To appear in A. Cutler (ed). Twenty-First Century Psycholinguistics: Four Cornerstones. Lawrence Erlbaum Press.

1 Biology and behaviour: insights from the acquisition of sign language*

Gary Morgan
Language and Communication Science
City University London

Introduction: Language Acquisition

Evidence from the acquisition of spoken language has fuelled centuries of debate on the biological bases of language behaviour. But language may be acquired through more than one modality. Sign language is acquired in a visual-spatial modality, and as evidence from the course of acquisition of sign languages becomes increasingly available it is possible to ask what parts of language acquisition are modality-general and what aspects are specific to speech or sign. Data on the influence of modality on language acquisition provides important new insights and makes further progress in elucidating the relationship of biology to language behaviour.

One of the major debates in the study of children's language development is the relative influence of nature and nurture (e.g. Tomasello, 2000; Fisher, 2002). What is inside of child (in their nature) versus what is outside of the child (in their nurture) that shapes development? Many researchers (Newport & Supalla, 1980; Newport & Meier, 1985; Meier, 2002 ; Petitto, 1997; Petitto, Katerelos, Levy, Gauna, Tétrault, Ferraro, 2001) have argued that the nature part of language acquisition is the same for children exposed to a sign or spoken language,

* I would like to thank Bencie Woll for the several hours of discussion we have had about ideas contained in this chapter. Thanks also to Ros Herman, Victoria Joffe, Neil Smith, Isabelle Barrière and especially Karen Emmorey for advice in the preparation of this work. I am also grateful to Anne Cutler for her suggestions for the lines of this chapter and also her enthusiasm in pushing me to write to the deadlines. I am also indebted to the audience and other speakers at the 'four corners' workshop at MPI.

while the nurture part is radically different between modalities The modality of sign impacts on how children will exploit their biological capacities for language acquisition.

Additionally, in the same way that research into reasons why some children fail to acquire language has provided valuable evidence for understanding normal language acquisition (e.g. van der Lely, 1990; Leonard, 1998), the documentation of developmental sign language impairments will open up a new window onto the debate into the origins of specific language impairment (SLI).

The grammar of British Sign Language: an overview

Once linguists began to seriously study sign languages they were faced with the inevitable conclusion that language was not synonymous with speech. British Sign language (BSL) is as expressively rich as any spoken language and is unrelated to English. As a natural human language, it has all the linguistic ingredients characteristic of any other language: a lexicon and a 'computational system' (Chomsky 1995: 6, 221) with syntax, semantics, phonology and morphology. In this section I provide a brief overview of selected parts of BSL (for more details see: Morgan, Smith, Tsimpli & Woll, 2002; Sutton-Spence & Woll 1999).

Phonology

A sign can be decomposed into three sets of features: hand configuration, movement and place of articulation. Hand configuration describes the particular shape the hand makes, including the extension or flexion of the fingers and the orientation of the hand relative to the body. This parameter is often labeled simply 'handshape'. The parameter of hand configuration can be described in terms of a hierarchy of complexity, where the 'simplest' handshapes involve the fewest number of features (selection of fingers, contact between fingers etc.) and so have been termed 'unmarked'. In BSL the four main unmarked handshapes have the labels B, 5, G and A and are shown in the context of lexical signs in figures 1-4. [1]

[1] Signed sentences that appear in the text follow standard notation conventions. Signs are represented by upper-case English glosses. When more than one English word is needed to capture the sign's full meaning

Figures 1 –4. Still images of four signs which use unmarked handshapes in BSL labeled B, 5, G and A.

Fig 1 'B' - 'BOOK'

Fig 2 '5' - 'MIRROR'

Fig 3 'G' - 'UNDERSTAND'

Fig 4 'A' – 'MY'

Signs differ in their primary movement (e.g. straight vs. arced) or absence of movement (holds). They may also differ in their local or secondary movement, such as finger wiggling, or opening and closing of

---

this is indicated through a hyphenated gloss. Repetition of signs is marked by '+'. 'IX' is a point to an area of sign space which acts as a syntactic index for referring to an argument in the sentence. Subscripted lower-case letters indicate coindexation.

the hand during transitions between one location and another. Signs are also contrastive in their place of articulation. Some signs make contact with the signer's body, arms, head or face (e.g. fig 4. MY), while in other signs the hands touch each other (e.g. fig 1. BOOK). All signs in BSL are made up of a handshape in combination with the other sign parameters, i.e. different handshapes at different places of articulation with different movements or holds. Signs can share one or more parameter. For example, the signs NAME and AFTERNOON are minimal pairs in BSL as they have identical handshape and movement, but differ in place of articulation (forehead and chin, respectively). For more details of sign phonology see Brentari (2002).

