Early bimodal bilingual development of ASL narrative referent cohesion: Using a heritage language framework

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A DISSERTATION

Submitted to the Department of Linguistics and the Graduate School of Gallaudet University in partial fulfillment of the requirements for the degree of Doctor of Philosophy

July, 2016

Acknowledgements

First, I would like to express my deepest gratitude to Dr. Deborah Chen Pichler for your on-going support, advising, teaching, mentorship, astute observations, guidance, patience, cheerleading, and friendship. This dissertation would have not been possible without you, Deb! Second, I sincerely thank my dissertation committee Dr. Gaurav Mathur, Dr. Lourdes Ortega, and Dr. Mary Thumann for all your time, and guidance. Also, thank you to my doctoral program cohort for being a part of this journey, Viola Kozak, Carla Morris, and Jeffrey Palmer.

I also send my deepest gratitude to Dr. Diane Lillo-Martin, Dr. Deborah Chen Pichler, and Dr. Ronice Quadros for establishing the Development of Bimodal Bilingualism project and lab and your guidance, and to all the research assistants for making this much needed research happen. A big two-handed THANK-YOU to the bimodal bilingual and Deaf children and their families who participated in the Development of Bimodal Bilingualism project in their longitudinal and experimental studies. I am also grateful for financial support from the Gallaudet Research Institute; CNPQ (Brazilian National Council of Technological and Scientific Development) Grant #200031/2009-0 and #470111/2007-0; and award number R01DC009263 from the National Institutes of Health (National Institute on Deafness and Other Communication Disorders). The content is solely the responsibility of the author and does not necessarily represent the official views of the NIDCD or the NIH.

Third thank you to Nick Russo, you have been my rock in providing me unrelenting support and patience through all my ups and downs. Much love to you my LP! Thank you to my Deaf parents, Bill and Lois Reynolds, who I hold dearest to my heart for giving me life and ASL/Deaf culture, the biggest gift of all. And of course thank you to my Coda siblings: Lina Hedrick, Brett Reynolds, Amanda McClure, Dustin Reynolds, and Catherine Reynolds for your on-going support and belief in me. Thank you to my fellow Coda researchers Paola Morales, Jenny Singleton, Bob Hoffmeister, Marie Coppola, Betsy McDonald, and Patty Clark. Lastly thank you to all the Codas (blood and non-blood sibs) I have met in and out of CODA International conferences for helping me understand of what it means to be Coda and how much of a treasure it is.

Abstract

This study examines the development of referent tracking in the signed narratives of six bimodal bilingual (Bibi) children who and are first language acquirers of American Sign Language (ASL) and English. This study investigates developmental patterns of referent tracking for these young Bibi children and compares them to those observed for Deaf age-matched peers, as well as for hearing heritage speakers from the spoken language bilingual literature. The Bibi child group (5;02-8;02) was comprised of three children who were born hearing, referred to as children of Deaf adults (Codas), and three children who were early cochlear implanted (DDCI). Six non-cochlear implanted Deaf children served as the control group (5;05-7;10). All twelve children were raised in families with Deaf, signing parents.

The study analyzed a total of 36 ASL narratives from a video-retelling task collected at two points in time from the Bibi children, and once from the Deaf controls. Videos were coded for referential function of all subjects, both overt and null. Developmentally, the Bibi children produced more overt forms at Time 1 than at Time 2, especially pronominals for functions where null forms are expected, i.e. maintenance and reintroduction. However, the Bibi children also produced null subject forms at both Time 1 and Time 2 for maintenance and reintroduction, but to a lesser degree than the Deaf comparison group. Furthermore, the Bibi children preferred null subjects occurring with plain verbs for maintenance and reintroduction, whereas the Deaf children preferred null subjects with depiction verbs. Another noteworthy difference between Bibi and Deaf

children was an increasing preference for fingerspelled nominals by the Bibi children, in contrast to a preference for lexical nominals by the Deaf control group.

The Bibi results are reminiscent of referent tracking patterns of unimodal bilingual children acquiring two spoken languages (Serratrice, 2007; Sorace et al., 2009), late bilingual adults acquiring their first signed language as a second language (Bel et al., 2014; Frederiksen & Mayberry, 2015), and adult heritage speakers of spoken languages (Lee et al., 2016; Montrul, 2004; Polinsky 1997). Notable similarities include a higher frequency of overt forms compared to monolinguals and the use of language-specific yet non-target (innovative) structures. The results of this study contribute to the growing literature on bimodal bilingual children (Lillo-Martin, et al., 2012; Palmer, 2015; Quadros et al., 2013) suggesting divergent development from their Deaf counterparts, and proposing that bimodal bilinguals may be best described as heritage signers.

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Chapter I: Introduction

Eighty percent of Deaf parents in the United States bear children who can hear (Mitchell & Karchmer, 2004, Mitchell et. al, 2006), who are known in the Deaf community as Codas (Children of Deaf Adults). This means that the majority of people who are native signers of American Sign Language (ASL) are not Deaf. Yet the field of ASL acquisition has traditionally focused on a minority of the signing population (5%), Deaf children of Deaf parents. Building a model of acquisition that is more representative of the native-signing population requires widening our focus from ASL acquisition by Deaf native-signers to ASL acquisition by all native signers, to include both Deaf and Coda children. This dissertation takes a step in that direction with an examination of narratives produced by native ASL signing children who have also acquired spoken English.

The past twenty years have seen a growing interest in bilinguals who know a spoken and a signed language, known collectively as *bimodal bilinguals*. Yet framing Codas as bimodal bilinguals emphasizes the interactions between their spoken and signed languages, instead of focusing on Codas as a unique type of native signers. Codas with signing Deaf parents are bilingual first language acquirers of a sign language, like their Deaf native-signing peers. Due to the lateral transmission of ASL from parent to child, Compton (2014) considers both Deaf and hearing native signers as *heritage signers*. However, in this dissertation I suggest that Codas resemble heritage language users or *heritage speakers* more than their Deaf counterparts. Heritage speakers are spoken language bilinguals who acquired their heritage language naturalistically in contexts mainly limited to the home, with divergent and varied language competencies in their home language as compared to monolinguals

(Rothman, 2009). Furthermore, heritage speakers experience a shift in language dominance from their home language to the majority language (Polinsky & Kagan, 2007). Like heritage speakers, Codas have limited access to their heritage language (ASL) and seem to experience a switch dominance to majority spoken language (English), typically upon entrance into school, yielding varied ASL competence. In contrast, the linguistic outcomes of Deaf native signing counterparts are not as varied, since ASL is their main mode of communication at home, at school, and with the community. Since Codas' language acquisition contexts and varied language outcomes seem to parallel that of heritage speakers, their linguistic development may be best understood through a heritage language framework (Compton, 2014).

This dissertation uses the sociolinguistic context of heritage language users as a springboard to study the development of linguistic forms used for referent cohesion in the signed narratives of native-signing bimodal bilinguals. In this study, native-signing bimodal bilinguals are comprised of two types of native signers who are acquiring a spoken language at an early age: Codas and Deaf children from Deaf families who use cochlear implants (DDCI). The control group in this study are non-cochlear implanted Deaf children with Deaf parents. Narrative development of referent cohesion provides a rich context for studying language universal forms. Languages track referents by using overt nominal forms to introduce or reintroduce characters, and reduced or covert null forms to maintain referents. Previous studies on referent tracking by heritage speakers using null subject languages show a preference for overt forms where monolinguals would use covert forms. The results of the current study suggest early bimodal bilinguals are more similar to heritage speakers than to

their Deaf native signing peers with respect to referent forms used in their ASL narratives. The following subsections will introduce several foundational concepts for this dissertation, including Codas, bimodal bilinguals, heritage speakers, and referential cohesion.

Who are Codas?

When investigating sign language acquisition by Codas who are hearing bilingual first language acquirers (BFLA), it is also important to consider perspectives of the signing abilities of Codas by the Deaf community and by Codas themselves. Coda ASL sign skills are typically viewed by Deaf people as being either native-like, almost on par with other Deaf native signers, or at the other extreme, as heavily English-influenced. Similarly, Codas self-reflect their own signing skills in a dichotomous fashion (Pizer, 2013). Pizer interviewed 13 American Codas about various topics, including ASL proficiency. She found that only three participants felt their ASL skills were as good as their English skills, good enough to be often perceived as Deaf by members of the Deaf community. The remaining participants reported a dependence on English-like structures in their signing, with some participants citing wide variations in signing abilities among their siblings. Rigid assumptions about Codas' heritage language skills by the Deaf community and by Codas themselves are challenged by the results of the current study, which instead suggest a continuum of varied ASL skills unique to this native signing population who can hear. This variation among the largest group of native signers raises many questions which will be discussed later in the dissertation, some of which have been addressed by recent studies on Codas in the US and

abroad, such as the degree to which language environment influences Coda proficiency in their sign language and the role of parental input (Kanto et al. 2013; Kanto 2016; Palmer 2015).

It is also important to recognize the emerging sense of Coda identity evidenced by establishment of the organization CODA International, incorporated in the 1980s (Napier, 2008). CODA International hosts yearly conferences reserved for people who can hear and who have at least one Deaf parent. CODA conferences provide workshops and networking opportunities for people with a shared experience growing up hearing with Deaf parents. A strong connection exists between Coda language and identity, evoked in Preston's (1994) anthropological journey through Coda experiences in his book, *Mother Father Deaf,* and recounted by one Coda this way:

> *To me, I think [signing is] the greatest gift. It's not just a talent, it's a gift that I'm fortunate (sic) to have deaf parents because I've learned a language that's so expressive. If any person really wanted to know what I was saying and not hear it but see it, this is the language to go to. That's how you get to know me*. (Preston, 1994:136)

In the quote above, the Coda speaker explains her deep connection with ASL and the impact of having Deaf parents on her overall identity. Instead of exploring Coda identity or Coda language attitudes, the current dissertation focuses on the parallels and divergences between the narratives of young native signers who can hear and their Deaf native signing counterparts.

Who are bimodal bilinguals?

The term *bimodal bilingual* is used in the literature to refer to individuals who are bilingual in a signed language and a spoken language, regardless of their age of acquisition and hearing status. The term is most typically considered synonymous with the term *Coda*, assuming acquisition of both languages from birth (Emmorey, Borinstein, Thompson, & Gollan, 2008; Johnson, Watkins, Rice, 1992; Petitto et al., 2001), but it is sometimes also applied to hearing signers who learn a sign language as a second language (L2) in a second modality (M2), or M2-L2 (Williams, Darcy, Newman, 2015, Chen Pichler and Koulidobrova, 2015). Additionally, the term has been used to refer to deaf cochlear-implanted children of Deaf parents (DDCI) who, like Codas, receive early exposure to both a spoken and a sign language (Davidson, Lillo-Martin, Chen Pichler, 2013). Less commonly, deaf sign-print bilinguals, or ASL users who acquire written English, but not spoken English, are also sometimes labeled as bimodal bilinguals, on the argument that printed language is a distinct modality from either sign or speec (Kuntz, Golos, & Enns, 2014). For the purposes of this thesis, the term *bimodal bilingual* will be restricted to native-signing children with Deaf parents, who acquire a sign language and a spoken language through auditory means, i.e. Codas and DDCI. Research on bimodal bilingual language development affords insights to language acquisition patterns between a child's two languages in two different modalities, furthering our understanding of how languages develop and interact when learned at the same time. Roughly speaking, bilingual acquisition follows a similar trajectory to monolingual acquisition, a common finding in the bilingual literature as promoted by researchers such as De Houwer (2009) and Genesee & Nicoladis (2007).

Bimodal bilingual acquisition research has reported similar results between age-matched Coda and Deaf children in phonological development (Siedlecki & Bonvillian, 1993), lexical development (Prinz & Prinz, 1979), ASL question forms (Jones & Quigley, 1979), and early language benchmarks in their home sign language (Petitto et al., 2001). The theme across the sparse literature on American Codas and DDCI is that they are native signers and develop many ASL skills much like their Deaf native signing counterparts. Yet bimodal bilingual sign development does not always resemble that of their Deaf peers; as mentioned earlier, Codas are often viewed as poor signers in the Deaf community, indicating that at least on some level, their signing diverges noticeably from that of their Deaf counterparts. This dissertation views those developmental divergences through the lens of a heritage language framework, as explained in the following subsection.

Who are heritage speakers?

The term *heritage language* is a minority language spoken in the home that is acquired in conjunction with the dominant majority language and is also referred to as *mother tongue, native language,* and *community language* (He, 2010). Heritage speakers in the US are typically children of immigrants who learn a minority home language (the heritage language) from their parents. An example would be children raised in America by Taiwanese-speaking parents. These children learn Taiwanese at home, and English in the community. Children living in Taiwanese-dominant areas of Taiwan may take English classes and thus also become English-Taiwanese bilinguals, but they differ from heritage Taiwanese speakers with respect to the sociolinguistic settings in which their two languages

are used, and the dominance status of their two languages, all of which impact language development and Taiwanese language proficiency attainment.

Non-heritage bilinguals typically experience their home language at school, and both languages in the general community. An example of a non-heritage bilingual is a child growing up in Swedish-speaking regions in Finland, where both Finnish and Swedish are both official languages of the country and are both used at school. In this situation, there is no minority-majority status ascribed to Finnish and Swedish. In contrast, heritage speakers do not generally receive formal schooling in their minority heritage language. The heritage language setting is limited to home, extended family, community events, and possibly travels to their parents' home country. Due to these restricted language contexts, speakers' proficiency in their heritage language is highly variable (Benmamoun et al., 2013).

Much of the work on heritage speakers' language proficiency focuses on *heritage language learners* (HLL). HLL are students of their heritage language in a post secondary setting, for example a Chinese heritage speaker taking Chinese in college. Heritage language learners occupy a wide spectrum, ranging from those who have only receptive knowledge of their heritage language, to those who can understand but do not speak the language, to those with near-native language abilities (Benmamoun et al., 2013). Despite their varying proficiency in their heritage language, heritage speakers are still culturally tied to the language (He, 2010), much like what has been noted for Codas with respect to Deaf culture (Pizer, 2013; Preston, 1998). For the purposes of this study I am focusing on participants who have some level of competency in their home sign language.

Researchers have noted that heritage speakers' grammar strongly resembles that of

native controls in some respects, yet diverges in others (Benamamoun et al., 2010, Rothman, 2009). Vocabulary, morphosyntax, complex syntax, and discourse are reported to be vulnerable in the grammars of heritage speakers (Montrul, 2010). Phonetics and phonology of heritage speakers are typically characterized as spared. However, some studies reveal that heritage speakers score lower than monolinguals in tests of productive pronunciation proficiency, although they score higher than second language learners (Au, Knightly, Jun, and Oh, 2002; Oh, Jun, Knightly, and Au, 2003). Heritage speakers also typically experience significant vocabulary gaps, again due to restricted experience in their heritage language. Heritage speakers have been found to have differentiated word class knowledge with better facility with verbs than with nouns and adjectives (Polinksy, 2005) and overall slowed lexical access and retrieval compared to monolingual controls (Polinsky, 1997). Inflectional morphology is the most markedly affected linguistic aspect in the grammars of heritage speakers. Gender, number and case markers in the nominal domain and subject-verb agreement and tense in the verb domain have all been observed to be vulnerable aspects of heritage language grammars (Montrul, 2010). Heritage speakers of languages with variable word order seem to better comprehend and prefer canonical word orders, compared to noncanonical structures involving features such as fronted objects (Song et al., 1997). Differential patterns at the discourse-pragmatic level have also been noted for heritage speakers of null subject languages. Heritage speakers have been found to prefer overt subject forms in contexts where null forms are used by monolinguals (Montrul, 2004; Polinsky, 2007; Silva-Corvalan, 1994). Some researchers such as Sorace and Serratrice (2009) have proposed that grammatical aspects that lie at the interface between linguistic levels, such as

referent tracking, are especially challenging for heritage speakers to acquire. This is an important point for the current dissertation, and I will return to it in the next subsection.

Heritage speakers' simplified and varied grammars has led to debates over how to best characterize their grammar. Some argue that heritage speakers fully acquired their home language at some point, but subsequently attrite (Montrul, 2008). Others argue that heritage speakers experience incomplete acquisition of their heritage language grammar, perhaps due to insufficient input (Polinsky, 2006). Yet other researchers such as Pires and Rothman (2009) argue that heritage speakers' linguistic development is a case of divergent acquisition or *missing-input competence divergence*:

> HSs [heritage speakers] do not acquire properties that are part of the competence of educated monolingual speakers primarily because monolingual speakers, differently from HSs, had sufficient exposure to a standard dialect (i.e. through formal education) that is distinct in certain respects from their colloquial dialect (see e.g. Pires and Rothman, 2008, forthcoming; Rothman, 2007, and references therein). (214).

From this last perspective, heritage speakers' divergent competence of their heritage language is attributed to insufficient input of standard or formal dialects. Rothman (personal communication, September 12, 2015) uses a pizza metaphor for the acquisition context and competence for monolinguals as compared to heritage speakers. Monolinguals are given a whole pizza, representing the wide range of language input in varied contexts, whereas heritage speakers are given a pizza with some pieces missing, which represents colloquial language contexts. Like monolinguals, heritage speakers eat all the pizza they were given, so in this sense their acquisition of the heritage language is complete; but because the two groups were given different portions to begin with (i.e. exposed to different input), their outcomes are divergent. In the next section I examine some specific ways in which Codas

and DDCI are similar to heritage speakers in their language acquisition input contexts and language competency for their non-dominant home language.

Who are heritage signers?

The concept of heritage speaker laid out above is very applicable to bimodal bilingual children who grow up in Deaf signing families. Like heritage speakers, Codas and DDCI are acquiring a minority language with input typically limited to the home. Historically, educational policies and have prevented Codas from attending schools in their heritage sign language. Like many immigrant communities in the U.S., the Deaf community has experienced and continues to experience the pressure to linguistically assimilate to English. This pressure is also felt in the education system, where Deaf parents are not permitted to enroll their Coda children in signing or Deaf education programs in the U.S. due to their audiological status of being able to hear. A notable exception is PS347 in New York City, a public school that allows Coda and hearing children to be educated alongside their Deaf peers in ASL and English. As for DDCI children, the picture is less clear. A recent study on the beliefs of bimodal bilingualism by Deaf parents of 24 cochlear implanted children suggests that they too are often educated in English-only environments (Mitchiner, 2015), accounting for 70% of DDCI children in the study.

Unlike their Deaf native-signing counterparts, the majority of Codas and possibly DDCI attend hearing schools entirely in English, so their sign language input does not include formal and academic contexts where one would be exposed to a wide range of vocabulary or specialized aspects of grammar. At the same time, bimodal bilinguals are

native signers with strong cultural connections to the Deaf community, and are distinct from second language learners. Even though the literature on language acquisition by Coda and DDCI children is relatively sparse, it is growing rapidly and internationally. The picture that is emerging of Coda children's sign language development suggests notable differences from that of native-signing Deaf children (Bogaerde and Baker, 2009; Hofmann & Chilla, 2015; Kanto, 2015). Differences in sign language fluency have also been observed for adults, with Deaf native signing adults outperforming most Coda adults on ASL tasks, but Codas outperforming late exposed Deaf signers on the same task (Supalla, Hauser, and Bavelier, 2014). This dissertation adds to the growing linguistic research on the ways in which early bimodal bilingual development differs from Deaf development, potentially as a result of heritage signer status, focusing on the complex phenomenon of narratives and reference cohesion.

The inclusion of this understudied population of early bimodal bilinguals can contribute to both academic and community-based settings. The current study serves to inform theories of bilingual and heritage language development by accounting for bilingualism in two modalities. The results of the study converge with the findings of spoken language bilinguals and offer insights into bimodal bilinguals' creative interplays between their signed and spoken languages. Sign interpreter training programs and ASL instruction may also benefit by recognizing Codas as a special type of heritage language learner, as they come to institutions of higher learning with varied linguistic skills very different than their native-signing Deaf counterparts or hearing second language learners. Coda community based youth programs such as KODA (Kids of Deaf Adults) camps may also use the results

of this study to advocate for increased language maintenance for bimodal bilingual children. Last but not least, recognizing Codas as native signers may serve to strengthen and reinforce their membership in the Deaf community.

What is reference tracking and cohesion?

Reference tracking in narratives is a discourse function that requires global analysis beyond the sentence level, taking into consideration knowledge of both the speaker and the listener. Keeping track of characters or referents in a narrative requires the ability to encode the information status or function of a referent following the general pattern of using overt forms to introduce and reintroduce referents, and reduced forms for maintenance of referents already active in the discourse. Accordingly, new referents or topic shifted referents typically appear in full NP form, while referents that are continued or maintained occur as pronouns or null subjects/objects, both considered reduced forms. However, languages differ on the forms used for referent maintenance because they differ in the extent to which null forms can occur. In pro-drop languages such as Italian and ASL, null forms can be used for maintenance, where as non pro-drop languages such as English use pronominal reduced forms.

Referent cohesion cross-linguistically shows a protracted learning pattern in the narratives of monolinguals, stabilizing around 9 years (Bamberg, 1986; Hickmann, 2003; Hickmann & Hendriks, 1999; Karmiloff-Smith, 1981, 1983, 1985; Morgan, 2005). Development can take even longer for bilingual children, who have been observed to favor overt forms where monolingual controls would use a reduced or null form (Chen & Lei, 2012; Serratrice, 2007; Sorace & Serratrice, 2009). This tendency for bilinguals to be "overly

overt" surfaces regardless of the null subject parameter setting of the language pairs, as evidenced by studies in which children speaking two null-subject languages still overproduce overt forms in their non-dominant (presumably heritage) language (Sorace & Serratrice, 2009). Independent of narrative studies, heritage speakers have been found to have a divergent grammar in regards to the pro-drop feature of their heritage language in narrative contexts (Montrul, 2004; Lee & Zalasky, 2015; Polinsky et al., 2007; Silva-Corvalán, 1994) and as explained by as Benmamoun (2010) for non-narrative contexts:

> "...null pronominals seem to be significantly affected: heritage languages whose baseline is *pro*-drop are reported to lose the *pro*-drop feature or to use it in a more limited manner" (Benmamoun et al., 2010: 34)

The dominant language of the bimodal bilingual children in the current study, English, is not a null subject language, whereas their heritage language, ASL, is. We would expect bimodal bilingual children to experience influence from English to ASL, affecting the referential forms they choose in their signed narratives. These patterns of use can then be compared to reports from the limited literature on the development of signed narratives by Deaf children (Morgan, 2005; Reilly, 2000). Some preliminary support for my initial prediction of over-reliance on overt forms by bimodal bilingual children comes from adult L2 learners of sign language, who demonstrated an over-dependence on overt subject referent forms in their signed narratives (Bel, et al., 2014; Frederiksen & Mayberry, 2014). I will be drawing from these and other studies of signed narratives and compare them to the child narratives collected for this thesis.

In this study I examine patterns of referent cohesion in the signed narratives by young bimodal bilinguals focusing on three research questions, with the first two questions relying

on data collected for this study:

RQ1: What are developmental patterns of referential cohesion in signed narratives by young bimodal bilinguals?

RQ2: How are the patterns of referent cohesion by bimodal bilinguals similar or different to those of age-matched Deaf peers?

RQ3: What do the bimodal bilingual patterns of referent cohesion tell us about bilingual narrative development and do they match patterns reported in the literature for heritage speakers of two spoken languages?

Chapter 2 reviews the relevant literature on cross-linguistic patterns of referent cohesion by adults, development of narrative cohesion by both monolingual and bilingual children, then examines the small extant literature on referent cohesion in signed narratives. Lastly, a discussion on the social and linguistic characteristics of bimodal bilinguals as heritage language users will be provided. Chapter 3 lays out the methodology for data collection, coding and analysis of narratives by bimodal bilingual children and Deaf controls. Chapter 4 reports findings and analyses, and Chapter 5 presents a discussion highlighting the parallels in narrative patterns across these bimodal bilingual children, arguing that they are consistent with patterns previously reported for heritage speakers. The discussion closes with some thoughts on how the research in this dissertation project can inform programs that support heritage signers in maintaining their heritage language at home, and extending it as heritage language learners later in life.

Chapter II: Literature Review

In this chapter I provide a crosslinguistic review of referent cohesion by adult and development of referent cohesion in monolinguals, unimodal bilinguals, second language learners of sign language, and bimodal bilinguals. Then I apply a heritage language framework to bimodal bilinguals by examining social and linguistic characteristics. Lastly, I provide the dissertation research questions and the accompanying predictions.

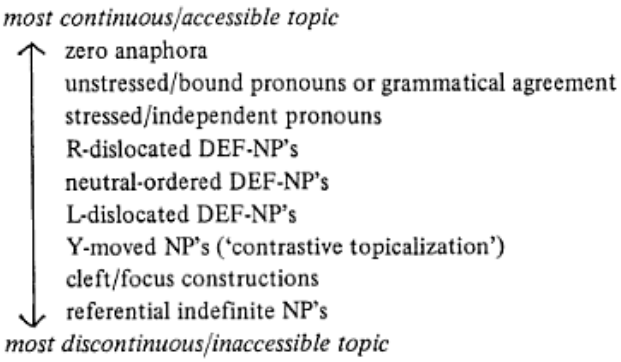
2.1 NARRATIVE REFERENT COHESION

The structural definition of a narrative is at least two clauses that convey a sequence of events (Labov & Waletsky, 1967). A well-formed narrative is both coherent and cohesive. *Coherence* is the semantic interpretation or the sense-making that arises between and across sentences in extended discourse (Van Dijk, 1980). *Cohesion* is the use of linguistic devices to indicate clausal relationships (Halliday and Hassan, 1976). Clausal relationships may encode temporal information (e.g. sequencing of events) or referential information (e.g. tracking of entities). Referent cohesion is achieved through grammatical and lexical means within and across sentences to track referents (Halliday & Hasan, 1976), providing shared knowledge between the speaker and the addressee (Chafe, 1976). Since the focus of this study is *reference cohesion* of subject entities in narratives, I will discuss cross-linguistic similarities and differences of reference cohesion with respect to accessibility and the new-given status of referents, followed by discussion of referent cohesion in sign languages. Considerations of the treatment of information status in discourse will be discussed for both ASL and English throughout.

2.1 CROSSLINGUISTIC ADULT PATTERNS OF REFERENT COHESION

Cross-linguistically, languages employ overt nominal forms for referents that are not functionally accessible in discourse, and reduced forms for referents that are highly accessible (Givón, 1983). *Accessibility* refers to the anaphoric property of referents that are held in memory and are coded by grammatical structures or the position of topics in discourse. This form to function mapping is what gives narratives referent cohesion. Givón proposed a scale of coding topic accessibility based on a cross linguistic study of eight languages, identifying the most common grammatical devices ranging from the most continuous/accessible topic to most discontinuous/inaccessible topic, shown in Figure 2.1.

Figure 2.1: Scale of coding of topic accessibility (Givón, 1983, 17)



The continuum of topic accessibility is determined by a mixture of morphology, intonation or stress and word order. At the most inaccessible end of the scale lie referential indefinite NPs, since they do not have preexisting anaphoric property, while null subjects or zero anaphora is used for the most continuous or most accessible topic in discourse with a strong anaphoric property.

Referent accessibility in extended discourse can also be framed in terms of topic

continuity and its discourse function. Typologically different spoken languages use overt nominal forms for the function of introducing and reintroducing subject referents, while references to those entities thereafter are typically maintained through reduced or covert null forms (Givón 1984; Hickmann & Hendriks, 1999). Similar findings for natural signed languages have also been reported for American Sign Language (BSL; Wulf, Dudis, Bayley, & Lucas, 2002; Frederiksen & Mayberry, 2015); British Sign Language (Morgan, 2005); Australian & New Zealand Sign Languages (Auslan and NZSL; McKee, Schembri, McKee, & Johnston, 2011); Catalan Sign Language (LSC; Bel, Ortells, and Morgan, 2014); and German Sign Language (DGS; Perniss & Özyürek, 2015). Figure 2.2 provides a schematic representation of the *Principle of Quantity* for topic continuity (Perniss & Özyürek, 2015, 39) proposed by Givón (1984) that holds true for the aforementioned associations between linguistic form, referent accessibility, and referential context/function for both spoken and signed languages, well as co-speech gestures.

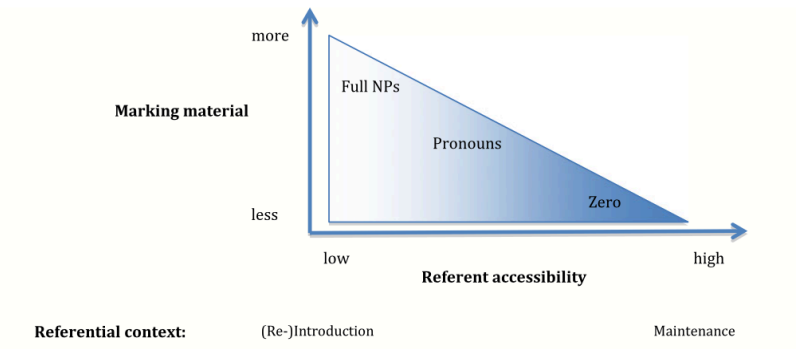


Figure 2.2 Schematic representation of the *Principle of Quantity* (Givón, 1984) for topic continuity (Perniss & Özyürek, 2015, 39)

Topic accessibility can also be coded in terms of the newness or giveness of the referent, impacting grammatical structures and lexical forms used in creating referent cohesion. New referents are the least accessible in discourse, while given referents are highly accessible. Languages differ in the ways new and given referents are coded linguistically and include verbal positioning, definite-indefinite distinction, and allowance of null arguments determined by pro-drop and zero-topic parameters.

