22

Sign language acquisition studies

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22.1 Introduction

In this chapter,[1] I overview aspects of sign language acquisition studies conducted over the past twenty years, and speculate on the future of such studies. I have organized the research into five themes, according to some of the goals of these works. These themes are as follows.

(1) *Exploring the parallels between sign and spoken language acquisition.* In this category I include a variety of studies which show that sign language acquisition takes a similar path as spoken language acquisition, under comparable input conditions (i.e. children whose parents sign to them fluently from birth). Such studies serve to drive home the point that sign languages are fully natural languages and by implication, are deserving of all the rights associated with full natural languages.

(2) *Explaining the differences between sign and spoken language acquisition.* In this category are studies which note potential differences in the path of acquisition of sign and spoken languages, and attempt to account for them, often by appealing to the modality. In some cases the differences are quite straightforwardly due to the modality (e.g. although sign phonology and spoken phonology have abstract principles in common, they are deeply rooted in modality differences); in others, a good argument has been made that ties the difference to a particular aspect of the modality.

[1] This chapter is a revised version of 'Sign language acquisition studies: Past, present and future' (Lillo-Martin 2008), published in the online proceedings of the conference on Theoretical Issues in Sign Language Research 9, held in Florianópolis, Brazil in December 2006. I sincerely thank Ronice Müller de Quadros and the organizing committee of TISLR 9 for inviting me to give the presentation on which this chapter is based.

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(3) A. *Using sign language acquisition data to inform us about sign language grammar.*
B. *Using sign language grammar to inform us about sign language acquisition.*
These two categories are grouped together to emphasize the importance of a strong, reciprocal relationship between studies of grammar and studies of acquisition. Studies in this category show how acquisition studies can bear on theoretical questions in grammatical analysis, and how grammatical developments can lead to new questions or reanalysis in acquisition studies. Such relationships between acquisition and grammar are not unique to sign language studies, of course, but sign language researchers can and do profitably participate in these kinds of works.

(4) *Using sign language acquisition data to inform us about theories of language acquisition.* Again, sign language research is not alone in pursuing the goal of developing and testing explicit theories of how language acquisition proceeds, but it has much to contribute to such goals. It is particularly important to include sign languages in the database of language acquisition facts which theories strive to explain, since any such theory would have as its goal providing an explanation for the ability of *any* child to learn the natural language he or she is exposed to.

(5) *Using sign language acquisition data to tell us about the nature of language.* Sign languages and deaf communities allow us to understand in more detail the nature of language since, due to experiments of nature, they sometimes reveal what happens to language in extreme circumstances. Information about what emerges is of great significance to theories of language.

Of course, many studies fall into more than one of the categories above, and others may not have been specifically directed at any of these topics. However, I think it can be useful to take this type of view and examine the broader impacts of studies, whatever their original goals were. The overview provided here is not meant to be exhaustive, but selects examples of studies falling into each theme, to give the reader an idea of directions and possibilities. Additional research in all of these areas is eagerly anticipated. Before discussing these five themes I provide a brief background.

22.2 Background

Any study of the acquisition of sign languages must begin with information regarding the participants and their language-learning situation. Unlike the vast majority of children, deaf children typically do not receive (accessible) linguistic input from birth. Only about 5 per cent of deaf children are born

to deaf, signing parents (Mitchell & Karchmer 2004). These children are the focus of much research on sign language acquisition, since their input conditions are relatively comparable to that for children learning a spoken language. Most of the studies described here have been conducted with children in this condition, unless otherwise specified (primarily in theme 5). Other deaf children can be studied to gain a better understanding of the effects of delayed or imperfect input on the course of language acquisition (see Goldin-Meadow Ch. 9 for some discussion of the 'homesigning' sometimes produced by deaf children with no sign language model).

The sign languages under investigation here are natural languages, distinct from the spoken languages of the surrounding hearing communities. Most of the examples discussed here come from American Sign Language (ASL), and there are some examples from other sign languages including Brazilian Sign Language (LSB), and Sign Language of the Netherlands (SLN). It will be useful for the reader to understand that the sub-lexical (phonological) structure of individual signs is typically described in terms of handshape, location, and movement. In the research literature, signs are glossed using upper-case words from a spoken language with approximately the same meaning, with additional notational devices to indicate relevant modifications such as agreement and reduplication. Non-manual markers (facial expressions and body position) are usually noted on a line above the glosses which indicates their extent.

