Acquisition of Sign Languages

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Abstract
Natural sign languages of deaf communities are acquired on the same time scale as spoken languages are, if children have access to fluent signers providing input from birth. Infants are sensitive to linguistic information provided visually, and early milestones show many parallels. The modality may affect various areas of language acquisition; such effects include the form of signs (sign phonology), the potential advantage presented by visual iconicity, and the use of spatial locations to represent referents, locations, and movement events. Unfortunately, the vast majority of deaf children do not receive accessible linguistic input in infancy, and experience language deprivation. Negative effects on language are observed when first-language acquisition is delayed. For those who eventually begin to learn a sign language, language and academic outcomes are better the earlier input has been available. Further research is especially needed with a broader diversity of participants.

Keywords
Sign language, acquisition, deaf, input, critical period, language deprivation

1. Introduction: Sign Language Communities

This article concerns the natural sign languages which evolve in and are used by communities of deaf[1] people (see sidebar). Throughout history and around the world, deaf people form communities focused on the use of a natural sign language. As languages, natural signed languages display many of the characteristics that have come to be familiar to linguists from the study of spoken languages. As languages in the visual/manual modality, they display some other characteristics, such as grammatical use of spatial elements. Studying variation in languages based on modality spotlights what aspects of language can be expected to be truly universal, and which ones are tied to a specific modality.

It might be expected that, as natural languages, sign languages would be acquired in much the same way that spoken languages are, with some potential differences that could be attributed to modality. Hearing children generally acquire the language of their caregivers (their native language); in many communities, they also acquire additional languages. In comparable contexts, deaf children and their deaf, signing parents also share a language. These children generally acquire the sign language used by their parents, and the written form of a community language (e.g. English). Acquisition of sign languages by children in this linguistic context will be the focus of section 2 of this paper.

However, the contexts in which deaf and hearing children acquire language are rarely comparable. In contrast to deaf children and their deaf, signing parents, the vast majority of deaf children (estimated to be over 90%) are born to hearing, non-signing families (Mitchell & Karchmer 2004). If these children do not access the auditory signal of their parents' language, and the parents do not know a sign language, the children will almost inevitably experience a period of delayed access to language, known as language deprivation (Hall 2017; Hall et al. 2017b).

[1] In some writings, a capital D is used in 'Deaf' to distinguish between audiological status and membership in a signing community; however, recently many have rejected this usage with the aim of greater inclusivity (Pudans-Smith et al. 2019).

Language development in the context of inaccessible linguistic exposure has been the focus of a great deal of research, for several reasons. First, it provides a unique opportunity to understand the relationships between input and language development. Specifically, it allows researchers to evaluate the hypothesis that there is a sensitive period for language development, and closely examine issues concerning potential interplay between the development of language and other cognitive functions. These topics will be addressed in section 3. Yet, there are life-long consequences for children whose early linguistic experience is delayed. Recently, scholars have been raising the alarm about the potential for harm from this situation, and supporting various means of harm reduction. As developmental scientist Marie Coppola is fond of remarking, *Language deprivation is good for science, but bad for humanity.* These issues will be discussed in section 4, where we look at political and educational issues related to the acquisition of a first language in contexts that typically involve educational institutions, primary language input coming from outside the home, and overall delayed access.

Much of the research on sign languages in the past few decades has focused on standard sign languages (e.g. American Sign Language (ASL), British Sign Language (BSL); see Annual Review articles by Fischer 2017; Sandler 2017; Schlenker 2017). These sign languages have two important characteristics: (a) they are used by people who hold positions of privilege and power within their communities; and (b) they are found in urban areas, where they are mostly used by deaf people and people working with deaf people.[2] Almost all research on sign language acquisition is based in such contexts, and focuses on the so-called 'standard' variety of these urban sign languages.

Nevertheless, even from the early years of sign language research, sociolinguists were interested in dialectal variation within sign language communities. As early as 1973, sign linguists were exploring contacts between spoken and sign languages (Woodward 1973). By the 2000s, pressure from corpus, dictionary, standardization, and assessment development processes in sign language research forced researchers to consider dialectal variation within sign languages (Johnston 2003) and even from sign languages in contact with each other (e.g. ASL/LSM; Quinto-Pozos 2008). By 2010, researchers and community activists in the States were examining racial and ethnic community based dialectal variations such as Black ASL and Chicanx ASL (Hill 2017; McCaskill et al. 2011) and also differences between deaf and hearing communities of signers via discussion of hearing dialects (McDermid 2014). However, unfortunately, the acquisition of these varieties has not been studied, so our review will not be able to include them.

At the end of the paper, we raise questions about topics that are not as widely researched, but deserve mention here and full study in what we hope will be the near future.

In the next section, we explain what sign language development looks like in situations of early access to fluent input.

[2] See Annual Review article by de Vos & Pfau (2015) for a review of studies of a contrasting type of sign language, rural sign languages, and de Vos (2012) for a rare example study of children's acquisition of a rural sign language.

2. Sign Language Development under Conditions of Early Access

Children with exposure to a natural sign language from birth constitute a small percentage of those who develop a sign language. Yet, they are the group who has been most intensively studied, as they allow researchers to consider how sign languages are acquired with appropriate access to input, and how aspects of the modality in which a language is produced and perceived might relate to the acquisition path observed. In the following subsections, we summarize research on the early milestones of sign language development (2.1); studies of the potential readiness for sign language in infants at the beginning of the language acquisition process (2.2); and studies that focus on potential modality effects in native acquisition of sign languages (2.3).

2.1 Early milestones are parallel to those for spoken languages

While there is still much research to be done, there is ample evidence that the development of a sign language with early access to fluent signers largely progresses along the same timeline as expected given previous research on the development of a variety of spoken languages (Baker & Woll 2008; Chen Pichler 2012; Chen Pichler et al. 2017a; Lieberman & Mayberry 2015; Lillo-Martin 2016; Meier 2016; Morgan 2014; Schick et al. 2006). In the following paragraphs we review three classic examples.

Babbling. It is well known that hearing babies begin to produce language-like sounds, or babbling, at around four to five months of age (Vihman et al. 1985). Many scholars consider babbling to be a crucial early step of linguistic development, providing the infant with practice in producing the formational elements of their language, as well as communicative social exchanges with a caregiver.

It is not surprising that there is a parallel in the development of sign languages: manual babbling. Petitto & Marentette (1991) found that deaf sign-exposed infants (ages 10-14 months) produced meaningless manual gestures that, like vocal babbling, made use of the components that are found in natural sign languages. They found that the manual babbles became more complex as the children grew, and that deaf sign-exposed babies produced more complex manual babbles and a greater variety of manual babble types when compared to the gestural productions of hearing infants who were not exposed to a sign language.

Petitto & Marentette (1991) interpreted their findings of parallels between manual and vocal babbling as supporting the notion that “there is a unitary language capacity that underlies human signed and spoken language acquisition” (p. 1495). What this implies is that, at a minimum, common linguistic mechanisms are used in the acquisition of languages in the two modalities. Numerous other parallels between the development of sign and spoken languages (when sufficient input is accessible) support this conclusion.