Morpho-syntax

In sign languages, morphological person agreement is realized by the movement of the verb stem between locations in front of the signer, which have been previously indexed as BOY and GIRL. Thus spatial locations act as referential indexes (either the spatial location of the present referent or an arbitrary location assigned to a non-present referent). An example of an utterance with arbitrary syntactic locations is shown in (1). The first IX point is directed towards a location to the front and right of the signer. The signer then signs GIRL and directs the movement of the sign ASK from her own body location. The movement of the verb between locations in sign space is shown in the photo still in figure 5.

(1) BOY_j IX_j $GIRL_k$ $_kASK_j$
'There is a girl and there is a boy (she) asks (him)'

Figure 5 Movement of the verb ASK between two locations in sign space to encode morphological person agreement. Syntactic arguments are given in the previous sentence.

$_{k}ASK_{j}$
'(she) asks (him)'

BSL also uses classifiers or polycomponential forms comprising of both spatial and syntactic information. Classifiers appear in BSL with verbs to encode location and movement of nouns. For example a noun coming from the class of long thin animates, such as a vertically erect person, can be described as moving rightwards in a zigzag manner by selecting a G handshape (with the index finger pointing upwards) and articulating the path of that form through sign space. In addition, signers use classifiers as anaphoric devices. The sentence in English, 'The boy just managed to clear the top of the fence' is produced in BSL by spreading the information across the two hands and face. This simultaneity of production depends on the use of antecedent nouns which licence the classifiers for BOY and FENCE. The face articulates the manner of the movement ('just managed'), the right hand signs the movement of the boy with a classifier and the left hand shows the wall, again through a classifier (See Emmorey, 2003 for more details on sign language classifiers). With this brief background on BSL grammar complete, I turn to discuss the role of modality in sign language acquisition.

Topic 1: Phonological processing

It is argued that children are better language learners than adults despite their limited cognitive abilities (e.g. Newport, 1990). Some have suggested one reason for this is because of their early sensitivity to the prosody of language (Jusczyk, 1997). When the language to be learned is perceived through the eyes, do children continue to be better learners than adults? How are children's abilities in the processing of phonology and their first attempts at producing language altered when the input and phonetics are radically different?

A related line of research to this set of questions is to do with the robustness of children's language acquisition abilities. Many deaf children experience late and impoverished exposure to a first language.[2] The reasons for this are numerous but one major factor is that 90 to 95% of deaf children are born to hearing parents who have no knowledge of sign language or how to modify their communication when interacting with a young deaf child. The question is, if you are in a critical period for language but there is no accessible input, how long can that sensitivity last?

Studying the behavioural differences between late and early sign learners allows one to observe the impact of environment on the biological capacity for language acquisition in an otherwise normal socially stimulating nurture. It is known that deaf children can create the rudiments of a gesture based communication system with their non-signing hearing parents (Goldin-Meadow, 2003) and that if enough individuals come together a full-blown language is created (Kegl, 2002; Senghas, 2003). But what are the outcomes for language processing of late first language acquisition? Mayberry, Lock & Kazmi (2002) addressed this question using a sign 'shadowing' task (repeating a sentence while watching it). Subjects were more able to shadow what they were seeing if they were able to predict signs based on grammatical knowledge and pragmatic context. In order to do this it is crucial that subjects get beyond the phonological level of processing and further into accessing semantic content; however, the high processing demands of the task make this difficult.

Mayberry compared three groups of signing adults. Each group had had at least 30 years experience of American Sign Language (ASL) but differed in their age of first exposure to the language. The early

[2] 'Deaf' here means born with a hearing loss that significantly impacts on the ability to acquire spoken language.

learners were exposed to ASL during 0-3 years, child learners at 5-8 years and late learners between 9-13 years. Mayberry measured the level of sign processing by comparing what the signers saw with what they produced themselves. The results of the study showed that all groups substituted signs either for semantically similar vocabulary (e.g. BROTHER for SISTER) or phonologically similar signs (e.g. the (ASL) minimal pairs, AND for SLEEP). Mayberry found that the late learners made many more phonological substitutions even when the resulting utterances were ungrammatical while the early learners made more semantic errors but still produced grammatically correct sentences.