22.3 Five themes

22.3.1 Exploring the parallels between sign and spoken language acquisition

In this category I include research which aims to show that a particular sign language 'is a language' and is acquired on a par with spoken languages (see Lillo-Martin 1999, Newport & Meier 1985 for reviews of some of this research).

One clear example comes from the work of Laura Ann Petitto. Her body of research makes the strong claim that sign language is acquired in exactly the same way as oral language. For example, in one of her own overviews she claims, 'Deaf children exposed to signed languages from birth acquire these languages on an identical maturational time course as hearing children acquire spoken languages' (Petitto 2000: 43). Milestones claimed by Petitto to be 'identical' in signing and speaking children include babbling (7–12 months of age); the first-word stage (11–14 months); and the first two-word stage (16–22 months). Furthermore, Petitto says, 'social and conversational patterns of language use ... as well as the types of things that they "talk" about ... have demonstrated unequivocally that their language acquisition follows the identical path seen in age-matched hearing children acquiring spoken language' (Petitto 2000: 44).

Similar reports that the general path of language acquisition is similar for signed and spoken languages can be found in studies of sign languages other than ASL; for example, Italian Sign Language (Caselli & Volterra 1990), Brazilian Sign Language (Quadros 1997), and Sign Language of the Netherlands (Van den Bogaerde 2000), among others.

Consider the case of babbling. Research on the babbling of hearing children shows that vocal babbling (repetitive, syllabic sounds such as 'baba') emerges around 6 to 8 months of age, and continues (with certain changes) until it disappears as words come in (see also Vihman *et al.* Ch. 10). Petitto and Marentette (1991) similarly observed that deaf children exposed to sign language produced 'manual babbles' during this same period. They found manual babble activities occurring as 32–71 per cent of the gestures produced by two deaf children studied at 10, 12 and 14 months of age. Petitto and Marentette argued that manual babbling is like vocal babbling in satisfying three conditions. First, the babbles employed phonetic units restricted to those used in signing; second, they showed syllabic organization; and third, they were used non-communicatively. Petitto (2000: 45) concludes, 'the discovery of babbling in another modality confirmed the hypothesis that babbling represents a distinct and critical stage in the ontogeny of human language.'

The similarities in babbling between children learning a sign language and children learning a spoken language were emphasized and expanded on in studies by Meier and Willerman (1995) and Cheek *et al.* (2001), although they propose that babbling in both modalities is a consequence of motor development rather than an expression specifically of the linguistic faculty. Like Petitto and Marentette (1991), Meier and Willerman and Cheek *et al.* observed manual babbling in children exposed to sign language: they observed five deaf children at approximately 7, 10 and 13 months and reported manual babbling in between 25 and 93 per cent of all gestures produced. However, unlike Petitto and Marantette, who reported that manual babbling was much less frequent in the three hearing subjects they studied (about 20 per cent of gestures), Meier and Willerman and Cheek *et al.* report that the five hearing children not exposed to sign language whom they studied produce manual babbles much like those of deaf children, at rates of 44–100 per cent of all gestures.

Both of these studies find strong similarities between children developing sign language and children developing spoken language. Both also connect their findings to theoretical explanations which stress similarities in the development of sign and spoken languages, although their theories are different. Both are thus good examples of parallels between sign and spoken language acquisition.

Why is it important to demonstrate that deaf children with native signing input acquire sign languages along an 'identical' – or even parallel – time course as that of children learning spoken languages? For Petitto, the implication of this finding is that the human propensity for language is not modality dependent. Rather, the mechanisms that make language development possible apply equally well to a visual–gestural language as to an auditory–vocal language. As we seek to understand how language acquisition is possible, our theories might need to be changed to accommodate such modality independence.

Such conclusions about the nature of the language-acquisition mechanisms would not be warranted if sign languages were considered anything less than full, natural human languages with the same biological foundations as well as similar social environments. Nowadays, well-informed linguists and psychologists do not question the status of sign languages. However, there are still many people who are not well informed on this subject and oftentimes they are in positions which allow them to make decisions regarding the welfare of (potential) sign language users. For this reason, the point cannot be stressed too much.