New information universally appears near the end of utterances, while given information appears at the beginning of utterances (Hickmann & Hendriks, 1999). In English example (1) the new referent 'a dog' appears at the end of the utterance, while in the following sentence in the created utterance set (2), the given information 'the dog' appears at the beginning of the utterance.'

(1) There is **a dog**.
(2) **The dog** was hungry.

However, language differences such as post-verbal subject positioning vary across and within language types (Serratrice, 2007). For example, English typically introduces new referents pre-verbally and only allows post-verbal subjects in restricted contexts, such as for verbs of motion (e.g. *out came an owl)*. Italian, a SVO language like English, allows post-verbal positioning of focused subjects, while preverbal subjects are topics of the sentence. Furthermore, languages that have flexible word order (e.g. Cantonese and Spanish) allow subject-verb inversion for the purposes of referent introduction to mark newness (Sridhar, 1989).

In lieu of post-verbal subject positioning, languages with the definite-indefinite

distinction, such as English, encode new referents with an indefinite NP (3), and given referents with a definite NP (4) or a pronoun (5) (Hickmann & Hendriks, 1999).

(3) Yesterday I saw **a cat**. [New referent → indefinite NP]
(4) **The cat** rubbed against my leg. [Given referent → definite NP]
(5) **It** was very cute. [Given referent → pronoun]

Additionally, a given referent that presupposes shared knowledge may surface as null ellipsis in restricted contexts in English (e.g. *Deb went home and ø folded origami*). The sketch provided in (6) displays the continuum of presupposition of the existence of referents in discourse of shared knowledge from new to given information for languages, such as English, that have the definite-indefinite distinction (Hickmann & Hendriks, 1999, p. 420):

(6) a cat < the cat < it < 0

Sign languages, like many spoken languages (e.g. Russian), do not mark differences between definite and indefinite noun phrases lexically, and instead mark the distinction though discourse pragmatics and syntactic parameters including pro-drop and zero-topic (Morgan, 2005). Languages also differ typologically in how they mark the new given distinction, depending on whether they allow null subjects and objects (Hickmann & Hendriks, 1999, Jaeggli & Safir,1989). Pro-drop languages allow certain classes of pronouns to be null when they are pragmatically inferable in discourse, impacting pragmatic patterns of referent cohesion. In pro-drop languages such as Italian (7), thematic subjects are omitted due to a rich verbal morphology system

(7) parl-a molto
pro talk-s much
'(s)he talks a lot'

ASL allows pro-drop for a class of agreeing verbs that are spatially modified (Lillo-Martin,

1986). The ASL response B in (8) includes an agreement verb, SEND, for which the first person subject agreement and the third person object agreement are encoded in the verb through spatial means.

(8) A: YOUR MOTHER, CARD YOU $_2$SEND$_3$?
"Did you send your mother the card?"
B: YES, $_1$SEND$_3$

Other languages such as English, a non pro-drop language, require overt thematic subjects.

Languages that have the 'zero-topic' parameter, such as Chinese, do not have morphological systems that mark subjects (Hickmann and Hendriks, 1999), but allow null subjects through a different process. Example exchange (9) demonstrates how Chinese permits null elements via topic chains across utterances (Huang, 1984: 533).

(9) Speaker A: Zhangsan kanjian Lisi le ma?
Zhangsan. see Lisi LE-aspect Q
'Did Zhangsan see Lisi?'

Speaker B: Zhangsan shuo [*e* kanjian *e* le].
Zhangsan say see LE-aspect.
'Zhangsan said that [he] saw [him].'

ASL also allows null arguments for plain verbs which are not spatially modified (Lillo-Martin, 1986). In (10) the topic of the first sentence MY SISTER surfaces as a null topic in the following sentence.

(10) YESTERDAY MY SISTER FLY NEW-ZEALAND. ø STAY ONE YEAR.
"My sister flew to New Zealand yesterday. [She] is staying there for one year."

In this respect, ASL is similar to Chinese by the allowance of null subjects licensed by discourse factors (Lillo-Martin, 1986). If an interaction between ASL and English appears in bimodal bilingual narratives, one way it may manifest is the reduced use of null subjects.

As mentioned earlier, the new-given distinction is another feature relevant to reference

cohesion. Some languages have grammaticalized this distinction in clausal structures, as in French, where maintenance of old information as direct or indirect object results in a pronoun clitic in preverbal position (italicized *le* and *lui* in 11). This is in contrast to objects representing new information, which appear in canonical post-verbal position (underlined *le livre* and *a Marie* in 11) (Hickmanm and Hendriks, 1999: 422).

(11) Jean donne le livre a Marie. Il *le lui* donne.

('John gives the book to Mary.' 'John gives it to her.' [Lit.: 'He it her gives'])

Sign language modality-specific forms for tracking referents warrants discussion at this juncture and includes the use of grammatical space for indexical pronouns and depictive devices (classifier constructions and role shift). Like spoken languages, signed language pronouns appear after first mention of the full noun phrase, yet are different from spoken languages in that pronouns are given a unique point in space for maintenance referential purposes (Wilbur, 1979). An example of an indexical pronoun used for reference in ASL is shown in (12) where the referent identified through the noun phrase SPIDER is followed by an indexical pronoun in an established space marked *a*. In the next sentence (13) the spider is referred to with an indexical pronoun IX(spider) at the same location (a), maintaining the previous referent by referring to the same pronominal space. The indexical pronoun in (13) is less explicit than a full noun form that it refers to in (12).

(12) SPIDER IX(spider)-a ZOOM.
"The spider ran away quickly."

(13) IX(spider)-a SEE STICK.
"He spotted a stick."

Despite the frequency of pronouns in sign languages, there are very few studies that focus on their distribution in signed narratives. There is no consensus or clarity of their frequency in

signed discourse; however, narrative studies on ASL (Frederiksen and Mayberry, 2015), BSL (Morgan, 2000), LSC (Bel et al., 2014), and DGS (Perniss & Özyürek, 2015) all categorize indexical pronouns as a reduced (or "leaner") form compared to full NPs, typically serving the function of maintaining or reintroducing referents.

In sign languages, entity classifiers and role shift are common predicate types used to maintain referents in extended discourse through spatial means (Morgan, 2005) and are also collectively referred to as depictive devices. Classifier handshapes entities carry information about the size and shape of entities, such as the 3 handshape for transportation (e.g. cars, bikes, etc.) and the 1 handshape for upright animate entities (e.g. person, bear, etc.). In use, classifier handshapes are manipulated to provide information about how the entity moves (14) (Supalla, 1986) and topographical information (15) (Emmorey & Herzig, 2003).

(14) CAR CL:3-car-drive-fast-down-street-&-hit-speed bump.
"There was a car driving down the street very quickly and hit the speed bump."

(15) TREE MAN CL:1-man-stands-by-a-tree.
"There was a man standing by a tree."

Role shift (Loew, 1984) and referential shift (Emmorey & Reilly, 1998) are terms for depictive constructions that show referents' actions, thoughts, or words. Dudis (2007) further specifies the depiction of actions as constructed action (Metzger, 1995), and thoughts or words as constructed dialogue (Tannen, 1989). Figure 2 shows a native BSL signer producing a constructed action of a dog jumping up at a beehive from the non-word storybook "Frog where are you?" by Mercer Mayer (1969).

Figure 2*: "The dog jumps up at the beehive."* (Morgan, 2005, 320)

The signer's hands depict the dog's paws as he jumps up in the air, while the face depicts the dog looking up at the beehive and barking. The constructed action references the noun phrase antecedent, DOG, supplied earlier in the narrative.

Depictive constructions (classifiers and constructed action/role shift) are verb predicates that encode referential information that spatially refer to previously established nominal subjects. In signed languages, depictive constructions involving classifiers and role shift typically occur with null subjects, and thus occupy one end of the gradient for null referential constructions..

Research on adults has demonstrated very similar patterns of form-to-function mapping for referential cohesion across sentences in a discourse (specifically, in narratives). In general, adults use overt forms for referents that are inaccessible; full noun phrases tend to be used for introduction, and reduced forms (pronouns and null) are used for maintenance and reintroduction. The specific patterns of the use of null forms vary according to language-specific properties (e.g. whether or not the language is a pro-drop and/or zero-topic

language). As we will see in following sections, referential cohesion shows protracted development for both monolinguals and bilinguals.

2.2 MONOLINGUAL DEVELOPMENT OF REFERENT COHESION

Monolingual children's acquisition of referentially cohesive narratives shows protracted development and starts to stabilize at around 9 years of age (Bamberg, 1986; Hickmann, 2003; Hickmann & Hendriks, 1999; Karmiloff-Smith, 1981, 1983, 1985; Morgan, 2005). Across languages young children around the age of four are able to control anaphoric relations at the local or referring expression level, with an increasing ability to control relations at a global utterance level (with anaphoric functions across intervening referents). Recent cross-linguistic studies (Hickmann & Hendriks, 1999; Hickmann, 2003; Hickmann, 2009) have focused on the development of narrative anaphora as a complex and gradual task that is guided by universal pragmatic principles and language specific properties, as illustrated in the following quote:

> "Irrespective of the language to be acquired, development implies learning a system of form-function relationships that organize sentences and discourse, a task that requires growing cognitive capacity in all domains. However, depending on the particular language and domain to be learned, this multi-functionality also presents children with different problems to solve, which constrain the process whereby they become competent native speakers" (Hickman, 2009, 288).

Language specific properties relevant to the current study include the definite-indefinite distinction, pro-drop and topic drop parameters, and sign language-specific devices such as depiction and spatial modification. Since this is a study on the interactions between young bimodal bilinguals' development of referent cohesion of a spoken and a signed

language, I will review Karmiloff-Smith (1985) for insight on English development patterns, and the one study on sign language acquisition of referent cohesion in British Sign Language (BSL) by Morgan (2005) for the development of sign language-specific spatial referent encoding.

Seminal work by Karmiloff-Smith details the sequence of referent cohesion development through a three-stage model based on the referring patterns of child monolingual speakers of English and French, both languages with the definite-indefinite distinction. Before delving into a description of referent tracking stages by children, first a brief description of fully developed adult forms is provided. Adults who are speakers of a definite-indefinite distinction language introduce referents using an indefinite article, while nominal forms with definite articles are used when there is a switch in reference (reintroduction). References just mentioned in the previous utterance are maintained with a pronominal, when continued in the subject position. In the created adult narrative in (16), the subject switches from the boy to the man, to the boy again, then to the man.

(16) Adult form: There is a little boy walking along. He's in the sunshine and he's got a hat on. There is also a man and the man asks for some money, so the boy gives him some money, and then the man gives him the balloon.

The first stage of development (roughly between ages 4-5) is characterized by the frequent introduction of referents with pronouns and demonstrative or definite noun phrases instead of indefinite noun phrases typical of adult forms (Bamberg, 1986; Karmiloff-Smith, 1985). Typical errors of this type are shown in bold in (17).

(17) Level 1: "**The little boy's** walking along. He's in the sunshine and he's got a hat on. **The man's** giving him a balloon…a green balloon. He [man] asks for some money so he [boy] gives him [man] some money and then he [man] gives him [boy] the balloon. And then he goes home to show it to his mummy. But it's blowing in…in

the wind and he lost it, so he's crying because he can't have his balloon any more." (Karmiloff-Smith, 1985, 71)

Children at this stage immediately maintain referents with a pronominal instead of with a definite noun phrase, as shown in the underlined examples in the second sentence. Maintenance and reintroduction of referents are often ambiguous for both main and subsidiary protagonists, indicated by the insertion of disambiguated brackets in (17).

Contrastively, level two (roughly ages 6-7) is characterized by the consistent and correct introduction of referents by indefinite noun phrases (18) shown in bold, and maintained anaphorically. The hallmark of level two is the rigid reservation of the subject slot to one main protagonist underlined in (18), known as the 'thematic subject constraint.' Bamberg (1986) also observed the thematic subject constraint in effect for younger German monolingual children at four years of age, which might suggest language-specific differences.

(18) Level 2: "There's **a little boy** in red and he sees **a balloon man** and he takes a balloon and he goes off holding it. But he lets it go and loses it, so he starts to cry." (Karmiloff-Smith, 1985, 71)

Level three narratives (roughly ages 8-9) are typified by less rigid application of the thematic subject constraint, where the subject slot may switch to subsidiary protagonists and is consistently introduced by indefinite noun phrases, maintained with pronominals, and reintroduced with definite noun phrases (18).

(19) Level 3: "A little boy is walking home. He sees a balloon man. **The balloon man** gives him a green balloon, so he happily goes off home with it. But the balloon suddenly flies out of this hand and so he starts to cry." (Karmiloff-Smith, 1985, 72)

Level 3 is characterized by the adult use of anaphoric strategy for referent cohesion in

extended discourse using global strategies.

Modality specific spatial forms for tracking referents in sign languages emerge early, yet language development of referential cohesion signed languages also go through a protracted period of development (Morgan, 2005). Modality-specific spatial forms that carry referent information emerge early, around 2 years of age; studies for native-ASL signing deaf children report early use of non-present referents in naturalistic contexts (Loew, 1984; Meier, 1982; Lillo-Martin & Quadros, 2011; Quadros & Martin, 2007). Early research on spontaneously produced sign language data has focused on forms that require space for reference tracking: indexical pronouns, and verb agreement and role shift, two constructions that tend to occur with null subjects. Children first exhibit control of indexical signs with present referents via at roughly 3 years of age. Control of indexical signs with non-present referent stretches into the fourth or fifth year (Loew, 1984; Meier, 1982), and suggests that time is needed to develop cognitive control for remembering referents in specific loci in space. Age of acquisition of verb agreement has shown varied results. Loew (1984) found deaf children at 3;4 only use subject and object verb agreement with present referents and citation verb forms with non-present referents. A second stage emerges at 3;11 with children inconsistently producing agreement for both present and non-present referents, however, control of referential space is not solidified, as evidenced by stacking of referents in the same location. At the last stage, children consistently produce agreement for present and non-present referents at 4;09 as reported by Loew. However, more recent work by Quadros & Martin (2007) shows an earlier appearance of verb agreement by counting eye gaze without cases of omission starting at two years old. Referential role shift emerges in deaf children at

1;07 indicated by eye gaze and non-manual expression (Lillo-Martin & Quadros, 2011), and starts to stabilize around age 6 with correct timing and scope (Reilly, 2000). In sum, the linguistic devices that are necessary for maintenance and reintroduction of referents in ongoing discourse in ASL emerge in young monolingual ASL children rather early, around age 1 to age 4 depending on the device, and they consolidate in usage relatively soon, between ages 3 to 4 for indexical signs and verb agreement, and between ages 1 to 5 for referential shift.

Global form-function control of referents in signed languages shows protracted development and solidifies in a narrative context later in childhood starting at around 9 years of age (Morgan, 2005; Reilly, 2000). Morgan (2005) explored reference cohesion using the classic book, *Frog where are you?* to elicit narrative retellings by twelve native or near-native deaf British Sign Language (BSL) signers, comparing them to narratives by two native adult Deaf controls. The children were divided into three age groups, with four children per group: 4-6 years, 7-10 years, 11-13 years. Morgan coded the referential function of all occurrences of full noun phrases (pronouns were not counted), classifiers and role shift produced by the children. Table 2 summarizes the function served by those three forms in children's production in each age group. Note that the tilde symbol indicates an estimation from the figures, while the numbers without the tilde indicates an exact percentage given in the results section.

Table 2.1: Percentage of occurrence by referent form Native signing children use of referent by function and form by age group in Morgan (2005).
(NP=noun phrase; CL=classifier; RS=role shift)

	4-6 year old			**7-10 year old**			**11-13 year old**			**Adults**		
Form	NP	CL	RS	NP	CL	RS	NP	CL	RS	NP	CL	RS
Introduce	70	8	11.25	80	~9	~6	90	~5	~5	96	4	0
Maintain	22.5	12.5	~52	~10	20	~58	~19	24	~50	6	31	59
Reintroduce	~61	~5	~24	~70	~9	~11	~85	~7	~8	~50	~17	~33

With respect to introduction, even the youngest children mirrored adults in their use of full nominal forms (96%) to introduce referents the majority of the time (70%), and this function of NPs increased for the middle (80%) and oldest (90%) groups. The two adult controls never used role shift for introduction and only rarely used classifier constructions for this function (4%); classifiers used for introduction were followed by mention of the noun they referred to (cataphoric reference). The youngest children made modest use of both role shift and classifier forms for introduction, but did not identify the referent cataphorically like the adults generally did. Usage of both role shift and classifier constructions decreased for the older children for the purposes of introduction.

All groups favored the use of role shift for maintenance, ranging from ~50-59%, followed by increasing use of classifier constructions as children aged, approaching adult patterns (Morgan, 2005). These results echo those of Reilly (2000), who reported that her youngest ASL signers (3;0-5;0) signaled referent shift for direction quotation by breaking eye contact and taking on the nonmanuals of the referent, yet were inconsistent in the timing and scope of referent shifts until around 6 years of age. Reilly also analyzed the overt

identification of the referent before an instance of direct quotation, also known as constructed dialogue. The Deaf adults in her study produced a nominal or pronominal referent form 95% of the time before an instance of direct quotation. The Deaf children increasingly produced overt referent forms before depicting the words of a referent over time, accounting for 70% of instances by age 7.

An unexpected pattern reported by Morgan (2005) was the use of full noun phrases for reference maintenance. Although adults occasionally used NPs in these contexts (6%), children did so at a higher rate, even in the oldest age group (~19%), Morgan suggests that the use of reduced forms for maintenance is more protracted than spoken for languages, and still is developing at 11-13 years of age for signing children. Another unexpected finding is the use of full noun phrases for reintroduction that becomes less adult-like with age. The youngest group's use of NPs for reintroduction was already higher than that of the adults (~61% vs. ~50%) and usage increased with each consecutive age group (~70% and ~85% for the middle and oldest children, respectively). As was reported for maintenance, here we see a similar pattern of children being more explicit than adults in the forms they use for reintroduction. Finally, the youngest age group used role shifting (~24%) for reintroduction at a rate similar to the adults (~33%), but older children used this form less and less over each consecutive age group (~11% and ~8% for the middle and oldest children, respectively). Morgan does not suggest a reason behind the unexpected trend.

In sum, monolingual children regardless of language modality develop referent cohesion on a local level around age 4 but do not reliably establish appropriate global discourse-pragmatic mapping of function and form until around age 9. These general

benchmarks apply to sign language development, too, based on the very limited extant literature on sign language narrative development. Signing children show protracted use of unnecessarily explicit forms for maintenance and reintroduction, compared to adults. In contrast, children resemble adults in their use of explicit forms (NP) for introduction and reintroduction, rather than less explicit role shift and classifier constructions. With monolingual developmental patterns in mind, we now turn to the next section, which delves into bilingual development of referent cohesion.

2.3 BILINGUAL DEVELOPMENT OF NARRATIVE REFERENT COHESION

Bilingual development of referent cohesion is characterized by higher than monolingual levels of overt subject pronoun use (Chen & Lei, 2012; Serratrice, 2007), even when the two languages in the language pair both license pro-drop (Sorace & Serratrice, 2009). Thus this characterization of bilingual development goes beyond language interaction or transfer, and seems rather to be a characteristic of bilingual referent tracking (Montrul, 2004; Lee & Zalasky, 2015; Polinsky et al., 2007; Silva-Corvalán, 1994). This section discusses reference tracking patterns by unimodal bilingual children, hearing adult L2 signers (sometimes referred to as late bimodal bilinguals), and early bimodal bilingual children.

2.3.1 Development of referent cohesion by unimodal bilinguals

Much of the unimodal bilingual literature discusses language influence from one spoken language to the other, which also occurs in the realm of narratives and referent cohesion. In this section I review three representative developmental studies of referential

cohesion by young bilinguals retelling the story in the wordless picture book, *Frog, where are you?* (Mayer, 1969). These studies all examine the reference tracking patterns of bilingual children with a null subject language and English, a non-null subject language. The language pairs represented are Italian-English (Serratrice, 2007), Spanish-English (Alvarez, 2003), and Chinese-English (Chen & Lei, 2012). The three reviewed studies demonstrate reliance on overt forms that occurs regardless of language dominance (Lang A influencing Lang B and vice versa) and production of grammatically acceptable forms that are typically less favored by monolinguals.

Serratrice (2007) investigates twelve English-Italian bilinguals' (6;11–8;4) use of nominal expressions in narratives for introducing, reintroducing and maintaining reference, compared to age-matched monolingual English- and Italian speaking children. Analysis focused on possible cross-linguistic influences in the children's narratives, due to differences between Italian and English in the use of null and overt subject/object pronouns. First, subjects used for the purpose of referent introduction in Italian are positioned post-verbally, while in English the position is pre-verbal. Second, differences in subject and object reference maintenance exist between the two languages. Italian null subject pronouns are obligatory in [-topic shift] contexts, whereas English requires overt subject pronouns in both [+topic shift] and [-topic shift] contexts. As for object pronouns, Italian allows them in pre- or post-verbal position, with semantically distinct interpretations, while English uses only post-verbal object pronouns. The more common Italian clitic object pronoun [-topic shift], *lo*, appears before the verb as seen in the example (16) (p. 1066, English glosses added).

(16) poi cè anche un falco e il bambino lo vede.
then there's also a falcon and the boy him sees

'Then there's also a falcon and the boy sees him.'

Less commonly, the Italian object pronouns *lui (*singular) or *loro* (plural) can be used for contrastive focus in [+topic shift] contexts and appear after the verb, as in (17) (p. 1066, English glosses added).

(17) il cane # e un bambino guardando la rana # che [/] che la rana guarda anche **loro**.
the dog and a boy look-at the frog that that the frog looks also at-them
'The dog and a child watch the frog that the frog watches them too.'

Serratrice predicted cross-linguistic transfer from English to Italian, affecting reference maintenance in several cases. The results of her study reveal similar performance between the bilingual and monolingual children. However, as predicted, bilinguals' Italian narratives were influenced by English, with new subjects appearing in preverbal position twice as often as in narratives by monolingual Italian children. As for Italian overt subject pronouns in maintenance contexts, surprisingly both monolinguals and bilinguals equally produced a small proportion of overt subject pronouns. However, bilingual children produced more full object noun phrases for maintenance in their Italian than their monolingual counterparts (18), avoiding the preverbal clitic pronouns used by the Italian monolinguals (19).

(18) il bambino vede **la rana**
the boy sees the frog
'the boy sees the frog'

(19) il bambino **lo** vede
the boy it sees
'the boy sees it'

It is important to note that the bilingual children did not inappropriately produce post-verbal object pronouns in [-topic shift] contexts as shown in the hypothetical sentence in (20).

Instead, they chose a grammatically acceptable alternative by avoiding the morpholo-syntactic complex clitic altogether (19) to prevent violating their Italian grammar.

(20) *il bambino vede **lui**
the boy sees it
'the boy sees it'

The use of object maintenance in English also displayed an unexpected pattern. The bilingual children used less full noun phrases for object maintenance than the English monolinguals, exhibiting a use of pronouns that may be influenced from their other language, Italian.

Like Sorace (2007), Alvarez (2003) and Chen & Lei (2012) also report young bilingual first language learners utilizing language-specific forms for referent cohesion in narratives, but with some transfer patterns. Alvarez (2003) analyzed the same story retold by a Spanish-English bilingual child each year from 6;11 to 10;11 for presentational relatives. These constructions are used in Spanish for referent introductions in existential constructions that topicalize the referent as the subject in the following predicate, as shown in bold (21).

(21) Érase una vez **un niño que** tenía un perro y una rana (9;11)
'[there] was once **a boy that** had a dog and a frog'

The child used more presentational relatives in English to introduce characters than English monolinguals did, displaying a pattern more typical of Spanish monolingual narratives. Alvarez suggests that this direction of linguistic transfer is due to the bilingual child being dominant in Spanish.

In a more recent study Chen & Lei (2012) investigated 30 Chinese-English bilingual children's (8;7 to 10;9) use of narrative reference tracking. The bilingual children showed no

significant differences in the forms used to maintain characters in both languages as compared to their monolingual peers, an interesting finding, since Chinese allows null forms for maintenance whereas English does not. The bilingual children differed from their English monolingual peers in character introduction, and differed from Chinese monolingual peers in character reintroduction.

New information in Chinese is marked obligatorily by clause structure, appearing post-verbally with sentence-initial topics, whereas English requires nominal determiners for new information (Hickmann and Hendriks, 1999). The bilingual children differed from their English monolingual peers by producing fewer indefinite noun phrase target forms and more definite noun phrases to introduce characters in their English narratives, yet showed no frequency differences in their Chinese narratives as compared to their Chinese monolingual peers. Second, bilingual children used more overt noun phrases for reintroduction in their Chinese narratives than their monolingual Chinese counterparts (79.9% vs. 69.2%), yet showed no frequency differences when compared to their English monolingual counterparts. It is important to note that both Chinese monolingual and bilingual children produced varied forms for reintroduction, including null pronouns and overt pronouns, with bilingual children producing reduced forms at a slightly lesser rate. The bilingual children exhibited influence from Chinese to English for introduction, and from English to Chinese for reintroduction. This finding is significant in that the cross-linguistic influence is bidirectional, depending on function.

The common thread between all three studies reviewed is age-matched performance in most areas of referent cohesion, demonstrating mastery of semantically appropriate forms

in both of the child's languages. Bilingual children often match their monolingual peers in most aspects of narrative referent cohesion. Furthermore, bilingual children may surpass monolinguals in the development of certain grammatical structures. Another similarity between all three studies is the presence of non-monolingual like use of referent cohesion in either one or both of their languages. Differences in referent cohesion may be attributed to transfer from their stronger to their weaker language as Alvarez and Chen & Lei suggest. As Serratrice points out, language dominance cannot be the whole picture, as other factors such as input and language-specific differences in each child's language. Furthermore, Serratrice's results do not lend themselves to direct transfer interpretation from English to Italian. Instead the bilingual children in her study avoided preverbal clitic pronouns, favoring the acceptable use of full object noun phrases for referent maintenance in Italian. In sum, narratives by young bilinguals (English as one of their first languages and Italian, Spanish, or Chinese as their other language) show a reliance on overt subject forms that are grammatical in each of their languages but are less favored by their monolingual counterparts. In the next section, we will see that the preference for overt referent forms has also been reported for second language learners of a signed language, even when both of their languages license pro-drop.

2.3.2 Adult L2 bimodal bilingual development of referent cohesion

The developmental pattern described above of over-reliance on overt forms in reference cohesion is not restricted to child L1 learners only. Similar tendencies have been observed for adult L2 (second language) learners, as summarized by Frederiksen and Mayberry (2015). This tendency may manifest as an over-reliance of nouns for L2 learners of

Mandarin (Polio, 1995), Korean (Jung, 2004), and French (Gullberg, 2003, 2006), or an over-reliance on pronouns instead of null elements for L2 learners of English (Munoz, 1995) and Italian (Sorace & Filiachi, 2006). The overuse of both nouns and pronouns by L2 learners of Spanish (Saunders, 1999) and Japanese (Yoshioka, 2008) has also been noted.

Very recently, researchers have started to examine the development of reference cohesion by hearing second language learners of a signed language, referred to as M2L2, or L2 learners of a language in a second modality (Chen Pichler and Koulidobrova 2015). These studies report mixed results with respect to overreliance of overt forms. Bel et al. (2014) found that advanced adult learners of Catalan Sign Language (LSC) used more overt pronouns for subject maintenance and reintroduction than native signers. This result is interesting since both spoken Catalan and LSC allow null subjects, so the M2L2 signers' over-reliance on overt forms in these cases cannot be attributed to their lack of familiarity with null forms in their L1.

In contrast, Frederiksen and Mayberry (2015) studied referent cohesion by beginner and intermediate ASL learners and found that they patterned like Deaf native signers in marking maintained referents mostly with null subjects occurring with plain verbs, although L2 signers used fewer classifier constructions than native signers (11% vs. 20%) for the same function. The L2 ASL signers diverged more clearly from Deaf controls in reintroduction contexts, where Deaf signers overwhelmingly preferred zero anaphora (77%) followed by nominal forms. L2 signers used zero anaphora in only about half of their reintroduction contexts and produced more nominal forms than native signers. They also used classifiers and pronouns for reintroduction, two forms not used by their Deaf participants in that

context.

Methodological differences may be behind the opposing results reported by Frederiksen and Mayberry (2015) and Bel et al. (2014). The video stimuli used by Frederiksen and Mayberry (2005) were short in length with few events depicted, and a small number of actors, one main and one secondary character. These elicited narrative retellings were much shorter than those elicited by Bel et al. (2014), and this relative shortness may have somehow led to more use of null forms in maintenance contexts with referents being highly accessible. Another methodological difference is instead of a video retelling, Bel et al.'s subjects watched a video as a narrative prompt to recount an event that happened to a friend. This approach may have encouraged participants to recount more detailed events, hence longer narratives. Additionally, the difference in L2 participants' sign proficiency across the two studies may also have played a role, albeit counterintuitvely with the more advanced M2L2 CSL signers behaving less target like than the less advanced signers. Nevertheless, both studies indicate that there is at least some tendency for underuse of null forms in adult M2L2 signers, regardless of modality and the availability of null forms in their L1.

2.3.3 Early bimodal bilingual development of referent cohesion

Research on the acquisition of narrative skills by bimodal bilinguals is extremely limited, consisting of just one study by Morgan (2000). Morgan tracked referential devices in two elementary school-aged children learning British Sign Language (BSL) and British English. The study analyzed narratives elicited from two bimodal bilingual children, Sam

(7;1) and Cloe (9;10), using a short picture telling task. The children were shown pictures of a boy and a girl painting each other's faces, then pouring water over each other's heads, and finally, being scolded by their mother. Sam told the story first in English then in BSL while Cloe narrated in the opposite order. The picture book was removed during the narrations to promote the use of signing space for cohesion purposes.