First signs. If a unitary mechanism (or set of mechanisms) underlies sign and spoken language development, and this mechanism is relevant for the timing of various acquisitional milestones, then it might not be expected that there would be a significant difference between the average age of first sign versus spoken words. Nevertheless, such a difference has been found.

The typical age for a baby’s first spoken words is about 10-11 months, although there is considerable variability. Yet there is widespread belief that first signs occur much earlier than this, as early as 6 months (hence the appeal of ‘baby signs’ which, ironically, are generally more supported for hearing families than for deaf children; see Chen Pichler 2016). More rigorous

evaluations of the mean age for first signed words have put this milestone at approximately 8.5 months, a 1.5-2 month advantage. Meier & Newport (1990) reviewed available evidence and concluded that there does seem to be an early advantage for first signs, although not for subsequent milestones such as a 10-word vocabulary and first word combinations. We note that Anderson & Reilly (2002) found median vocabulary sizes for 12-17-month-old native signing children to be greater than those for English-speaking children, suggesting that the early sign advantage may persist for some months; however, Anderson and Reilly used self-report data, and no replication study has taken place.

Meier & Newport (1990) suggest that the findings about first spoken/signed words are compatible with the conception of a unitary language mechanism once we take into consideration the additional effect of peripheral factors. Motor control of the articulators necessary for production of signed words develops earlier than that for production of spoken words. Accordingly, the timing mechanism is such that infants are cognitively ready to produce first words at a somewhat earlier age. Children exposed to a natural sign language can articulate recognizable words at this point; but children exposed to a spoken language will not be able to speak recognizable words until somewhat later. Later milestones will be equivalent across modalities once the spoken language production mechanisms have caught up.

Grammatical development. Following the milestones of babbling, first words, and a 10-word vocabulary, the next typical milestone of language development is the production of two-word utterances, seen as the entry to syntax. For English-speaking children, this milestone is typically reached around 18-24 months, although again there is some variability (Brown 1973). Meier & Newport (1990) assessed available reports from the development of ASL, and concluded that this is the same timetable seen for the emergence of two-word utterances in ASL, although the comparison is complicated by varying methods of collecting data and in what counts as two-word utterances. For comparison, the four children in the SLAAASh project analyzing ASL longitudinal spontaneous production data (https://slla.lab.uconn.edu/slaaash/) achieved two-sign utterances including a verb and a non-pointing lexical noun by 17-21 months (Lillo-Martin et al. 2017).

Since the target language to which ASL-learning children are exposed exhibits word order variability, children might be expected to vary widely in their use of word orders, or to closely match the orders produced in their input. But, Chen Pichler (2001, 2008) found neither of these possible results. Instead, she observed that four deaf native signers used both the canonical, pragmatically-neutral order Subject-Verb-Object (SVO) in ASL, and that they made grammatically-appropriate use of order-changing operations resulting in linguistically-constrained V-S and O-V word orders, by around 22-26 months. Similar results were obtained by Coerts (2000), in her study of two native deaf signing children acquiring the sign language of the Netherlands (NGT), and by Lemos Pizzio (2006), in her study of one native deaf signer of Brazilian Sign Language (known as Libras).

The results of these studies of the acquisition of word order in ASL, NGT and Libras are compatible with theories and observations from spoken language acquisition, indicating that basic, canonical word order is typically observed as soon as words are combined, and that children acquiring languages with word order variability generally quickly acquire the operations that grammatically alter word order for various information-structure effects (Slobin 1986).

Shortly after children begin to combine two words, they enter a phase sometimes considered to be marked by a grammar ‘explosion’. This refers to the fact that many different grammatical features co-occur in child language at the same time. Between the ages of 3 and 5, pre-school

children acquiring spoken languages typically perform at or close to adult-like levels in many domains of grammar, including their use of syntactic movement operations such as scrambling or WH-movement, appropriate use of null elements of various types, licensing of anaphoric elements, interpretation of quantifiers, and many more (see Annual Reviews by Crain 2017; de Villiers 2017; Gleitman et al. 2019; Lidz & Gagliardi 2015, among others).

Much more research is needed on comparable areas of sign language development. Research on the development of sign languages by preschoolers has mostly focused on issues that relate to potential modality effects because of the difficulties of documenting child signing development. For this reason, we will summarize some of these studies in section 3.3, where we bring up the potential effects of modality. But first, we mention some recent research examining the very early potential for sign language acquisition by investigating aspects of sign perception in infants.

2.2 Studies of sign language perception in Infants

What these and other studies affirm is that (with access to appropriate input) infants are ready for linguistic input, whether it comes as spoken language or sign language. There are a few studies specifically examining infants' perception of sign or sign-like stimuli, at very early ages when they might be expected to show the most plasticity in terms of linguistic modality.

Baker et al. (2006) tested hearing non-signing infants to determine if they could recognize ASL phonological distinctions. Baker et al. used the infant-controlled habituation procedure, which involves presenting a sequence of identical stimuli during a habituation phase, followed by a test phase containing either the same stimulus or a different one. Infants' looking time is measured to determine whether they notice the different item. The study reported by Baker et al. presented infants with visual stimuli taken from the continuum ranging from the completely open handshape [] (all fingers open and spread) to the more closed handshape [] (all fingers touching the thumb, with the fingers relatively flat), to assess whether the infants perceived these stimuli categorically. They found that 4-month-olds looked significantly longer at out-of-category handshapes after habituation, while 14-month-olds did not. These results indicate that the younger children were perceptually attentive to linguistically contrastive differences, but by 14 months of age this behavior disappears. The results can be interpreted as showing that all infants are prepared for perceiving the contrasts of a sign linguistic system, but this early attention changes over time; just as similar results indicate for spoken languages (see Maurer & Werker 2014 for a discussion on perceptual narrowing).

Stone et al. (2018) further examined infants' early sensitivity to sign linguistic stimuli. They considered sonority, a type of perceptual salience that can be observed in both spoken languages and sign languages. In spoken languages, sonority makes some sounds more salient by using greater openness of the vocal tract; hence, vowels are high in sonority, and obstruents are low in sonority. Gómez et al. (2014) proposed that sonority (in spoken languages) is one of the language universals present at birth.

Stone et al. considered visual sonority in sign languages to be exhibited by the degree of visibility in sign movements: movements made at the shoulder joint are highly visible, while those made with finger joints have much lower visual sonority. For greater experimental control, they confined their experiment to stimuli displaying more or less salience in terms of the contrast between open and closed hands.

Stone et al. (2018) used an eye-tracking task with 6- and 12-month-old hearing children who were not exposed to a natural sign language. The stimuli they presented to the children used ASL fingerspelling with high sonority (high differentiation between the fingertips and the palm) or low sonority (low differentiation between the fingertips and the palm). They found that 6-month-olds showed a significant looking preference for the high sonority items, while the 12-month-olds showed no preference. This finding, like that of Baker et al. (2006), reveals an early behavioral pattern recognizing sign-specific phonological features, and later perceptual narrowing, which generally has been found to be largely specific to the features of an infant's input language(s).