22.3.2 Explaining the differences between sign and spoken language acquisition

This category of research focuses on where sign language and oral language acquisition might be different, and attempts to explain this as, for example, effects of the modality. Such modality effects may include iconicity and motor/articulatory development, among others.

An example of research considering the role of modality in explaining differences between sign language and spoken language development looks at the appearance of first signs versus spoken words. Numerous authors have claimed that first signs appear before first words by as much as six months, and the current enthusiasm for 'baby signing' in the hearing population is based on this idea. Meier and Newport (1990), in a thorough review of the literature documenting acquisition milestones for sign versus speech, came to several important general conclusions about the similarities and differences. First, the 'advantage' for signs seems to be about 1.5 to 2.5 months (roughly age 8.5 months for first signs versus age 10–11 months for first words), and this difference is seen only with the earliest context-bound signs, not purely symbolic ones. Second, they argued that the sign advantage exists only for first words, not for first word combinations (early syntax). Finally, Meier and Newport offered a possible explanation for the sign advantage in terms of 'peripheral' mechanisms – that is, the mechanisms used in the production and/or perception of signs versus words. They provided reasons to think that it takes longer for speaking children to develop sufficient articulatory control to produce utterances which can be recognized as words than for signing children to develop comparable control. Thus, the difference boils down to a *disadvantage* for spoken language at the earliest stages of lexical development.

Another body of research which examines effects of modality on sign language acquisition concerns early sign phonology. Researchers have studied which components of signs children are more or less accurate with, and found that in many cases children's development can be explained by appealing to the development of motor and perceptual mechanisms. Both of these explanations emphasize the role that modality plays in sign language acquisition. It may well be that modality plays an especially important role in explaining patterns of phonological development.

For example, several researchers find more errors on handshape than on location in early signs. Young children's first signs tend to use a handshape with all fingers extended, whether spread or lax (), or with the fingers all in a fist (), or with just the index finger extended (). These handshapes will often be substituted for others in target signs which use more complex handshapes. However, the location of signs is much more frequently produced correctly. A possible explanation offered for this pattern is that fine motor control is needed for handshape, but this develops later than the gross motor control which is needed for location (Cheek *et al.* 2001, Conlin *et al.* 2000, Marentette & Mayberry 2000). On the flip side of the coin, researchers suggest that it may be easier for children to perceive differences in location as compared with different handshapes, also contributing to the earlier accuracy with the former.

Researchers have also noticed that children's earliest signing often involves movement repetition (Meier 2006). This can be directly related to repeated movements in motoric development such as the stereotypes of repeated kicking or arm waving. Meier (2006) also observes that children sometimes produce certain two-handed signs with incorrect movement. In these signs, the target form has one hand acting on the other as a base. However, children may erroneously use identical movements on both hands. Meier proposes that such errors may be explainable by reference to a phenomenon known as 'sympathy', whereby children have difficulty inhibiting the action of one hand when the other is active.

Meier (2006) argues that studying articulatory factors in the development of sign phonology is important for at least two reasons. First, knowing which effects come from articulation helps identify those which require other explanations. Second, he suggests that articulatory factors may promote particular kinds of linguistic organization – especially for children – which might lead us to think that these effects may reflect not only different levels of performance with grammar (for signing and speaking children), but also different competences.

Identifying whether children's developing ability to produce signs reflects performance or competence differences is difficult, but there are some cases for which an articulatory/perceptual explanation is probably unwarranted. For example, Conlin *et al.* (2000) and Marentette and Mayberry (2000) suggest that some location errors are not consistent with a motoric explanation, but rather indicate that the child has misrepresented the target location of certain signs. This suggestion reinforces Meier's comment that understanding articulatory factors helps to identify those aspects of the development of signs which require alternative explanations.

These examples have emphasized the modality dependence of the proposed explanations of phonological development. However, it should be pointed out that articulatory factors may well explain some aspects of early phonological development in spoken languages as well (e.g. MacNeilage & Davis 1990). 'Modality' effects are present in both modalities, then, and in this sense attending to modality is not only a way of explaining how sign language development and spoken language development are different, but again how they are alike.