Morgan (2000) focused on five morphosyntactic structures of BSL: noun phrases for introducing referents, and role shifting, agreement verbs, verb phrase anaphor or ellipsis, and indexical pronouns for maintaining referents. The results of his study are presented in Figure 2.2 below, showing referential use by child and language (Morgan, 2000, 294). Cloe, the older child, clearly produced all five structures in both BSL and English, placing her between the 2nd and 3rd phase of Karmiloff-Smith's (1985) discourse organization model. In contrast, Sam showed mixed results for both languages, as discussed in the next paragraphs, prompting Morgan to place him between the 1st and 2nd phase of the aforementioned model.

Figure 2.2: Bimodal bilingual referent cohesion results comparison by child and language (Morgan, 2000) [Sam (7;1) and Cloe (9;10)]

Individual comparison of reference use and proposed phase of development

Child:	**Sam**		**Cloe**	
Forms:	***BSL***	***English***	***BSL***	***English***
Referent establishment	Attempted	Unclear	Clear	Clear
Pronominals	Over redundant use of NP	Deictic use of pronouns	Clear	Clear
Verb inflections	Ambiguous use of sign space	Clear	Clear	Clear
Verb phrase anaphor	Absent	Absent	Clear	Clear
Shifted reference	Attempted	Attempted	Clear	Clear
Discourse organization in Karmiloff-Smith model	Between 1st and 2nd phase	1st phase	3rd phase	Between 2nd and 3rd phase

In his English narratives, Sam used ambiguous pronouns (21) instead of full noun phrases to introduce all three characters (boy, girl, mother).

(21) They are painting. He paints her face. She paints his face. (Morgan, 2000, 288)

Conversely in BSL, Sam identified characters repeatedly in the story with overt NPs (BOY, GIRL) instead of using indexical pronouns for referent maintenance. Recall from Morgan (2005) that the propensity for full NPs as repeated referents has been noted for young deaf children (ages 4-6) but not for older deaf children (ages 7-13). However, previous studies of monolingual children show a protracted use of full noun phrases for English maintenance up until 8 years old (Serratrice, 2007). Sam did not produce verb phrase ellipsis in either language and instead used verb repetitions to indicate dual actions as seen in (21) with three repetitions of *paint*.

With respect to verb agreement for non-present referents, Sam has clearly acquired verb inflection reference in English, yet exhibits inconsistent use of verb inflection in his BSL narrative at age 7. Previous studies show deaf signing children acquiring control of verb agreement for non-present referents by preschool age (Hänel 2005; Quadros and Lillo-Martin 2007), so Sam's development of this aspect of BSL may be somewhat protracted. Finally, Sam attempted only one instance of referential shift in BSL, with ambiguous referents and unclear timing and scope, consistent with error patterns reported by Reilly (2000) for younger Deaf ASL signers.

Morgan also notes that whereas deaf children in his previous study (Morgan 1998) used *locative-verb constructions,* the hearing children of Deaf parents did not. His definition of

locative-verb constructions seems to include a shift in reference that includes a depiction of how an object (e.g. a paintbrush) is directionally handled, to recount the face-painting scene (22). The first depictive verb, PAINT-OUT, depicts the act of the girl painting the boy's face, in an outward direction. The second verb, PAINTED-ON-FACE, depicts two characters simultaneously, with the signer's hand representing the girl's hand and the signer's face representing the boy's face.

(22) GIRL PAINT-OUT BOY PAINTED-ON-FACE
girl RS:girl-paints-on-boy-face, boy RS:boy-face-get-painted-by-girl
"...the girl paints the boy's face..."

Instead of using depicting verbs discussed in (22), the hearing children of deaf parents produced *linear lexical constructions* found in (23) and (24) with modified glosses for clarity (294). Sam (23) establishes the boy then uses a linear construction to convey the event without depicting a character's point of view or using his body for space in PRO(boy) PAINT GIRL FACE.

(23) AND PRO(boy) BOY FACE PRO(boy) PAINT GIRL FACE.
and he boy face he paint girl face.
"and he, the boy, he paints the girl's face."

Similarly, Chloe (24) produced a non-depicting linearly organized utterance to convey the actions of both the girl and the boy as they flick each other's faces (24).

(24) FLICK GIRL FACE. GIRL NOT-LIKE PRO(girl) SAME PRO(boy) FLICK FACE.
flick girl face. girl not-like she same he flick face.
"...flicks the girl's face. The girl doesn't like (it), she flicks his face too."

Morgan suggests that linear lexical constructions in lieu of locative-verb constructions might

be an effect of obligatory subjects in spoken English. Assuming that BSL is grammatically similar to ASL, utterances 23 and 24 are grammatically acceptable, albeit rather English-sounding. This pattern may be typical of bimodal bilingual signers as heritage signers, as discussed later in this dissertation.

In summary, the forms and devices used for referent cohesion vary cross-linguistically depending on language specific properties, such as whether a language employs pro-drop and zero-topics, and grammatical distinctions of definiteness and giveness. Signed narratives also involve spatial forms (including indexical pronouns, classifiers, and role shift) that appear to be specific to signed languages. Generally speaking, development of narrative referent cohesion stabilizes around age 9 (Karmiloff-Smith, 1986) for both monolingual and bilingual children, although the latter display some difference in developmental patterns that may reflect cross-linguistic transfer (Alvarez, 2003; Chen & Lei 2012; Morgan, 2000) or creative alternate structures that are grammatically acceptable in both languages (Serratrice, 2007).

Yet reference cohesion remains a severely understudied aspect of sign language development, for both Deaf and (bimodal) bilingual signers. As observed in the bilingual studies reviewed earlier in this chapter, some patterns of bilingual referent cohesion diverge from those reported for monolingual comparisons. In the case of signing children in the current study, all of them are bilingual in English and ASL, regardless of whether they are Deaf, Coda, or DDCI. Yet the degree of cross-linguistic transfer from English to ASL is more pronounced in the signing of the bimodal bilingual children, suggesting that there is more than one bilingual profile for ASL-English bilinguals. Comparison of sign language

developmental patterns of Deaf vs. bimodal bilingual children can shed light on the question of whether the latter group qualify as *heritage signers*, parallel to heritage speakers from the spoken language literature, which I review in the next section.

2.4 HERITAGE SPEAKERS AND SIGNERS

Compton (2014) was the first researcher to extend the notion of heritage language to signing communities. She frames both Deaf and Coda children with signing Deaf parents in the US as *heritage language signers*, based upon the similar transmission of ASL from parent to child. While both Deaf and Coda children experience vertical transmission of their home language, I suggest that Coda and DDCI children form a distinct group of heritage signers. Recent proposals of Codas as a unique type of *heritage language learners* have focused on reflective surveys of language experiences in interpreting and interpreting education (Isakson, 2016; Williamson, 2015). However, there is sparse research on the ways in which Codas' linguistic outcomes parallel that of heritage speakers (Chen Pichler et al., 2016; Lillo-Martin et al., 2012; Palmer, 2015; Reynolds and Palmer, 2014; Reynolds et al., 2015). In this section the ways in which early bimodal bilinguals fit the description of a heritage language user from an acquisition perspective both contextually and linguistically are discussed.

2.4.1 Acquisition context of heritage language users

While both Deaf and hearing early bimodal bilinguals of signing Deaf parents and are native signers who experience sign language transmission from parent to child, the quantity and quality of each group's exposure to their heritage language is different. These variations

in early bimodal bilinguals' home language experiences impact their linguistic development and language proficiency, providing justification that Codas and DDCIs are not like their Deaf counterparts, and constitute a unique category of their own. A discussion of the early language experiences and consequently different language outcomes between Deaf and early bimodal bilinguals follows.

Table 2.2: Distinction between heritage speakers and early bimodal bilingual

	Bilingual heritage speakers	**Early bimodal bilingual heritage signers**	**Deaf native signers**
Language status	Home minority language	Home minority language	Home minority language
Education	Majority language	Majority language	Instruction in minority language
Language settings	Limited	Limited	Limited in the general public
Proficiency in home language	Highly variable	Highly variable	Not as variable

Table 2.2 compares the language acquisition experience of three different types of heritage language language users: heritage speakers, early bimodal heritage signers, and Deaf heritage signers. The similarities between heritage speakers and early bimodal bilinguals are striking, both contextually and linguistically. Like heritage speakers, early bimodal bilinguals do not typically receive schooling in their heritage language, limiting input to the home and

community environments. On the other hand, Deaf heritage signers in the US typically receive schooling in ASL, either as the primary language in schools for the Deaf or through interpreters, and may have Deaf peers in mainstream programs. Barring deaf populations with intellectual disabilities, Deaf heritage signers tend to attain full proficiency in their heritage language (ASL). In this regard, they differ significantly from typical early bimodal bilingual signers.

Another important difference between heritage speakers/early bimodal heritage signers and Deaf heritage signers is access to the majority language and language settings. Early bimodal bilinguals, like heritage speakers, have full auditory access to the surrounding spoken language and attain written and spoken proficiency in the majority language. Deaf children who do not have full auditory access to English may vary widely in their ability to speak and hear via assistive devices, and are often literate in English through visual means (Goldin-Meadow & Mayberry, 2001). In this sense, American Deaf native signers may be considered sign-print bilinguals of ASL and English text. The key difference between American Deaf native signers and early bimodal bilinguals is the variability in input of their sign languages. Non-cochlear implanted Deaf native signing children receive a wide range of input (academic, social, etc.) in their sign language, while early bimodal bilinguals receive reduced input often limited to the home, much like heritage speakers. Variable bilingual input has been noted to impact language development in various domains including the home, siblings and peers, language varieties, and school (Unsworth, 2016). These domains that have variable input have also been noted in the heritage speaker literature (Montrul, 2012; Rothman, 2007). Bilinguals, heritage speakers, and early bimodal bilinguals

experience reduced input and limited varieties of their heritage language, impacting proficiency. Due to the significant input parallels between heritage speakers (a type of bilingual) and early bimodal bilinguals, I depart from Compton's sociological definition of heritage signers to include only Coda and DDCI individuals. This departure is founded on early age of acquisition of a minority language, variable input that is typically limited to the home that does not include schooling, and language development patterns. Distinguishing early bimodal bilinguals from Deaf native signers is advantageous for the field of ASL acquisition in order to identify different developmental patterns. For the purposes of this study heritage signers refers only to early bimodal bilinguals, while Deaf native signers serve as my control group.

2.4.2 Heritage grammar characteristics

Variation in adult bimodal bilinguals sign language proficiency has been noted across diverse sub-fields such as sociolinguistics (Pizer, 2013), cognition (Supalla et al., 2014), interpreting (Isakson, 2016; Williamson, 2015), and ASL college instruction (Ashton et al., 2013). Recent early bimodal bilingual research suggests ASL development may show divergent patterns from Deaf monolingual age-matched peers much like studies that compare the grammatical systems of young bilingual heritage speakers to that of monolingual speakers. In this section, I review distinct linguistic aspects of the divergent grammars of heritage speakers and early bimodal bilingual signers that relate to narratives, including lexical gaps, code mixing, verbal morphology, and syntax.

Lexical gaps

Polinsky (2016) argues that heritage language ability correlates roughly with vocabulary and speech rate, showing considerable differences between heritage speakers and monolinguals. Since vocabulary is shaped by language experience, which for heritage speakers is typically limited to the home during childhood years, this results in significant vocabulary gaps and slower speeds of lexical retrieval (Polinsky, 1997, 2007). Heritage speakers who have low proficiency in Russian are found to have differentiated knowledge of word classes, showing better control of verbs than of nouns and adjectives in tasks of word recognition and translation accuracy (Polinsky, 2005).

Lexical gaps for Coda heritage signers have not been as clearly identified or detailed as in the heritage speaker literature. However, differences between Coda heritage language learners and second language learners have been noted. The ASL Teaching Association (ASLTA) in the United States actively considers Codas as heritage language learners because "students raised in the rich heritage of Deaf culture may possess varying degrees of ASL proficiency" (Ashton et al., 2013: 12). Ashton et al. (2013) note that "students without previous exposure to ASL may find the rapid pace of native ASL discourse limits their comprehension, heritage learners may find unfamiliar topics and registers challenging" (2013:15). The lack of standard lexical signs in Codas' heritage language has also been noted (Pizer et al. 2013). In one of Pizer's interviews, one Coda describes her experience learning ASL as an adult, when she realized some of the signs she used were homesigns (signs specific to the home), not ASL. She laments that her parents "never forced us to sign while talking. And I wish that they had" (86). This recognition and regret of proficiency in a

heritage language has also been noted in the heritage speaker literature (He, 2010). Deaf parents may view their Coda children as hearing, with speech being a more natural way for Codas to communicate. Thus, heritage speakers' and signers' lexical gaps may not only stem from a lack of heritage language input in a variety of settings such as school, they may also be exacerbated by the tolerance of the majority language in the home.

Code mixing

Among heritage speakers, compensatory strategies for lexical gaps include code switching to their more dominant language (Lindsey, 2006), occurring more for nominals than verbs and adjectives (Poplack, 1980). Polinsky (2007) notes that verbs carry more semantic information than noun, which would be more detrimental to lose. While code switching is frequently utilized by unimodal bilinguals of spoken languages, bimodal bilinguals are more likely to utilize code-blending (Baker & van Bogaerde, 2008; Emmorey et al., 2008), a type of code-mixing specific to bimodal bilingualism that might also be a compensatory strategy for lexical gaps. Code-blending is when "ASL signs are produced simultaneously with spoken English" (Emmorey et al., 2008: 44). It is essential to make a distinction between code-blending and Simultaneous Communication (Sim-Com). Sim-Com is an invented type of Manually Coded English that includes features of English morphology and syntax, primarily used by educators of the deaf in conjunction with fully spoken English sentences. Conversely, code-blending is a naturally occurring phenomenon (Chen Pichler, Lee, and Lillo-Martin, 2014; Emmorey et al., 2008) typically associated with bimodal bilingual interactions. Code-blending is generally understood by both Deaf and bimodal bilinguals, whereas Sim-Com has been observed to be hard to understand by Deaf users

(Chen Pichler, Lee, and Lillo-Martin, 2014).

Other researchers also include mouthed words without phonation (voice or whispering) in their definition of code-blending (Baker & van Bogaerde, 2008; Fung, 2012), but this is a minority view. The one narrative study on young bimodal bilinguals did not cite the use of code-blending (Morgan, 2000), but in the current study, I transcribed code-blended utterances as detailed in the methodology section to account for possible influence of English forms on bimodal bilingual signed narratives. Lastly, factors other than a direct influence of one language on another including issues such as language acceptability, language dominance, and amount of input in both languages will be considered as possible factors of dependence on overt forms for referent tracking in the discussion.

Morphology

In heritage language literature, morphological structures are hallmarks of heritage speakers' divergent grammar. Gender marking has shown to be highly affected in heritage languages that include this grammatical feature. For example, Russian has a three-way gender distinction but is produced by heritage speakers with only a two-way distinction; heritage Russian speakers mark only masculine and feminine, with the omission of neuter (Polinsky, 2008). As for heritage languages with complex case marking (e.g. Russian, heritage speakers have been found to reduce the six-way nominal distinction to only two (Polinsky, 2007). Benmamoun, Albirini, Saadah, and Montrul (2008) discovered Arabic heritage speaking adults' use of plural forms were similar to that of monolingual Arabic speaking children in the use of overextension of the feminine plural suffix to masculine environments. Similar case marking reductions have also been found for Spanish (Montrul

and Bowles, 2009) and Korean heritage speakers (Song, O'Grady, Cho & Lee, 1997). Lastly, verb agreement errors uncommon for monolingual native speakers are found in the grammars of heritage speakers. These types of errors include errors in the subjunctive mood in Spanish (Montrul, 2007), aspectual distinctions in both Russian and Spanish (Montrul, 2002, Polinsky, 2007; Silva-Corvalan, 1994), and inflected infinitives in Brazilian Portuguese (Rothman, 2007).

To date, only one study has observed divergent morphology by four young bimodal bilingual children acquiring ASL as a heritage language (Palmer, 2015). Palmer's dissertation examined the development of ASL word order in bimodal bilinguals (20-42 months) and noted the lack of reordering morphology (aspect, handling, spatial and locative) typical of native-signing deaf children (20-30 months) (Chen Pichler, 2001). This type of morphological reordering licenses non-canonical word orders, which occur with strikingly less frequency for the bimodal bilingual children in Palmer's study, compared to Deaf of Deaf counterparts. Thus, although the impact of heritage language on morphological development has not yet been explicitly investigated for ASL, there is at least some indication that morphology in this language is not acquired along the same timetable as it is for Deaf children from Deaf families.

Syntax

Heritage language researchers have also displayed differential use of syntactic structures compared to monolinguals in the areas of word order (Montrul, 2010), long distance dependencies (Kim et al. 2009), and relative clauses (Polinsky, 2011). Heritage speakers of languages that allow variable word order (e.g. Spanish and Russian) have been

observed to rely more on basic word order than non-heritage speaker comparison groups (Song, et al., 1997). Heritage speakers of Spanish have also shown decreased comprehension of preverbal objects, yet accurate comprehension of structures in basic SVO word order (Montrul, 2010). Heritage speakers have been found to exhibit atypical use of long distance dependencies by way of reflexive pronouns in Korean (Kim, Montrul, and Yoon, 2009) and Russian (Polinsky and Kagan, 2007). For example, Korean monolinguals use a specified three-anaphor system for long and local distance antecedents, whereas heritage Korean speakers have a simplified two-way system (Montrul, 2010: 9). Relative clauses are another vulnerable area for heritage speakers of Russian (Polinsky, 2008; O'Grady, Lee & Choo, 2001). Montrul (2010) reviews Russian heritage speakers' comprehension problems in interpreting object relative clauses (e.g. *the cat that the dog is chasing)* as opposed to subject relative clauses (e.g. *the dog that is chasing the cat*) (9).

Bimodal bilingual children have also exhibited an over dependence of basic word order SVO in ASL (Palmer, 2015) and Wh-question word order in ASL and Libras (Brazilian Sign Language) (Lillo-Martin, Koulidobrova, de Quadros, & Chen Pichler, 2012). The acquisition of canonical and non-canonical word order has been observed in native-signing Deaf children at around 23 months of age (Chen Pichler, 2001). Using the same measures, young bimodal bilingual children (2 Coda & 2 DDCI) of 20-42 months only seem to have acquired canonical word order with non-canonical orders accounting for less than 1% of utterances. Variable word order for Wh-questions has also been observed to be a vulnerable area for American and Brazilian bimodal bilinguals (Lillo-Martin et al., 2012). ASL and Libras allow variable word order for Wh-words and may appear sentence-initial, sentence-

final position, or both. In a study of young deaf ASL signers (4;0-6;0), the youngest children produced all possible word orders for Wh-questions, yet the 5- and 6-year old children showed more variable word order use, producing Wh-final and Wh-double constructions (Lillo-Martin, 2000). Using the same elicitation methods, age-matched bimodal bilingual children were observed to strongly prefer Wh-initial constructions for question word orders (Lillo-Martin et al., 2012).

Referent tracking in narratives

Adult heritage speakers have been observed to have a propensity for overtness in tracking referents in contexts of shifts in reference and topic in null subject languages (Montrul, 2004; Lee & Zaslansky, 2015; Polinsky, 2007). In interview situations, adult Russian heritage speakers were found to repeat full NPs in contexts where a pronominal or a null form would be more pragmatically appropriate (25). The second NP translated as *my other friend he* is co-referenced with the preceding NP *my other friend*, providing redundant subject information.

> (25) I tam **moj drugoj drug$_i$** i **moj drugoj drug$_i$ on** ne umel drive a stick-shift.
> and there **my other friend** and **my other friend he$_{RP}$** NEG could drive a stick-shift
> 'My other friend was there; he didn't know how to drive a stick-shift car.'
> (Polinsky, 2007, 244)

This observation prompted Polinsky (2007) to propose reference tracking grammar of Russian heritage speakers as consisting of a two-way system (overt pronominal>full lexical description) instead of a Russian monolingual three-way system (null copy> overt pronominal>full lexical description) (243-244).

In narrative retelling contexts, adult heritage speakers of Spanish (Montrul, 2004) and Korean (Lee & Zaslansky, 2015) have been noted to produce null subjects in appropriate discourse-pragmatic contexts, however, to a lesser degree than language matched monolinguals. The results of Montrul's study show advanced Spanish heritage speakers patterning similarly to Spanish monolinguals in the use of overt subjects (47.2% and 42.8%) and null subjects (52.7% and 57.2%) for referent tracking. Intermediate heritage speakers, showed the reverse pattern, producing significantly more overt subject forms (68.6%) and significantly fewer null subjects (31.4%). The intermediate heritage speakers also produced the highest percentage of redundant overt subjects (4.7%) and illicit null subjects (15.5%) to refer to a change in referent. An example of an illicit null subject can be found in (26). The first two null subjects (*pro*) accurately refer to Little Red Riding Hood, yet the final null subject is an illicit error in the context of a switch in reference to the grandmother.

(26) Caperucita Roja salió a ir a la casa de su abuelita con una canasta de comida porque *pro* estaba, *pro* iba a visistarla porque ***pro*** estaba enferma.

'Little Red Riding Hood went out to go to her grandmother's house with a basket of food because *pro* was, *pro* was going to visit her because **pro* was sick.'

(subject # 206, intermediate, Montrul, 2004, 133)

As for overt forms, intermediate heritage speakers of Spanish produced the highest percentage of pronominals (30.2%), of which half were redundant. In summary, the findings from Montrul's study show that both groups of heritage speakers do not avoid the use of null subjects completely, but intermediate speakers use null subjects to a significantly lesser degree than non-heritage controls. Furthermore, the majority of errors by intermediate

speakers are in the redundant use of pronominal and null subjects for changes in referent (26).

Similar to advanced heritage speakers of Spanish (Montrul, 2004), heritage speakers of Korean used null subject for referent cohesion as frequently as monolinguals in a video retelling task (Lee & Zaslansky, 2015). However, Korean heritage speakers were found to use null subjects in different discourse contexts than Korean monolinguals, who used null subjects in contexts where the referent is the immediately preceding topic. In contrast, Korean heritage speakers used the same for topic shifts with more frequent use of subject shifts overall. In this regard, Korean heritage speakers pattern similarly to intermediate heritage speakers of Spanish where null subjects are inaccurately used for shifts in referents.

Parallels between heritage speakers and bimodal bilinguals have been observed in a variety of ways. Culturally, Compton (2014) observed that the ties Codas have through family and community contexts are similar to those reported for heritage speakers. Empirically, parallel patterns of simplification of verbal agreement and word order has been observed for early ASL bimodal bilinguals (Palmer, 2015; Lillo-Martin, 2012). Qualitatively, observations of lexical gaps (Ashton et al., 2013; Pizer et al. 2013) and framing Codas as heritage learners of a sign language (Isakson, 2016; Willamson, 2015) has also been noted. Yet much work remains to be done. Bimodal bilinguals' code-mixing patterns have been observed (Baker & van Bogaerde, 2008; Emmorey et al., 2008) but have not been associated with lexical gaps as has been done for studies of heritage languages (Lindsey, 2006). Lastly, heritage speakers have been observed to depend on overt forms for reference tracking (Lee et al., 2016; Montrul, 2004; Polinsky, 2007). Only one study exists on the reference tracking

patterns by two young bimodal bilinguals and cites a lack of modality specific depictive covert forms typical of Deaf native-signing children (Morgan, 2000). This dissertation fills a gap in the acquisition literature on the development of reference tracking by early young bimodal bilinguals. Furthermore, the current study serves to contribute to the growing field of framing bimodal bilinguals as heritage language users supported by empirical data.

2.6 PREDICTIONS

RQ1. What are the developmental patterns of referential cohesion in the signed narratives of young bimodal bilinguals?

The first research question (RQ1) focuses on the developmental aspect of ASL referent cohesion for 6 bimodal bilingual children at two points in time, roughly a year and a half apart. The age range of children in time one (T1) is from 5;02 to 6;09, while in time two (T2) their ages range from 6;07 to 8;01. I propose one general prediction for RQ1 and two discourse function specific predictions. First, I predict that the bimodal bilingual children will overall use more overt forms in T2 than in T1. This specific prediction is based on the increase in the time and length in a monolingual English school environment. The children at T1 are in the middle of the school year, grades ranging from preschool to the first grade, while in T2 the children have just completed kindergarten up to the third grade. T1 represents their early elementary school phase while in T2 the children overall are experiencing the majority of their weekdays in English for a longer period of time. Their linguistic environment in T2 represents a period of change for the children, similar to what has been noted for heritage speakers in a switch in language dominance.

This change in the amount of ASL input in an extended amount of time suggests that T2 is the vulnerable time for their home language and may lead to use of ASL forms for referent cohesion that are more English like. However, this change does not necessarily mean direct transfer from English but could indicate a preference to chose structures to conform to both languages, or which overlap in both languages, like those patterns found for younger bimodal bilinguals for verb agreement and word order simplification (Palmer, 2015). Table 2.3 details overlapping forms and language-specific forms in ASL and English by reference function. The overlapping forms for all functions are overt nominal and pronominal. ASL forms for referent cohesion that might be vulnerable are zero anaphora, as licensed by zero topic and pro-drop properties and modality specific forms including depiction. This prediction is also in line with observations of Coda children's dependence on overt forms instead of sign language specific depictive forms (Morgan, 2000).

Furthermore, dependence on overt forms has been cited for bilinguals where one language is more dominant than the other as found for unimodal bilingual children (Chen & Lei, 2013; Serratrice, 2007), late M2L2 adults (Bel et al., 2014; Frederiksen & Mayberry, 2015) and adult heritage speakers (Lee et al., 2016; Montrul, 2004; Polinsky 1997).

Table 2.3: Referent tracking forms by function in ASL and English

Function	**English specific forms**	**Overlap in forms**	**ASL specific forms**
Introduction	Definite-indefinite distinction	Nominal forms	-
Maintenance	Definite-indefinite distinction	Pronominals	Zero anaphora & depiction
Reintroduction	Definite-indefinite distinction	Nominal & pronominal forms	Zero anaphora & depiction

The first form-function developmental prediction is an increase of full noun phrases for both introduction and reintroduction as found in native signing Deaf children in Morgan's study (2005). The second form-function developmental prediction for maintenance suggests an increase in pronominals and a decrease in null subjects occurring with plain and depiction verbs.

RQ2. How are the patterns of referent cohesion by bimodal bilinguals similar or different to age-matched Deaf peers?

RQ3: What do the bimodal bilingual patterns of referent cohesion tell us about bilingual narrative development and do they match patterns reported in the literature for heritage speakers of two spoken languages?

Referent cohesion requires discourse-pragmatic control by skilled language users for form-function mapping. Since the Bibi children are receiving variable input as bilinguals of a heritage language, as opposed to the native Deaf control group, I would expect a difference in ASL competency and development of referent cohesion. This difference in competency

may pattern like language groups who are still developing reference tracking control like that found in young monolinguals, young bilinguals, M2L2 signers, and adult heritage speakers in their reliance of overt forms, including nouns and pronouns. The second research question compares referent tracking by bimodal bilingual children to their deaf aged-matched peers. I predict that the bimodal bilingual children will produce more overt forms overall (including nominals and pronominals) than their Deaf peers. I also predict that Bibi children will use null subject forms, however, to a lesser degree as their ASL dominant Deaf peers. If the prediction for RQ2 is indeed the case, then the answer to RQ3 would suggest that early bimodal bilinguals pattern more like heritage speakers in their dependence on overt forms for referent cohesion.

Chapter III: Methods

The current study examines the development of referent cohesion in the signed narratives by young native-signing bimodal bilinguals (Coda and DDCI) compared to their age-matched Deaf signing non-cochlear implanted counterparts. The narrative data were collected as a part of the IRB approved Bimodal Bilingual Binational[1] (Bibibi) project, a longitudinal and experimental project, led by Diane Lillo-Martin, Ronice Quadros and Deborah Chen Pichler (for project website see http://bibibi.uconn.edu/). This chapter presents the stimulus design, data collection procedure, participant groups, and the transcription and coding methods for this dissertation.

3.1 PARTICIPANT DATA

Narratives were collected from 12 native-signers of ASL, six bimodal bilingual children and six Deaf children. A total of 48 narratives (8 per child, 4 in ASL and 4 in English) were collected from the bimodal bilingual children, ages ranging from 5;03-6;09 years of old. The six bimodal bilingual children selected for this study can be broken down into two groups: three Coda children and three DDCI children as shown in Table 3.1 along with their ages. Roughly a year and half later, the same narratives were collected from the same six bimodal bilingual children to observe developmental differences. The first set of narrative data is referred to as Time one, whereas the second set of data collected a year and a half later is referred to as Time two. As mentioned previously, the current study selected

[1] This work was supported by the NIDCD of the National Institutes of Health [R01DC009263 to D.L-M. and D.C.P.]. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

the same two ASL narratives in both time one and time two, for a total of 12 bimodal bilingual narratives in order to track linguistic development.

Table 3.1: Bimodal bilingual characteristics and ages at time one and time two

Child	**Gender**	**Type of bimodal bilingual**	**Age at Time 1**	**Age at Time 2**
Nik	Male	Cochlear implanted	05;02	06;07
Fin	Male	Cochlear implanted	05;05	06;09
Kim	Female	Hearing	06;01	07;05
Gia	Female	Cochlear implanted	06;04	07;09
Tom	Male	Hearing	06;09	08;01
Ben	Male	Hearing	06;09	08;02

The home language for all Bibi children is ASL and English is used at school and with most of their relatives. I have provided a brief synopsis of detailing each Bibi child's language environment at home, with parents and siblings, parent's language background, and with extended family. I also provide languages used at preschool and elementary school, as well as age of cochlear implantation for the DDCI children.

