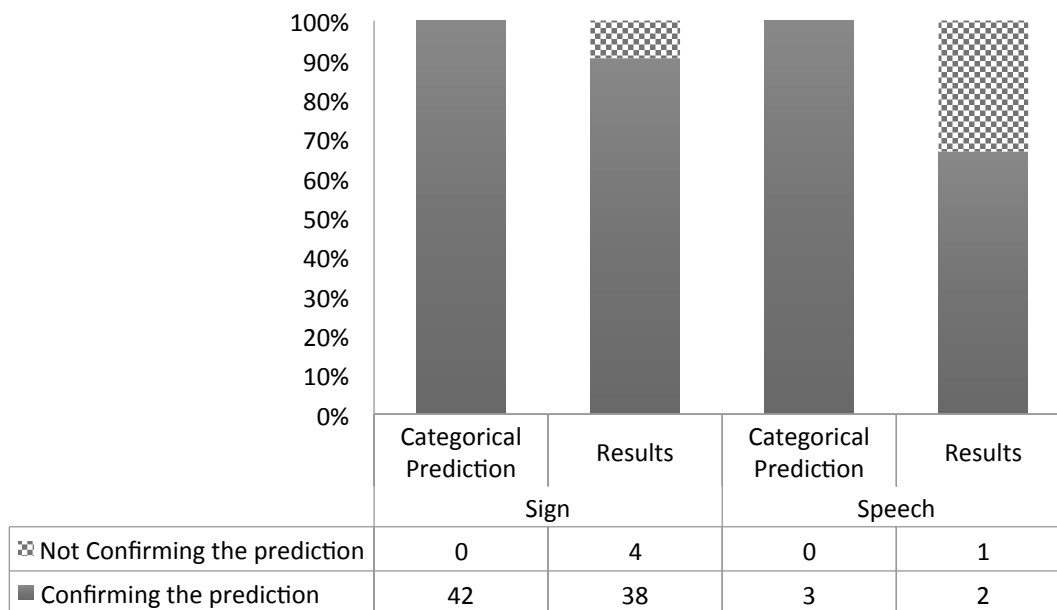


Chart 2: Eyegaze Results for 3rd Person from Adult Iterlocutors of Ben

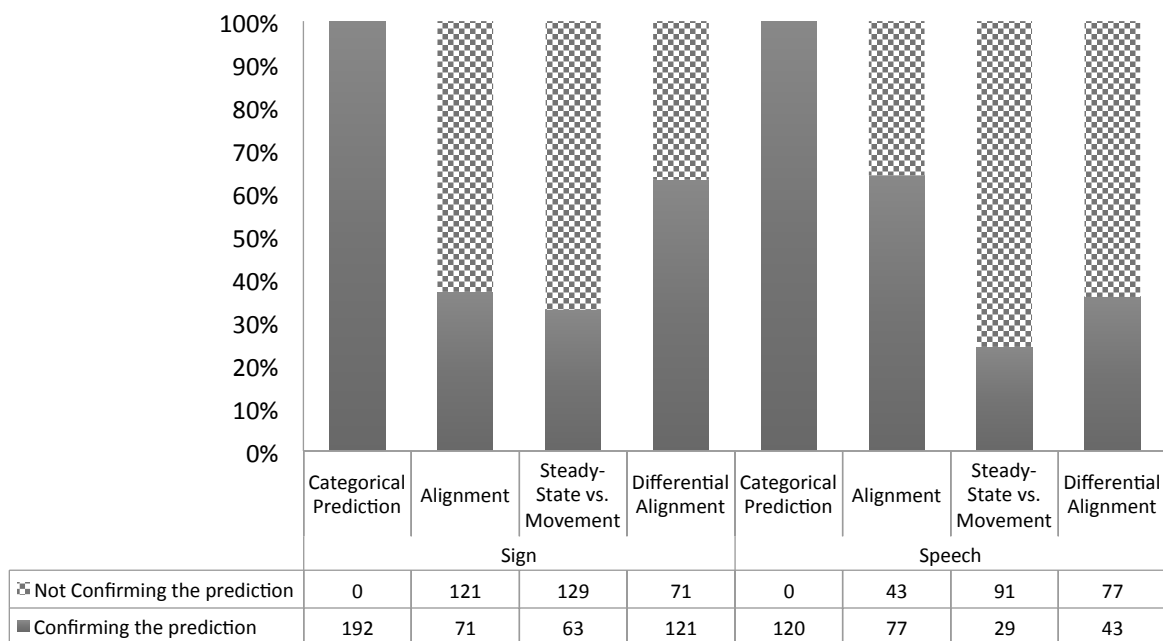


Chart 3: Children's and adults' looking rates at the addressee and a third person referent in this study

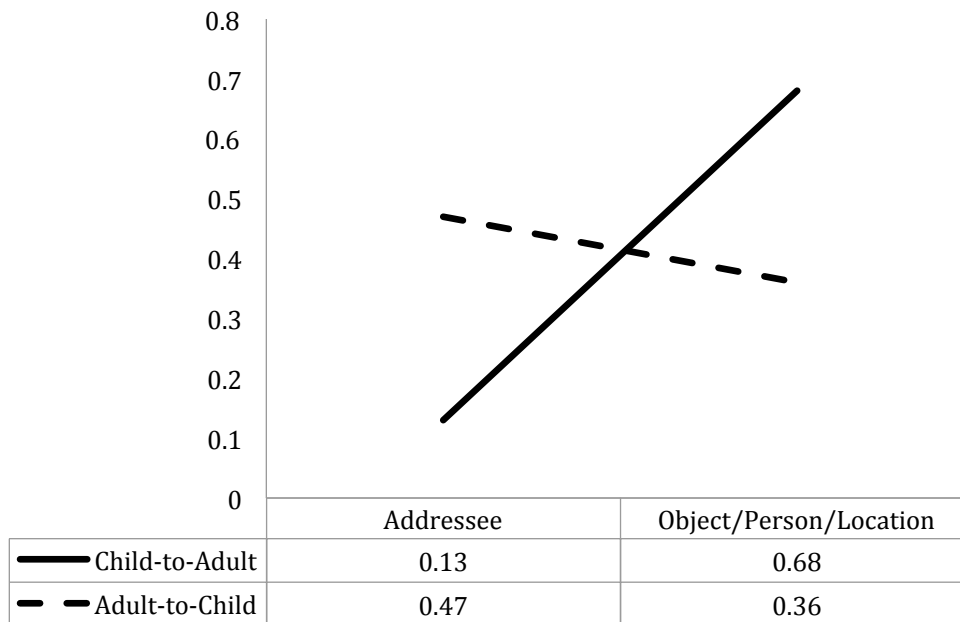


Chart 4: Adults' looking rates while interacting with their child interlocutors in this study (dashed line) compared with adults' looking rates while interacting with other adults in Lillo-Martin and Meier (2011) (solid line)