With these results in mind, children who are exposed to a sign language would be expected to attend to communicative visual stimuli differently from children not so exposed. This is compatible with the finding from Brooks et al. (2020). They studied the gaze following of deaf, sign-exposed infants (with deaf, signing parents) and compared them with hearing, non-signing infants. The deaf infants were significantly higher in following the gaze of an experimenter; they also looked back at the experimenter after looking in the direction of the experimenter's gaze. These behaviors are likely related to the requirement for gaze shifts to receive linguistic input in a sign language. Together with the previous results, the implication is that infants are ready to receive linguistic input in the visual modality, and will learn from it, when they have input at a very early age.

2.3 Potential modality effects on sign language development

We have already seen that children can perceive and develop a sign language in ways that are mostly parallel to spoken language development, despite the modality difference. However, there are some modality effects to be taken into consideration as well. For example, the different physical development of the articulators for sign vs. speech likely plays a role in the apparent earlier first signs, as discussed earlier. In this section we will discuss potential modality effects associated with greater iconicity in the visual modality, the use of the face and body for prosodic information, and the ways that signing space is integrated into the grammar of a sign language.

Iconicity. As primarily visual languages, sign languages lend themselves to visual iconicity, in which the visual form of a sign bears some resemblance to visual aspects of the concept it conveys (see papers in the special issue of *Language and Cognition*, 2020). In the early years of sign language research, linguists tended to downplay the relevance of iconicity in sign languages, in part to allay any misinterpretations that the existence of iconic signs might detract from considering sign languages as 'real' natural languages (see review in Thompson 2011). However, more recently two developments have led to a change in perspective. First, the status of sign languages has been firmly established in linguistics (though not necessarily in other contexts); second, some researchers looking at spoken languages have also noted the existence and role of (auditory) iconicity (as in the *Language and Cognition* issue mentioned above).

Current perspectives consider visual iconicity to be a prevalent factor in the organization of sign languages, existing alongside arbitrariness and within conventionalized grammatical patterns. This viewpoint, and an increasing availability of relevant data, re-opens the possibility for studying potential modality effects of iconicity in language development.

Thompson et al. (2012) conducted an analysis of the acquisition of vocabulary in 8- to 36-month old deaf children with deaf, signing parents, who were learning British Sign Language (BSL). They used parent report data from the BSL version of the MacArthur Bates Communicative

Development Inventory (CDI; Woolfe et al. 2010). Their analysis revealed an effect of iconicity on which signs were produced and comprehended. The iconicity effect in production was above and beyond an expected effect of the phonological complexity of signs.

However, Caselli & Pyers (2017), who conducted a similar study based on data from the ASL CDI (Anderson & Reilly 2002) (and a larger sample), found important effects of additional lexical factors. Their analysis included phonological neighborhood density, iconicity, and subjective frequency ratings. While they found a significant effect of iconicity, they also found a significant role for the phonological and frequency factors, like that found in the acquisition of spoken languages. In a follow-up study, Caselli & Pyers (2020) compared two types of iconicity, pantomimic vs. perceptual. Although pantomimic iconicity might be expected to be more facilitative, since it roots the sign labels in actions of a child's experience, type of iconicity wasn't predictive of age of acquisition; only degree of iconicity had that effect.

The role of non-manual markers. The research on sign language acquisition that we have discussed so far focuses on the manual component, in particular, lexical signs produced by the hands. However, it has long been recognized that there is an important non-manual component to sign languages. Non-manual markers are used in several domains of sign language grammars, and the argument can be made that 'non-manual marking' is not a coherent category (Sandler 2012). However, many non-manual markers are part of the prosody of sign languages, and specifically, configurations of the upper face are often used as components of intonation, conveying important information about sentence pragmatics and interpretation (Sandler et al. in press).

Reilly and colleagues conducted a series of investigations about children's development of these non-manual markers in ASL, including those used to convey topics, questions, and negation (a series of studies are summarized in Reilly 2006). They observed a common result, which they labeled 'hands before faces'. That is, when the grammar gives the option of conveying an interpretation through the use of manual signs or non-manual marking, children acquire the manual version first. This result was found in their studies of negation (Anderson & Reilly 1997), WH-questions (Reilly & McIntire 1991), and other domains. The exception was yes/no questions, where the non-manual marking is the only way to signal a question; this marking was acquired quite early.

Reilly (2006) interprets the pattern of hands before faces as support for the idea that children are not only using general-purpose cognitive mechanisms for learning language. Since facial expressions are widely used even by very young children for demonstrating affect, a general-purpose learner might readily take advantage of the affective use of the face at early stages of language acquisition. The observation that children pull apart linguistic and affective functions and tackle the structure of language as if it is expected to be componential, is taken by Reilly to indicate separability of language from other cognitive functions.

Grammatical uses of space. The grammatical use of space in sign languages requires accessing a three-dimensional, continuous (not discrete) physical space which in many cases is used in ways that are not categorical, unlike the physical continua used for discrete linguistic categories in spoken languages. This use of space is found in the pronominal system, verb marking sometimes known as directionality (arguably signaling grammatical agreement), and predicates often known as classifiers, which visually depict aspects of the movement or

appearance of their referents[3]. The acquisition of each of these components of the grammar of sign languages has received some attention.

Children acquire the forms of personal pronouns around the age of 2 years. Petitto (1987) observed a period with some pronoun reversals (using 'you' for 'me' or vice-versa) in two ASL-acquiring children around the age of 21-23 months. Lillo-Martin & Chen Pichler (2018) observed accurate use of points to self by 24 months, and of points to addressee by 28 months, in the four children they observed. This seems to be very similar to the ages for acquisition of personal pronouns in English-acquiring children.

Verb directionality seems to take a bit longer to be productive and fully accurate. To be used correctly, verb directionality requires a locus in space to be identified as associated with a referent, either through physical presence or through a grammatical process. Once the loci and their referents are associated, verbs move between these locations to mark agreement. Meier (1982, 1987) observed consistently accurate use of verb agreement in ASL by native signing children around the ages of 3;00-3;06. Morgan et al. (2006) observed productive use of agreement by one child acquiring British Sign Language (BSL) by 2;11. Quadros and Lillo-Martin (2007) report even earlier use of verb agreement by two deaf children acquiring ASL and two acquiring Libras; they found accurate use (but infrequent) even before the age of 2. The errors that children make when using this system frequently involve omission of the first step, assigning a location in space to stand for a referent. Therefore, children succeed first with cases of physically present referents. A study by Hou (2013) examined the ways that directional verbs are marked for plurality by children acquiring ASL and ASL native signing adults. This study found that three- to five-year-old native signing children produced markers of plurality on directional verbs, but did not do so consistently, and performed at a rate significantly lower than adults did.

