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Acquisition of Sign Languages

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Abstract

Natural sign languages of deaf communities are acquired on the same time scale as that of spoken languages 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 these children 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, earlier input is associated with better language and academic outcomes. 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 that evolve in and are used by communities of deaf[1] people (see the sidebar titled Deaf Communities). Throughout history and around the world, deaf people form communities focused on the use of a natural sign language. As languages, natural sign languages display many of the characteristics that are 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.

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

Studying variation in languages on the basis of modality spotlights what aspects of language may be truly universal and which ones are tied to specific modalities.

Natural sign languages:

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

Modality:

the channel through which a language is communicated (e.g., visual–manual, print, auditory–spoken)

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 is the focus of Section 2 of this review.

However, the contexts in which deaf and hearing children acquire language are rarely comparable. In contrast to deaf children with deaf, signing parents, the vast majority of deaf children (estimated to be over 90%) are born to hearing, nonsigning 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, which is known as language deprivation (Hall 2017, W.C. Hall et al. 2017).

Language development in the context of inaccessible linguistic exposure has been the focus of much 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 to closely examine issues concerning potential interplay between the development of language and other cognitive functions. These topics are addressed in Section 3. Yet, there are lifelong consequences for children whose early linguistic experience is delayed. Recently, scholars have raised the alarm about the potential for harm from this situation and have supported various means of harm reduction. As developmental scientist Marie Coppola is fond of remarking, language deprivation is good for science but bad for humanity (M. Coppola, personal communication). These issues are 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 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 used mostly by deaf people and by people working with deaf people (for a review of studies of a contrasting type of sign language, rural sign languages, see de Vos & Pfau 2015; for a rare example study of children's acquisition of a rural sign language, see de Vos 2012). 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 have shown interest 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 had forced researchers to consider dialectal variation within sign languages (Johnston 2003) and even from sign languages in contact with each other (e.g., ASL and LSM; see Quinto-Pozos 2008). By 2010, researchers and community activists in the United 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). Unfortunately, the acquisition of these varieties has not been studied, so we cannot include them in our review.

At the end of this review, we raise questions about topics that are not as widely researched but that deserve 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. SIGN LANGUAGE DEVELOPMENT UNDER CONDITIONS OF EARLY ACCESS

Children who are exposed to a natural sign language from birth constitute a small percentage of those who develop a sign language. Yet, they are the group that has been studied the most intensively because 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 (Section 2.1), studies of the potential readiness for sign language in infants at the beginning of the language acquisition process (Section 2.2), and studies that focus on potential modality effects in native acquisition of sign languages (Section 2.3).

2.1. Early Milestones Are Parallel to Those for Spoken Languages

While much research remains to be done, there is ample evidence that, when learners have early access to fluent signers, their development of a sign language 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.

2.1.1. Babbling.—It is well known that hearing babies begin to produce language-like sounds (i.e., babbling) at around 4–5 months of age (Vihman et al. 1985). Many scholars consider babbling a crucial early step of linguistic development that allows infants to practice producing the formational elements of their language and enables communicative social exchanges with caregivers.

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 (aged 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 deaf sign-exposed babies produced more complex manual babbles and a greater variety of manual babble types compared with the gestural productions of hearing infants who were not exposed to a sign language.

Petitto & Marentette (1991, p. 1495) 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.” This interpretation implies 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.

2.1.2. 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 one might not expect to see a significant difference between the average age of first signs and that of first spoken words. Nevertheless, such a difference has been found.

Signs:

physical articulations that are roughly equivalent to spoken words; they can be monomorphemic or multimorphemic

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—as early as 6 months (hence the appeal of “baby signs,” which, ironically, are generally more supported for hearing families than for families with 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—an advantage of 1.5 to 2 months. Meier & Newport (1990) reviewed available evidence and concluded that there does seem to be an early advantage for first signs but not for subsequent milestones such as a 10-word vocabulary and first word combinations. We note that Anderson & Reilly (2002) found median vocabulary sizes of

12- to 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. A recent replication and extension of Anderson & Reilly's (2002) study by Caselli et al. (2020) did not make direct comparisons between ASL and English vocabulary size.

Meier & Newport (1990) suggested that the findings about first spoken and/or 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.