22.3.3 The reciprocal relationship between sign language grammar and acquisition

22.3.3.1 Using sign language acquisition data to inform us about sign language grammar

When competing grammatical models make different acquisition predictions, developmental data can be used to test the models. This is a principle of spoken language research as well as sign language research, although it has only been applied in sign language research relatively recently. Here I will discuss two examples, the first one only briefly.

Conlin *et al.* (2000: 52) state, 'Studies of early sign development ... may help us decide between competing models of the adult language.' For example, they suggest that children's early signs may help in the determination of canonical signs. The usefulness of looking at child signing for this purpose is already clear. Researchers have identified certain handshapes as phonologically unmarked (for example, only these handshapes may appear as the base hand of certain two-handed signs). It has long been recognized that the earliest occurring handshapes come from the set of unmarked ones in the adult language (Battison 1978). Conlin *et al.* also hope that analyses of children's signing can help in the evaluation of models of adult grammar, in particular when certain models are better able to capture the generalizations about children's productions. Karnopp (2002) takes such an approach in her investigation of the development of phonology in Brazilian Sign Language. She adopts the Dependency model of van der Hulst (1993) and finds that it makes strong predictions about sign phonology acquisition which were borne out in the data she analysed from one deaf signing child. For example, the Dependency model identifies the finger selection aspect of handshape as a 'head', and the finger configuration aspect (e.g. whether the fingers are open or bent) as a 'dependent', and therefore predicts that finger configuration will be acquired only after finger selection. Karnopp concludes that the sign

language acquisition data she analysed provide strong support for the theoretical model used.

A second example comes from the area of syntax. Lillo-Martin and Quadros (2006, in press) investigated the acquisition of topic, focus and wh-questions in American Sign Language (ASL) and Brazilian Sign Language (LSB). They argued that the child-language data helps to reveal the correct analyses of these structures. We will start with a few examples.

In both ASL and LSB, certain signs can appear in a sentence twice, once in their usual position and again at the end of the sentence, to indicate emphasis on that sign. These constructions are often called 'doubling'. Some examples are given in (1) (examples in this section are grammatical in both ASL and LSB; they are reproduced from Lillo-Martin & Quadros in press).

(1) a. JOHN CAN READ CAN
'John really CAN read.'
b. MARY FINISH GO SPAIN FINISH
'Mary ALREADY went to Spain.'
c. I LOSE BOOK LOSE
'I did LOSE the book indeed.'

Also in both of these languages, the same category of signs which can occur in doubling constructions can occur in the sentence-final position only. These sentences can be referred to as 'final constructions'. Examples are given in (2).

(2) a. JOHN READ CAN
b. MARY GO SPAIN FINISH
c. I BOOK LOSE

According to one type of grammatical analysis, doubling and final constructions are related. Both are used for emphatic focus, and according to these theories, their derivations are related (Nunes & Quadros 2006, 2007, Petronio 1993, Wilbur, 1997).

However, there is another kind of focus, known as new information focus (for short, 'I-focus'). Unlike the emphatic focus, this places the focused material in the sentence-initial position (Lillo-Martin & Quadros in press, Neidle 2002). Such new information focus is used, for example, in the context of answering a question, as in example (3). The basic word order (SVO for both ASL and LSB) is also permitted in such contexts.

(3) S1: WHAT YOU READ?
'What did you read?'
I-focus
S2: BOOK STOKOE I READ
or I READ BOOK STOKOE
'I read *Stokoe's book.*'

Table 22.1. Summary of results – Lillo-Martin and Quadros (2005)

Child	Age of acquisition of each structure I-focus	Doubling	Final
Aby	1;9 ***	2;1	2;0
Sal	1;7 ***	1;9	1;9
Ana	1;6 **	2;0	2;1
Leo	1;10 ***	2;1	2;2

**$p<0.005$
***$p<0.001$

According to the proposals of Lillo-Martin and Quadros, I-focus is derived syntactically through a completely different mechanism from that of emphatic focus. They predicted that if their analyses are correct, children would acquire doubling and final constructions together, since these are both instances of emphatic focus, but these might be acquired independently from I-focus, since it is derived differently. Lillo-Martin and Quadros (2005) tested their prediction by looking at the longitudinal spontaneous production data from two deaf children acquiring ASL as a native language (Aby, Sal), and two deaf children acquiring LSB as a native language (Ana, Leo). All four children have deaf, signing parents. They were videotaped regularly starting before the age of 2. Their utterances were examined to determine when they started productively using I-focus, doubling and final constructions. The results of this study are summarized in Table 22.1.