> Nik is a DDCI, who was born Deaf, and was cochlear implanted with one implant at 16 months and his second implant at age 3;6. Nik has two Deaf parents, and both of their extended family are all hearing. Nik's father was born Deaf and learned ASL at a young age at school. His mother was born and raised in Poland and communicated only in spoken Polish until she moved to the United States as an adult and then learned ASL. Nik has two younger siblings, a brother and a sister, who were both born Deaf and cochlear implanted at a young age. Nik and his siblings attended an all-English

speaking daycare the majority of the time. His younger siblings also attended a signing preschool at a school for the deaf a few times a week before starting elementary school. From the background forms, it seems that Nik did not attend the signing preschool at the school for the deaf. Nik's elementary school is entirely in English without any ASL input. Nik and his siblings communicate with each other entirely in English. The parents report communication with Nik consisting of mainly ASL with his father and ASL and sign-speech blending with his mother.

Kim is a female Coda, who was born hearing and has a Deaf mother. Information on her father's hearing status was not reported and does not seem to play a role in her home life. Kim's home language environment as reported by her mother includes ASL, Spanish, and English. From the background form, it was not clear when the mother learned ASL and if she has any other Deaf family members. Kim attended an elementary school completely in English.

Gia is a DDCI, who was born Deaf, and was cochlear implanted with her first implant at 18 months. The age of her second implant is unclear but seems to have taken place before she attended elementary school. Gia has two Deaf parents, and both of their extended family are all hearing. Gia's father learned ASL at a young age at school, while her mother learned in early adulthood. Gia has an older brother and a younger sister who are hearing and communicate with each other entirely in English. Her parents describe her home language environment as consisting of ASL, English, and code-blending in speech and sign. Gia attended an all English elementary school.

Fin is a DDCI, who was born Deaf, and was cochlear implanted at 19 months. Fin has Deaf parents, and a Deaf maternal aunt and Deaf maternal grandparents. His mother is a native signer while his father learned ASL as a young adult. Fin has one younger sibling who was born Deaf and was cochlear implanted at a young age. Fin and his brother communicate with each other mainly in spoken English. His parents describe his home language environment as mainly ASL with his parents and some spoken English with his father. Fin attended an all English speaking elementary school.

Tom is a male Coda, who was born hearing, and has two Deaf parents. Both parents acquired ASL at a young age at school. Tom has one younger hearing sister with whom he communicates with in English. As reported by his parents, his home language environment includes ASL, English, and mixed use of ASL and English in blended utterances. Tom has no other deaf family members other than his parents. His school language environment at preschool and elementary school is entirely in English.

Ben is a male Coda, who was born hearing, and has two Deaf parents, one Deaf older sibling and one older Coda sibling. Ben communicates with his Deaf brother in ASL and his hearing sibling in English. Ben also has one Deaf maternal grandmother. Ben's mother was born Deaf and did not learn ASL until her Deaf mother went back to college. Ben's mother (a young adult at the time) and grandmother both learned ASL at the same time. His father lost his hearing in his early teens, and learned ASL as a

young adult. Ben's communication with his parents is mostly ASL with some use of sign-speech blending. Ben attended a signing preschool with Coda and Deaf peers at a school for the deaf. He attended an elementary school with a separate deaf educational program. His mother reports that he played with the Deaf children at his school during recess and participated in sports with Deaf teammates.

Six Deaf native signing children served as the control group. Two children per major age group of the bimodal bilinguals (5, 6, 7 years old) are represented in the control data. The Bibibi lab at Gallaudet University collected narrative data from three native Deaf signing children without cochlear implants as shown below in Table 3.2, using the same narrative stimuli and elicitation methodology, except for spoken English elicitation. The Bibibi lab collected three additional child narrative data from Deaf children in Texas. All of the Deaf children attend schools for the deaf and use ASL as their mode of communication at home and school.

Table 3.2: Native signing Deaf children control group

Control	**Location**	**Gender**	**Age**
Ivor	Texas	Male	05;05
Ward	Texas	Male	05;11
Kloe	Texas	Female	06;10
Ada	Gallaudet	Female	06;10
Bel	Gallaudet	Female	07;01
Lee	Gallaudet	Female	07;10

The Deaf children serve as controls, as they are native-signers with no auditory access to English yet with access through visual means. The control group is an appropriate comparison covering the general range of bimodal bilingual ages, keeping in mind that age is not always the most reliable feature for comparing L1 development. Like the Coda and DDCI bimodal bilinguals, the Deaf children are native ASL signers, yet with more access to their home language in educational settings through direct instruction.

Due to recent findings within the Bibibi project, I analyzed the Coda and DDCI children as one group of bimodal bilinguals. Davison, Lillo-Martin, & Chen Pichler (2014) found that both Coda and DDCI children in the larger Bibibi study fell near or above age expected reported ranges in an ASL receptive language skills test that is normed on native-signing Deaf children. Furthermore, the Coda and DDCI bimodal bilingual children on measures of spoken English development showed comparable scores on standardized language measures (Davidson, Lillo-Martin, and Chen Pichler, 2014). Taken together, ASL receptive skills test and measures of English development show that Coda and DDCI children pattern similarly in multiple aspects of their linguistic development, and therefore comprise the group of bimodal bilingual children in this study.

3.2 Stimuli & Data collection procedure

As a research assistant involved in the Bibibi project, I took part in creating the narrative elicitation task used in the current study. Children watched and retold four short video clips using the French children video series, *Miniscule* (Giraud & Szabo, 2006). Each clip averaged two minutes long, and involved tiny animated creatures (flies, ants, snails, etc.) doing things such as racing, fighting over a lollipop, and sliding on a slide. The video clips

did not contain dialogue, although the clips did include sound effects (i.e. motorcycle revving sound effect for the team of flying flies). Since longer picture series prompts have been found to elicit more cohesive narratives than shorter prompts (Bavin, 1987; Wigglesworth, 1997), we created video stimuli that averaged around two minutes.

Collecting bilingual narratives presents a challenge, since narratives in both of the child's languages have to be collected as close in time to each other as possible. One way to avoid order and practice effects is to provide more than one video-stimulus and to vary the order of presentation by language (Pavlenko, 2008). With these conditions in consideration, a quasi-experimental design was adopted and counterbalanced for the ordering of language elicited for the bimodal bilingual children. The first two narratives were elicited first in ASL and then in English, and in the reverse for the last two narratives, English and then ASL as shown in Table 3.1. For the Deaf non-cochlear implanted control group, narratives were collected only in ASL.

Efforts were made in the elicitation process to create a context where the addressee does not have any knowledge of the story during the retelling. In picture retelling tasks where the addressee could see the stimulus, Kail and Hickmann (1992) found that children used deictic or definite forms for referent introduction, as though shared perception of referents made them "old" even before they had been mentioned in the narrative. Yet in contexts lacking mutual knowledge, where the addressee was blindfolded, children produced adult-like indefinite forms for introduction. To avoid mutual knowledge in our methodology, interlocutors did not watch the stimulus videos with the child, and each child was under the impression that the interlocutors had never seen the videos before. A native Deaf research

assistant and a Coda research assistant (myself), with whom the bimodal bilingual children were already familiar from previous studies, served as the interlocutors for the ASL and English narratives, respectively. The researchers told the children that neither of them had seen the video and were looking forward to their stories. In lieu of blindfolding the addressees, the researchers faced a wall opposite the child as he or she watched the video clips. In order to control the language of elicitation, the Coda researcher faced the wall while the bimodal bilingual children retold the story in ASL to the Deaf researcher, and vice versa. The presence of the Coda researcher in the room during the ASL retelling and the elicitation method of alternating languages of the narrative may have had some unanticipated effects such as code-blending, which is examined in the discussion section.

Table 3.3: Order narrative elicitation by video-stimulus and by language

Video clip number	Video clip	Order of narrative language elicitation
1	*Spider at a picnic*	ASL, then English
2	***Lollipop***	**ASL, then English**
3	***Snail slide***	**English, then ASL**
4	*Hornets and ladybug race*	English, then ASL

Out of the four ASL narratives, two narratives *Lollipop* and *Snail Slide* were selected for the current study. The clips were selected based on the order of language elicitation for the bimodal bilingual children, number of episodes, and character types. *Lollipop* was the

second narrative elicited, collected first in ASL then in English, while *Snail Slide* was third narrative elicited and was first collected in English, and then in ASL. These two narratives in particular were also selected because they comprised roughly the same number of episodes (11 and 12, respectively), as detailed in appendices A and B, respectively.

The video clips selected for narrative analysis varied in entity types and number. This methodological consideration is important in a study of reference tracking, to create a range of possible referent forms with numerous shifts in reference. *Lollipop* features five flies, seven ants, and one spider. First the ants happen along a lollipop and gather around and attach to the pink lollipop. The crew of flies spots the lollipop, flies down and works as a group to pull up the lollipop by the stick, with the ants in tow. A humorous struggle ensues with the flies shaking the lollipop which causes the lollipop to slide off the stick. The groups then alternately act independently to grab pieces of the lollipop that has broken into pieces. After the flies fly away and the ants scurry away, a spider enters the scene to obtain the lollipop stick. The final scene shows the spider swinging on a swing made from the lollipop stick.

Figure 3.1: Screenshots of *The lollipop* narrative stimulus

First the ants happen along a lollipop and gather around and attach to the pink lollipop.

The crew of flies spots the lollipop, flies down and works as a group to pull up the lollipop by the stick, with the ants in tow.

A humorous struggle ensues with the flies shaking the lollipop which causes the lollipop to slide off the stick.

The groups then alternately act independently to grab pieces of the lollipop that has broken into pieces.

After the flies fly away and the ants scurry away,

a spider enters the scene to obtain the lollipop stick.

The final scene shows the spider swinging on a swing made from the lollipop stick.

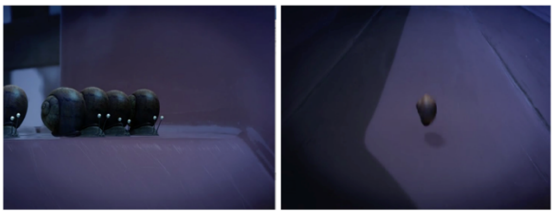
The second video clip *Snail Slide* features only one group of small creatures, five snails. This story focuses on the snails both as a group and independently. The snails move in a line at night and glide up a playground. At the top of the playground, the snails gather at the top of the playground slide. One snail retracts into its shell and rolls down the slide, shooting off the end like a canon ball. He hits the ground and rolls to a stop, then comes out of his shell, eyes rolling in different directions to indicate dizziness. The rest of the snails then take turns sliding down the slide and climbing back up.

Figure 3.2: Screenshots of *Snail Slide* narrative stimulus

The snails move in a line at night and glide up a playground.

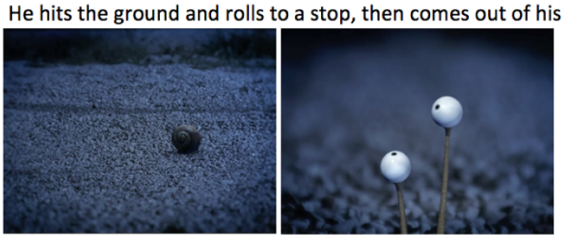
At the top of the playground, the snails gather at the top of the playground slide.

One snail retracts into its shell and rolls down the slide



, shooting off the end like a canon ball.

He hits the ground and rolls to a stop, then comes out of his shell, eyes rolling in different directions to indicate dizziness.



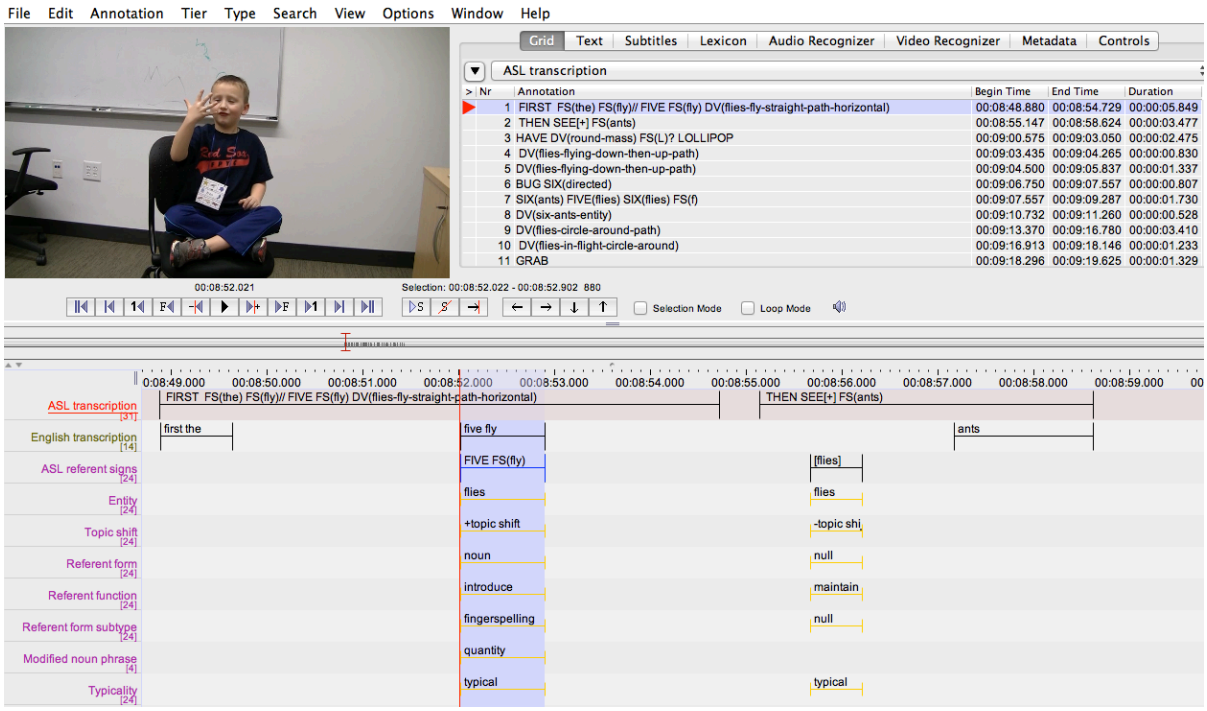
The rest of the snails then take turns sliding down the slide and climbing back up.

In sum, the two selected narratives are varied in the number of creature types and number per type, and are rich in episodic events, promoting a wide range of referent forms, shifts, and the use of depiction.

3.3 TRANSCRIPTION OF ASL AND ENGLISH

A total of 36 ASL narratives (elicited using the *Lollipop* and *Snail Slide* videos) were transcribed and coded for seven referent elements using a video-integrated transcripton tool, ELAN (http://tla.mpi.nl/tools/tla-tools/elan/) developed by the Max Planck Institute for Psycholinguistics (Crasborn & Sloetjes, 2008). Figure 3.3 shows an ELAN screenshot of the first two utterances from *The Lollipop* narrative as told by Ben's, a Coda participant, at Time 1.

Figure 3.3: ELAN screenshot of Ben's first two utterances in his retelling of *The Lollipop* at Time 1

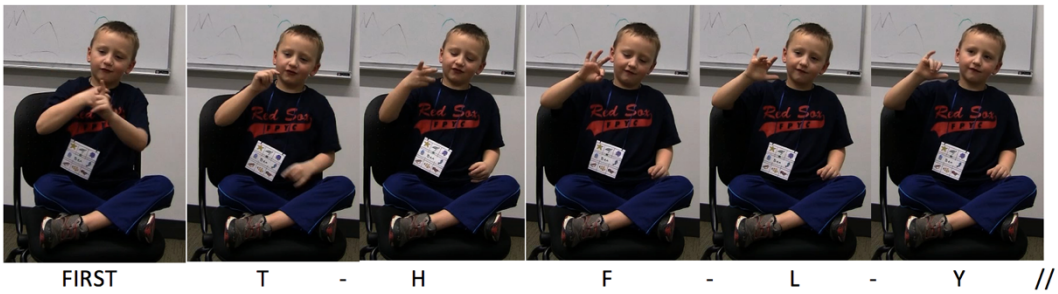


Utterance boundaries are important when coding for subject referents, since sentence delineations may impact whether or not a referent is counted as a subject. To determine utterance breaks, I followed a set of manual and prosodic criteria based on four major cues.

Major cues can determine an utterance break independently but are often accompanied by one or more supporting cues. The first major cue is manual, and is defined as relaxing the hands after signing. The second major cue is a long prosodic sign hold. A long sign hold is defined as the maintenance of the final static position of a sign that is held in space for at least 165 milliseconds in ASL narratives (Brentari, 2010). The last two cues are both related to eye behavior of the signer and include an extended eye blink (Wilbur, 1994) or a change in eye gaze (Bahan and Supalla, 1995).

The narratives were transcribed in ASL gloss using conventions for sign and speech transcription of child bimodal bilingual corpora (Chen Pichler, Hochgesang, Lillo-Martin, Müller, 2010). These transcription conventions for bimodal data were developed to encourage consistency in investigations of simultaneous bimodal bilingual first language acquisition for comparison across research groups. The summary table of bimodal bilingual transcription conventions used in the current study can be found in Appendix C. In order to illustrate how bimodal bilingual transcriptions conventions work, I have supplied a transcription (27) of the first utterance of a narrative retelling of *Lollipop* at Time 1 by a Coda:

(27)
English translation: "First the fly…five flies flew as a group." (Ben 6;9 utt 1)
ASL utterance: FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)



The initial sign in Ben's utterance is temporal, FIRST, followed by an atypical English influenced fingerspelled noun phrase, partially spelling out the first two letters of *the* and full fingerspelling of *fly* as indicated by the fingerspelling gloss convention, FS. The two backward slashes (//) indicate a self-interruption immediately after the fingerspelled phrase. He retraces the fingerspelled noun phrase with the manual signs FIVE FLY. The last sign of the utterance is a type of depiction (classifier construction) showing the action of the five flies, flying down together as a group, with the glossing convention DV followed by a description in parenthesis.

Phonated English production is annotated on separate tiers from sign production in ELAN. This is an important distinction in documenting code-blended utterances, since researchers differ in their criteria for what degree of phonation is required for an utterance to

qualify as speech. For van den Bogaerde and Baker (2008), mouthing without phonation is counted as speech, while most other researchers studying bimodal bilingual production, including the current study, follow the definition of code-blending presented by Emmorey et al. (2008) as the simultaneous production of signs and *phonation* of speech, either spoken at normal speech volume or whispered. In (28), I build on the previous ASL transcription, with the addition of the spoken English tier in bold. In this example, Ben voiced four select words in English that are roughly time-aligned with their corresponding ASL signs.

(28)
English translation: "First the fly…five flies flew as a group." (Ben 6;9 utt 1)
Spoken English: ***first the*** ***five fly***
ASL utterance: FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)

After the transcriptions were completed, animate subject referents for each utterance were identified on a separate *ASL referent* tier. The referent fulfills the syntactic function of subject and is the first subject entity mentioned in each full utterance, excluding embedded clauses. If a noun phrase is self-interrupted, as indicated by (//), only the retrace was counted as a referent, to prevent inflation of referent counts. For example, in (29) the noun phrase *(FS(th) FS(fly)//)* indicates a self-interruption followed by a nominal retrace FIVE FLY. The retrace is identified as the ASL referent, FIVE FLY, not the previous noun phrase that was self-interrupted. Modified noun phrases are further coded in another tier, detailed in section 3.4.6.

(29)
English translation: "First the fly…five flies flew as a group." (Ben 6;9 utt 1)
Spoken English: *first the* *five fly*
ASL utterance: FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)
ASL referent: **FIVE FLY**

Subjects within embedded clauses were not selected for referent analysis. For example, in (30) Ward, a Deaf child, produced an utterance with an embedded clause [DV(stop-look) STICK PUZZLED] which was not analyzed as a subject referent. The coded subject referent is the first referent identified, SPIDER, that precedes the embedded clause yet also is the subject of the embedded clause. If one were to also count the depiction in the embedded clause, it would conflate the number of subjects.

(30)
English translation: "The spider (?) …crawled over to the stick, (Ward, 5;11)
looked down at the lollipop stick and was puzzled and ran away."
ASL transcription: SPIDER YYY// DV(crawl-ground-55) [DV(stop-look) STICK
PUZZLED VANISH]
ASL referent: SPIDER

In summary, all narratives were transcribed for both ASL and English phonation and then delineated for utterance boundary in adherence to established criteria. Finally for each utterance, the subject referent is identified in a separate tier. The following section details seven coding methods for each ASL subject reference.

3.4 CODING METHODS

In the following subsections 3.4.1-3.4.7, the established coding methods for ASL referents for the following seven aspects of the narratives are discussed: entity, topic shift, referent function, referent form, referent form subtype, modified noun phrase, and typicality. Table 3.4 provides a comprehensive look of the coding procedures, including the established controlled vocabulary created in ELAN with a coded example of the first ASL referent (3) produced by Ben in his lollipop narrative at Time one.

Table 3.4: Coding procedures of ASL narratives for subject referents including example from Ben time one *Lollipop* first utterance for the ASL referent FIVE FLY

	Aspect	**ELAN tier name**	**ELAN controlled vocabulary**	**Example**
	ASL Referent	ASL Referent	-	FIVE FLY
1.	*Lollipop* entities *Snail Slide* entities	Entity	a. flies b. fly c. ants d. ant e. spider f. flies & ants g. snail h. snails i. subset of snails j. first snail k. second snail l. third snail	flies
2.	Topic shift	Topic shift	a. +topic shift b. -topic shift	+topic shift
3.	Referent function	Referent function	a. introduce b. maintain c. reintroduce	a. introduce
4.	Referent form	Referent form	a. noun b. pronominal c. null	a. noun
5.	Referent form subtype	Rform subtype	a. lexical NP b. fingerspelled NP c. indexical pronoun d. non-indexical pronoun e. agreement verb f. depictive verb g. plain verb	a. lexical NP
6.	Modified NP	Modified NP	a. quantity b. adjective c. determiner/locative PP d. none	a. quantity
7.	Typicality	Typicality	a. typical b. atypical	a. typical

3.4.1 Entity

As in traditional studies of narrative development, only animate entities have been coded for referent cohesion. Each ASL referent is coded for entity type using a controlled vocabulary set in ELAN that includes 12 referents, listed in Table 3.4. The *Lollipop* video stimulus included the following entities: *flies*, *ants*, and a *spider*. Singular entities, *fly* and *ant,* are also included, as certain insects act individually in sections of the video stimulus, as well as in groups (*flies*, *ants* or even *flies+ants)*. As mentioned previously, the *Snail Slide* video stimulus is limited to one subject type, *snails*. As in the other stimuli, the snails sometimes act individually (*snail*), individually in a sequence (e.g. in an episode when the snails take turns going down the slide: *first, second and third snail*), as a subgroup (*subset of snails*), and as one group (*snails*). In (31) the coded entity for the ASL referent is *flies* as indicated by the ASL referent FIVE FLY.

(31)

English translation:	"First the fly…five flies flew as a group."	(Ben 6;9 utt 1)
Spoken English:	*first the* *five fly*	
ASL utterance:	FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)	
ASL referent:	FIVE FLY	
1. Entity:	**flies**	

This coding feature is helpful in identifying referents in utterances that are null in form such as (32), the next utterance following (31) in Ben's narrative. The entity referred to in (32) is the same entity as the subject *flies* in (31) and appears in null form. The verb SEE is in uninflected citation form and occurs without an overt subject, so this qualifies as an example of subject pro-drop.

(32)

English translation:	"[The flies] see the ants." (Ben 6;9 utt 2)
Spoken English:	---
ASL utterance:	SEE+ FS(ants).
ASL referent:	[flies]
1. Entity:	**flies**

SEE+ A - N - T - S

3.4.2 Topic Shift

All ASL referents were coded for topic shift status, either +topic shift and –topic shift. The first mention of the referent in the narrative in the subject position is coded as + topic shift (33). The continuation of a subject referent that is maintained across two adjacent clauses is coded as -topic shift (34) (Serratrice, 2007). When a referent switches into the subject position from an object position, the referent is coded as +topic shift (35). Note again, that (33), (34), (35) are consecutive utterances in the same narrative.

(33)

English translation:	"First the fly…five flies flew as a group." (Ben 6;9 utt 1)
Spoken English:	*first the* *five* *fly*
ASL utterance:	FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)
ASL referent:	FIVE FLY
1. Entity:	flies
2. Topic shift:	**+topic shift**

(34)

English translation:	"[The flies] see the ants." (Ben 6;9 utt 2)
Spoken English:	---
ASL utterance:	SEE+ FS(ants).
ASL referent:	[flies]
1. Entity:	flies
2. Topic shift:	**-topic shift**

(35)

English translation:	"[The ants] have a round thing a l…lollipop." (Ben 6;9 utt 3)
Spoken English:	*round*
ASL utterance:	HAVE DV(round-mass) FS(L)// LOLLIPOP
ASL referent:	[ants]
1. Entity:	ants
2. Topic shift:	**+topic shift**

HAVE DV(round-mass) L- // LOLLIPOP

3.4.3 Referent function

Each referent was coded with respect to its discourse function: introduction, maintenance or reintroduction. A referent is counted as an introduction (36) at the first mention of the referent (Morgan, 2005) in the narrative. Maintenance of a referent (37) is defined as continued reference to the character (–topic shift) across two adjacent clauses (Serratrice, 2007). A referent that has already been introduced and comes back into focus +topic shift, was coded as a reintroduction. The topic status of the referent in the previous step was used to determine the referent function (Serratrice, 2007).

(36)

English translation:	"First the fly…five flies flew as a group." (Ben 6;9 utt 1)
Spoken English:	*first the five fly*
ASL utterance:	FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)
ASL referent:	FIVE FLY
1. Entity:	flies
2. Topic shift:	+topic shift
3. Referent function:	**introduce**

The second utterance in Ben's narrative (37) SEE+ FS(ants) translated as "The flies see the ants," the subject *flies* are null in form. The topic shift tier is coded as [-topic shift] since the null form indicating *flies* is a continuation of the topic of the last utterance, maintaining the subject from the previous utterance.

(37)

English translation:	"[The flies] see the ants." (Ben 6;9 utt 2)
Spoken English:	---
ASL utterance:	SEE+ FS(ants).
ASL referent:	[flies]
1. Entity:	flies
2. Topic shift:	-topic shift
3. Referent function:	**maintenance**

3.4.4 Referent form

Each referent was coded for form, using labels on a continuum from highest to least explicitness: noun phrase > pronoun> null. In (38) the ASL referent is FIVE FLY and its referent form was coded as a noun.

(38)

English translation:	"First the fly…five flies flew as a group." (Ben 6;9 utt 1)
Spoken English:	*first the five fly*
ASL utterance:	FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)
ASL referent:	FIVE FLY
1. Entity:	flies
2. Topic shift:	+topic shift
3. Referent function:	introduce
4. Referent form:	**noun**

Sometimes children produced a sequence of referent forms to refer to a single entity. In those cases, the following coding criteria were established for determining which referents would count for analysis. If an utterance has an overt subject noun phrase that is followed or proceeded by one of the less explicit forms to indicate the same entity, such as an indexical pronoun as in (39) IX(flies-there) FLY-Y, then the most overt form is coded for referent form, and the index is coded as a locative, as detailed in section 3.4.5.

(39)

English translation: "The…a…there's flies flying around."	(Tom 6;9 utt 1)
Spoken English:	*the// a// there's flies flying around*
ASL utterance:	FS(th)// FS(a)// IX(flies-there) FLY-Y DV(flying) DV(path-horizontal)
ASL referent:	IX(flies-there) FLY-Y
1. Entity:	flies
2. Topic shift:	+topic shift
3. Referent function:	introduce
4. Referent form:	**noun**

Null subjects could occur with different three different types of verbs: agreeing verbs, plain verbs, and depiction. Utterance (40) provides an example of a null subject that occurred with a plain verb. It is important to note that verbs that include information about the referent, depicting constructions (including classifier constructions, constructed action, and constructed dialogue) and verbs bearing verb agreement, are also coded as null, as long as they occur without any overt subject noun phrase (in (40), the identity of the null subject is indicated in square brackets). The type of verb that occurs with null subjects is coded in section 3.4.5, form subtype.

(40)

English translation:	"[The flies] see the ants."	(Ben 6;9 utt 2)
Spoken English:	---	
ASL utterance:	SEE+ FS(ants).	
ASL referent:	[flies]	
1. Entity:	flies	
2. Topic shift:	-topic shift	
3. Referent function:	maintenance	
4. Referent form:	**null**	

3.4.5 Form subtype

In order to capture in-depth patterns of forms beyond nominal, pronominal, and null, each referent was coded for ASL referent form subtype. I coded each referent for one of the 11 subtypes displayed in table 3.5.

Table 3.5: Subtype forms categorized by referent form

Referent form category	**Subtype form**	**Example**
Noun	1. Lexical noun phrase	SPIDER
	2. Fingerspelled noun phrase	FS(spider)
Pronominal	3. Indexical pronoun	IX(flies)
	4. Non-indexical pronoun	FS(it) OTHER SIX ALL MOST
Null	5. With agreement verb	[flies]-LOOK-AT-[ants]
	6. With depiction Classifier construction Constructed dialogue Constructed action	 [flies]-DV(fly-downward) [spider]-DV("have idea") [spider]-DV(spider-hide-behind-rock-look-at-stick)
	7. With plain verb	[flies] SEE+ FS(ants).

Continuing with the example Ben's first utterance in his *Lollipop* narrative at Time 1, the subject FIVE FLY is coded as having the form subtype lexical noun phrase in (41), while the null subject in (42) is coded as occurring with a plain verb.