2.1.3. 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, which is 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 criteria regarding what counts as a two-word utterance. For comparison, in a project analyzing ASL longitudinal spontaneous production data called SLAAASh (Sign Language Acquisition: Annotation, Archiving, and Sharing) (https://slla.lab.uconn.edu/slaaash/), the four child participants achieved two-sign utterances including a verb and a nonpointing 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. However, 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 of subject–verb–object in ASL and that they made grammatically appropriate use of order-changing operations, resulting in linguistically constrained verb–subject and object–verb 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 word order acquisition 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, in general, children acquiring languages with word order variability 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 in which many different grammatical features emerge at the same time, which is sometimes called a grammar explosion. Between the ages of 3 and 5, preschool children acquiring spoken languages typically perform at or close to adult-like levels in many domains of grammar, including the use of syntactic movement operations (e.g., scrambling, *wh*-movement), the appropriate use of various types of null elements, licensing of anaphoric elements, and interpretation of quantifiers (see, e.g., Crain 2017, de Villiers 2017, Gleitman et al. 2019, Lidz & Gagliardi 2015).

Much more research is needed on comparable areas of sign language development. Research on the development of sign languages by preschoolers has focused mostly on issues that relate to potential modality effects because of the difficulties of documenting child signing development. For this reason, we 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 that has examined 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

Studies of sign language perception in infants, along with other studies, affirm that (with access to appropriate input) infants are ready for linguistic input, whether it comes as spoken language or as sign language. A few studies have specifically examined 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 nonsigning infants to determine whether 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. 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 that, by 14 months of age, this behavior had disappeared. 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 (for a discussion on perceptual narrowing, see Maurer & Werker 2014).

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. (2018) 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 that displayed 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 preference for looking 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 of recognizing sign-specific phonological features, followed later on by 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, one would expect children who are exposed to a sign language to attend to communicative visual stimuli differently from children who are not so exposed. This expectation is compatible with findings from Brooks et al. (2020), who studied the gaze following of deaf, sign-exposed infants (with deaf, signing parents) and compared it with the gaze following of hearing, nonsigning infants. The deaf infants were significantly more responsive to 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. These results, along with the previous findings, imply 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

As discussed above, children can perceive and develop a sign language in ways that are mostly parallel to spoken language development despite the modality difference. However, some modality effects also need to be considered. For example, the different physical development of the articulators for signs versus speech likely plays a role in the apparent earlier first signs, as discussed above. In this section, we discuss potential modality effects associated with greater iconicity in the visual modality, the use of the face and body for prosodic information, and the integration of signing space into the grammar of a sign language.

2.3.1. 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* at https://www.cambridge.org/core/journals/language-and-cognition/landc-special-issues/special-issue-on-iconicity). 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 (for a review, see Thompson 2011). However, 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 special issue of *Language and Cognition* cited above).

Current perspectives consider visual iconicity to be a prevalent factor in the organization of sign languages—a factor existing alongside arbitrariness and within conventionalized grammatical patterns. This viewpoint, and an increasing availability of relevant data, may inform the study of potential modality effects of iconicity in language development.

Thompson et al. (2012) analyzed the acquisition of BSL vocabulary in 8- to 36-month-old deaf children with deaf, signing parents. The authors 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 the 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—similar to that found in the acquisition of spoken languages. In a follow-up study, Caselli & Pyers (2020) compared two types of iconicity: pantomimic versus 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 was not predictive of age of acquisition; only degree of iconicity had that effect.

Pantomimic:

a type of iconicity in which the signer portrays actions of a referent

Perceptual:

a type of iconicity in which the signer represents features of a referent

2.3.2. The role of nonmanual 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 nonmanual component to sign languages. Nonmanual markers are used in several domains of sign language grammars, and one could argue that nonmanual marking is not a coherent category (Sandler 2012). However, many nonmanual markers are part of the prosody of sign languages; specifically, configurations of the upper face are often used as components

of intonation to convey important information about sentence pragmatics and interpretation (Sandler et al. 2020).

Nonmanual marking:

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

Reilly and colleagues conducted a series of investigations about children's development of these nonmanual 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 nonmanual marking, children acquire the manual version first. This result was found in Reilly and colleagues' studies of negation (Anderson & Reilly 1997), *wh*-questions (Reilly & McIntire 1991), and other domains. The exception was yes/no questions, for which nonmanual marking is the only way to signal a question; this marking was acquired quite early.