It is clear that the children did acquire doubling and final constructions together, but these two constructions were acquired later than I-focus (highly significant by Binomial Exact Probability). These results can be taken to support theoretical analyses which relate doubling and final constructions in ASL and LSB over analyses which give them distinct derivations.

The two examples presented have shown areas in which data from sign language acquisition can bear on theoretical questions of grammatical analyses. For both sign and spoken languages, there are many cases in which different theoretical proposals do not obviously make different predictions for acquisition, so acquisition data may not bear on such issues. However, other cases lead to expectations of ordering, such that phenomena that are related in the adult grammar can be expected to be acquired together; or phenomena that are separated are expected to be acquired separately. In some cases, specific ordering predictions can be made, such as when a particular construction has others as prerequisites (for discussion of examples, see Snyder & Lillo-Martin in press). In these cases, language acquisition data can provide important support – or disconfirmation – of theoretical proposals.

22.3.3.2 Using sign language grammar to inform us about sign language acquisition

Category 3A looks at ways in which acquisition studies can inform studies of grammar. The present category of studies goes in the opposite direction, using new developments in grammar to inform acquisition studies. These two categories are closely related, since both show the close relationship between acquisition studies and linguistic theory, and in fact there is often a spiral effect such that both fields benefit from and influence each other in the same domain.

An example of this category comes from studies of children's development of word order. Coerts and Mills (1994) undertook a study of two deaf children's development of the subject – object – verb word order in the Sign Language of the Netherlands (SLN), between the ages of about one-and-a-half years to two-and-a-half years. They found that children showed a great deal of variability in their ordering of subjects and verbs. This variability in the acquisition of word order was puzzling and left without a full explanation. Then, Bos (1995) identified SLN as having a process known as Subject Pronoun Copy (SPC) (cf. Padden 1988). According to SPC, the subject of a sentence (glossed INDEX) can be repeated as a pronoun in the sentence-final position, as shown in (4a). However, it is also possible for the sentence-initial subject to be unexpressed (this is a general process found in SLN as well as in other sign languages). When the sentence-initial subject is left unexpressed, but the sentence-final subject pronoun is present, the surface order is verb – subject, as in (4) (examples from Coerts 2000).

(4) a. $\text{INDEX}_{\text{beppie}}$ FILM $\text{INDEX}_{\text{beppie}}$
'Beppie is filming'.
b. CRY $\text{INDEX}_{\text{dolls}}$
'The dolls are crying.'

Coerts (2000) then undertook to reanalyse the child data previously studied by Coerts and Mills (1994). First, it was clear that the children knew that SLN permits null subjects, as they used them appropriately and frequently. She then employed a fairly strict criterion for acquisition of the SPC process: the child must use a sentence-final subject pronoun in a sentence with an overt subject to show that they had acquired SPC. Once the children showed they had acquired SPC, at around two years, any later instances of verb – subject order in which the post-verbal subject is a pronoun were considered instances of SPC.

Using this reanalysis, Coerts found that the majority of the previously 'unexplained' word order examples were in fact explainable, and children's acquisition of word order was more in line with expectations. Coerts concludes:

knowledge of the adult language steers the choice of analysis procedures used for acquisition data ... an analysis procedure that takes subject pronoun copy into account results in a much clearer picture with respect to the acquisition of subject and verb position. (Coerts 2000: 107)

A project by Chen Pichler (2001a, 2001b) resulted in similar findings for ASL, and her study goes beyond consideration of SPC alone to include other instances of word order changes allowed in the adult grammar. Although there had been early claims that children strictly followed the adult basic SVO word order, Schick (2002) found no evidence for this strategy in two year olds, concluding instead that children's word order was 'random'. Chen Pichler used a similar approach to Coerts' and determined when children's use of verb–subject order could be considered cases of SPC, and when their use of object–verb order could be considered as following from adult-like word-order changing operations (for example, object shift).