The results from studies of children's development in the use of directionality indicate that the grammatical system in which verbs are modified may be in place by the age of three - which would be similar to the acquisition of productive agreement systems in various spoken languages - but implementing it in different contexts is more demanding.

Classifiers are complex signs employing a morphologically-specified handshape that picks out various classes of entities, based on semantic classes ('entity' classifiers), such as vehicles; or appearance classes (including 'size and shape' classifiers, 'instrumental' classifiers, and 'body part' classifiers), such as long and thin; or the way that a human hand would hold an object ('handling' classifiers) according to the object's size, shape, and function. The handshapes that are used in these different contexts are linguistically-specified and may vary across sign languages. When these handshapes are combined with a movement in a location, they demonstrate the movement, appearance, or action of the object represented. Some researchers prefer to use a term such as 'depicting signs' to refer to these constructions, avoiding the use of the term 'classifier' due to some differences between the sign language forms and the forms typically considered to be classifier predicates in spoken languages.

[3] We note that the analyses cited here are not uniformly accepted by sign linguists (e.g., Liddell 2003). In particular, a number of researchers have argued that directionality should not be analyzed as agreement (Fenlon et al. 2018), or that the predicates we refer to as classifiers are too distinct from spoken language classifier constructions to use that label (Dudis 2004). We discuss this issue further where these differences are relevant in the acquisition literature.

A number of studies have investigated children's acquisition of classifier/ depicting constructions in various sign languages, including ASL (Schick 1990; Supalla 1982), BSL (British Sign Language) (Morgan et al. 2008), Auslan (Australian Sign Language) (de Beuzeville 2006), and NGT (Sign Language of the Netherlands) (Slobin et al. 2003), among others. Some of these studies emphasize the morphological analysis of classifier constructions, while others focus on the aspects of depicting and iconicity involved. Langdon (2013) assessed these approaches along with some additional data from ASL, and determined that both were observationally adequate, although they account for different aspects of the system and in different ways. An overall conclusion that can be drawn from these studies (as described by Schick 2006) is that some aspects of the system come into play at very young ages (e.g., Slobin et al. 2003), but adult-like performance develops very gradually (e.g., Morgan et al. 2008; Schick 1990).

Linguistic analysis of the native acquisition of sign languages has much to offer to theories of language and language development, and there is a lot of research in this domain still to be done. However, a large portion of sign language acquisition research focuses on a different question, how delayed linguistic exposure affects ultimate language acquisition, since such delay is frequently a grievous circumstance for deaf children. We turn next to review studies of this context.

3. Sign Language Acquisition under Delayed Input

Modality effects may lead to some specific ways that sign language acquisition proceeds differently from spoken language acquisition. We do not claim that sign language and spoken language acquisition are quantitatively identical, but they are qualitatively identical. In general, when fluent input is available to a child from birth, the course of development is largely predictable. However, this is not the usual situation for many deaf children. As we've already mentioned, the vast majority of deaf children are born into hearing, non-signing households. For much of history, parents would not even know that their child was deaf for several years, during which time there would be no special effort in the form of early intervention to ensure that the child had access to language. In many locations this continues to be true.

More recently, in privileged countries the potential for deafness is detected at or soon after birth, by means such as Universal Newborn Hearing Screening (UNHS) (Wroblewska-Seniuk et al. 2017). Even if hearing parents are told their baby is deaf, valuable early language exposure time is often lost, for many reasons. Parents must decide if their child will access a sign language. If they do accept a natural sign language as a language in the home, they must find ways to learn it themselves, and ways to expose their child to multiple fluent signers. Since doctors and educators may recommend avoiding the use of a sign language, encouraging parents to pursue an approach employing hearing technology and spoken language only, the child may well experience a period without accessible linguistic input (Hall et al. 2019; Humphries et al. 2016; Spellun & Kushalnagar 2018). Hearing technology devices (hearing aids, cochlear implants, etc.) do not turn a child into a hearing child; rather, they are ways to increase access to sound. Even with technology, significant training is required for spoken language to develop, and outcomes are still highly variable (Niparko et al. 2010).

What often happens because of these varying circumstances is that a deaf child might begin to receive input in a natural sign language at some point well after birth, often years later. Moreover, although the child may have had spoken language used around them, which they may have partially accessed through hearing technology, and they may have had explicit

training in speech and/or writing, they might still be considered late *first*-language learners once they are exposed to a sign language.

3.1 Studies with adults who experienced delayed input

Most studies examining late first-language acquisition of a sign language are conducted with adults. While there are some with deaf children (e.g., Henner et al. 2016; Hrastinski & Wilbur 2016; Malaia et al. 2020), studies are extraordinarily limited by which population is accessed and how *delayed input* is defined. Studies with language deprived deaf adults document the long-term consequences of delayed language development in terms of non-target grammatical structures or non-native processing procedures. Participants in these kinds of studies typically self-report age of first exposure to a sign language, and are grouped into categories such as 'early' (exposure begins around ages 4-6, presumably age of entry in an educational program using a sign language), and 'late' (exposure begins in late childhood or the teens. Generally the participants are people who began their education in an oral-only program (where the focus was on listening and spoken language and sign languages were banned, often violently so) but switched to a program using sign language later). Their behavior on whatever task is used is generally compared to that of native signers, who report being exposed to a sign language from birth with deaf, signing family members (parents or older siblings); sometimes studies include as 'native' signers people who report their exposure at an early age (often 3 or below), even if they have no deaf immediate family members.

Various studies report that these later learners, as a group, perform much less accurately than native learners on tests of the structures of a natural sign language. For example, Boudreault & Mayberry (2006) used a grammaticality judgment task to assess participants' detection of grammatical vs. ungrammatical ASL sentences. They found an overall main effect for group: Native signers performed significantly better than 'early' signers (age of exposure 5-7), who performed significantly better than 'delayed L1' signers (age of exposure 8-13). Interestingly, the groups showed largely parallel performance across the different sentence types tested, hinting at a possible role of processing difficulty exacerbating differences in ease of decision-making even for the native signers. In addition, the ungrammatical variants were produced by changing the word order in an otherwise grammatical sentence (e.g., interposing a wh-word between a possessive sign and a noun); it might be expected that more subtle deviations from grammatical structures would lead to more pronounced group differences.

Cormier et al. (2012) followed up on the study by Boudreault & Mayberry, but they tested signers of British Sign Language (BSL), and they included English reading tests, to estimate the degree to which participants had learned BSL as a late first language vs. a second language. Cormier et al. (2012) found that accuracy in BSL judgment decreased as age of exposure increased (with nonverbal IQ and reading measures partialled out), but only for participants whose age of exposure was up to 8 years. The later learners whose exposure began at ages 9-18 were also significantly better readers than the earlier learners. These results led Cormier et al. to speculate that the later learners in their study had learned sufficient English early in life that their subsequent development of BSL was as a second language, not late first-language acquisition.