(41)
English translation: "First the fly…five flies flew as a group." (Ben 6;9 utt 1)
Spoken English: *first the* *five fly*
ASL utterance: FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)
ASL referent: FIVE FLY
1. Entity: flies
2. Topic shift: +topic shift
3. Referent function: introduce
4. Referent form: noun
5. Referent subtype form: lexical noun phrase

(42)

English translation:	"[The flies] see the ants." (Ben 6;9 utt 2)
Spoken English:	---
ASL utterance:	SEE+ FS(ants).
ASL referent:	[flies]
1. Entity:	flies
2. Topic shift:	-topic shift
3. Referent function:	maintenance
4. Referent form:	null
5. Referent subtype form:	**plain verb**

3.4.6 Modified NP

Sometimes the children would produce referent forms with a string of modifiers. To address these cases, a modified noun phrase tier was included. This coding procedure covered the following modifier types: quantity, adjective, determiner/locative, English determiners, and multiple modifiers, or none. In the example utterance (43), the modifier (FIVE) of the NP FLY is labeled as a quantifier.

(43)

English translation:	"First the fly…five flies flew as a group." (Ben 6;9 utt 1)
Spoken English:	*first the* *five fly*
ASL utterance:	FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)
ASL referent:	FIVE FLY
1. Entity:	flies
2. Topic shift:	+topic shift
3. Referent function:	introduce
4. Referent form:	noun
5. Referent subtype form:	lexical noun phrase
6. Modified NP:	**quantifier**

In (44) the indexical pronoun IX(flies-there) is coded as a determiner/locative that modifies the nominal FLY-Y.

(44)
English translation: "The…a…there's flies flying around." (Tom 6;9 utt 1)
Spoken English: *the// a// there's flies flying around*
ASL utterance: FS(th)// FS(a)// IX(flies-there) FLY-Y DV(flying) DV(path-horizontal)

ASL referent:	IX(flies-there) FLY-Y
1. Entity:	flies
2. Topic shift:	+topic shift
3. Referent function:	introduce
4. Referent form:	noun
5. Referent subtype form:	lexical noun phrase
6. Modified NP:	**determiner/locative**

3.4.7 Typicality

The final level of coding, typicality, was created to capture forms that are atypical in ASL. This category served to capture evidence of handshape errors by the children. Each referent was coded as being typical of ASL signing, with typicality determined according to the use of standard ASL handshapes of both lexical signs and depictive verbs. Any other atypical form other than handshape errors was coded as "atypical-other." In (45) the ASL referent FLY is produced with an open B handshapes bending repeatedly to recall the flapping of wings. This is a typical form that would normally be used in adult ASL for such a referent.

(45)
English translation: "First the fly…five flies flew as a group." (Ben 6;9 utt 1)
Spoken English: *first the five fly*
ASL utterance: FIRST FS(th) FS(FLY)// FIVE FLY DV(fly-downward)

ASL referent:	FIVE FLY
1. Entity:	flies
2. Topic shift:	+topic shift
3. Referent function:	introduce
4. Referent form:	noun
5. Referent subtype form:	lexical noun phrase
6. Modified NP:	quantifier
7. Typicality:	**typical**

In contrast, an example of an atypical referent form can be found in (46), Tom's first utterance of *Lollipop* at Time 1. Rather than choosing one of several typical ASL forms for *fly* (e.g. FLY(winged-animal), fingerspelling FS(fly), or substituting the general category sign BUG), Tom produced a novel form glossed as FLY-Y involving a Y-handshape in neutral space that twists repeatedly at the wrist.

(46)
English translation: "The…a…there's flies flying around." (Tom 6;9 utt 1)
Spoken English: *the// a// there's flies flying around*
ASL utterance: FS(th)// FS(a)// IX(flies-there) FLY-Y DV(flying) DV(path-horizontal)

ASL referent:	IX(flies-there) FLY-Y
1. Entity:	flies
2. Topic shift:	+topic shift
3. Referent function:	introduce
4. Referent form:	noun
5. Referent subtype form:	lexical noun phrase
6. Modified NP:	determiner/locative PP
7. Typicality:	**atypical**

T-H // A // IX(flies-there) FLY-Y DV(flying) DV(path-horizontal)

3.4.8 RELIABILITY

Intercoder reliability was established by having a second native-signer code 10% of narrative utterances for ASL referent and typicality. Coding decisions of the second coder agreed with mine 91.3% of the time for ASL referent and 100% of the time for typicality.

Chapter IV: Results

In this chapter I categorize the referent tracking results comparing bimodal bilingual (Bibi) developmental patterns to the Deaf control group. For some aspects of narrative development, Bibi children patterned similarly to the Deaf children at both times. For others, Bibi children displayed a differential pattern at Time 1 but became more similar to the Deaf children at Time 2, or Bibi children displayed continued divergent patterns from Deaf children from Time 1 to Time 2. The current chapter details the referent tracking results of Bibi development compared to the control group, while chapter five compares Bibi results to heritage speakers (HS) and modality language-specific differences.

4.1 Parallel patterns of referent tracking

Similar referent patterns between the Deaf and Bibi children were found in the use of topic shift, frequency of referent functions, and entities referred to in their narratives. The majority of subjects were a continuation of a referent or [-topic shift] as seen in Table 4.1 for both groups and times.

Table 4.1: Topic shift by native signer group and time

	+topic shift	-topic shift
Bibi T1 (144)	58 40.3%	86 59.7%
Bibi T2 (133)	58 43.6%	75 56.4%
Deaf (128)	52 40.6%	76 59.4%

Contexts where there is a shift in topic indicated a referent introduction or reintroduction, while topic continuation contexts indicate maintenance of referents. Bibi and Deaf children demonstrated roughly the same frequency of referent functions, with majority of referents being maintained, followed by reintroduction and introduction shown in Table 4.2. The distribution of referent function results is consistent with the majority of referents appearing in contexts of topic continuation, and is in line with demands of the task.

Table 4.2: Distribution of referent function by native signer group and time

	Introduction	Maintenance	Reintroduction
Bibi T1 (144)	27 18.8%	91 63.2%	26 18.1%
Bibi T2 (133)	30 22.6%	76 57.1%	27 20.3%
Deaf (128)	25 19.5%	79 61.7%	24 18.8%

Another similar pattern observed is the distribution of entities referred to in the two narratives. Both groups of children referred to the flies the most, and ants and flies the least in *The lollipop* narratives as shown in Table 4.3. For the *Snail slide* narrative, the children referred to the group of snails and the third snail the most as shown in Table 4.4. From these results, it seems that the native-signing children are not using a 'thematic subject constraint' as found in the second stage of development by young monolinguals (Bamberg, 1986; Karmiloff-Smith, 1985), since they are referring to a variety of entities in the subject position.

Table 4.3: The *lollipop* entities referrred to in occurrence and frequency by native signer group and Bibi time

	Deaf	Bibi T1	Bibi T2
Ants	13 18.1%	19 20.4%	20 26%
Flies	30 41.6%	40 43%	30 39%
Ants & Flies	11 15.3%	13 14%	8 10.4%
Spider	18 25%	21 22.6%	19 24.1%
Totals	72	93	77

Table 4.4: *Snail slide* entities referrred to in occurrence and frequency by native signer group and Bibi time

	Deaf	Bibi T1	Bibi T2
Snails	30 53.6%	28 54.9%	28 50%
First snail	13 23.2%	5 9.8%	9 16.1%
Second snail	4 7.1%	2 3.9%	4 7.1%
Third snail	1 1.8%	0 0%	3 5.4%
Subset of snails	1 1.8%	3 5.9%	3 5.4%
Snail	7 12.5%	13 46.4%	9 32.1%
Totals	56	51	56

Taken together, the Bibi and Deaf children similarly favored continued topics for the purpose of referent maintenance to refer to a variety of entities.

4.2 DEVELOPMENTALLY CONVERGENT PATTERNS OF REFERENT TRACKING

For other aspects of referent tracking development, the Bibi children displayed different patterns from the Deaf control group at Time 1 (T1) and then convergence at T2. This was the case for the numbers of subject referents and production of atypical referent forms. At T1, the Bibi children produced a higher number of subject referents overall (n=144) compared to the Deaf control group (n=128). Upon closer examination this difference is mainly attributed to more subject referents for *The Lollipop*, as shown in Table 4.5, and decreases to comparable levels to the Deaf children by T2 (n=133). Observationally, this difference in the higher number of referent forms might be attributed to the propensity of the Bibi children to convey relatively detailed event sequences in T1 as compared to T2.

Table 4.5: Number of coded ASL subject referents per narrative retelling by native signer group and time

	The lollipop	*Snail slide*	Total
Bibi T1	93	51	144
Bibi T2	77	56	133
Deaf	72	56	128

The second Bibi referent tracking pattern that almost converged with the control group was the production of atypical referent forms. Although the majority of the forms produced by the Bibi children were typical, they produced more atypical forms than the Deaf children, especially at T1. As seen in Table 4.6, the Bibi children at T1 produced 15.3% of

their referents in atypical form, in comparison to only 1.6% by the Deaf control group. However, at T2 the Bibi children reduced their overall percentage of atypical forms (3.8%), approaching that of the control group. The reduction of atypical forms by the Bibi children over time seems to indicate a protracted development of classifier handshapes, as detailed in 5.3 with an analysis of atypical error types by both groups of children.

Table 4.6: Typicality forms by native signer group and time

	Typical	Atypical
Bibi T1 (144)	120 83.3%	24 15.3%
Bibi T2 (133)	128 96.2%	5 3.8%
Deaf (128)	126 98.4%	2 1.6%

At both times, all Bibi children produced at least one atypical form, while among children in the control group, two out of the six children produced atypical forms. In Chapter 5, I detail the types of atypical referent forms for both groups of children.

4.3 CONTINUED DIVERGENT PATTERNS OF REFERENT TRACKING

Finally, the narratives of the Bibi children at T1 diverged from the Deaf control group in several respects, and continued to become even more divergent at T2. The frequencies of the three main referent forms (nominal, pronominal, and null) and frequency of noun phrase modifiers showed differences between the Bibi children and the Deaf control group. Recall that nominal forms are the least accessible in the topic accessibility continuum, and pronominals are moderately accessible and null forms are the most accessible (Givón, 1983).

The Deaf children preferred forms that are most accessible, null, while the Bibi children preferred forms that are least accessible and slightly more so in T2.

In T1 the Bibi children and the Deaf children both preferred null forms overall, yet to different degrees: 45.1% and 63.3%, respectively as shown in Table 4.7. At T2 the Bibi children's preference patterns slightly shifted, indicating equal preference for nominal and null forms. Bibi children also displayed a significant difference from Deaf controls in the frequency with which they produced pronominal forms. The Deaf children made sparse use of pronominals (5.4%) overall, while the Bibi children made productive use of pronoun forms, which averaged a quarter of total forms at both T1 and T2. Furthermore, the Bibi children increased their production of subject pronominal forms while decreasing their production of subject null forms over time.

Table 4.7: Distribution of referent form by native signer group and time

	Noun	Pronoun	Null
Bibi T1 (144)	49 34%	30 20.8%	65 45.1%
Bibi T2 (133)	50 37.6%	38 28.6%	45 33.8%
Deaf (128)	40 31.3%	7 5.4%	81 63.3%

Another continued difference between the Bibi children and the Deaf children is the frequency of nominal modifiers (Figure 4.8). At T1 and T2, the Bibi children produced modifiers for close to 19% of referent forms, while the Deaf children made scant use of nominal modifiers, producing only 6.3% with modifiers. Furthermore, in addition to native ASL sign modifiers, the Bibi children increasingly produced fingerspelling of English

determiners (e.g. FS(the), FS(a)) and invented Manually Coded English signs representing the English determiner THE. Conversely, the Deaf children only produced the modifiers native to ASL (adjectives, quantifiers, locative determiners). An in depth discussion is provided in section 5.3 on atypical forms.

Table 4.8: Frequency of ASL and English modifiers by native signer group and time

	Total number and percent of modifiers	ASL modifiers	English modifiers
Bibi T1	27/144 18.7%	26	1
Bibi T2	25/133 18.8%	21*	5*
Deaf	8/128 6.3%	3	0

*indicates the instance of a production of an ASL and English modifier in the same noun phrase

In sum, the Deaf and Bibi children showed similar patterns in the frequency of topic shift, distribution of referent functions and referred entities. The Bibi children over time showed similar patterns to the Deaf control group in the amount of subject referents and the frequency of atypical forms they produced. Conversely, an increasingly notable difference between the Bibi and Deaf children was observed in the frequency of different referent forms, with Bibi children increasing use of pronominal forms and decreasing use of null forms over time. The referent form findings show the Bibi children producing more noun phrase modifiers overall, and exhibiting an increasing use of atypical English determiners. Furthermore, Bibi children were observed to produce a higher frequency of overt forms than their Deaf counterparts.

In Chapter 5, I delve more deeply into the differences between the Bibi and Deaf narratives in the overall rate of overt referents, reflecting in the finding that the Bibi children prefer overt forms for all three discourse functions. I will also offer analysis of the finding that Bibi children used more pronominal forms than Deaf children for maintenance and reintroduction over time, consistent with patterns reported for heritage speakers. I will argue that this and other secondary patterns in data, including code-blending and English influenced referent tracking forms, are potential heritage signer effects, comparable to the better known heritage speaker effects as reported in the spoken language bilingual literature.

Chapter V: Discussion

This study examined the referent tracking patterns of young Bimodal bilingual children developmentally as compared to a Deaf control group. Chapter 4 categorized the results by comparative themes that emerged from the children, revealing some parallel patterns, some convergent, and some divergent patterns across the Bibi and Deaf children. The current chapter delves deeper into the patterns in the referent forms and related discourse contexts of Bibi children that diverge from those of the Deaf control group. The first analysis quantifies overtness and referent form frequencies by the discourse functions maintenance and reintroduction, contexts where we would expect null subject forms, compared to previous studies of bilingual heritage speakers. The second analysis details bimodal bilinguals' atypical referent tracking forms that are unattested for unimodal heritage speakers. Taken together, the Bibi children's divergent patterns of referent cohesion parallel what has been noted for young unimodal bilinguals and adult heritage speakers, and also display some overlap with patterns reported for M2L2 signers' narratives.

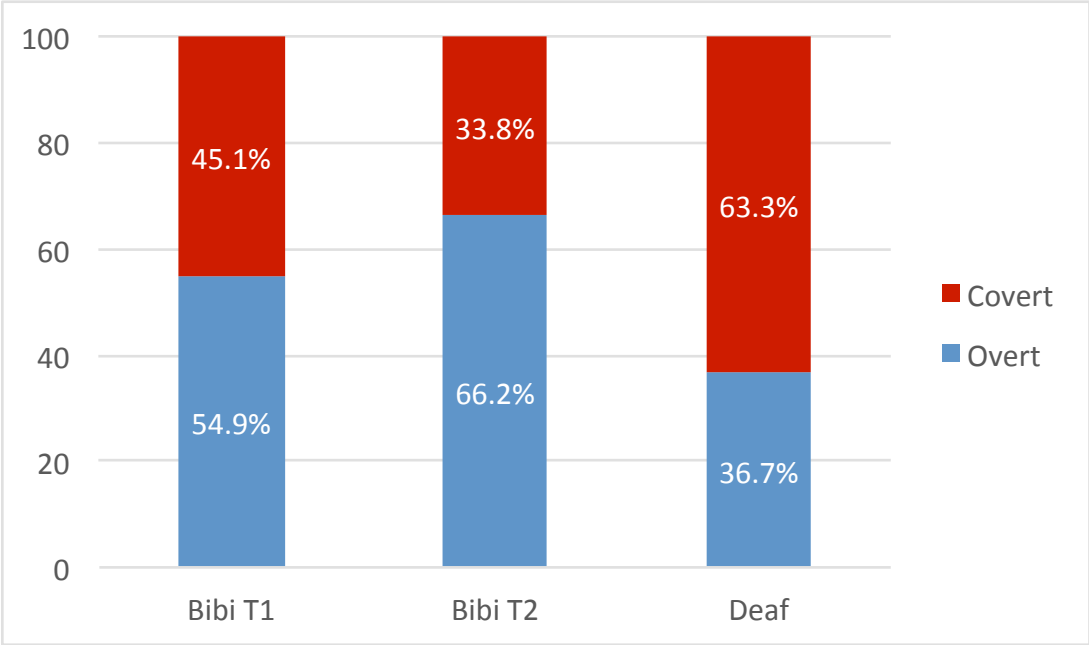
5.1 Parallel patterns with heritage speakers

Like the patterns found for heritage speakers (Lee & Zalasky, 2015; Montrul, 2004; Polinsky, 2007), the Bibi children displayed higher frequencies of overt subject forms for referent maintenance and reintroduction where null forms were used by their monolingual counterparts. As predicted, the Bibi children demonstrated an increasing dependence on overt forms overall and across all three discourse functions. I first examine the results for overall overtness for referent tracking (Figure 5.1) then overtness by discourse function (Figure 5.2).

Comparing overt vs. covert forms across Bibi times, the children show a slight tendency to produce more overt forms over time, as seen in Figure 5.1. At T1 half of the

referent forms produced by the Bibi children are overt (54.9%), while at T2 there is a slight increase in overtness (66.2%). Although the difference in overtness between T1 and T2 is not statistically significant, the increase in overtness is still notable.

Figure 5.1: Bimodal bilingual (Bibi) and Deaf children's distribution of overt and covert forms in percents



In order to examine whether Bibi generalized patterns of overtness are reflected in their individualized patterns, Table 5.1 provides an overview of overtness by time and individual rate of overtness change for contexts where we would expect the use of null subject forms, specifically maintenance and reintroduction. Overall, the Bibi children seem to individually fit the pattern of increased overtness except for Tom, who showed a slight decrease in overt forms by 9.4%. However, Tom produced the highest rate of overtness at T1 (82.1%) and again the highest rate at T2 (72.7%) even with the decrease in overt forms for referent maintenance and reintroduction. Another potential impact on his high use of overt

forms is Tom's linguistic environment. Tom's communication at home was reported to be both ASL and code-blended utterances and English with his youngest sister. This may have also impacted other differences noted for Tom including his frequent use of code-blended utterances and atypical referent forms (see Section 5.2.5.2), as well as his increasing dependence of fingerspelling in T2 (see Section 5.2.5.1).

Table 5.1: Bibi individual changes in overtness for maintenance and reintroduction across time

Bibi child	**T1 age**	**Overt forms T1**	**T1 overtness %**	**T2 age**	**Overt forms T2**	**T2 overtness %**	**Change in overtness**
Nik^	5;03	5/9	55.6%	6;08	5/5	100%	44.4%
Fin^	5;05	6/11	54.5%	6;10	9/15	60%	5.5%
Kim	5;11	4/12	33.3%	7;03	7/11	63.6%	30.3%
Gia^	6;04	10/25	40%	7;09	14/20	70%	30.0%
Tom	6;09	23/28	82.1%	8;01	16/22	72.7%	-9.4%
Ben	6;09	6/30	20%	8;02	12/30	40%	20.0%

^ Indicates that the Bibi child is DDCI

Another notable individual differences seen is the slight increase of overt forms by Fin. Fin only slightly increased the total amount of overt forms in T2 by 5.5%. This difference may be attributed to fact that he is the only Bibi child with an extended Deaf signing family as well as a native signing Deaf mother and aunt. Fin's exposure to ASL comes from multiple Deaf relatives, which has been suggested to impact young bimodal bilingual sign competency (Kanto et al., 2013). His rich exposure to ASL input might have impacted his development of overt forms for referent maintenance and reintroduction.

The last notable difference is the sparse amount of referent forms produced overall by Nik. He produced far fewer referents at T1 (n=9) than the other Bibi children and

increasingly less at T2 (n=5). After examination, the reason for this pattern is Nik's lack of reintroduction at both times. Typically, Nik introduced a new character, provided one or two utterances of maintenance for the same referent, then introduced a second referent and produced an utterance or two maintaining that referent. From these observed patterns, Nik seems to be the only child displaying the thematic subject strategy observed for English and German monolinguals in the second stage of referent tracking development (Bamberg, 1987; Karmlioff-Smith, 1985), by keeping the focus on one referent at a time. Nik's referent production is thus quantitatively different from the other children's in his lack of the discourse function reintroduction. Finally, Nik's sign linguistic environment may be less ASL-dense than that of Fin, with the frequent use of code-blended utterances in his home environment.

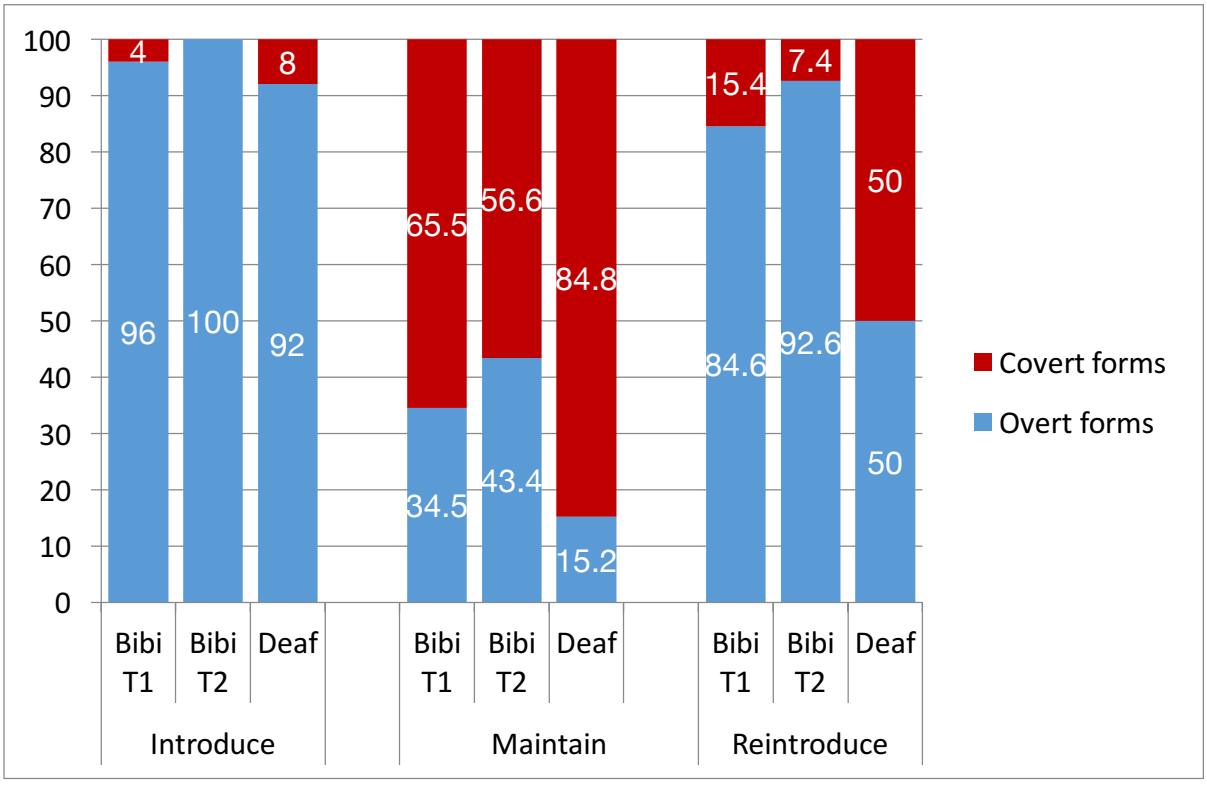
Another approach to examine generalized patterns of overtness is to divide the Bibi children into Coda and DDCI subgroups, but doing so does not yield any clear patterns. Instead, what is seen is a mixed group pattern based on the number of referent tokens for maintenance and reintroduction. Nik (DDCI), Fin (DDCI), and Kim (Coda) cluster at the low end of number of referent tokens produced, while Ben (Coda), Tom (Coda), and Gia (DDCI) cluster together at the high end. Age might be a contributing factor, with the lowest number of referent tokens being produced by the youngest children (Nik, Fin, and Kim), and the highest number by the oldest children (Ben Tom, and Gia). As mentioned for Tom, Fin, and Nik, various other factors include the amount of ASL input the youngest children have received, the quality of input, as well as individual differences in talkativeness.

Moving along to the comparison between Bibi and Deaf children, we see an increasing difference in overtness. In Figure 5.1, the results show the Bibi children at T2 slightly preferring **overt** subject referent forms (66.2%), while the Deaf children prefer **null** forms (63.3%). A chi-square test was conducted between native signer child group (Bibi and Deaf) and overt referents forms. Bimodal bilingual children were significantly different than the deaf children in the use of overt forms overall at T2 (χ^2 =22.650, p<.000) but not at T1 (χ^2=3.488, p<.062). This finding suggests a developmental divergence in overt forms for tracking referents.

These results parallel the observations of Montrul (2004), in which intermediate heritage speakers of Spanish overall preferred **overt** subject referent forms (68.6%), in contrast to the advanced heritage and monolingual speakers who preferred **null** forms (~55%). The results suggest that the Bibi children at T2 are more like the adult intermediate heritage speakers of Spanish than their Deaf peers. The adult heritage speakers in Montrul's study and the Bibi children in the current study both experienced less input in their home language due to the fact that they did not receive schooling in their home language. Furthermore, both of their home languages (Spanish and ASL) are null subject languages, and the other, dominant language for both groups is English, a non-null subject language. It seems that regardless of the difference in modality between ASL and Spanish, in both cases the dominant language (English) has influenced their heritage language. Thus, just like the adult Spanish heritage speakers, the Bibi children seem to exhibit a heritage language effect by transferring features from their dominant language, which does not allow null subjects, into their home language.

Frequencies of overt forms across referent functions between the Bibi children and Deaf children also differ. As mentioned previously, the tendency to be overly **overt** has been noted in the narratives of early unimodal bilinguals (Chen & Lei, 2012; Serratrice, 2007), early bimodal bilinguals (Morgan, 2000), late bimodal bilinguals (Bel et. al, 2014; Frederiksen & Mayberry, 2014), and bilingual heritage speakers (Montrul, 2004). Like these bilingual groups, the Bibi children showed a trend towards overtness across all functions, as seen in Figure 5.2. From T1 to T2, the Bibi children displayed a 3.7% increase in overtness for introduction, a 9.4% increase for maintenance, and an 8% increase for reintroduction.

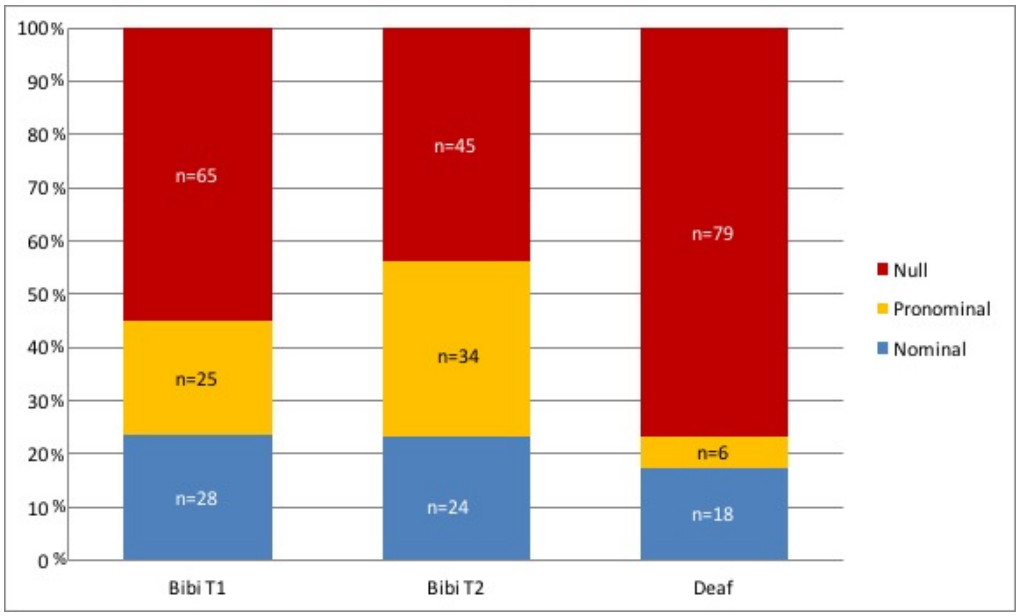
Figure 5.2: Bimodal bilingual (Bibi) and Deaf children's distribution of overt and covert forms by time and discourse function (Percentages)



The increase in overt forms for introduction by Bibi children at first glance seems to be a developmental change, since cross-linguistically, adult introduction forms are overt, and more specifically, nominal. The Bibi children at T1 and T2 both used overt forms more frequently than their Deaf counterparts, and upon further inspection, they used some pronominal forms for introducing referents, as shown in Figure 5.4 and discussed later. Over time, we expect that exclusive use of nominal forms will develop for both Bibi and Deaf children, as is typical of adult signed forms for introduction (Bel et al., 2014; Frederiksen & Mayberry, 2015; Morgan, 2005). For the remaining part of the current 5.1 section, discussions of referent form and function mapping will be limited to maintenance and reintroduction.

Another Bibi pattern emerges when shifting from a binary analysis of overtness to a tertiary analysis of nominal, pronominal, and null forms used for the function of maintenance and reintroduction. Figure 5.3 displays a detailed analysis of the Bibi data for reintroduction and maintenance combined, revealing an increasing frequency of pronominal forms at both T1 (21.2% of referent forms for maintenance and reintroduction) and T2 (33%). In contrast, Deaf children made sparse use of pronouns, which accounted for only 5.8% of all subjects in maintenance and reintroduction contexts. The Deaf children overwhelmingly preferred the use of null forms instead (76.7%); the Bibi children also showed an overall preference for null forms in reintroduction and maintenance contexts, but to a lesser degree at T1 (55.1%) and even less so at T2 (43.7%). Nominals showed a similar frequency pattern across groups and times, and accounted for less than a quarter of forms.