Reilly (2006) interpreted the pattern of hands before faces as support for the idea that children make use of qualitatively different mechanisms in language development, not just general-purpose cognitive ones. Since facial expressions are widely used even by very young children to demonstrate affect, a general-purpose learner might readily take advantage of the affective use of the face at early stages of language acquisition. In Reilly's view, the observation that children pull apart linguistic and affective functions and tackle the structure of language as if it were expected to be componential indicates separability of language from other cognitive functions.

2.3.3. Grammatical uses of space.—The grammatical use of space in sign languages requires one to access 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, in a type of verb marking sometimes known as directionality (arguably signaling grammatical agreement), and in predicates often known as classifiers, which visually depict aspects of the movement or appearance of their referents.[2] The acquisition of each of these sign language grammar components 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 to 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. These ages are very similar to the ages for acquisition of personal pronouns in English-acquiring children.

[2]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) and 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.

Verb directionality seems to take a bit longer to be productive and fully accurate. To be used correctly, verb directionality requires identification of a locus in space 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 to 3.5 years. Morgan et al. (2006) observed productive use of agreement by one child acquiring BSL by age 2 years, 11 months. Quadros & Lillo-Martin (2007) reported even earlier use of verb agreement by two deaf children acquiring ASL and two acquiring Libras; they found accurate (but infrequent) use even before the age of 2. The errors that children make when using this system frequently involve omission of the first step of 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 in which directional verbs are marked for plurality by children acquiring ASL and ASL native signing adults. This study found that 3- to 5-year-old native signing children produced markers of plurality on directional verbs, but they did not do so consistently, and they performed at a rate significantly lower than that of adults. 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 3 years—which would be similar to the acquisition of productive agreement systems in various spoken languages—but implementing it in different contexts is more demanding.

Directional verbs:

verbs that move between spatial loci indicating subject–object arguments and/or source–goal locations; these are sometimes called indicating verbs

Locus (*pl*. loci):

a location in signing space that can be understood as standing for a referent (animate/inanimate) and/or location

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 based on how 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 other terms, such as "depicting signs," to refer to these constructions; this usage avoids the term "classifier" because there are some differences between the sign language forms and the forms that are typically considered to be classifier predicates in spoken languages.

A number of studies have investigated children's acquisition of classifier/depicting constructions in various sign languages, including ASL (Schick 1990, Supalla 1982), BSL (Morgan et al. 2008), Auslan (Australian Sign Language) (de Beuzeville 2006), and NGT (Slobin et al. 2003). 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 can contribute significantly to theories of language and language development, and much research in this domain remains to be done. However, a large portion of sign language acquisition research focuses on a different issue: how delayed linguistic exposure affects ultimate language acquisition, since such delayed exposure 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 sign language acquisition to proceed differently from spoken language acquisition in some specific ways. 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 mentioned above, the vast majority of deaf children are born into hearing, nonsigning households. For much of history, parents would not even know that their child was deaf for several years, and thus there would be no early intervention to ensure that the child had access to language. In many locations, this continues to be the case.

More recently, in privileged countries the potential for deafness is typically detected at or soon after birth, by means such as universal newborn hearing screening (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 whether their child will access a sign language. If they accept a natural sign language as a language in the home, they must find ways to learn it themselves and expose their child to multiple fluent signers. Since doctors and educators may recommend avoiding the use of a sign language and instead encourage an approach that employs 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 (e.g., hearing aids, cochlear implants) do not turn a deaf 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).

Hearing technology:

devices (e.g., hearing aids, cochlear implants) that can increase access to sound but not restore it

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 some children 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 some have included 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 nontarget 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 their age of entry in an educational program using a sign language) and late (exposure begins in late childhood or the teens; in general, these participants 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). The language-deprived participants' behavior on a given task is generally compared with that of native signers, who report having been 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 versus 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, which suggests 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.