The results of this study indicate that the effects of late exposure to first language are long lasting. Late sign learners process sign slower and at a more superficial level than native signers. We can interpret these results in relation to the question of whether children are superior to adults as sign learners. It is better to learn a sign language within an early-activated critical period for sign language (see Newport, Bavelier & Neville, 2001 for a wider discussion of critical period). This suggests that the advantage over adults that children have in acquiring a language extends into sign language acquisition also. Children appear to benefit from limited cognitive resources at the start of language acquisition as this forces them to carry out a componential rather than holistic analysis of their language and presumably lay down more robust phonological representations in the process. These differences surface in processing abilities 30 years after first exposure and discriminate between different groups of otherwise fluent signers (see Morford & Mayberry, 2000; Kegl, 2002 for more discussion of these effects). Early exposure to sign is crucial in allowing the biological component of language acquisition to switch on and maximise processing abilities. As well as the developing phonological system, phonetic constraints appear during early language acquisition. The phonetic inventories of sign and speech differ radically but for both modalities children have to master complex motoric behaviours to communicate successfully.

Research on children acquiring a native sign language has revealed systematic differences between the child's production and the input to the child from surrounding adult models. These differences have been documented in relation to handshape, place of articulation and type of movement (e.g. Cheek, Cormier, Repp & Meier, 2001). During the first period of language acquisition signing children substitute marked forms with unmarked. This is especially observable in the development of handshapes. Stoneham (2003) in a case study of BSL acquisition reported that the child signed COW at 1;5 but substituted a G handshape

for the citation Y hand (thumb and little finger extended). The G handshape is simpler in the phonological system as it has fewer finger selection features. As well as substitutions children may insert gestural fillers into signs. This happens by the child modifying or inserting a new movement between handshape transitions, which require local or internal movements. These meaningless pauses and gestural movements embedded within signs are not observed in the adult model. Sign fillers are similar to phonological processes in spoken language acquisition and are used by the young child to make the job of sign segmentation easier. In a separate study of a child of the same age, more substitutions of handshape appeared with signs that were at the periphery of the child's field of vision: i.e. more handshape substitutions were found in signs located on the head, compared with signs articulated on the forearm (Bakker, 2003). This result suggests that young children acquiring sign language are less able to monitor their own signing when they have less visual feedback.

These results indicate that in the acquisition of sign phonology and phonetics, the types of simplification processes for managing and representing language are similar across modalities. This suggests that children at the start of language acquisition approach segmentation, representation and early production with similar motivations. The major effect of modality is in how these child strategies get expressed differently through simplifications of movement, or handshape substitutions rather than a preference for simple over complex sounds or the substitution of stops for fricatives in early speech development. Modality moves limitations in the perceptual system from hearing to vision. These underlying abstract similarities between what children do with signs and words in the beginning of language acquisition forces consideration of the strong biological component acting on these processes.

Topic 2: Development of grammar

Children developing spoken language between ages 2;6 and 4;0 are reported to produce the different verb argument structures of their language with minimal errors (Pinker, 1989). When errors appear they are generally rule-governed; for example, children may over-generalize verb argument structures from the adult language to verbs whose meanings and structures do not fit that pattern, saying things like: 'Daddy go me round' (Bowerman, 1982).

Across different language typologies, children work out the specific way their target language links meaning to form (e.g. Allen,

1996). In spoken languages this may be through word order and/or case and/or inflectional morphology. Sign languages use the same grammatical devices but map meanings onto spatial contrasts. In a series of studies we have been documenting the emergence, longitudinal acquisition and overgeneralization of inflectional morphology for encoding person agreement in children natively acquiring BSL (Morgan, Barrière & Woll, in press; Morgan, Herman & Woll, 2002). This work has highlighted the influence of modality in terms of both language typology and input in the acquisition of BSL grammar. The influence of modality on the unfolding of grammar provides us with a window on the relationship between biology and behaviour. In work on longitudinal acquisition of BSL person agreement morphology we have highlighted two effects of modality in this domain (Morgan, Barrière & Woll, in press). Verb inflections are not simple to segment in sign languages, and Meier (2002) has argued that in ASL, since inflections are not suffixal, syllabic or stressed, the markers of agreement are not discrete affixal language units. The relatively late onset of verb agreement morphology in children's signing, compared with similarly morphologically rich spoken languages, reflects this segmentation difficulty. Coupled with typology is the crucial effect of the visual environment in which children learn to sign.