Figure 5.3: Bimodal bilingual (Bibi) and Deaf children's distribution of referent forms in percents and total occurrences for the functions maintenance and reintroduction



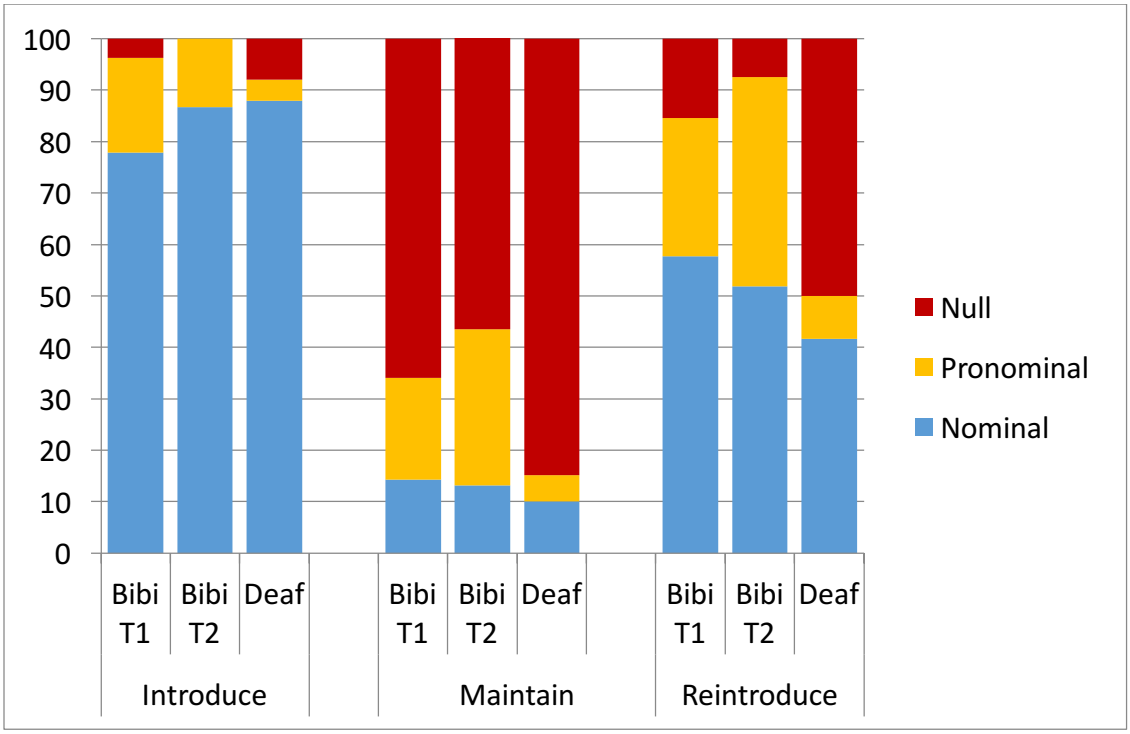
The general patterns of distribution of referent forms show a developing dependence on pronoun forms for Bibi signers for maintenance and reintroduction. Pronouns are less explicit in form than nominals, yet more explicit than the null forms preferred by the Deaf children for these functions. So the increased use of pronouns rather than null subjects at T2 may be affected by the status of null subjects in the Bibi children's two languages. ASL allows null subjects with plain verbs, agreeing verbs and depiction, but English lacks counterparts to any of those null subjects. Null subject forms appear to be the preferred referent tracking strategy for referents that are already given in ASL discourse, as evidenced by the Deaf children in this study and Deaf ASL signing adults studied by Frederiksen et al. (2015). The prevalence of pronominal forms in Bibi child narratives for given referents may

serve as a middle ground between forms that are highly explicit (nominals) and forms that are the least explicit (null).

A finer-grained analysis of referent forms across specific discourse functions reveals that the Bibi children produced increasingly more explicit forms and fewer null forms for referent maintenance and reintroduction, even when calculated separately from each other (Figure 5.4). The tendency to be overly explicit for the purpose of referent maintenance and reintroduction has been noted in the narratives of young monolinguals (Karmiloff-Smith, 1985), early unimodal bilinguals (Chen & Lei, 2012; Serratrice, 2007), early bimodal bilinguals (Morgan, 2000), late bimodal bilinguals (Bel et. al, 2014; Frederiksen et al., 2014), and heritage speakers (Montrul, 2004; Polinsky, 2007). The use of nominals in contexts where a reduced pronominal would be more appropriate (Morgan, 2000; Karmiloff-Smith, 1985; Polinsky, 2007; Serratrice, 2007) or the use of pronominals in contexts where a null subject would be more appropriate (Bel et al., 2004; Montrul, 2004; Morgan, 2000) are two manifestations of an over-reliance on explicit forms, the latter of which Bibi children tended to use more frequently over time, as shown in Figure 5.4. This early bimodal bilingual tendency to use explicit forms for referent tracking was first observed by Morgan (2000). He noted that young Bibi BSL signers recounted picture stories using strings of explicit referent forms and plain verbs (lexical linear constructions) in lieu of classifier constructions that license null subject forms more typical in the narratives of Deaf children. The quantitative results of this study show an increasing use of explicit referent forms for the purpose of maintenance and reintroduction (examined together and separately), as alluded to by Morgan (2000).

Before delving back into maintenance and reintroduction, a discussion of the forms for introduction is necessary. The Bibi children used pronouns for introduction purposes less than 5% at both times (T1 n=5; T2 n=4); while their Deaf counterparts used one pronoun for introduction as seen in Figure 5.4. Furthermore, there was one instance of null subject form with depiction for introduction purposes by Ben at T1 and Igor in the Deaf control group. This finding points to the fact that Bibi children at the ages studied are still developing their abilities in form to function mapping.

Figure 5.4: Bimodal bilingual (Bibi) and Deaf children's distribution of forms by referent function



Furthermore, after separating out the forms used for maintenance from reintroduction we can see a dramatic difference in patterns between the two functions, with many more nulls used for maintenance than for reintroduction, showing a similar pattern between the Bibi children

and the Deaf control group. Figure 5.4 reconfirms the pattern portrayed in Figure 5.3, in which the Bibi children preferred null forms at both times for referent maintenance, yet to a lesser degree at T2 (56.6%) than at T1 (65.9%), and comparatively less than the Deaf children (84.8%). The Bibi children showed an increase in pronominal forms from T1 (19.8%) to T2 (30.3%), while the Deaf children used this form only sparingly for maintenance (5.1%). A Mann-Whitney U test was run to determine if there were differences in the use of forms between Bibi and Deaf children for referent maintenance in T1 and in T2. Distributions of the three forms (nominal, pronominal, and null) for Bibi and Deaf children were moderately different for maintenance at T1 ($p=0.014$) and significantly different for the same function at T2 ($p=.001$).

For the purposes of reintroduction, the Bibi children preferred nominal forms both times. In contrast, the Deaf children preferred either null forms (45.8%) or nominal forms (41.7%) at roughly similar rates for this referential function. The Bibi children made increasingly productive use of pronouns from T1 to T2 (26.9% to 40.7%) for referent reintroduction, while the Deaf children made sparse use of the same form and function (8.3%). A Mann-Whitney U test was run to determine if there were differences in the use of forms between Bibi and Deaf children for referent reintroduction in T1 and in T2. Distributions of the three forms (nominal, pronominal, and null) for Bibi and Deaf children were slightly different for reintroduction at T1 ($p=0.42$) and moderately different for the same function at T2 ($p=.031$).

In this section I demonstrated that young Bibi patterns of language-general referent tracking forms parallel those of their Deaf counterparts for some aspects of referent cohesion,

but diverge in others. The divergent patterns described here bear similarities with patterns previously documented for heritage speakers, young unimodal bilinguals, and M2L2 signers. In section 5.2, I will turn to Bibi child patterns of ASL referent forms that are both modality-specific and atypical, providing further justification for framing Bibi signers as a unique type of heritage speakers (signers), that suggest Bibi children are developmentally distinct from their Deaf peers.

5.2 LANGUAGE AND MODALITY-SPECIFIC EFFECTS IN A HERITAGE SIGNED LANGUAGE

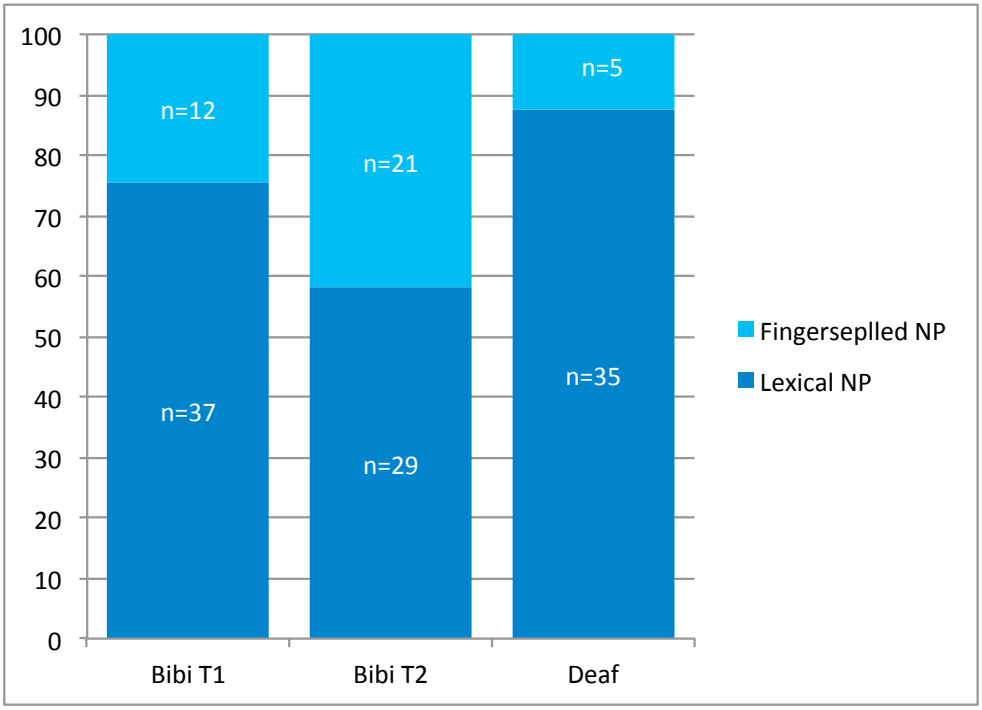
Bimodal bilinguals' preferred referent tracking forms in signed narratives have not been discussed in the literature, with the exception of Morgan's (2000) observation of BSL Bibi children's dependence on overt referent forms. In this section, I unpack the preferred referent form subtypes and atypical forms produced by Bibi children compared to those of their Deaf counterparts. The Bibi findings reveal unique bimodal interaction patterns between their signed and spoken language. These patterns surfaced through an examination of referent form subtypes preferences and sets up the structure of the following three subsections: the Bibi children showing an increasing dependence on fingerspelled nominals, indexical pronouns, and null subjects occurring with plain verbs over time, while the Deaf children preferred lexical nominals, lexical pronouns, and null subjects with depiction verbs. The Bibi children also were found to produce different types of lexical errors or atypical forms used for referent tracking compared to their Deaf peers.

5.2.1 Fingerspelled vs. lexical nominals

First, the preferred nominal form for both groups and at both times are lexical signs specific to ASL (e.g. SPIDER, BUG) with an emerging divergent pattern for the Bibi

children. As seen in Figure 5.5, the Bibi children produced twice as many fingerspelled nominal forms at T1 (n=12) than their Deaf peers (n=5). By T2 the frequency of fingerspelling doubles again (n=21), accounting for close to half (42%) of their nominal forms. A chi-square test was conducted between native signer child group (Bibi and Deaf) and nominal form subtype (lexical and fingerspelled). Bimodal bilingual children were significantly different than the deaf children in the use of nominal forms overall at T2 (χ^2=9.414, p<.002) but not at T1 (χ^2 =2.049, p<.152). This finding suggests a developmental divergence in nominal form subtype for tracking referents.

Figure 5.5: Bimodal bilingual (Bibi) and Deaf children's distribution of nominal forms and Bibi time



Four Bibi children, Ben, Fin, Gia, and Tom, increasingly produced fingerspelled referent forms, using them across all discourse functions at both times, as seen in Table 5.2. Tom was

observed to be the most productive fingerspeller, indicated by the total shift of all his nominals to fingerspelled forms at T2. A discussion of Tom's tremendous atypical shift to fingerspelled forms is elaborated on in section 5.3. In contrast, the Deaf children reserved fingerspelled forms for the discourse function of introducing and reintroducing referents.

Table 5.2: Number and frequency of fingerspelled subject referent forms by Bibi child per time

	T1	T2
Ben	2/7 28.6%	7/13 53.8%
Fin^	2/10 20%	3/9 33.3%
Gia^	2/9 22.2%	5/11 45.5%
Kim	0/5	0/6
Nik^	0/5	0/6
Tom	6/13 46.1%	8/8 100%

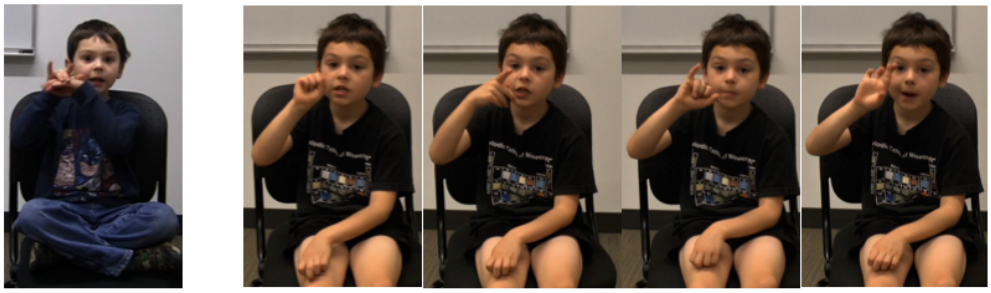
^ Indicates that the Bibi child is DDCI

One might hastily conclude that the increasing use of fingerspelling for Bibi lexical forms is a direct influence from spoken English. However, a discussion on the function of fingerspelling in ASL is necessary to fully understand the significance of the fingerspelled forms produced by Bibi children. ASL fingerspelling is a representation of written English in a manual form, described by Padden (1998) as being "two levels of representation removed from English," (p. 44). Fingerspelling is pervasive in the language, estimated to account for 7 to 10% of ASL vocabulary in informal contexts (Padden, 1991).

For some ASL signs, fingerspelled forms signal a specific semantic reading or grammatical function that differs from a non-fingerspelled form of the same word. For example, the ASL sign FREE means "liberated," while fingerspelled form FS(free) means

'free of charge' (Padden, 1998: 55). However, this type of distinction does not seem to be behind the choice of fingerspelled forms produced by Bibi children in this study. When they used fingerspelled representations of words for which common lexical signs exist (e.g. FS(spider) vs. SPIDER), the fingerspelled rendition referred to the same thing as the lexical sign would. Since there was no observed relation between nominal form and discourse function, I suggest that the increasing use of fingerspelling by the four Bibi children may be an effect of their increasing English literacy and increased time spent in English upon entering school. Observationally, many Deaf parents with Coda children often comment on this new reliance of fingespelling for signs the children have used lexical signs in the past and for new English words learned at school. Also, Deaf parents cite the increasing shift in fingerspelled forms as co-occurring with entrance into school that sometimes persists into adulthood.

(47) Lexical form of SPIDER form Tom's T1 narrative, and fingerspelled form from T2 narrative.



SPIDER S - P - I - R

Heritage speakers have been found to have lexical gaps which may be mediated by code-switching into their dominant language (Lindsey, 2006), as well as slower speeds of lexical retrieval (Polinsky, 1997, 2007). The four Bibi's increasing use of fingerspelled forms for lexical signs they had previously acquired might be a heritage speaker effect reflecting

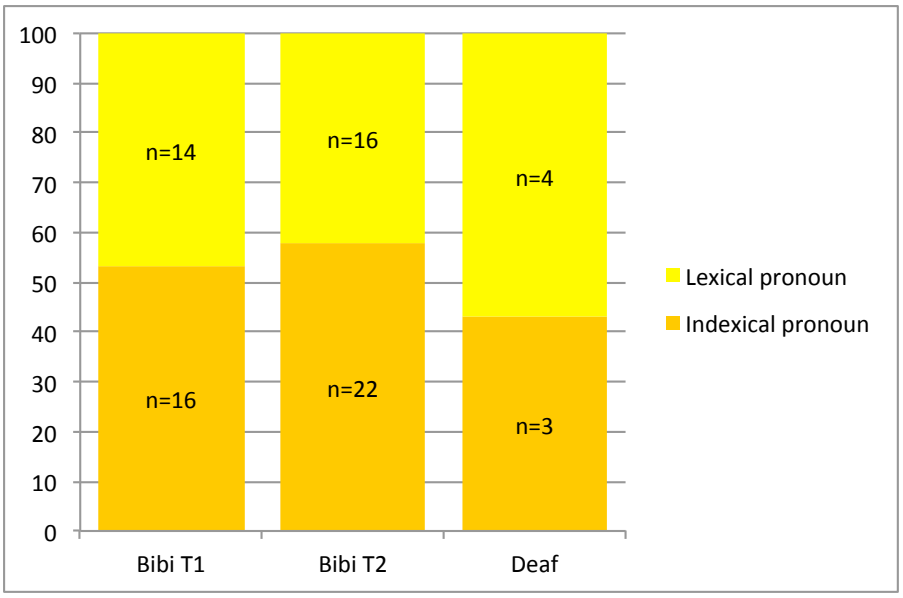
slowed lexical retrieval of ASL signs. Furthermore, the increase in fingerspelling might be strategy for filling in lexical gaps as their English vocabulary grows but their ASL vocabulary reaches a plateau. When failure to retrieve an ASL lexical sign is compensated by substituting the fingerspelled English translation equivalent, the result is a switch from ASL to English that occurs completely in the manual modality. This strategy is akin to code-switching by unimodal bilingual heritage speakers, wherein a lexical items from the stronger language is inserted in place of a translation equivalent in the hertiage language.

5.2.2 Indexical vs. lexical pronominal forms

Shifting to pronominal forms, the Bibi children produced both typical indexical pronouns (a point towards a referent's location) and what I will call lexical pronominal forms (quantifier or adjectival signs that modify a noun). Bibi children showed a slight preference for indexical pronouns at T1, accounting for roughly half of all pronominal forms, which slightly increased at T2 to 57.9%, as shown in Figure 5.6. Conversely, the Deaf children displayed a preference for lexical pronouns (57.1%). Lexical pronouns produced predominantly by the Bibi children included quantifier and adjectival signs such as ALL, OTHER, ONE, and THREE. While the categorization of such signs as lexical pronouns is not typical in the sign linguistics literature, they are in some sense reduced forms of nominals such as ALL FLIES, ONE SNAIL, THREE ANTS, etc., and as such can be considered as pronominal forms. These reduced lexical pronominal-like forms also appeared with nouns as modifiers, as is further detailed in Section 5.3.

The Bibi children produced more pronouns overall than their Deaf peers, especially at T2, as seen in Figure 5.6. Overall, the Bibi children produced slightly more indexical pronouns while the Deaf children produced slightly more lexical pronouns. The Deaf children produced a total of three indexical pronouns, which occurred once per discourse function, whereas the majority of indexical pronouns occurred for the Bibi children for the purpose of referent maintenance.

Figure 5.6: Bimodal bilingual (Bibi) and Deaf children's distribution of pronominal forms and Bibi time



Although studies on M2L2 signers did not include lexical pronouns, only indexical pronouns, both studies on hearing second language learners of a sign language produced more indexical pronouns overall (Bel et al., 2014; Frederiksen et al., 2015), for the purposes of referent maintenance in LSC (Bel et al., 2014) and reintroduction for both ASL and LSC (Bel et al., 2014; Frederiksen et al., 2015). I suggest that the Bibi children may show a

preference for indexical pronouns since they encode spatial information that serves to disambiguate referents. For example, in *The lollipop* narrative, the two main entity types in that narrative can be easily distinguished as insects that can fly (flies) versus insects that move along the ground (ants). This inherent feature of indexical pronouns to disambiguate entity types once they have been established through introduction via nominals may have contributed to the higher rates of overall pronominal production by the Bibi children, compared to the Deaf controls.

Interestingly, Frederiksen and Mayberry (2016) do not include pronominals in their proposed scale of accessibility for ASL referring expressions. This decision was based upon the results of data using a simple narrative task. The Deaf adults in their study only produced four instances of indexical pronouns, which accounted for roughly 1% of referent forms for maintenance. The Deaf children in the current study produced four instances of pronominals (three lexical pronouns and one indexical pronoun) for maintenance which accounted for 5% of maintenance forms. However, the Bibi children in this study made productive use of mainly indexical pronouns for maintenance accounting for 30.3% of forms for maintenance at T2. Frederiksen et al. (2016) suggest that since signed languages conventionalize space for grammatical purposes, referent tracking may be genre specific with narratives showing preference for depictive devices such as role shift.

5.2.3 Null subject forms with plain, agreement, and depictive verbs

Both groups preferred to use null forms with depiction, but to different degrees, as seen in Table 5.7. The Deaf children produced a higher percentage of null forms with

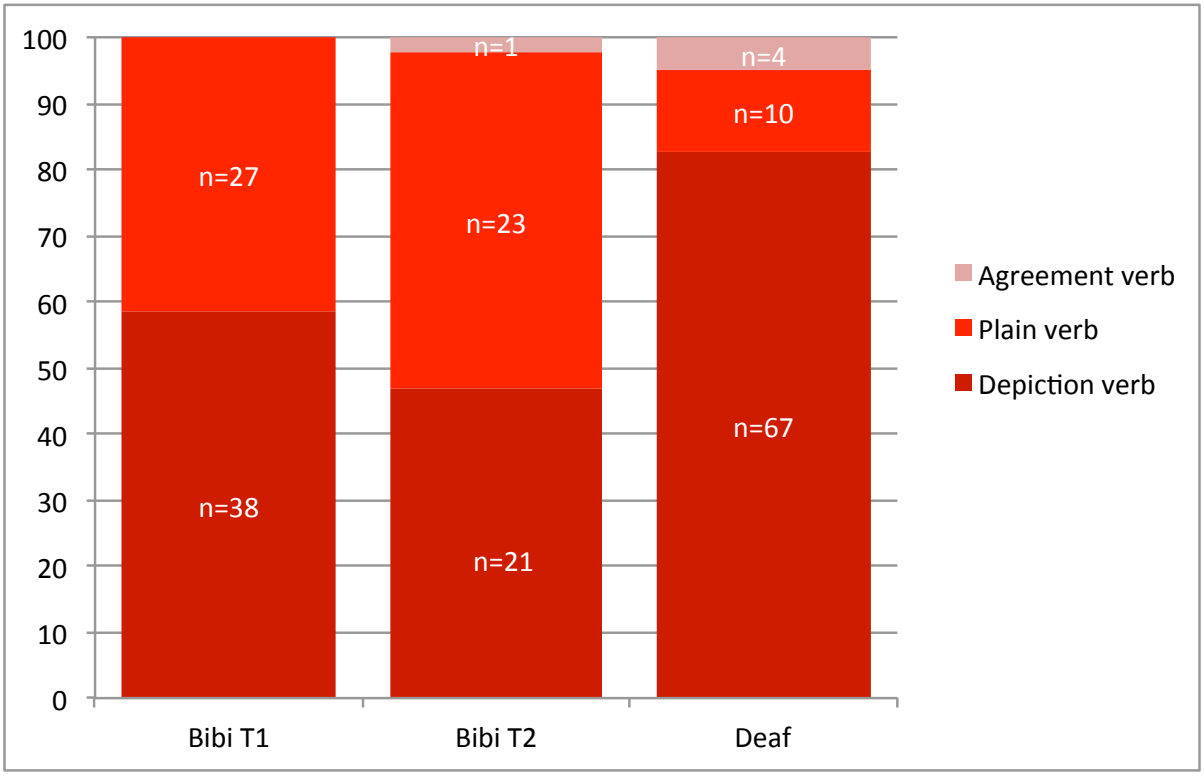
depiction(82.7%) than Bibi at T1 (58.5%), with a slight decrease at T2 (46.7%). The least preferred null forms occurred with agreement verbs by both groups and at both times. The Deaf children only produced three instances of null subjects with agreement verbs for maintenance and one for reintroduction, while the Bibi children only produced one instance for maintenance as seen in Figure 5.8. This finding may suggest that agreement verbs are not productive in ASL narratives in a complex retelling task. Yet in a recent publication using the same data from their 2015 study, Frederiksen & Mayberry (2016) reported that adult Deaf native ASL signers exhibited the productive use of null subiects with agreement verbs for referent maintenance, accounting for a quarter of forms in their simple retelling task. Differences in the frequency and range of reference tracking forms between the current study and the Frederiksen & Mayberry (2016) study may be attributed to methodological differences in task (see Tarone and Parrish (1988) for a review of task-related variation).

Differences between the use of null subjects occurring with plain verbs were also observed between groups. The Bibi children preferred the use of null subjects occurring with plain verbs three times more than the Deaf children (12.3% vs. 41.5%, respectively) and increasingly so at T2 (51.1%) as seen in Figure 5.7. As compared to the Deaf adults in the 2016 study by Frederiksen et al., the Bibi children overall produced twice the amount of null subjects with plain verbs while the Deaf children produced considerably less. Again, the study disparities may be an effect of methodological differences.

A chi-square test was conducted between native signer child group (Bibi and Deaf) and null subject forms occurring with plain verbs and depiction. Agreement verbs were removed from this analysis due to the infrequent occurrences. Bimodal bilingual children

were significantly different than the deaf children in the use of occurrence of null subject occurring with different verb forms at both T1 (χ^2=14.580, p<.000) and T2 (χ^2 =21.384, p<.000).

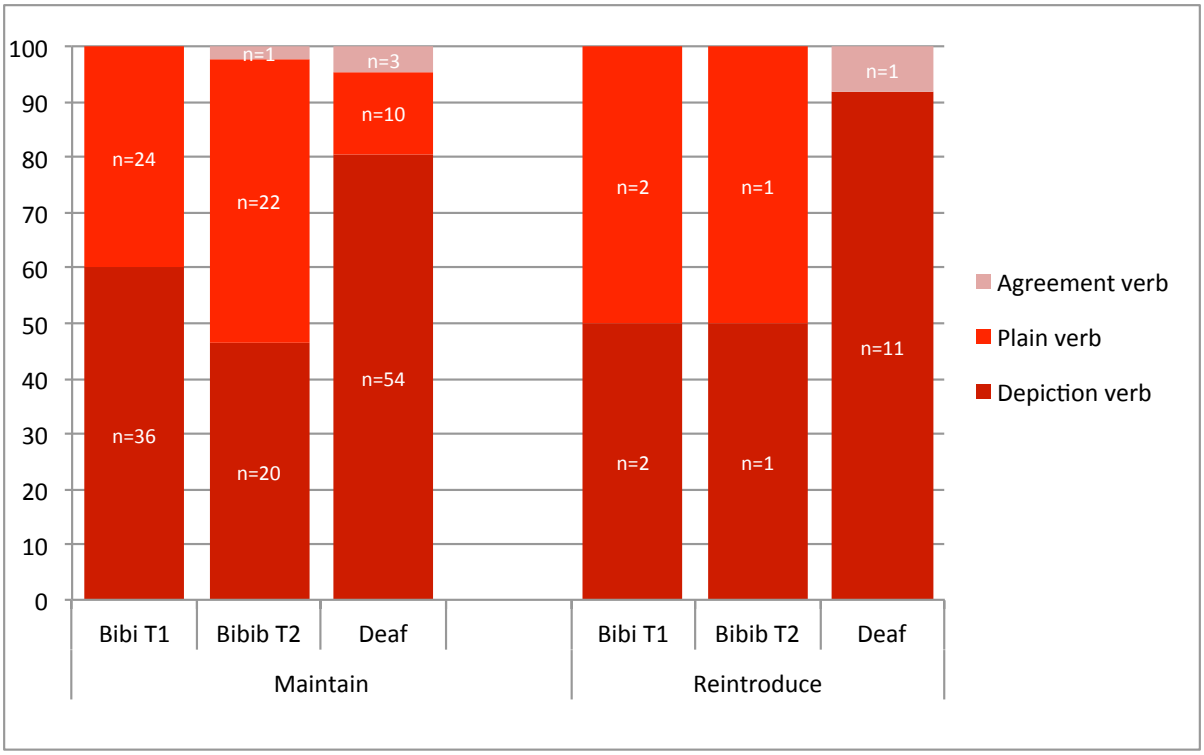
Figure 5.7: Bimodal bilingual (Bibi) and Deaf children's distribution of null forms and Bibi time



As mentioned previously, Morgan (2000) notes a lack of depictive forms produced with null subjects for referent maintenance and reintroduction by British Coda children. Differently, as detailed in Figure 5.8, the Bibi children at T1 preferred null subjects occurring with depiction for maintenance, while at T2 the children show a shift by equally preferring null subjects occurring with plain verbs and depiction. The Deaf children preferred null subjects with depiction more (80.6%) than the Bibi children at T1 (60%). Another difference

is the preferred null subject type for referent reintroduction. The Deaf children did not produce any null subjects with plain verbs for the purposes of reintroduction, while Bibi children at both times equally produced preferring null subjects occurring with plain verbs and depiction for the same function.

Figure 5.8: Bimodal bilingual (Bibi) and Deaf children's distribution of null forms by referent maintenance and reintroduction



Adult heritage speakers of Spanish (Montrul, 2004) and Korean (Lee & Zalasky, 2015) have been shown to produce null subjects in their narratives yet to a lesser degree than their monolingual counterparts. Like heritage speakers, the Bibi children produced null subjects with plain verbs (licensed by a zero-topic) as well as depiction and agreement verbs (licensed by verbal morphology), yet less than their Deaf counterparts. Furthermore, over time the Bibi children preferred null subjects with plain verbs (zero anaphora), the least explicit class of

verbs that licenses null forms. These findings are somewhat in line with the observations made for BSL signing Coda children (Morgan, 2000). While the BSL Coda children were not as productive in their use of depiction like their Deaf counterparts, the Bibi children in this study produced depiction regularly, although more often at T1 than at T2. This pattern of decreasing depiction use may be a heritage language effect, due to reduced input in the home language, and an increase in English through school. ASL-specific features that were once prevalent in their earlier signing may be replaced by other permissible structures that allow null subjects, such as plain verbs which can appear with null subjects, an option that gains popularity at T2.