Chen Pichler established clear criteria for counting utterances as legal order changes. For example, post-verbal subjects must be pronouns to be considered SPC; preverbal objects occurring with verbs marked for aspect, spatial location or handling classifier were considered instances of object shift. Using these criteria, Chen Pichler found that children's word order use demonstrates regularity in following grammatical options much earlier than previously thought. Thus, taking into consideration such developments in the syntactic analyses leads to more reliable acquisition studies.

Both of the examples provided illustrate the importance of considering the target adult grammar when studying language development. The goal of studying language acquisition is to understand how children become adult-like in their knowledge of language. When children differ from adults, an explanation for this difference must be sought. But sometimes researchers examining child development overlook developments in the study of the adult grammar. The description of the language children are exposed to, and will ultimately be users of, changes as researchers gather more data and form hypotheses which point in new directions for further study.

22.3.4 Using sign language acquisition data to inform us about theories of language acquisition

In the previous section, we considered theories of adult grammar and their relationship to studies of language acquisition. Here, we turn to theories of the process of acquisition. Alternative theories of how language develops can be tested and refined using real-time acquisition data from sign languages just as they are tested using data from spoken languages. These theories are general theories about language acquisition, not particular to sign languages (and in general, not developed on the basis of sign language data).

As an example, consider the Verb Island Hypothesis of Tomasello (1992, see also Tomasello Ch. 5). According to this model of language development, children go through an early period in which verbs are individual

'islands' of organization. It predicts that certain patterns (such as word order or inflections) will be found with individual verbs, although there will not be evidence that a whole class of verbs behaves in the same way. This early period of verb islands would begin when children are starting to use two-word combinations, but generalizations would be apparent some months later (say, around the age of two years for most children).

In support of this proposal, Morgan and Woll (2002: 275) conclude: 'we found no evidence for the child's exploitation of an abstract set of verb frames before 3;2. The child appeared to build argument structure afresh with each new verb and these verbs were uniquely tied to their communicative function.' Only later, they argue, do children build rules which hold over multiple verbs.

Schick (2002) also examined the verb island hypothesis in her study of early sign combinations. She found only limited evidence in support of the hypothesis, in that some of the children she studied showed consistent ordering patterns with some verbs. However, she found that in many cases, word order was quite varied even for individual verbs. This would appear to show neither verb islands, where individual verbs behave alike, nor evidence of word order rules which apply across the board to all different verbs.

In this context, we can return to the findings of Coerts (2000) and Chen Pichler (2001), reported in section 22.3.3.2. These authors reported systematic use of word order by young signing children when grammatical alternations allowed by the adult grammar are also considered. According to their results, children's signing is neither random nor organized into verb-specific islands. Rather, the rules which characterize the adult grammar are also found in this domain of children's language. Whether the data analysed by Morgan and Woll (BSL) and by Schick (ASL) are amenable to the same conclusion remains to be seen.

Another example can be raised from Reilly's study of the development of non-manual marking (as summarized in Reilly 2006). Reilly and colleagues have been interested in children's development of the use of linguistic non-manual markings versus often very similar affective and communicative facial expressions. Reilly sees this project as, in part, a test of the degree to which language is an innately specified independent cognitive function, because it assesses the separability of language from other cognitive functions. She suggests that an approach to language acquisition in which language is seen as a general cognitive system would predict that children would readily recruit their prelinguistic affective and communicative abilities in the service of linguistic functions, and thus acquire non-manual markings together with their co-occurring manual components. On the other hand, 'children would approach each linguistic structure and its morphology de novo' in a more modular approach (Reilly 2006: 268).

This question is clearly addressed with data from the development of non-manual marking of negation. The negative non-manual marker used in adult

ASL (indicated with 'neg' on the line above the sign glosses) is essentially like the negative headshake used communicatively by very young children, whether exposed to sign language or not. Negation can be expressed in adult ASL by a negative sign co-occurring with this negative headshake, or even by the negative headshake alone, as in the examples in (5) (examples from Reilly 2006; the notation 't' indicates a topic non-manual marker).

(5) t neg
a. BOOK READ ME CAN'T
I can't read the book.'
neg
b. ME EAT ICE-CREAM
'I don't eat ice cream.'