Another type of study examines the processing of natural sign language stimuli by different groups of participants. Emmorey et al. (1995) used both on-line and off-line tasks to compare native, early (age of exposure 2-7), and late (age of exposure 10-20) learners of ASL on tasks involving morphological patterns including verb agreement and aspectual marking. They found that all the groups were able to detect errors in aspect marking in the off-line task, but the early

and late learners showed differential sensitivity to morphological ungrammaticality in online sign monitoring tasks.

Studies of grammatical knowledge and processing with later learners are reviewed and synthesized by Mayberry & Kluender (2018). They address the question of a critical, or sensitive period for language. According to this hypothesis, language development is optimal when input is received at an early age - during the sensitive period. This hypothesis has been debated within the literature examining adult second-language learning, but Mayberry & Kluender argue that it is really late first-language learners who have the most to contribute to this discussion. When we focus on first-language learners, they conclude, the evidence is quite strong: late L1 acquisition has strong effects on ultimate grammatical attainment and processing.

What is less clear, even with the extensive existing studies, is whether late exposure leads to overall lower language proficiency or its effects are more targeted; and how effects are different when exposure begins at different ages (between roughly 3 and 13). While there are still numerous questions, some further evidence can be found in studies with children, which we turn to next.

3.2 Studies with children and adolescents who experienced delayed input

While most of the research on effects of delayed linguistic input has looked at the question of ultimate attainment, having been conducted with adults who have been using their sign language for decades, there are some studies that include children and/or teenagers, for a more direct look at the process of late learning once it has begun.

Berk & Lillo-Martin (Berk 2003; Berk & Lillo-Martin 2012) studied two children's development of ASL shortly after their exposure began at the age of about 6 years. They noted that the children seemed to go through a fairly typical two-word stage, although the utterances they produced sometimes employed more advanced semantics than would be expected for a two-year-old at a similar stage of development. This finding was taken to support the idea that the two-word stage in typical language acquisition is part of specifically linguistic development, not a consequence of more general cognitive limitations. Berk also found that the children showed specific grammatical effects in the domain of person-marking, a type of agreement found in ASL and many other sign languages (see section 2.3). Interestingly, while the children produced many erroneous forms in the person-marking system over the four year observation period, they did not show errors with the very similar system of locative agreement (Kwok et al. in press). This pattern of separation has not been observed in native signers, and appears to reflect a different grammaticization pathway for the two types of agreement.

Adolescent late learners have been studied by Morford (2003), Ferjan Ramirez et al. (2013), and Cheng & Mayberry (2019). All three of these studies show significant effects of late first-language access. The participants in Morford's study were two adolescents who had no access to language until their teen years, because they were born deaf and raised in a community without access to resources for instructing them in either a sign language or a spoken language. Maria was first exposed to ASL at the age of 13;07, and Marcus at 12;01. They showed severe impairments in comprehension of complex ASL structures even 7 years after their exposure began, although they showed relatively good production of such structures after about 2-½ years. Morford interprets this asymmetry as providing support for the hypothesis that delayed exposure particularly affects language processing, so that when faced with a task having a lower processing demand, performance is higher.

Ferjan Ramirez et al. (2013) studied three adolescents whose first exposure to ASL began at age 13-14, with the earliest data collection 1-2 years post immersion. They found relatively good vocabulary acquisition within the first years of immersion in ASL, as compared to native signers in their first two years of language development. They also observed characteristics of a two-word stage similar to those observed in the younger children by Berk & Lillo-Martin (2012). Cheng & Mayberry (2019) looked at the development of ASL word order one to five years post immersion in the same three participants and one additional adolescent first-language signer (Subject-Verb vs. Verb-Subject, and Verb-Object vs. Object-Verb). They observed that the participants produced a mixture of word orders in the first year or two post exposure, and then exhibited a strong preference for the canonical ASL orders of Subject-Verb, Verb-Object[4].

The studies with children and adolescents reviewed use in-depth analyses of very few participants. A different approach has been taken in several other recent studies, which compare larger groups of participants who are likely to be more representative of deaf children with delayed access to a natural sign language. These studies have included both native signers, who are exposed to ASL from birth, and children born to hearing families who are grouped by the age at which they entered a school for the deaf using a natural sign language as a primary pedagogical language. While it is possible that participants had exposure to a sign language before entering the school, it is also often the case that hearing families only send their deaf children to a signing school when it becomes clear to them that a mainstream or non-signing school has not provided a sufficiently rich linguistic environment.

Henner et al. (2016) assessed 688 deaf students, ages 7;06-18;05 on an ASL analogical reasoning task, and a subset of 455 students on an ASL syntactic judgment task. In the analogies test, participants were to choose the sign (out of four choices) that correctly fills in the analogy A:B::__:D. For the syntactic judgment task, participants viewed four ASL sentences, only one of which was grammatically acceptable; they were to select the acceptable version. Henner et al. found that both native exposure and age of entry in the signing school environment had significant effects. Subsequently, Henner et al. (2019) conducted further analyses of the analogies data from 267 participants, statistically bringing in ASL vocabulary and syntax abilities. They found that the ASL linguistic skills were more important for determining analogical reasoning results than age or home language alone. Importantly, those non-native signers who entered a signing school by the age of 6 years were the most likely to have scores in the same range as native signers, leading Henner et al. to recommend early exposure to fluent ASL as a primary or supplementary means of communication.

A similar overall finding emerges from a study of the relationship between academic achievement and ASL knowledge in a sample of 85 6th-11th grade students at a signing school (Hrastinski & Wilbur 2016). The researchers used school reports of ASL skills and academic achievement assessments, and found that those students who had high proficiency in ASL outperformed lower proficiency students in English language, reading comprehension, and mathematics. In this study, neither home language use nor age of entry to the school contributed significantly to the academic results with ASL proficiency controlled.

The results of the studies overviewed in the last two paragraphs can be interpreted as indicating that early exposure to fluent ASL in a signing-rich school setting can lead to high levels of

[4] Mayberry and her colleagues at the Laboratory for Multimodal Language Development at UCSD have also undertaken a series of studies of neurolinguistic processing in late first-language learners, as have MacSweeney and colleagues at the Deafness Cognition and Language lab at the University College London.

fluency in both ASL and English. For children with hearing parents, the school setting can do much to make up the language developmental difference otherwise seen between those children with deaf versus hearing parents. However, some differences do remain, and further study is needed to investigate in more detail the relative effects of home and school environments, particularly in those cases where hearing parents choose to learn sign with their children in the early years.

We now turn to examination of the linguistic situation for deaf children (and adults) before access to a natural sign language is available.