This finding is interesting because the Bibi children preferred null subjects with plain verbs (zero anaphora) instead of null subjects with depiction that encode referential information such as physical characteristics, movement, and location (Emmorey, 2003; Supalla, 1986); the latter were preferred by the Deaf children. Another point to reiterate from the literature review is the tendency of young bilinguals to avoid violating grammatical constraints of their home language (Alavarez, 2003; Chen and Lei, 2012; Serratrice, 2007). For example, the young unimodal bilinguals in Serratrice's study (who may be best characterized as heritage speakers of Italian, although they are not labeled as such in the article) avoided preverbal clitics, a complex structure preferred by Italian monolinguals for object maintenance. Instead of producing an ungrammatical structure (e.g. post verbal pronominals) the bilingual children produced postverbal noun phrases, an acceptable yet less typical form in Italian, for object referent maintenance. Similarly, depictive constructions in signed languages are complex forms, and although Bibi children did not avoid them, they

used them to a lesser degree than their Deaf peers and less over time for referent maintenance and reintroduction. Furthermore, Bibi children produced some instances of overt subject forms with depiction, which were not coded as a referent tracking form since the focus of this study is subject referent forms. This coding decision disregarded instances of depiction with overt subjects, and may have underestimated the total amount of depiction produced by the Bibi children.

The increasingly significant use of overt forms for maintenance and reintroduction by the Bibi children as compared to the Deaf children in this study may lead one to conclude that it is a transfer effect from English, a language that requires overt forms. In previous studies of bilinguals of languages that both allow null subjects, their less dominant language shows increased use of overt forms for referent tracking as compared to monolinguals. This pattern has been observed for both unimodal simultaneous bilinguals of two spoken languages (Sorace & Serratrice, 2009) and bimodal second language hearing learners of a sign language (Bel et al., 2014). In order to clearly tease apart transfer effects from dominance effects, a study of young simultaneous bimodal bilinguals of languages that both allow null subjects (e.g. Mexican Sign Language/LSM and Spanish) would be enlightening.

5.2.4 Summary of modality-specific forms

Overall, an analysis of the referent subtype forms by Bibi and Deaf children shows increasingly divergent patterns of preferred nominal, pronominal, and null subject forms. Bibi children showed an increasing dependence on fingerspelled nominals, indexical pronouns, and null subjects occurring with plain verbs over time, while the Deaf children

preferred lexical nominals and pronominals, and null subjects occurring with depiction for referent maintenance and reintroduction. The increasing preference for fingerspelled nominals by Bibi children may have been a result of increased exposure to English at school, the children's growing English literacy and shift in language dominance to the majority language, as observed for their heritage speaker peers. The increasing use of fingerspelled forms by the Bibi children may also serve as a compensatory strategy for slower lexical retrieval in their heritage language, ASL, as has been observed for heritage speakers of Russian (Polinsky, 1997) and other languages. The analysis of pronominal subtype forms also highlights the similarities between the Bibi children and M2L2 signers, in their abundant use of indexical pronominals for referent maintenance and reintroduction compared to Deaf comparison groups. The increase of indexical pronouns may be a modality effect, where entities are easily disambiguated in ASL through the use of space, (e.g. flies referred to with an indexical pronoun pointing high up in the signing space invoking referents in the air, while ants are referred to with an indexical pronoun pointing lower in signing space, invoking referents on the ground). And finally, the increasing use of null subjects occurring with plain verbs highlights similarities with young bilinguals producing alternative yet permissible forms in the heritage language (Serratrice, 2007), and adult heritage speakers producing null subject forms to a lesser degree than their monolingual counterparts (Lee et al., 2015; Montrul, 2004).

5.2.5 Atypicality

In this section, the Bibi children's production of atypical forms for referent tracking, including referent modifiers and referent form errors, are discussed in detail, with comparison to their Deaf counterparts. The Bibi children were observed to produce more referent modifiers at both times and showed a growing use of atypical English-influenced determiners. Second, the higher frequency of atypical referent form that showed a variety of notable error types at T1 decreased at T2, at which point Bibi children patterned more like their Deaf counterparts.

5.2.5.1 Atypical referent modifier

The Bibi children at both times produced roughly three times the amount of total modified noun phrases than their Deaf peers (~19% vs. 6.3%) with both groups mainly producing modifiers for the purpose of introduction (Table 5.3). Modifiers fell into four categories: quantitative & adjective modifiers, multiple modifiers, ASL determiner/locative modifiers, and English determiners. The Bibi children preferred adjective (48) and quantity (49) modifiers at both times (n=15), while the Deaf children roughly preferred both quantity and adjective modifiers and ASL determiner/locative modifiers, a category that included indexical locatives (50) and demonstratives (51). The occurrence of these forms in the Bibi and Deaf narratives is summarized in Table 5.3.

(48) **BLACK** SPIDER (Ben, Bibi, T1, introduce spider)
'a black spider…'

BLACK SPIDER

(49) **FIVE** FS(flies) (Tom, Bibi, T2, introduce flies)
'five flies…'

FIVE F- L- I- E-S

(50) **IX(there-bug)** BUG (Ward, Deaf, introduce ants)
'there were bugs…'

IX(there) BUG

(51) **THAT** SPIDER (FIN, Bibi, T2, introduce spider)
'that spider'

Table 5.3: Distribution of noun modified forms by native signer group and time

	Total modified noun phrases	Quantifier and adjective modifiers	Multiple modifiers	ASL determiner/locative modifiers	English determiners
Bibi T1	27/144 18.7%	15	3	8	1
Bibi T2	25/133 18.8%	15	3	3	5
Deaf	8/128 6.3%	3	1	4	0

Another difference between the Deaf and Bibi children is the occurrence of multiple nominal modifiers. At both times, Bibi children produced three instances of multiple modifiers (52) while the Deaf children produced only one (53).

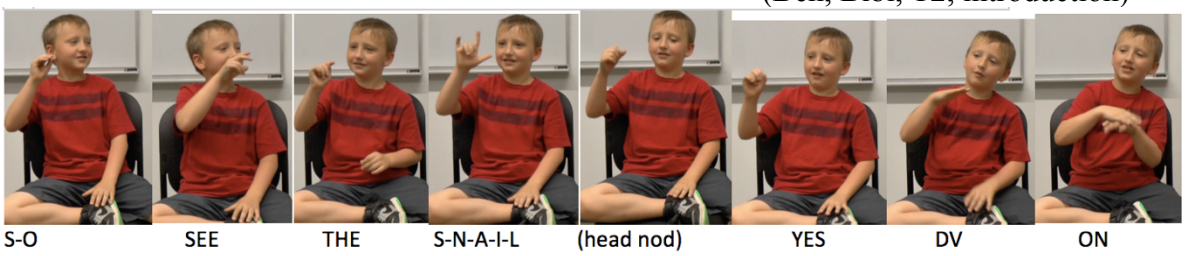
(52) **SMALL BLACK** SPIDER (Gia, Bibi, T1 introduce spider)

(53) **ONE** SPIDER **BLACK** (Kloe, Deaf, introduce spider)

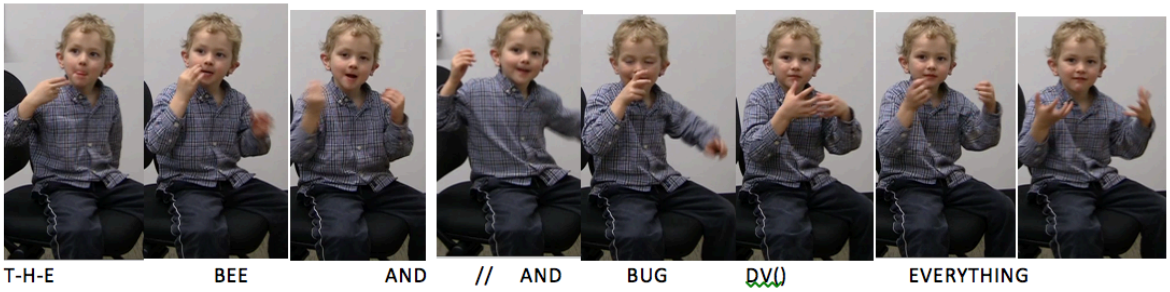
What is notable about the Bibi children's use of modifiers is their increase of English determiners to track subject referents at T2 (T1=1; T2=5). The Deaf children did not produce

any signed or fingerspelled English determiners, yet four out of the six Bibi children (Ben, Fin, Gia, and Nik) produced English determiners. English determiner forms included the Signed English form THE (n=4) for introduction purposes as seen in (54), and two instances of fingerspelled English determiners *the* (55), used once for maintenance and once for reintroduction. What is surprising about the English Signed determiner THE is that all children used the definite form to introduce referents, instead of an indefinite determiner, as is typical for spoken English (Hickmann & Hendriks, 1999). It appears the children are transferring the indefinite-definite distinction into their signed narratives, yet using the distinction incorrectly to introduce referents.

(54) FS(so) SEE **THE** FS(snail) (head nod) YES DV(snails-move-across-ground-5) ON GROUND TO PLAY GROUND
Spoken English: *so*
So this is what we see, the snails, yes, they slid across the ground to a play ground.'
(Ben, Bibi, T2, introduction)

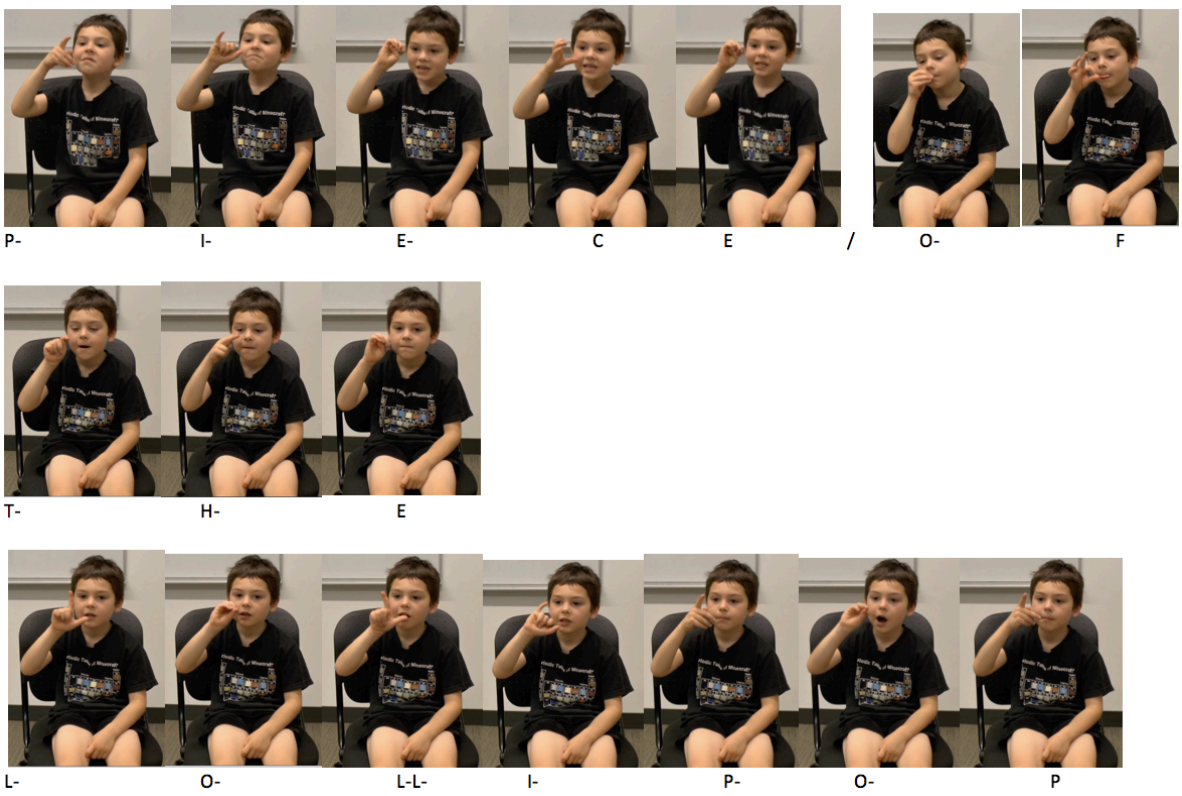


(55)
FS(the) BEE AND// AND BUG DV(flies-ants-take-candy-at-same-time) THING
Spoken English: *the bee and and ant take take take everything*
"the bees and the ants took everything [pieces of candy]"
(Fin, Bibi T1, reintroduction)



Another notable observation is the frequent co-occurrence of English determiner modifiers (4 out of 6) with spoken English (i.e. code-blended utterance) as found in (54). Although a full analysis of the frequency of code-blending across all narratives was not performed, Tom uniquely code-blended the majority of his utterances, excluding depictive constructions, confirming the code-blending patterns observed for Coda adults (Emmorrey et al., 2008). Although Tom did not sign any English determiners in the subject position, he did so frequently in the object position (56) at T2. This finding may indicate a growing subject-object asymmetry in Tom's grammar, producing signed English determiners for objects only. Additionally, Tom's utterance (55) is also highly unusual in that each word is fingerspelled rather than using lexical signs. As mentioned previously, Tom had a full shift to fingerspelled subject referent forms at T2 and (55) is an extreme example of this atypical production.

(56) FS(each) FS(fly) FS(and) FS(ant) FS(gets) **FS(a)** FS(piece) FS(of) **FS(the)** FS(lollipop)
Spoken English: *then each fly and ant gets a piece...of the lollipop*
"Then each fly and get gets a piece…of the lollipop." (Tom, Bibi, T2)



Furthermore, instead of producing signed English determiners in the subject position, Tom was observed to frequently use an ASL determiner/locative while speaking the English determiner (57-58). Tom produced the ASL indexical determiner for the majority of his modified NPs at both T1 and T2. In this sense the ASL determiner in conjunction with spoken English is a creative strategy that maintains an ASL form, yet functions as an English determiner.

(57) THEN **IX(spider)** SPIDER
Spoken English: *and then **the** spider*
"And then the spider" (Tom, Bibi, T1, introducing spider)

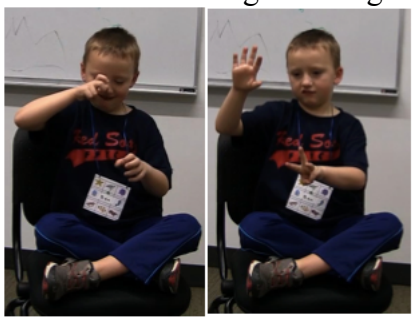
THEN IX(spider) SPIDER

(58) BUT-G ONE// ALL **IX(snails)** FS(sXils) DV(curl-up) IN IX(ball) BALL
Spoken English: *then one//, all **the** snails curl up into a ball*
"Then one, all the snails curled up into a ball."
(Tom, Bibi, T1, maintaining snails)

Lastly, Deaf and Bibi children behaved similarly with respect to the preferred placement of modifiers before a noun. Modifiers occurred mostly before the nouns they modified for all children. In their two Bibi instances of post-nominal modifiers, Ben did not produce any spoken English in (59), while Tom did in (60). As Tom fingerspelled FS(ants), he skillfully aligned the spoken English determiner and noun "*the ants."* Again, Tom is

producing ASL by fingerspelling the referent, while bringing in the English determiner via speech instead of a signed English form.

(59) BUG **SIX(directed)**
Spoken English: (none)
"There were six bugs on the ground." (Ben, Bibi, T1, reintroduce ants)



BUG SIX(directed)

(60) FS(ants) **IX(ants)**+ FS(try) FS(to) FS(bring) FS(a) FS(lollipop) FS(to) POSS(ants) FS(home)
Spoken English: *the ants try to bring a lollipop to home*
"The ants were trying to bring the lollipop to their home." (Tom, Bibi, T2, introduce ants)

A-N-T-S IX(ants) T-R-Y T-O B-R-I-N-G A L-O-L-L-I-P-O-P

T-O POSS(ants) H-O-M-E

So far we have seen modifier differences between the Bibi and Deaf children, with the Bibi children producing overall more modifiers, and preferring adjective and quantity modifiers, while the Deaf children preferred ASL determiner/locative modifiers. Although the reason

why Bibi children produced more modifiers is unclear, I can speculate that language-specific differences exist between ASL and English in frequencies of noun phrase modifiers. Observationally, the Bibi children had a tendency to very explicitly specify the exact number of referents involved in an event, whereas the Deaf children tended to gloss over that detailed information, focusing more on general event patterns. In all, the productive use of modifiers in a narrative retelling seems to be more characteristic of English. Furthermore, the definite-indefinite distinction in the English determiners in the subject position were all definite, which is non-target like for the function of introducing referents.

The Bibi children's increasing use of English modifiers of various types appears to be a direct influence from English via Signed Exact English (SEE), a system that seeks to represent English in a signed modality, inventing signs for English grammatical elements that do not exist in ASL. SEE is typically used in Deaf educational settings, so it is unclear where the Bibi children are learning SEE signs. Nevertheless, their use of English signed determiner forms reflects a strong influence from their newly developing dominant language, English. Lastly, we also observed the selective use of signed English determiners in the object position by Tom, as well as his homemade ASL-based strategy using a locative determiner (e.g. IX(entity-there)) to co-occur with the spoken English determiner *the*. Taken together, modifier patterns by the Bibi children show a strong influence from English integrated into ASL in creative and unpredictable ways.

5.2.5.2 Atypical referent forms

The last section focused only on referent modifiers, while in this section the focus will shift to subject referents only. As described in the methods section, all subject referents were coded for typicality to capture developmental patterns by the Bibi children compared to the Deaf children. Atypical productions of referent forms fell into one of the four following

categories: classifier handshape errors, fingerspelled errors, possessive errors, and created forms. Overall, as seen in Table 5.3, Bibi children showed a developmental pattern of decreasing atypical forms from 15.3% at T1 to 3% at T2. The Deaf children showed sparse referent form errors, accounting for only 1.6% of all forms (n=2).

Table 5.3: Atypical referent forms by native signer group and time

	Classifier handshape error	Lexicalized-like fingerspelling	Possessive Errors	Created forms
Bibi T1 18/144 12.5%	9	6	0	5
Bibi T2 4/133 3%	3	0	1	0
Deaf 2/128 1.6%	2	0	0	0

The Deaf children only produced two classifier handshapes errors in depictive constructions, which comprised the largest error category for the Bibi children. An example of a classifier handshape error in a depictive verb is found in (61) by Fin. He produced an entity classifier handshape 'V', typically reserved for animate beings with legs, to depict the movement of a snail climbing up a ladder. While signing the depictive construction, Fin moved the V fingers as if the snail had two legs and accompanied this sign with the English words *he crawl up*. This is a rare occurrence in the data of a spoken English phrase accompanying depiction; previous studies on adult Coda production suggests that depiction

typically does not co-occur with spoken English words, although it may be accompanied by sound effects (Emmorey et al., 2008).

(61) **DV(crawl-up-ladder)** DV(up-over-surface-path-1)
Spoken English: *and he crawl up* (Fin, Bibi, T1, maintain snail)
"And he crawled up, landed at the top and walked forward."

DV(crawl-up-ladder)

The reported numbers for classifier handshape errors did not include referents that occurred with an overt nominal forms. However, some interesting errors occurred that were not counted. For example, Gia at T1 produced this sentence introducing the spider, followed by two instances of depiction (62). The depiction *DV(path-walk-towards-stick)* is atypical in that Gia produced the same entity classifier handshape produced by Fin (61), typically reserved for entities with legs. The movement of the classifier handshape is the V handshape and resembles an entity kicking its two legs up and down in water, as if swimming. The following depictive construction *DV(as spider:(FS('oh'*)) is very typical of ASL narratives, and notable as an instance of constructed dialogue. Gia depicts the inner thought of the spider as it looks at a stick and suddenly comes up with an idea, exclaiming, "Oh!" Gia's example shows two instances of depiction, the first one produced with an incorrect handshape, while the following constructed dialogue depiction is produced correctly, as well as being inventive and engaging. This type of depiction was infrequent in this data set, perhaps since the animate entities in the stimuli were all insects. It is interesting to note that this instance of depiction (constructed dialogue of inner speech) is preceded by a nominal, albeit in the

previous noun phrase, to identify the referent and is parallel with the adults and the older children in Reilly's (2000) study.

(62) AND SMALL BLACK SPIDER HAPPEN **DV(path-walk-towards-stick)** DV(as spider:(FS('oh'))
Spoken English: *and small black spider, oh* (Gia, Bibi, T1, introduce spider)
"And a small black spider walked towards the stick, stopped and thought 'oh.'"

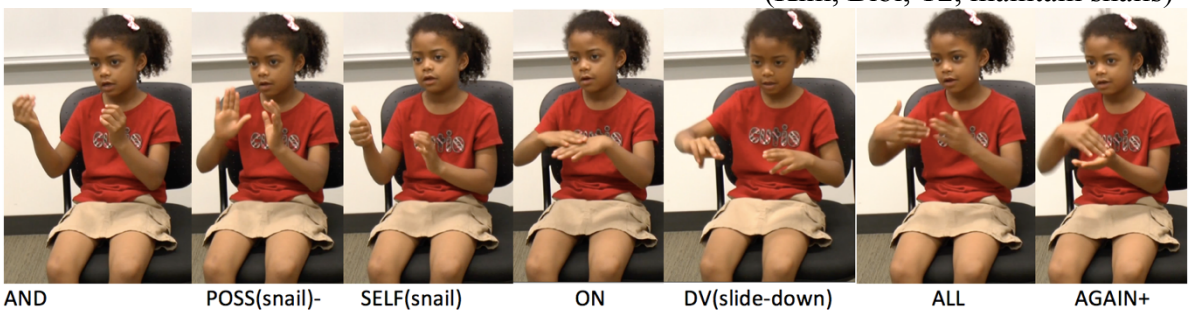
Common fingerspelled words may undergo a process of lexicalization (Valli and Lucas, 2000), resulting in lexical signs that no longer faithfully represent each component letter of the original fingerspelled word. Since ASL signs are typically limited to two handshapes, lexicalized fingspelled words typically delete word-internal letter handshapes and impose overall movement contours. For example, in the lexicalized fingerspelled sign traditionally glossed as #SALE, meaning "on sale/discount," the word-internal handshape *A* has been deleted and an overall counter clockwise movement is added to the sign. All of Tom's fingerspelled production of the *ants, flies, snails,* and *spider* (n=6) that occurred at T1 seem to follow the pattern of lexicalized fingerspelled words, much like that displayed by #SALE. In (63) Tom produced his lexicalized-like fingerspelled production of *snails,* with the word-internal letter handshapes *a, i, l,* deleted, and an addition of a semi-circle clockwise movement, as seen below.

(63) g(hey) IX(snails) DV(slide-along-flat-surface-B)// **FS(snXs)** DV(slide-along-flat-surface-path-B)
snails
"Hey there were snails sliding across the ground" (Tom, Bibi, T1, introduce snails)

In sum, the lexicalized-like fingerspelled occurrences seem to have been a temporary approximation strategy since Tom was not observed to use those same approximations at T2. Instead, at T2, Tom used full fingerspelled renditions for all of his subject referent forms (which is atypical).

Lastly, there was only one instance of an innovative atypical compound of two lexical pronominals, POSS(snail)-SELF(snail), by Kim at T2 (64). The sign co-occurred with a non-phonated mouthing of the English words *his* and *self*, with each English morpheme produced independently of the other, rather than as a single reflexive pronoun *himself,* typically encoded by the ASL reflexive sign SELF. This is clearly an example of the influence of an English reflexive comprising two morphemes influencing the structure of an ASL reflexive that would normally comprise only one sign.

(64) AND POSS(snail)-SELF(snail) ON DV(slide-down-U) ALL AGAIN+
Spoken English: - "And himself on slide down, all (of them) again and again."
And he, himself slid down the slide, and all of them (snails) did so over and over again.
(Kim, Bibi, T2, maintain snails)



The last atypical subject referent forms are Tom's five instances of a created sign glossed as FLY-Y, as seen in (65). The sign seems to have been invented on the spot, and follows the phonological parameters for nouns in ASL. The Y-handshape follows a repeated movement pattern, typical for nouns of noun-verb pairs, as well as reduplicated noun plural forms. Furthermore, each production of the invented sign FLY-Y was accompanied with the spoken English word, *flies.* The sign is notable in that Tom's production looks and feels like an established sign of the ASL lexicon.

(65) FS(th)// FS(a)// IX(flies-there) **FLY-Y** DV(flying) DV(path-horizontal)
Spoken English: *the a// there's flies flying around*
"The// a// there are flies flying around" (Tom, Bibi, T1, introduce flies)

FS(th)// FS(a)// IX(flies-there) **FLY-Y** DV(flying) DV(path-horizontal)

Overall the Bibi children developmentally exhibited less referent form errors from Time 1 to Time 2. We also observed an interesting pronominal error produced by Kim at T2, that is clearly an English influenced form mapping two English morphemes into an atypical production of two ASL morphemes. Lastly, we observed a temporary strategy by Tom at T1 of using atypical lexicalized-like fingerseplled forms that are inventive while conforming to the constraints of ASL sign structure.

5.3 SUMMARY OF DISSERTATION

In this section, I review the research questions motivating this dissertation and summarize the results of young bimodal bilingual children's developmental patterns of subject referent tracking in their ASL narratives, compared to their Deaf peers.

RQ1: What are developmental patterns of referential cohesion in signed narratives by young bimodal bilinguals?

The Bibi children overall produced more overt forms at T2 than at T1. I predicted this result would occur based on the fact that the Bibi children at T2 have experienced a sustained amount of time in a monolingual English environment at school, roughly a year and a half between T1 and T2. Thus the Bibi children are likely to experience a shift in language dominance. The Bibi children's increased overtness patterns may also be attributed to the difference in the null setting parameter between ASL and English, since ASL allows for several types of null subject forms, while English typically does not. The Bibi children may also prefer grammatical structures that are available in both of their languages for the purposes of referent tracking, namely nominals and pronominals. Lastly, the prediction of increasing overtness by the Bibi children was also influenced by previous research on the propensity of unbalanced bilinguals (including heritage speakers, early unimodal bilinguals, early bimodal bilinguals, and M2L2 signers) to prefer overt forms for referent cohesion.

RQ2: How are the patterns of referent cohesion by bimodal bilinguals similar or different to those of age-matched Deaf peers?

I predicted that the Bibi children would use more nominal forms to introduce and reintroduce referents over time, compared to their Deaf counterparts, reflecting a tendency towards increasing overtness and explicitness, as described in the previous paragraph. The Bibi children were observed to produce nominals for referent introduction at T2 at the same frequency as the Deaf children. For referent reintroduction, the Bibi children produced more nominals than the Deaf children, as predicted. Unexpectedly, however, the Bibi children showed increased use of pronouns for reintroduction, significantly more than the Deaf control group. Since pronouns are less explicit forms than nouns, this trend did not conform to the prediction of increasing explicitness for the Bibi children. And lastly, as predicted, the Bibi children increased the use of pronouns for referent maintenance.

RQ3: What do the bimodal bilingual patterns of referent cohesion tell us about bilingual narrative development and do they match patterns reported in the literature for heritage speakers of two spoken languages?

The referent tracking patterns reported in this subsection illustrate Bibi children's increasing dependence on explicit forms, particularly pronominals, for maintenance and reintroduction, compared to their Deaf peers. This increase is related to a decrease in Bibi children's use of null subject referents, constituting a divergent pattern from that of the Deaf children. However, it is important to note that the Bibi children did produce null forms like the Deaf children, just to a lesser degree than what was reported for other heritage language users (e.g. the intermediate heritage Spanish speakers observed by Montrul (2004)). In summary, the Bibi children produced more pronouns for referent maintenance than their

Deaf counterparts, much like adult intermediate Spanish heritage speakers (Montrul, 2004); young unimodal bilinguals (Serratrice, 2007), and M2L2 signers of LSC (Bel et al., 2014). The Bibi children also produced more explicit forms (both pronouns and full nouns) for referent reintroduction than their Deaf counterparts, much like young Chinese-English bilinguals (Chen & Lei, 2012), and M2L2 signers of LSC and ASL (Bel et. al, 2014; Frederiksen et al., 2014). These findings confirm that like heritage speakers, Bibi children display a tendency for over explicitness in their use of pronominals when null forms would be more expected. Furthermore, like their heritage speaker counterparts, Bibi children display effects from their increasingly dominant language, English.

Further evidence for the Bibi children as heritage signers comes from the atypical referent forms observed in the Bibi narratives. Some of these atypical forms are categorized as ASL developmental errors, such as selecting an inappropriate classifier handshape during production of a depictive construction. Bibi children may have experienced delays in controlling complex verbal forms, but they converged developmentally with their Deaf peers by T2. Other atypical forms observed in signed narratives from the Bibi children seem specific to bimodal bilingual development. These forms reflect a growing dominance of spoken English, but also a sensitivity to ASL grammar, integrating the two in creative and unpredictable ways. For example, Bibi children innovated determiner forms in their ASL, and alternative forms (e.g. lexicalized fingerspelled forms or classifiers with novel handshapes) for ASL referents. These atypical innovations by the Bibi children seem to be bilingual strategies, and demonstrate a sophisticated knowledge of ASL in addition to English grammar, and perhaps triggered by ASL being their heritage language.