Reilly and her colleagues found that deaf children acquiring sign languages, like hearing, non-signing children, produce communicative negative headshakes by about 12 months of age. The first negative signs, NO and DON'T-WANT, emerge at 18–20 months, followed by other negative signs up to age 3;6. For seven of the eight negative signs investigated, Reilly found that the manual sign first appears without the required co-occurring headshake. Several months later, the negative headshake is used together with the negative signs. This separation occurred despite the fact that the negative headshake was used prelinguistically by these children to mean essentially the same thing. Reilly concludes that children treat the negative headshake as it is used in ASL as a linguistic element which must be analysed independently. This would not be expected under the theory of language as a more general cognitive system, but only by the modular approach.

The two theories under discussion in this section – the verb island hypothesis and the modularity of language with respect to other cognitive systems – can be further tested using data from sign language acquisition, as can other theories of language development. In some cases, sign languages provide a new form of data, unavailable using the study of spoken languages alone. The study of the non-manual marking of negation is one such case. In other cases, sign language research provides needed breadth and diversity of languages brought to bear on a theoretical question.

22.3.5 Using sign language acquisition data to tell us about the nature of language

The study of sign languages and deaf communities can provide information about language development under extreme circumstances which are not found elsewhere. This is a unique contribution to our understanding of the nature of language and the mechanisms which make language acquisition possible. Researchers studying such circumstances have a very special role to play in advancing scientific knowledge.

Examples of such contributions come from the study of recently developed sign languages, late first-language learners of sign languages, learners with degraded input, learners of invented sign systems, homesigners, etc. These studies tell us about the ranges of possible languages, the path and properties of language emergence, 'resilient' properties of language which appear in the absence of evidence, critical period effects in language acquisition, how the learner modifies the input she or he receives, etc. The range of outcomes from such studies is so broad and important that there is no way to give it justice here. However, I will give one example to whet the reader's appetite; for a fuller meal please see the original works in this area.

Late first-language learners are virtually unheard of in spoken language communities, but not so in signers. Since about 95 per cent of deaf children have hearing parents (Mitchell & Karchmer 2004), it is not surprising that the vast majority are not exposed to sign language from birth. Sometimes, parents decide to educate their children orally (without sign language); some of these children are later exposed to a sign language after having learned only a portion of spoken language (often, not enough to communicate effectively). In other cases, children experience late exposure to sign language simply because the resources for exposing the child earlier were not available to the family. For various reasons, children may be exposed to sign language only after the age of two years, or five years, or twelve years, etc. It is not well understood exactly how such delayed linguistic exposure affects language development, but it is clear that there are some effects.

Morford and Mayberry (2000) provide an overview of some of the research investigating effects of delayed input on (first) language acquisition and processing. Most of this research has been conducted with adults whose exposure to sign language began at different times. By studying adults, researchers investigate the outcome of the language-development process, after years of experience have made the use of sign language a well-practised, familiar skill.

Overall, studies with adults whose age of first exposure to ASL was between approximately 4 and 16 years, as compared to native signers (those with exposure from birth), have consistently reported differences in both production and comprehension tests. Furthermore, studies looking at language processing have also found differences for different age-of-exposure groups. The degree of an effect is not uniform across different studies. For example, Newport (1990) found that later learners (those with exposure after age 12) scored lower than 'early' learners (those with exposure between 4 and 6), who in turn scored lower than native signers, on tests of ASL morphology production and comprehension. However, the three groups were not different on a test of basic word order. Similarly, Emmorey *et al.* (1995) found that late learners were different from native signers in a study of online processing of verb agreement, but not in aspect marking.

Mayberry, Lock and Kazmi (2002) extended such findings by comparing late first-language learners of ASL with late *second*-language learners of ASL: late-deafened adults whose exposure to sign language began in the same period as the late first-language learners (9–13). Their study asked participants to judge the grammaticality of complex sentences. The effects of late exposure were strongest for late first-language learners; late second-language learners performed close to natives.

These results reinforce the idea that early exposure to language is crucial for its normal acquisition. But what factor(s) will be most affected by delayed input when other factors are relatively spared? Newport (1990) hypothesizes that young children have the ability to detect patterns of the 'correct grain size' for the development of complex morphology, while the greater cognitive capabilities of older children or adults actually interfere with this type of analysis, thus leading to the differences in performance on syntactic versus morphological tests she observed.