3.3 What happens before input begins (homesign)

When children are not provided with accessible linguistic input, they are not content to simply wait for the right environment. Numerous studies have observed that they innovate a language-like system with rather sophisticated properties (see Annual Review by Brentari & Goldin-Meadow 2017). A series of studies by Goldin-Meadow and colleagues (Goldin-Meadow 2003) has shown that deaf children create gestural systems known as *Homesign*. Homesigners generate their own set of gestures that can be compared to lexical items; these include pointing signs and gestures that represent actions, objects, and attributes. They also follow systematic patterns in organizing their signs into utterances; furthermore, the same basic patterns of organization have been observed for children growing up in disparate communities. The systems generated by homesigners are not based on the spoken languages used around them; their caregivers produce gestures with much less and different structure.

In the U.S. and many other developed countries, young homesigning children usually receive accessible input in a natural sign language, or adequately develop their use of a spoken language, and give up the use of their homesigning system at some point. However, there are cases of adults who grew up as homesigners and were never adequately exposed to an accessible language; they remain users of homesign systems. Adult homesigners have been studied in Nicaragua (Coppola & Newport 2005) and in Brazil (Wood 2013), among other places. These studies have shown that adult homesigns systems can become elaborated enough to include fluent signing of extended utterances, with grammatically-governed processes including recursion, argument structure, and the grammatical use of signing space. However, such successes should not be taken as an indication that early exposure to a sign language is not needed; adult homesigners are isolated, their interlocutors do not systematically understand them (Carrigan & Coppola 2017), and they fail at typical tests of theory of mind (Gagne & Coppola 2017; Pyers & Senghas 2009).

Although many might think that homesigning, or the contexts that lead to it, is a thing of the past in developed countries, this is not true. Many deaf children experience periods of language deprivation, during which time they lack access to linguistic input, because there is no one signing with them (due to circumstance or choice of their caregivers), and they cannot make use of the language spoken around them (whether they are fitted with technological devices to increase access to sound or not). Unsurprisingly, they show up for school underprepared. If they are fortunate, they will receive access to language at that point. Nevertheless, valuable time that should have been spent in the normal process of acquiring a language will have been lost. Out of a deep concern for the fate of children in such circumstances, efforts have been undertaken to develop systems that will correctly identify those for whom further intervention is needed. In the next section, we turn to discussion of such efforts.

4. Politics of sign Language Acquisition in Deaf and Hard of Hearing Signing Children

4.1 Language deprivation

Given the situation in which children are not able to access spoken language due to their hearing loss, if they are not exposed to a sign language they can be considered to be in a situation of *language deprivation*. Here we define language deprivation as creating environments in which children do not have maximal access to direct and indirect language. While any child can experience deprivation from access to a full language, for example, if they have a disability that impacts their locomotive functions (see Walle & Campos 2014 for a discussion on walking and language), deaf and hard of hearing children are most at risk of language deprivation because the disability itself coupled with social stigmas against learning sign languages creates naturally language deprived environments. Language deprivation itself is responsible for a host of maladies, including impaired social and cognitive functioning, as well as being a leading cause of traumatic experiences for many deaf and hard of hearing people (Hall 2017; Hall et al. 2019).

Recognizing the harm of language deprivation, in the past ten years, advocacy groups who support ensuring that all deaf children have accessible language environments successfully helped several states pass laws that monitor language acquisition milestones in deaf children for both spoken and sign languages. Several such laws are known as Language Equality and Acquisition for Deaf Kids laws or LEAD-K. Pushes for LEAD-K laws have partially been inspired by a recognition that deafness itself does not impair cognition nor language, but instead, language deprivation does (Hall et al. 2017a).

The idea behind LEAD-K laws is that a committee of experts would monitor the language development of deaf children aged 0-5 using the best available assessments. The goal of the committee is to prevent language deprivation by ensuring adequate mentoring and intervention services are provided to children who are not meeting language milestones in either sign or spoken languages. These laws do not specify which language(s) are to be used, but only seek to evaluate language acquisition in a population susceptible to experiencing language deprivation.

4.2 Challenges of assessing early sign language acquisition

The goal of LEAD-K and similar laws or policies is to identify children at risk by evaluating and assessing language development widely. However, at the time of writing, very few adequate assessments exist for monitoring sign language acquisition in deaf children younger than 5 (see Henner et al. 2018 for a discussion on this topic). The bulk of available assessments are checklists, which require assessment of productive language often by hearing signers who themselves may not be proficient in the language they are assessing, and furthermore use normative hearing lenses when interpreting data regarding sign language and communicative behavior.

Part of the challenge with creating new assessments to measure language acquisition in signing deaf children is that in spite of almost forty years of studying the topic, we really only have a good idea of what sign language acquisition looks like in one kind of deaf child - one who has full access to sign language at home and at schools, as summarized in section 2.

Deaf and hard of hearing children in non-signing households, however, have variable access to language. Either their parents have chosen not to sign with them, or their parents are learning sign language at the same time as their child. While there has been some research on the sign language acquisition of deaf children with hearing parents, their language experiences are so variable that much of the data from them looks like large amounts of noise. For example, in producing and interpreting a heat map analysis of the responses to a vocabulary test by deaf children with hearing parents, Henner, Hoffmeister, and Reis (2017) demonstrated that the amount of variability that likely language-deprived children bring to the assessment results requires different and creative ways of analyzing the data. To be specific, it is no longer reasonable to analyze the data solely through presentation of the average results through means-based statistics, as reporting the means will not provide an accurate picture of the distribution of data.

Further complications can be found in the fact that existing data and assessments do not sufficiently take into consideration possible linguistic varieties used by different signers. In nondeaf children, language acquisition as measured by assessments is known to be variable and moderated by multiple identities such as race, class, and sex/gender, We can assume that language acquisition in deaf and hard of hearing children would also be affected by such factors, but we are not sure how since deafness is a low incidence population, and signing deaf children are a small percentage of a small percentage of the population. Thus far, finding enough child and school aged minoritized populations within the signing deaf communities to satisfy traditional statistical approaches has been difficult.

It is past time for researchers who focus on sign language assessments to begin to address how to best assess dialectal variation in sign languages through production-based and receptive-based assessment techniques (Henner et al. 2018). For example, in adapting the Test Battery for American Sign Language Morphology and Syntax to Auslan, Schembri et al. (2002) found enormous variation in signer responses from individual to individual making variability management in the assessment data and norming of the assessment difficult.

While dialectal variation in sign languages has been studied for approximately fifty years as of 2020, limited research has been done on how to effectively recognize, analyze, and assess dialectal variation in sign languages, whether in adults or in child development. As Snoddon (2018) asks, “Whose ASL counts?”. The language acquisition research community is aware of dialectal variations in sign languages. However, limited research has been conducted in this sphere because of the difficulty in accessing the population.

A further complication of assessment is that children may use a combination of communicative behaviors that include some elements from a natural sign language but are not restricted to such established linguistic units, and thus may not be identified by raters or machine scored assessments. Or, they may use communicative behaviors that combine elements from a sign language with elements from another language, something that has come to be known as *translanguaging*.