In a follow-up to the study by Boudreault & Mayberry (2006), Cormier et al. (2012) tested signers of BSL and included English reading tests to estimate the degree to which participants had learned BSL as a late first language versus a second language. Cormier et al. found that accuracy in BSL judgment decreased as age of exposure increased (with nonverbal IQ and reading measures partialed 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 online and offline tasks to compare native, early (age of exposure 2–7), and late (age of exposure 10–20) learners of ASL on tasks that involved morphological patterns including verb agreement and aspectual marking. They found that all the groups were able to detect errors in aspect marking in the offline 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 were reviewed and synthesized by Mayberry & Kluender (2018), who addressed 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 have argued that late first-language learners have the most to contribute to this discussion. According to their conclusion, when we focus on first-language learners, the evidence is quite clear: 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 used their sign language for decades, some studies 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 the development of ASL in two children shortly after their exposure had begun 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 2-year-old at a similar stage of development. This finding was taken to suggest that the two-word stage in typical language acquisition is part of specifically linguistic development, not a consequence of

more general cognitive limitations. Berk (2003) 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 during the 4-year observation period, they did not show errors with the very similar system of locative agreement (Kwok et al. 2020). This pattern of separation has not been observed in native signers, and it appears to reflect a different grammaticalization pathway for the two types of agreement.

Adolescent late learners have been studied by Morford (2003), Ferjan Ramírez et al. (2013), and Cheng & Mayberry (2019). All three of these studies showed 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 had been born deaf and raised in a community without access to resources for instructing them in either a sign language or a spoken language. One of the participants, Maria, was first exposed to ASL at the age of 13 years, 7 months; the other participant, Marcus, was first exposed at 12 years, 1 month. They showed severe impairments in comprehension of complex ASL structures even 7 years after their exposure had begun, although they showed relatively good production of such structures after about 2.5 years. According to Morford, this asymmetry suggests that delayed exposure particularly affects language processing, as reflected by the participants' higher performance on tasks with lower processing demands.

Ferjan Ramírez et al. (2013) studied three adolescents whose first exposure to ASL began at age 13–14, with the earliest data collection 1–2 years postimmersion. They found relatively good vocabulary acquisition within the first years of immersion in ASL compared with native signers in their first 2 years of language development. They also observed characteristics of a two-word stage similar to those observed in younger children by Berk & Lillo-Martin (2012). Cheng & Mayberry (2019) looked at the development of ASL word order 1–5 years postimmersion in the same three participants and in one additional adolescent first-language signer (subject–verb versus verb–subject, and verb–object versus object–verb). They observed that the participants produced a mixture of word orders in the first year or two postexposure, after which they exhibited a strong preference for the canonical ASL orders of subject–verb, verb–object.[3]

The studies with children and adolescents reviewed here used in-depth analyses of very few participants. A different approach has been taken in several other recent studies, which have compared larger groups of participants that 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 that used a natural sign language as a primary pedagogical language. While some participants may have had exposure to a sign language before entering their school, a hearing family often sends a deaf

[3]Mayberry and her colleagues at the Laboratory for Multimodal Language Development at University of California, San Diego, have also undertaken a series of studies of neurolinguistic processing in late first-language learners (e.g., Mayberry et al. 2018), as have MacSweeney and colleagues at the Deafness Cognition and Language Research Centre at University College London (e.g., Twomey et al. 2020).

child to a signing school only when it becomes clear that a mainstream or nonsigning school has not provided a sufficiently rich linguistic environment.

Henner et al. (2016) assessed 688 deaf students (aged 7.5 to about 18.5 years) on an ASL analogical reasoning task and a subset of 455 students on an ASL syntactic judgment task. In the analogies test, participants were asked to choose the sign (out of four choices) that correctly filled in the analogy A:B::__:D. For the syntactic judgment task, participants viewed four ASL sentences, only one of which was grammatically acceptable, and were asked 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 and focused on ASL vocabulary and syntax abilities. They found that the ASL linguistic skills were more important than age or home language alone in determining analogical reasoning results. 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 emerged from a study of the relationship between academic achievement and ASL knowledge in a sample of 85 sixth- to eleventh-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 when the researchers controlled for ASL proficiency.