5.4 LIMITATIONS AND FUTURE WORK

The limitations of the current study include the lack of analysis of the following elements, and comprises the list of future work: object referents, depiction with overt subjects, depiction types, and overall code-blending patterns. Since the current study focused on subject referent tracking forms, object referents were not analyzed and may have revealed different patterns such as young English-Italian bilinguals' avoidance of object clitics (Serratrice, 2007). For example, one child did not produce any Signed English determiners for referents in the subject position, yet did so for referents in the object position, suggesting a subject-object asymmetry. Secondly, instances of depiction that occurred with overt subject forms were not analyzed. These modality-specific devices demonstrate ASL fluency and were a common device used in their narratives that often were produced with overt subjects. Furthermore, instances of depiction were not coded for depiction sub-types which includes constructed action, constructed dialogue, and classifier verbs.

Lastly, future work should include an analysis of the Bibi children's English narratives that were collected as part of the current study. The English narratives could be analyzed for referent tracking patterns, evidence of ASL structural influence and the patterns of code-blended utterances. An independent study by Koulidobrova (2012) analyzing the English production of some of the same Bibi children participating in the current study reported non-targetlike use of null subjects in their English spontaneous production. Although the distribution of referent forms in spontaneous production may well be expected to differ from that in a narrative task, Koulidobrova's findings suggest potentially interesting non-targetlike aspects of the Bibi children's developing English grammar due to their knowledge of ASL.

5.5 CONCLUSION & APPLICATIONS

Results from the current study show the bimodal bilingual children pattern more like heritage speakers than their Deaf counterparts in tracking subject referents in their signed narratives. The results suggest that bimodal bilinguals are not only like heritage speakers in their similar language acquisition context, but also like heritage speakers in their grammatical patterns, which diverge from their monolingual counterparts. Furthermore, the interaction patterns between a young bimodal bilinguals' two languages inform bilingual acquisition and heritage language frameworks by accounting for bilingualism in two modalities.

Applications of the current study include heritage signer language maintenance efforts. In recent years, Deaf and Coda grassroots efforts have been on the rise, with programs such as youth summer camps for Kodas (Kids of Deaf adults) lead by Coda adults across the U.S., and the establishment of Deaf parent-led groups such as "Koda Capitol" in the D.C. area. Both examples serve to encourage the development of young Codas' identity and create stronger bonds between Deaf parents and their Coda children. In the same way that bilingual education programs provide bilinguals the opportunity to develop their heritage language in different registers, heritage sign language programs may also be developed. Lastly, sign language interpreting programs are typically designed for hearing second language learners of a sign language (M2L2), but these programs may better serve adult bimodal bilinguals, heritage sign language learners, with pedagogy informed by research on the unique acquisition patterns of heritage signers. Overall, the suggested applications of this study frame bimodal bilinguals as heritage signers, recognizing their heritage sign language and cultural patrimony with the goal of ensuring ongoing linguistic and cultural ties to their Deaf families.

References

Alvarez, E. (2003). Character introduction in two languages: Its development in the stories of a Spanish-English bilingual child age 6; 11–10; 11. *Bilingualism: Language and Cognition*, 6(03), 227-243.

Ashton, G., Cagle, K., Kurz, K. B., Newell, W., Peterson, R., & Zinza, J. E. (2013). Standards for learning American Sign Language. *American Sign Language Teachers Association*.

Au, T. K. F., Knightly, L. M., Jun, S. A., & Oh, J. S. (2002). Overhearing a language during childhood. *Psychological Science*, 13(3), 238-243.

Bamberg, M. G. W. (1987). *The acquisition of narratives: Learning to use language*. Berlin: Mouton de Gruyter.

Bel, A., Ortells, M., & Morgan, G. (2014). Reference control in the narratives of adult sign language learners. *International Journal of Bilingualism*, 1-17, published online 10 April 2014. doi: 10.1177/1367006914527186.

Benmamoun, E., Albirini, A., Saadah, E., & Montrul, S. (2008). Agreement and plural features in heritage Arabic speakers. *Second Heritage Language Summer Institute*, Harvard University, Cambridge, MA.

Benmamoun, E., Montrul, S., & Polinsky, M. (2010). White paper: Prolegomena to heritage linguistics. *Harvard University*, 12, 26-43.

Benmamoun, E., Montrul, S., & Polinsky, M. (2013). Heritage languages and their speakers: Opportunities and challenges for linguistics. *Theoretical Linguistics*, 39(3-4), 129-181.

Bogaerde, B. van den & Baker, A.E. (2009). Bimodal language acquisition in Kodas kids of deaf adults. In M. Bishop & S.L. Hicks (Eds.), *Hearing, mother-father Deaf: Hearing people in Deaf families*, 99–131. Washington, DC: Gallaudet University Press.

Chafe, W. (1975). Givenness, contrastiveness, definiteness, subjects and topics. In C.N. Li (Ed.), *Subject and Topic* (22-56). New York: Academic Press.

Chen, L. and Lei, J. (2012). The Production of referring expressions in oral narratives of Chinese-English bilingual speakers and monolingual peers. *Child Language Teaching and Therapy*, 29(1), 41-55.

Chen Pichler, D., & Koulidobrova, H. (2015). Acquisition of sign language as a second language. In M. Marschark (Ed.) *The Oxford Handbook of Deaf Studies in Language: Research, Policy*, *and Practice* (218-230). Oxford University Press.

Chen Pichler, D., Lee, J., & Lillo-Martin, D. (2014). Language development in ASL–English bimodal bilinguals. *Multilingual Aspects of Signed Language Communication and Disorder*, 11, 235.

Chen Pichler, D. (2001). *Word order variation and acquisition in American Sign Language.* Doctoral Dissertation. University of Connecticut, Storrs.

Chen Pichler, D., Hochgesang, J., Lillo-Martin, D. & Quadros, R. M. 2010. Conventions for sign and speech transcription of child bimodal bilingual corpora in ELAN. *Language, Interaction and Acquisition*, 1, 11-40.

Chen Pichler, D., Lee, J. & Lillo-Martin, D. (to appear). Language development in ASL-English bimodal bilinguals. In D. Quinto-Pozos (Ed.), *Multilingual aspects of signed language communication and disorder.* Bristol, UK: Multilingual Matters.

Christiansen, T. (2011). *Cohesion: a discourse perspective*. Bern: Peter Lang.

Crasborn, O., Sloetjes, H. (2008). Enhanced ELAN functionality for sign language corpora. In O. Crasborn, T. Hanke, E. Efthimiou, I. Zwitserlood & E. Thoutenhoofd (Eds.), *Construction and Exploitation of Sign Language Corpora, 3rd Workshop on the Representation and Processing of Sign Languages* (39-43). Paris: ELRA.

Compton, S. (2014). American Sign Language as a Heritage Language. In T. G. Wiley, J. K. Peyton, D. Christian, S. C. Moore, & N. Liu (Eds.), *Handbook of Heritage, Community, and Native American Languages in the United States: Research, Policy, and Educational Practice*. New York: Routledge and Center for Applied Linguistics.

Cormier, K., Smith, S., & Zwets, M. (2013). Framing constructed action in British Sign Language narratives. *Journal of pragmatics*, *55*, 119-139.

Davidson, K., Lillo-Martin, D., and Pichler, D.C. (2014). Spoken English language development in native signing children with cochlear implants. *Journal of Deaf Studies and Deaf Education* 19, 238–250. doi: 10.1093/deafed/ent045

De Houwer, A. (2009). *Bilingual first language acquisition*. Multilingual Matters.

Van Dijk, T. A. (1980). Text and context explorations in the semantics and pragmatics of discourse. Monograph Collection.

Dudis, P. (2007). *Types of Depiction in ASL*. Manuscript, Gallaudet University.

Emmorey, K., Borinstein, H.B., Thompson, R., & Gollan, T.H. (2008). Bimodal bilingualism. *Bilingualism: Language and Cognition*, 111, 43-61.

Emmorey, K., & Herzig, M. (2003). Categorical versus gradient properties of classifier constructions in ASL. In K. Emmorey (Ed.). *Perspectives on classifier constructions in signed languages* (222-246). Mahwah, NJ: Lawrence Erlbaum Associates.

Emmorey, K., & Reilly, J. (1998). The development of quotation and reported action: Conveying perspective in ASL. In *Proceedings of the Twenty-Ninth Annual Stanford Child Language Research Forum*, 81-90.

Frederiksen, A. T., & Mayberry, R. (2015). Tracking reference in space: How L2 learners use ASL referring expressions. In *Proceedings of the 39th annual Boston University Conference on Language Development*, 165-177.

Frederiksen, A. T., & Mayberry, R. (2016). Who's on first? Investigating the referential hierarchy in simple native ASL narratives. *Lingua*. doi: http://dx.doi.org/10.1016/j.lingua.2016.03.007.

Fung, C. (2012). *Code-blending in early Hong Kong Sign Language: A case study*. Master's thesis, The Chinese University of Hong Kong.

Genesee, F., & Nicoladis, E. (2007). Bilingual acquisition. In E. Hoff & M. Shatz (Eds.), *Handbook of Language Development* (324-342). Oxford: Blackwell.

Giraud, H. and Szabo, T. (2006). Minuscule - la vie privée des insectes [Motion Picture]. France.

Givón , T. (1983). Topic continuity in discourse: A quantitative cross-language study. In T. Givón (ed.), *Topic continuity in discourse: An introduction* (1-42). Amsterdam: Benjamins.

Goldin-Meadow, S., & Mayberry, R. I. (2001). How do profoundly deaf children learn to read?. *Learning Disabilities Research & Practice*, *16*(4), 222-229.

Grosjean, F. (2012). An attempt to isolate, and then differentiate, transfer and interference. *International Journal of Bilingualism*, 16, 11-21.

Gullberg, M. (2003). Gestures, referents, and anaphoric linkage in learner varieties. In C. Dimroth & M. Starren (Eds.), *Information Structure and the Dynamics of Language Acquisition* (311–328). Amsterdam/Philadelphia: John Benjamins Publishing Company.

Gullberg, M. (2006). Handling discourse: Gestures, reference tracking, and communication strategies in early L2. *Language Learning*, 56(1), 155–196.

Halliday, M.A.K., & Hasan, R. (1976). *Cohesion in English.* London: Longman.

Hänel, B.（2005). The Acquisition of agreement in DGS: Early steps into a spatially expressed syntax. In H. Leuninger, D. Happ (Eds.), *Gebärdensprachen: Struktur, Erwerb, Verwendung* (201-232). Hamburg: Buske.

Hassanzadeh, S. (2012). Outcomes of cochlear implantation in deaf children of deaf parents: comparative study. *The Journal of Laryngology & Otology*, *126*(10), 989-994.

He, A. W. (2010). The heart of heritage: Sociocultural dimensions of heritage language learning. *Annual Review of Applied Linguistics*, 30, 66-82.

Hickmann, M. (2003). *Children's discourse: Person, time, and space across languages*. Cambridge: Cambridge University Press.

Hickmann, M., & Hendriks, H. (1999). Cohesion and anaphora in children's narratives: a comparison of English, French, German, and Mandarin Chinese. *Journal of Child Language,* 26, 419-452.

Jones, M. L., & Quigley, S. P. (1979). The acquisition of question formation in spoken English and American Sign Language by two hearing children of deaf parents. *Journal of Speech and Hearing Disorders*, 442, 196-208.

Kail, M., & Hickmann, M. (1992). French children's ability to introduce referents in narratives as a function of mutual knowledge. *First Language*, 12(34), 73-94.

Kanto, L., Huttunen, K., & Laakso, M. L. (2013). Relationship between the linguistic environments and early bilingual language development of hearing children in Deaf-parented families. *Journal of Deaf Studies and Deaf Education,* 18(2), 242- 260.

Karmiloff-Smith, A. (1985). Language and cognitive processes form a developmental perspective. *Language and Cognitive Processes*, 11, 61-85.

Koulidobrova, H. (2012). *When the quiet surfaces: 'Transfer' of argument omission in speech of ASL-English bilinguals*. Doctoral dissertation. University of Connecticut at Storrs.

Labov, W. and J. Waletzky (1967). Narrative analysis: oral versions of personal experience. In: J. Helm ed., *Essays on the verbal and visual Arts* (12-44). Seattle: University of Washington Press.

Lanza, E. (2001). Temporality and language contact in narratives by children acquiring Norwegian and English simultaneously. In L. Verhoeven, S. Stromqvist (Eds.), *Narrative development in a multilingual context* (15–50). John Benjamins, Amsterdam.

Lillo-Martin, D., & Quadros, R. M. (2011). Acquisition of the syntax–discourse interface: The expression of point of view. *Lingua. International Review of General Linguistics.*

Revue Internationale de Linguistique Generale, 121(4), 623–636, http://doi.org/10.1016/j.lingua.2010.07.001.

Lillo-Martin, D. & Pichler, D.C. (2006). Acquisition of syntax in signed languages. In M. Marschark et al. eds. *Advances in Sign Language Development by Deaf Children*, Oxford Univ. Press, pp. 231-261.

Lillo-Martin, D., & Quadros, R. D. (2005). The acquisition of focus constructions in American Sign Language and Língua de Sinais Brasileira. In *BUCLD 29: Proceedings of the 29th Annual Boston University Conference on Language Development*, 365-375.

Lillo-Martin, D., & de Quadros, R. M. (2011). Acquisition of the syntax–discourse interface: The expression of point of view. *Lingua*, 1214, 623-636.

Lillo-Martin, D., Koulidobrova, H., Quadros, R. M. D., & Chen Pichler, D. (2012). Bilingual language synthesis: Evidence from WH-questions in bimodal bilinguals. In A. K. Biller, E. Y. Chung, & A. E. Kimball (Eds.), *Proceedings of the 36th Annual Boston University Conference on Language Development*, (Vol. 302, p. 314). Somerville, MA: Cascadilla Press.

Lillo-Martin, D. (1986). Two kinds of null arguments in American Sign Language. *Natural Language & Linguistic Theory*, 4(4), 415–444.

Loew, R. (1984). *Learning American Sign Language as a first language: Roles and reference.* Doctoral dissertation. University of Minnesota.

Mayer, M. (1969). *Frog Where Are You?* New York: Dial Books.

Meier, R. P. (1982). *Icons, analogues, and morphemes: The Acquisition of verb agreement in American Sign Language*. Doctoral dissertation. University of California, San Diego.

McKee, R., Schembri, A., McKee, D., & Johnston, T. (2011). Variable "subject" presence in Australian Sign Language and New Zealand Sign Language. *Language Variation and Change*, 23(03), 375–398.

Metzger, M., (1995). Constructed dialogue and constructed action in American Sign Language. In Lucas, C. (Ed.), *Sociolinguistics in Deaf Communities,* (255-271). Gallaudet University Press, Washington, DC.

Montrul, S. (2012). Is the heritage language like a second language?. *EuroSLA Yearbook*, *12*(1), 1-29.

Montrul, S. (2004). Subject and object expression in Spanish heritage speakers: A case of morpho-syntactic convergence. *Bilingualism: Language and Cognition,* 7, 1–18.

Morgan, G. (2006). The development of narrative Skills in British Sign Language. In B. Schick; M. Marschark & P. Spencer (Eds.), *Advances in Sign Language Development in Deaf Children* (314-343). Oxford: Oxford University Press.

Morgan, G. (2000). Discourse cohesion in sign and speech. *International Journal of Bilingualism*, 4, 279-300.

Muysken, P. (2000) *Bilingual Speech: A Typology of Code-mixing*. Cambridge: Cambridge University Press.

Napier, J. (2008). Exploring linguistic and cultural identity: My personal experience. In M. Bishop & S. Hicks (Eds.), *Hearing, mother father Deaf: Hearing people in Deaf families* (219-243). Washington DC: Gallaudet University Press.

Palmer, J.L. (2015). *Bimodal bilingual word order development*. Doctoral dissertation. Gallaudet University.

Pavlenko, A. (2008). Narrative analysis in the study of bi- and multilingualism. In M. Moyer & W. Li (Eds.), *The blackwell guide to research methods in bilingualism* (311-325). Oxford: Blackwell.

Petitto, L. A., Katerelos, M., Levy, B. G., Gauna, K., Tétreault, K., & Ferraro, V. (2001). Bilingual signed and spoken language acquisition from birth: Implications for the mechanisms underlying early bilingual language acquisition. *Journal of Child Language*, 2802, 453-496.

Pizer, G. (2008). *Sign and speech in family interaction: Language choices of deaf parents and their hearing children*. Doctoral dissertation. University of Texas at Austin.

Pizer, G. (2013). Bimodal bilingual families: The negotiation of communication practices between deaf parents and their hearing children. In Schwartz, M., & Verschik, A. (Eds.), *Successful family language policy: Parents, children and educators in interaction* (203-222). doi: 10.1007/978-94-007-7753-8_9.

Polinsky, M. (2007). Incomplete acquisition: American Russian. *Journal of Slavic Linguistics,* 14, 191–262.

Preston, P. (1995). *Mother father deaf: Living between sound and silence*. Harvard University Press.

Prinz, P. M., & Prinz, E. A. (1979). Simultaneous acquisition of ASL and spoken English in a hearing child of a deaf mother and hearing father: Phase I: Early lexical development. *Sign Language Studies*, *25*1, 283-296.

Quadros, R., Chen Pichler, D., Lillo-Martin, D., Cruz, C.R., Kozak, L., Palmer, J.L., Lemos Pizzio. A. & Reynolds. W. (2015). Methods in bimodal bilingualism research: Experimental studies. In E. Orfanidou, B. Woll & G. Morgan (Eds.), *The Blackwell guide to research methods in sign language studies* (250-279). Oxford: Wiley Blackwell.

Quadros, R. & Lillo-Martin, D. (2007). Gesture and the acquisition of verb agreement in sign languages. In H. Caunt-Nulton, S. Kulatilake, I. Woo (Eds.), *Proceedings of the 31st Annual Boston University Conference on Language Development* (520-531). Somerville, MA: Cascadilla Press.

Padden, C. A. (1998). The ASL lexicon. *Sign Language & Linguistics*, 1(1), 39-60.

Rathmann, C., Mann, W., & Morgan, G. (2007). Narrative structure and narrative development in deaf children. *Deafness & Education International*, 9(4), 187-196.

Reilly, J.S. (2000). Bringing affective expression into the service of language: Acquiring perspective marking in narratives. In *The signs of language revisited,* K. Emmorey and H. Lane (Eds.) (415-433). Mahwah, NJ: Lawrence Erlbaum Associates.

Reynolds, W. and Palmer, J. L. (2013). *Codas as heritage signers*. Paper presented at the 29th Biannual Conference of CODA International, CODAZONA, Tempe, AZ.

Reynolds, W., Palmer, J. L., Chen Pichler, D., Muller de Quadros, R., Kozak, L. V., & Lillo-Martin, D. (2015). *Heritage Signers: Bimodal bilingual children from Deaf families*. Paper presented at the Generative Approaches to Language Acquisition Conference 12, University of Nantes, France.

Rothman, J. (2009). Understanding the nature and outcomes of early bilingualism: Romance languages as heritage languages. *International Journal of Bilingualism*, *13*(2), 155-163.

Rothman, J. (2007). Heritage speaker competence differences, language change, and input type: Inflected infinitives in heritage Brazilian Portuguese. *International Journal of Bilingualism*, *11*(4), 359-389.

Serratrice L. (2007). Referential cohesion in the narratives of bilingual English-Italian children and monolingual peers. *Journal of Pragmatics*, 39, 1058-1087.

Siedlecki Jr, T., & Bonvillian, J. D. (1993). Location, handshape & movement: Young children's acquisition of the formational aspects of American Sign Language. *Sign Language Studies*, *78*1, 31-52.

Singleton, J.L., & Tittle, M.D. (2000). Deaf parents and their hearing children. *Journal of Deaf Studies and Deaf Education*, 5(3), 221-236.

Sridhar, S. N. (1989). Cognitive structures in language production: a cross-linguistic study. In B. MacWhinney & E. Bates (eds.) *The Cross-linguistic study of sentence processing* (209-224). Cambridge, MA: C.U.P.

Supalla, T., Hauser, P. C., & Bavelier, D. (2014). Reproducing American Sign Language sentences: Cognitive scaffolding in working memory. *Frontiers in Psychology*, 5, 00859, DOI=10.3389/fpsyg.2014.00859.

Supalla, T. (1990). Serial verbs of motion in ASL. *Theoretical Issues in Sign Language research*, 1, 127-152.

Tannen, D., (1989). *Talking Voices: Repetition, Dialogue, and Imagery in Conversational Discourse*. Cambridge University Press, Cambridge.

Tarone, E., & Parrish, B. (1988). Task-Related Variation in Interlanguage: The Case of Articles. *Language Learning, 38*(1), 21-44. doi:10.1111/j.1467-1770.1988.tb00400.x

Unsworth, S. (2016). Quantity and quality of language input in bilingual language development. In E. Nicoladis & S. Montanari (Eds.), *Lifespan perspectives on bilingualism* (136-196). Berlin, Germany: APA and Mouton de Gruyter.

Wilbur, R. (1994). Eyeblinks & ASL phrase structure. *Sign Language Studies*, *84*(1), 221-240.

Williams, J. T., Darcy, I., & Newman, S. D. (2016). Bimodal bilingualism as multisensory training?: Evidence for improved audiovisual speech perception after sign language exposure. *Brain Research*, 1633, 101-110.

Wulf, A., Dudis, P., Bayley, R., & Lucas, C. (2002). Variable subject presence in ASL narratives. *Sign Language Studies*, *3*(1), 54–76.

APPENDICES

APPENDIX A: AN EVENT DESCRIPTION OF "THE LOLLIPOP" VIDEO NARRATIVE STIMULUS BY EPISODE

Event number	Event description	Sound effects
1	A gang of five flies race across the fields	(racing car sound effect as the flies fly)
2	towards a pink lollipop on the ground stick facing upwards.	
	A gang of seven ants are attempting to pick up the lollipop from the candy base.	
3	The flies latch on to the lollipop stick	(racing car sound effect as the flies fly)
	and pull the lollipop up.	(racing car revving sound effect)
4	The ants are latched on the lollipop base with a few of the ants dangling	(racing car revving sound effect)
	as the flies lift the lollipop stick and a few dangle in the process.	(racing car revving sound effect)
	The flies and the ants both are latched on to the lollipop as the flies take them all for a ride through a meadow.	(racing car sound effect as the flies fly)
5	The flies stop in mid-air and attempt to shake off the ants by moving the lollipop from side to side	(racing car sound effect as the flies fly)
	and up and down	
6	The lollipop candy base slides off of the lollipop stick	
	Candy falls towards the ground with the ants still attached.	

Event number	Event description	Sound effects
	The flies let go of the stick	(racing car sound effect as the flies fly)
7	And race towards the candy on the ground.	(racing car sound effect as the flies fly)
	Scene cuts to the dirt ground with the pink lollipop broken into 11 pieces with the gang of ants on the left side and the gang of flies arriving on the ground on the right side. The lollipop stick is in the scene on the ground as well.	(racing car sound effect as the flies fly)
	One of the ants takes a piece of the broken candy and runs away	(flying buzzing sound effect)
	and a fly takes a piece of the broken candy and flies away	(flying buzzing sound effect)
	they alternate until all the pieces are gone.	
8	The gang of flies escape into the sky each with a piece of the lollipop.	(flying buzzing sound effect)
9	The gang of ants run away with a piece of the lollipop on their back except one.	
10	Shot of the lollipop stick on the ground.	
	Spider pokes its head out from a rock	
	Looks towards the lollipop stick.	
	Spider walks towards the stick	
	and stops to look at it.	
11	Shot of the spider running away with the stick.	

Event number	Event description	Sound effects
	Screen close and open with a shot of a large tree	
12	Shot of one of the tree branches close up with the spider swinging on a swing he made with the lollipop stick and web threads.	(squeaking sounds of the lollipop swing and cute melodic music)

APPENDIX B: AN EVENT DESCRIPTION IN "THE SNAIL SLIDE" VIDEO NARRATIVE STIMULUS

Event number	Event description	Sound effects
1.	Snails moving slowly in a row, on rocks in front of children toys in the night, close up of snails	Creaking sound depicting snail movement
2.	Long shot of five snails moving slowly in a row in front of wooden structure	Creaking sound depicting snail movement
	Five snails moving slowly up a wooden beam backdrop is the starry sky, close up of snails, then long shot with moon in background & snails in vertical movement	Creaking sound depicting snail movement Dogs barking in background
	Row of snails moving over a red plastic tube one by one	Creaking sound depicting snail movement
	Snails in a row side by side arrive at the top of the slide	Creaking sound depicting snail movement
3.	Shot of a snail eyes looking down the slide from the bottom of the slide perspective	Cricket sounds
	Long shot view of a children's jungle gym with two houses in the background	Cricket sounds & dogs barking
	Close up of snails at the top of the slide, second snail from the left slides (snail1) up to the edge of the slide, shot then pulls out a little	
4.	Shot of snail1 body looking down the slide from the bottom of the slide perspective	

Event number	Event description	Sound effects
a. Snail1	Snail1 pulls into his shell, other shells are watching, snail1 rocks back and forth then rolls down the slide	Sounds of rock hitting metal then sound effect of snail shooting out and landing on rocks
	Snails look on from up on the slide slink down move their eyes in a worried manner	
	Snail1 unfolds itself and eyes roll as if dizzy	Sound effect of eyes rolling sounds like an old spring
5. b. Snail2	Snail group unslink, and the first snail on the right (Snail2) rolls inside its shell and rolls down the slide	Sounds of rock hitting metal then sound effect of snail shooting out and landing on rocks
	Snail2 unfolds itself while Snail1 moves back towards the slide	Unpopping sound
	Snail2 unfolds itself and eyes roll as if dizzy	Sound effect of eyes rolling sounds like an old spring
6. c. Snail3	The snail on the right (Snail3) rolls inside its shell and rolls down the slide, lands on the rocks	Sounds of rock hitting metal then sound effect of snail shooting out and landing on rocks
	Two snails moving slowly up a wooden beam backdrop is the starry sky	Creaking sound depicting snail movement
7.	Ground perspective-one snail rolls down the slide	Sounds of rock hitting metal then sound effect of

Event number	Event description	Sound effects
d. Snail4		snail shooting out and landing on rocks
8. e. 4Snails	Four snails rolling down the slide, lands on the rocks	Sounds of rock hitting metal then sound effect of snail shooting out and landing on rocks; dogs barking
9.	Three snails moving slowly up a wooden beam backdrop is the starry sky	Creaking sound depicting snail movement; dogs barking
10 f. 6Snails	Six snails shoot out of slide, shot of a snail at the top of the slide	Shooting sounds per snail
11.	Shot of the moon	

APPENDIX C: BIMODAL BILINGUAL TRANSCRIPTION CONVENTIONS

Item	Convention	Example
Reflexives	SELF followed by referent in lowercase letters (except for proper names), enclosed in parentheses (hyphens between words)	*SELF(self)* *SELF(mother)*
Indicating verbs	Provide the ID-gloss for the sign only; do not add information about referents	*GIVE* *GO*
Depicting verbs	Gloss with label *DV* followed by description in parentheses (hyphens between words)	*DV(bird-sits-on-tree)*
Fingerspelled words	Gloss with label *FS* followed by the unhyphenated word in parentheses	*FS(Nokia)* *FS(apple)*
Name signs	Gloss with label *NS* followed by name in parentheses. Codenames are used to protect children's privacy	*NS(Debbie)* *NS(BEN)*
Repeated signs	Add [+] (the plus symbol enclosed in brackets) to end of gloss	*MOTHER*[+]
Held signs	Add [_] (underscore enclosed in brackets) to end of gloss	*MOTHER*
Pause within utterance	Represent pauses with # (a single hatch mark) attached to previous gloss	*IX(self) CHOOSE# RED*
Interruption	Add / (slash) to end of last gloss before interruption	*WANT/*
Self-interruption	Add // (double slash) to end of last gloss before interruption	*WANT//*
Retracing without correction	Add [/] (slash enclosed in brackets) to end of last gloss before retracing	*IX(self) WANT*[/] *IX(self) WANT IX(toy)*
Retracing with correction	Add [//] (double slash enclosed in brackets) to end of last gloss before retracing	*IX(self) WANT*[//] *IX(self) DON'T-WANT IX(toy)*
Retracing with reformulation	Add [///] (triple slash enclosed in brackets) to end of last gloss before retracing.	*IX(self) WANT*[///] *IX(toy) IX(self) WANT*
Trailing off	Add … (ellipsis) to end of last gloss before trailing off	*WANT…*
Gesture	Gloss with label *g* followed by concise meaning in parentheses	*g(angry-face)*
Emblem	Gloss with label *e* followed by name of emblem in parentheses	*e(come-here)*
Showing	Gloss with label *show* followed by name of object shown in parentheses	*show(toy)*
Mouthing	Gloss with *m* followed by word mouthed	*m(okay)*
Word is not clear (meaning)	Add [?] (question mark in brackets) to end of unclear gloss; add description of phonetic form on phonological tier if necessary	*WANT APPLE*[?] *PLEASE*
Word is not clear (alternative)	Type best guess first as gloss, followed by [=? ALTERNATIVE] (equal sign followed by question mark and alternative gloss in brackets)	*WANT APPLE*[=?*ONION*]
Word is not clear (form)	Gloss each unclear word as YYY (there may be more than one). Add description on phonological tier of each YYY gloss	*WANT YYY PLEASE*
Word is not clear	Gloss each unclear word as XXX (there may be more than one)	*WANT XXX PLEASE*
Shortenings	Put the unpronounced part of a word in parentheses	*(be)cause*
Sound effects	Use &= (ampersand and equal sign) before the sound (such as cries, laughter, and whistles)	&=*cries* &=*laughs*
Imitations	Use &=imit: (ampersand, equal sign, *imit*, and colon) before the sound imitation (such as sounds imitating another person, animal or machine)	&=*imit:baby* &=*imit:plane*