In spoken language assessment studies, researchers like Shohamy (2011) exhort us to acknowledge that fair assessment of languages is an issue of justice, and Schissel, Lueng, Lopez-Gopar, and Davis (2018) say it behooves us to recognize that monolingual, closed type language assessments do not really examine the multi-faceted translanguaging that any multi-lingual language user manages in everyday discourses. If the primary language of a signer is a dialectal variant of the standard language, then any mediation between the standard variant and

the dialect requires translanguaging. Language use in signing societies between signers is messy, in a very beautiful way.

The concept of constant contact between different dialectal variations of sign languages and spoken languages has been aptly described by Kusters, Spotti, Swanwick, and Tapio (2017) as *the linguistic repertoire*. They write, “The boundaries between different sign and spoken languages and modalities become fuzzy in sign language contexts; for example, in practices that draw from several modalities and languages at the same time” (p. 224). Here, they reference simultaneous communication, or the act of speaking and signing at the same time, but their observation can also apply to concepts like fingerspelling, or gesturing, or mouthing words without making sounds. The signer is always navigating contact between multiple languages and dialects, yet very little is known about how these skills and language mechanisms are acquired. We know only how they play out in social interactions between deaf and deaf, and deaf and nondeaf (De Meulder et al. 2019).

4.3 Providing early access to sign language input for deaf children in hearing families

If, recognizing the potential harms of language deprivation, hearing parents choose to use a natural sign language with their deaf children, how can they go about this? In the United States, some states have early intervention programs which can provide access to sign language education for the families of deaf children between birth and 3 years. Many of these programs include home-based and /or school-based activities with ASL, such as a program with a deaf adult who visits the family to tutor them and provide information about raising a deaf child (Hamilton & Clark 2020).

Early intervention programs that involve access to a sign language include a long-term goal of bi- or multi-lingualism, since in addition to fluency in the natural sign language, facility with the majority spoken language, whether in the spoken modality or primarily as a written language, is a necessity. That *bimodal bilingualism* is a feasible outcome can be observed by considering the case of deaf children with deaf, signing parents who choose cochlear implantation and bilingual language approaches for their children. Although there are few studies with such children, they have found that children with full early access to a natural sign language develop both their sign language and their spoken language on par with other successful bilingual children (Davidson et al. 2014; Goodwin & Lillo-Martin 2019). However, as previously noted, that kind of deaf child represents fewer than 10% of the overall deaf population (Mitchell & Karchmer 2004). How can such outcomes be achieved for children who are not born into signing households?

Researchers of multilingualism recognize that maintaining multilingualism in children requires a community of multilinguals (Linton 2004). Linton posits a *critical mass* model of multilingual language acquisition in multilingual communities. Maintaining multilingualism requires cognitive resources. If the community does not support multilingualism, children are more likely to move towards monolingualism (e.g. a child in an immigrant family speaking English exclusively). In Linton’s work, she found that simply living in a community with a critical mass of multilinguals increases the odds of multilingualism by 50%. People retain multilingualism for a variety of reasons, including identity; however, the need to communicate seems supreme. Critical mass models applied to deaf and hard of hearing children indicate that for them to learn a sign language, they must be around other signing peers and in signing environments. Therefore, a community of bimodal bilinguals is most likely to lead to success for signing deaf children.

4.4 Challenges to providing early and sustained access to sign language input for deaf children in hearing families

While a community of peers and role models who use both a sign language and a spoken/written language is logically the ideal context, hearing parents with no prior knowledge of deafness need support from their local and educational environments to find this. However, many states have moved towards structures which support listening and spoken language exclusively, while structures that support sign language acquisition are no longer available. In North Carolina, there used to exist early intervention pre-schools focused on critical mass socialization and language acquisition in deaf and hard of hearing children. Every single one of those schools closed as parents moved towards cochlear implantation and "inclusion"-based education. The impact on sign language acquisition for deaf and hard of hearing children of hearing parents is very clear.

While hard numbers are difficult to come by, the number of hearing parents choosing sign language as a language for their deaf and hard of hearing children seems to be dwindling, especially given a push by medical and educational professionals to stop using sign language with deaf and hard of hearing children out of concern that they may choose to not speak (Hall 2017; Hall et al. 2019; Mauldin 2019).

The loss of residential schools and large inclusion programs and the transition to isolated deaf and hard of hearing children in inclusive classrooms means there is often no critical mass to support sign language acquisition. Crucially, a single sign language model (even a deaf mentor) does not provide critical mass. Deaf and hard of hearing children who sign often have a single member of the signing community in their classrooms, a hearing interpreter who learned sign language late in life and is often not fluent in the language (Schick et al. 1999).

In the past, even if parents elected language environments exclusively providing spoken language input, deaf and hard of hearing children could rely on their peers within educational settings to provide an environment with access to sign languages. Although for much of the 20th century, residential schools in the United States (and elsewhere) enacted policies which banned the use of sign languages among deaf and hard of hearing children, in the face of threats of physical and emotional violence they often nonetheless created signing communities amongst each other (Anglin-Jaffe 2013). Yet Anglin-Jaffe reminds us that the covert signing communities were not benevolent; they were enacted out of necessity.

> However, it is important not to romanticise this phenomenon of Deaf peer education nor to imply that it is superior nor wholly distinct from traditional models of adult-child education. The peer learning processes of the Deaf children in Nicaragua and Thailand [also applicable to residential schools in the U.S. and elsewhere -DLM/JH] were the result of necessity and were opportunistic, rather than reflective and planned. (p. 267).

The loss of functioning sign language communities because of the decline of the traditional pillars of sign language transmission, the schools for the deaf, also led to decreases in numbers of clubs for the deaf, and sports for the deaf (Bahan et al. 2008; Gannon 2011). With the movement towards exclusive listening and spoken language instruction for deaf and hard of hearing children, the result is that fewer deaf children are learning a sign language as a native language today.

4.5 Sign language acquisition by hearing learners

Because of social policies which deprioritize sign language acquisition by deaf children, a large proportion of new signers are hearing people. One group are hearing parents with hearing children, who are trying out *baby sign language*, a simplified lexicon of signs that have limited connection to the actual natural sign languages they are based on (Chen Pichler 2016). Another group are hearing high school and college students who may be taking sign language courses to satisfy language requirements or as supplementary to careers in which they may be working with deaf and hard of hearing people.

The discrepancy between the number of deaf and hard of hearing signers versus hearing signers means there is now conflict on who owns the language and who gets to be spotlighted by the media and communities for using sign language publicly. Robinson and Henner (2018) detail additional conflicts between the deaf communities who sign and institutions of higher education who provide sign language classes to their students. They describe discussions about who gets to teach the classes, and the ethics of universities profiting from classes on sign languages while not providing proper access and accommodations (e.g. qualified sign language interpreters) to deaf students.