The results of the studies summarized in the two paragraphs above suggest that early exposure to fluent ASL in a signing-rich school setting can lead to high levels of fluency in both ASL and English. For children with hearing parents, the school setting can significantly make up for the language developmental difference otherwise seen between children with deaf parents and those with hearing parents. However, some differences 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 a sign language 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 children in such circumstances innovate a language-like system with rather sophisticated properties (see 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 sets of gestures that are comparable to lexical items; these include pointing signs and gestures that represent actions, objects, and attributes. Homesigners 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.

Homesign:

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

In the United States 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 stop using their homesigning system at some point. However, some adults have grown up as homesigners and have never been adequately exposed to an accessible language; they remain users of homesign systems. Adult homesigners have been studied in Nicaragua (Coppola & Newport 2005) and Brazil (Wood 2013), among other places. These studies have shown that adult homesigning 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 do not indicate 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 (regardless of whether they are fitted with technological devices to increase access to sound). 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 concern for the fate of children in such circumstances, efforts have been undertaken to develop systems to 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

Children who are not able to access spoken language because of hearing loss and who are not exposed to a sign language can be considered to be in a situation of language deprivation. Here we define language deprivation as an environment in which a child does not have maximal access to direct and indirect language. While any child can experience deprivation from access to a full language—for example, if a child has a disability that affects their locomotive functions (for a discussion on walking and language, see Walle &

Campos 2014)—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 is responsible for a host of maladies, including impaired social and cognitive functioning, and is a leading cause of traumatic experiences for many deaf and hard of hearing people (Hall 2017, Hall et al. 2019).

Advocacy groups who support ensuring that all deaf children have accessible language environments have recently 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 (LEAD-K) laws. Pushes for LEAD-K laws have partially been inspired by a recognition that deafness itself does not impair cognition or language; rather, language deprivation does (M.L. Hall et al. 2017). The idea behind LEAD-K laws is that a committee of experts will monitor the language development of deaf children aged 0–5 using the best available assessments. These laws do not specify which language(s) is to be used; their scope is limited to evaluating language acquisition in a population susceptible to 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, to date, few adequate assessments exist for monitoring sign language acquisition in deaf children younger than 5 (for a discussion on this topic, see Henner et al. 2018). Most of the available assessments are checklists, which are often completed by hearing signers who themselves may not be proficient in the language they are assessing and who may use normative hearing lenses when interpreting data regarding sign language and communicative behavior.

Part of the challenge in creating new assessments to measure language acquisition in signing deaf children is that despite almost 40 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 nonsigning 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 the 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 the data often resemble 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 et al. (2017) demonstrated that the amount of variability that language-deprived children likely brought to the assessment results required 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 arise from the fact that existing data and assessments do not sufficiently account for 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 because 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 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 (adult) signer responses from individual to individual, which made variability management in the assessment data and norming of the assessment difficult.

While dialectal variation in sign languages has been studied for approximately 50 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) asked, “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 includes some elements from a natural sign language but that is 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—a process known as translanguaging.

Translanguaging:

process by which people integrate different ways of communicating seamlessly (e.g., switching between different languages or dialects)

In spoken language assessment studies, some researchers, such as Shohamy (2011), exhort us to acknowledge that fair assessment of languages is an issue of justice, and Schissel et al. (2018) stress that monolingual, closed-type language assessments do not really examine the multifaceted translanguaging that any multilingual language user manages in everyday discourse. 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 et al. (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” (Kusters et al. 2017, p. 224). In

this work, they reference simultaneous communication—the act of speaking and signing at the same time—but their observation can also apply to concepts like fingerspelling, gesturing, and 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 among deaf people and in those between deaf and nondeaf people (De Meulder et al. 2019).

Simultaneous communication:

an artificial combination of signs and speech in which the spoken language dominates exclusively

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 that 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 multilingualism because, 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, the studies that have been conducted 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 noted above, that kind of deaf child represents less 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?

Bimodal bilingualism:

the use of languages in two modalities (e.g., a sign language and a spoken or written language)

Researchers of multilingualism recognize that maintaining multilingualism in children requires a community of multilinguals. Linton (2004) has posited 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 toward monolingualism (e.g., a child in an immigrant family

who speaks English exclusively). Linton 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, deaf children are most likely to learn a sign language if they are part of a bimodal bilingual community.