An alternative proposal is put forth by Morford and Mayberry (2000), who emphasize the differences in phonological processing skills for native or early learners versus late learners, and suggest that what is missing for late learners is what is learned by those with native exposure in the first year of life. In particular, a great deal of phonological development takes place during this period, and studies show infants' sensitivities to phonological information from a very early age. What Morford and Mayberry propose is that 'the true advantage of early exposure to language is the development of the phonological system prior to the development of the lexical–semantic and morpho-syntactic systems' (p. 124). Problems in phonological processing can have 'cascading' effects on other levels of language processing, showing up in the various areas of effects of language delay.

The study of late learners has much to contribute to theories of language and language development. The effects of delayed input should not be random or general, but rather should fall along fault lines which the grammar makes available. Theories of why children are better language learners than adults are must make reference to crucial aspects of the language-learning mechanism. Such theories have little data to go on outside of the realm of late first-language acquisition in deaf children, since second-language learning appears to have different constraints and consequences in some ways.

22.4 Research which cuts across themes

Many areas of sign language acquisition research touch on more than one of the themes discussed above. One area of research which touches on all of the themes is the acquisition of verb agreement, which has been a subject of attention for well over twenty years.

In ASL and other sign languages, subject and object person-agreement is expressed on a class of verbs (such as HELP and ASK) by modifying the initial and final locations of the verb. Agreement with source and goal location in another class of verbs (such as MOVE and GO) takes a similar form, but the endpoints represent location arguments rather than person. A third class of verbs (including LIKE and EAT) takes no agreement marking at all.

Meier (1982) examined the acquisition of verb agreement in ASL in comparison to the acquisition of verbal morphology in spoken languages. He argued that sign language agreement is acquired in a similar fashion as is complex, unstressed verb agreement in some spoken languages. On the other hand, Morgan, Barriere and Woll (2006), in their study of the acquisition of verb agreement in British Sign Language (BSL), argue that 'spatial' aspects of verb agreement in sign language make it unlike that in spoken languages. The form of agreement is not an affix, but a modification of the root, which Morgan *et al.* argue involves a high degree of simultaneity, making segmentation difficult for the young child. Both of these research groups found that children make errors of omission and commission in marking verbs for agreement, until at least the age of three years.

On the other hand, Quadros and Lillo-Martin (2007) found that verb agreement errors were extremely rare, for two children acquiring ASL and two children acquiring LSB. They attributed the differential error rate to a different theoretical view of contexts for obligatory use of verb morphology. They argue that the acquisition data support an approach which identifies verbs needing agreement in particular sentential contexts rather than lexically marking certain verbs as always requiring agreement, a view which is confirmed in studies with adult signers.

Verb agreement has also been studied in late learners, as it seems to be an area of special problems. Adult late learners have been shown to err on using verbal morphology (Newport 1990), and they also have processing difficulties in this domain (Emmorey *et al.* 1995). Studies of verb agreement in late learners provide some evidence that there are specifically grammatical differences between early and later learners as well as proposed processing differences. Berk (2003) studied two children whose exposure to ASL began at the age of six. She found that the later learners were particularly affected in their production of person-marking agreement on ASL verbs. They made numerous errors of both omission and commission, continuing without a decrease in error rate over four years of observation. Other verbal morphology, indicating location agreement, was not affected, as the late learners appropriately used such marking, although the form of location agreement is very similar to that of person agreement. A specifically grammatical deficit would seem to be implicated in order to explain such a difference.

22.5 The future of sign language acquisition research

What does the future of sign language acquisition research look like? Our hope is that future research on sign languages will continue to enhance connections with the questions asked of spoken language acquisition. Theories of language, and of language acquisition, need to accommodate sign language data, so sign language research that informs and benefits from studies of spoken languages is desirable. Even more studies of an enhanced range of populations is encouraged – for example, cross-sign language comparisons, studies of the effects of differences in input quality and timing, etc. Such studies have much to offer, both scientifically and practically.

Suggestions for further reading

Chamberlain, C., Morford, J.P., & Mayberry, R.I. (Eds.). (2000). *Language Acquisition by Eye*. Mahwah, NJ: Lawrence Erlbaum Associates.

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