5.0 Conclusion

5.1 How studies of sign language acquisition inform linguistics

We have summarized some of the research on sign language acquisition and how it relates to theories of linguistics, language, and language development. Starting with the context of deaf children exposed to a sign language since birth from their deaf, signing parents, we saw that there are aspects of language acquisition that apply in parallel across signed and spoken languages. We also saw that there are some ways in which the modality of transmission could have an effect: for example, in determining the timing of the first linguistic words, or in the ways that the physical space around a signer are used to indicate referents. We also saw that studies with infants indicate a readiness for the perception of sign languages as well as spoken languages, for participants who have had no exposure to a sign language as well as for those who have.

While these results indicate the equal potentiality for acquiring a sign language and a spoken language, there is not equal potentiality in the world for deaf children to acquire a sign language, due to the fact that the vast majority are born to hearing parents who do not sign. If deaf children cannot access the spoken language used around them, and do not experience input in a natural sign language, they will experience a delay in first-language development. Linguistic research has shown long-lasting effects on grammar and processing given this context, whether participants are observed relatively soon after their immersion in a signing environment or decades later. This research confirms that without exposure to accessible linguistic input during the early years of life, subsequent language development will be significantly affected.

In an effort to avoid damaging situations of language deprivation, there are some who have called for increased awareness of deaf and hard of hearing children's language status through regular assessments. For those parents who choose to ameliorate language deprivation effects through early use of a natural sign language, there is also a need for increased opportunities to learn a sign language, for deaf children as a first language and for their parents as a second language. There are many challenges to these efforts, however, including difficulties of

assessment and limited opportunities for creating the necessary critical mass of a community with fluent signing peers and role models.

While there has been research in the areas just described, certainly much more study is needed. In the next subsection we review a few additional areas in which future research might delve.

5.2 Additional areas for research on sign language acquisition

Bimodal bilingualism. Approximately 80% of the children of deaf parents are hearing. These children often acquire a sign language from their parents and a spoken language from their broader community. As such, they often live on *the border* of deaf and hearing communities (Hoffmeister 2008). Hoffmeister points out that many children of deaf parents (known as CODA or KODA) feel like they move between communities, often considering themselves as not belonging fully to either. As many CODA/KODAs lack the critical mass environment to fully acquire their sign language, they may display variable acquisition of their sign language but non-variable acquisition of their spoken language; nonetheless, they may express the idea that their sign language is emotionally closer to them. Given their context of developing a minority language at home, they can be considered users of a *heritage* language (Chen Pichler et al. 2017b, 2018; Quadros & Lillo-Martin 2018).

Studies of the development of bimodal bilingualism have included explorations of *code-blending*, a modality-specific bilingual characteristic akin to code-switching, in which (parts of) an utterance can be produced simultaneously (Emmorey et al. 2008; Kanto et al. 2017; Lillo-Martin et al. 2016; van den Bogaerde & Baker 2009). Other studies have focused on additional characteristics of bilingual development such as language choice (Lillo-Martin et al. 2014), and language interaction effects (Koulidobrova 2017). Further studies of KODA children could serve as an important comparison case for future studies of bilingual development in deaf children with early access to both a sign language and spoken language input (Goodwin & Lillo-Martin 2019).

L2 acquisition. In recent years there has been increased interest in research on second language acquisition of sign languages (Chen Pichler et al. 2019; Geer & Keane 2017; Rosen 2004, 2008; for an overview, see Chen Pichler & Koulidobrova 2016). The focus of such research is often on areas of the new modality that are considered to be most difficult for learners of a second language in a second modality (L2M2), such as handshape discrimination, which is a salient component of sign language phonology.

While there is a growing number of studies that look at second-language signers taking courses for general interest or for language requirements, there are virtually none that consider the L2 acquisition of hearing parents with deaf children who have elected to learn to sign as a family. Since their needs and motives are very different (Chen Pichler 2017), it is important to study this group of second-language learners to see what methods might be most effective for them.

Ethnographic approaches. Because of the variety of environments and condition under which sign languages are acquired, Hou and Kusters (2020) recommend that linguists employ linguistic ethnographic documentation methods whenever possible. The focus of linguistic ethnography, according to Hou and Kusters is “viewing language as a culturally and socially constituted and situated practice.” (p. 340). More to the point, language, here specifically sign languages, cannot be studied outside of its use among deaf and hard of hearing people, and between them and nondeaf people. In addition to examining how and when deaf and hard of

hearing people acquire linguistic structures, Hou and Kusters point out that linguists should also examine what Kusters et al. (2017) called the “semantic repertoire” of deaf and hard of hearing children. This includes considerations of a wider range of communicative behaviors not limited to those of a formal language.

5.3 Responsibility of academics to the communities of their research

As discussed here, the study of sign language acquisition has seen remarkable changes over the past seventy years of the field. Many of these changes were fueled not only by developments in technology, but also by socio-cultural factors regarding who is privileged enough to learn sign languages at home and in the schools. While the future of sign language and sign language research remains a question because of technology development and new movements to suppress sign languages in deaf and hard of hearing children, we are assured by Veditz’s proclamation that “as long as we have deaf people on earth, we will have signs”. As linguists who profit from the study of sign languages, we have an obligation to ensure that the wishes and needs of the communities with whom we work are respected. In this case, this includes ensuring that the families of deaf and hard of hearing children also have access to signs. Thus, dear reader, we hope that you too will advocate for deaf and hard of hearing children to sign.

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Terms and Definitions

Natural sign languages emerge in communities of deaf people and have their own grammars; they are not representations of spoken languages.

Modality concerns the channel that a language is communicated through (e.g. visual/manual, print, auditory/spoken).

Signs are roughly equivalent to spoken words; they can be monomorphemic or multimorphemic.

Sign language phonology is the study of the rule system underlying the form of signs.

In *pantomimic iconicity*, the signer portrays actions of a referent; in *perceptual iconicity* the signer represents features of a referent.

Non-manual marking involves the use of facial expressions (e.g., brows, eyes, mouth), head and body positions for linguistic functions.

Directional verbs move between spatial loci indicating subject/ object arguments and/or source/ goal locations.

Loci are locations in signing space that can be understood as standing for referents (animate / inanimate) and locations.

Hearing technology includes hearing aids and cochlear implants which can increase access to sound but not restore it.

Homesign is a communicative system generated by a deaf person without access to a signing community for interacting with their family and community.

When *translanguaging*, people integrate different ways of communicating seamlessly (e.g. switching between different dialects or formal languages).

Simultaneous communication is an artificial combination of signs and speech in which the spoken language dominates exclusively.

A *bimodal bilingual* person uses languages in two modalities: a sign language and a spoken or written language.

A *CODA/KODA* (child/kid of deaf adults) is a hearing offspring raised in a deaf-parented, signing family.

Sidebar

Deaf communities.
Sign languages are used by communities of deaf people. Signing deaf people define themselves by their language and culture, not from a medical perspective of people who need fixing (Padden & Humphries 1988). Unlike other communities, however, for most deaf people the home is not the primary source of this community; rather, deaf people are enculturated into the community through schools, clubs, events, and other community activities. Just as with speakers of an indigenous endangered language, members of the deaf community are threatened when their language and culture face the possibility of incursion from outside sources.