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 who have no prior knowledge of deafness need support from their local and educational environments to find such a community. However, many states have moved toward structures that support listening and spoken language exclusively and have phased out structures that support sign language acquisition. For instance, North Carolina used to have early intervention preschools focused on critical mass socialization and language acquisition in deaf and hard of hearing children, but all of those schools closed as parents moved toward 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 a natural sign language as a language for their deaf and hard of hearing children seems to be dwindling. This trend has been accelerated by a push by medical and educational professionals to stop using sign languages 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 transitioning of isolated deaf and hard of hearing children into 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. Many deaf and hard of hearing children who sign 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 that exclusively provided 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. For much of the twentieth century, residential schools in the United States (and elsewhere) enacted policies that banned the use of sign languages among deaf and hard of hearing children; nonetheless, in the face of threats of physical and emotional violence, these children often created signing communities among each other (Anglin-Jaffe 2013). Yet Anglin-Jaffe (2013, p. 267) 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 United States and elsewhere] were the result of necessity and were opportunistic, rather than reflective and planned.

The loss of functioning sign language communities that resulted from the decline of the traditional pillars of sign language transmission—the schools for the deaf—also led to decreased numbers of clubs for the deaf and fewer sports programs for the deaf (Bahan et al. 2008, Gannon 2011). With the movement toward 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 that deprioritize sign language acquisition by deaf children, hearing people make up a large proportion of new signers. One group comprises hearing parents with hearing children who are trying out baby sign language, a simplified lexicon of signs that have limited connection to the natural sign languages they are based on (Chen Pichler 2016). Another group consists of 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 over who owns the language and who gets to be spotlighted by the media and communities for using sign language publicly. Robinson & Henner (2018) have detailed additional conflicts between the deaf communities that sign and institutions of higher education that provide sign language classes to their students. Relevant issues include determining 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. 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 by their deaf, signing parents since birth, we have shown that some aspects of language acquisition apply in parallel across signed and spoken languages. We also have discussed some ways in which the modality of transmission could have an effect: for example, in determining the timing of a child's first linguistic words or in the ways in which the physical space around a signer is used to indicate referents. We also have shown 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 had some such exposure.

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 because 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, some people 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. However, there are many challenges to these efforts, including difficulties of assessment and limited opportunities to create the necessary critical mass of a community with fluent signing peers and role models.

CODA/KODA (child/kid of deaf adults):

a hearing offspring raised in a deaf-parented, signing family

5.2. Additional Areas for Research on Sign Language Acquisition

While there has been research in the areas described above, certainly much more study is needed. In the subsections below, we review a few additional areas into which future research might delve.

5.2.1. Bimodal bilingualism.—Approximately 80% of the children of deaf parents are hearing. Many of these children 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) has pointed out that many children of deaf parents (known as CODAs or KODAs) feel like they move between communities and often consider themselves as not belonging fully to either. As many CODAs lack the critical mass environment to fully acquire their sign language, they may display variable acquisition of their sign language but nonvariable acquisition of their spoken language; nonetheless, they may indicate 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 CODAs 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).

5.2.2. Second-language acquisition.—In recent years, there has been increased research interest regarding 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, such as handshape discrimination, which is a salient component of sign language phonology.

Sign language phonology:

the study of the rule system underlying the form of signs

While a growing number of studies have looked at second-language signers taking courses for general interest or for language requirements, virtually none have considered the second-language 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.

5.2.3. Ethnographic approaches.—Because of the variety of environments and conditions under which sign languages are acquired, Hou & Kusters (2020) have recommended that linguists employ linguistic ethnographic documentation methods whenever possible. The focus of linguistic ethnography, according to Hou & Kusters (2020, p. 340), is “viewing language as a culturally and socially constituted and situated practice.” More to the point, language—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 & Kusters have pointed out that linguists should also examine what Kusters et al. (2017) called the “semiotic repertoire” of deaf and hard of hearing children. Such examination should consider a wider range of communicative behaviors that is 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 70 years of the field. Many of these changes were fueled not only by developments in technology but also by sociocultural 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 1913 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, our responsibilities include 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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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 many deaf people the home is not the primary source of this community; rather, deaf people are enculturated into deaf communities through schools, clubs, events, and other community activities. As a cultural community, members of the deaf community are threatened when their language and culture face the possibility of incursion from outside sources.