The input to signing children is dependent on adults timing their language to match children's visual attention. Deaf children do not see the same amount of adult sign language as hearing children listen to or overhear in the ambient spoken language. This is simply because once they look away from the adult signer their access to the input disappears. This is not the case for hearing children acquiring spoken language. The use by adults of simplified child-directed signing makes it more visually salient but qualitatively different to adult-adult sign. Adults address quantitatively less obligatory inflectional morphology to children than when signing to other adults (Morgan, Barrière & Woll, in press). The type of inflectional morphology sign languages use, as well as differences between seeing and hearing language, influence the rate of development of specific features of BSL grammar. Despite deaf children experiencing significantly less language directed to them or in the ambient environment than hearing age peers they go on to develop sign fluency at approximately the same ages. In specific aspects of grammar there are cross-modality differences but these modality effects are local and not global. This developmental parity between deaf and hearing language acquisition with very different *amounts* of input may mean that much of the speech addressed to hearing children is redundant. The acquisition of

language can take place with significantly less raw material to analyse and with significantly more of a biological component.

Topic 3: Specific language impairment

Specific language impairment (SLI) in hearing children acquiring spoken language is diagnosed where there is a deficit in normal language acquisition with no apparent cognitive, social or neurological cause (Leonard, 1998). Since hearing loss is specifically excluded in diagnosing SLI, it has been impossible to explore SLI in deaf children. Frequently problems are reported with phonology, syntax and inflectional morphology (e.g. van der Lely, 1998; Leonard, 1998). SLI encompasses many different sub-types including language perception and production difficulties as well as higher order semantic/pragmatic problems. There is much debate about the underlying core cause of language impairment. Current explanations include an auditory processing deficit (Bishop, 1992) or an impairment of a grammar-processing module (van der Lely, Rosen. & McClelland 1998). Although there are different explanations for different impairments and for different children, the common prevailing hypothesis has been that 'most children with SLI have some auditory processing problems' (Bishop, 1992). More recently there has been an attempt to separate out auditory processing difficulties from cases of impairments in the processing of grammatical relations.

There are very few reported studies of atypical development in children acquiring a sign language in the literature (Woll, Morgan & Herman 2003). One reason for this is that up until recently language pathologists have known little about sign language acquisition and consequently SLI was not normally considered if the child's primary mode of communication was sign. Additionally sign was considered perfectly learnable by deaf children who had previously failed to learn a spoken language, but there was little understanding of the difference between a sign language and gestures, or sign supported English vs. British Sign Language.

However, if the incidence of language impairment is the same in children who are born deaf (or are the hearing offspring of deaf signing parents) as it is in the general population, then at least 7% of children learning sign language *will have* language impairment (figure from Leonard, 1998). It may even be the case that the incidence of sign SLI is higher in the deaf population because of the more generalised neurological insults which may accompany deafness (e.g. sequelae of

meningitis, rubella or cytomegalovirus). We are interested in finding out what language impairment looks like in a sign language and what parts of the language are affected. Is it the same as or different from SLI in spoken language development?

This area of research, while of great importance to current debates, is difficult to carry out for several reasons:

1. Characteristics of the signing population. Because late learners represent the biggest group within the signing community (they are typically atypical) much care is needed in distinguishing language delay caused by language deprivation and delay from language disorder. Individuals who experience late exposure to a first language are **not** language impaired. The subtle differences between native and non-native signers seen in high demand contexts (such as Mayberry's shadowing task) are more similar to the differences between fluent native and non-native speakers, although the non-native signers differ from non-native speakers in that they have no native first language. It is of course possible that late language learning children are at more risk of a language disorder if they are already on the borderline for impairment. Deaf children are rarely referred for specialist sign language intervention and therapy, and this only occurs after a protracted time in other types of speech and language therapy, thus exacerbating the problem. The signing population is very heterogeneous and therefore controlling for other cognitive differences between impaired and un-impaired groups (e.g. language mediated memory, visual-spatial processing) is crucial.

2. Design of tests. Aside from the abilities of the testers[3], the tests used to measure sign language impairment need to distinguish between poor performance because of late language learning and poor performance as a result of a language disorder. The late sign language learner may exhibit *a)* a normal developmental path but with delays (same sequence of milestones but different ages) or *b)* a different developmental path which cannot be explained by considering deficits outside the language faculty (e.g. deficits in non-verbal cognition). We are currently working with the hypothesis that errors with language structure in children with

[3] When evaluating language development in signing children testers must be sensitive enough to identify children who use very skilled communication strategies (e.g. gesture) to compensate or disguise poor linguistic development.

sign SLI will show a different pattern than typical first language acquisition or second language development.

This prediction is supported by recent findings from research on unimpaired but late sign exposed deaf children (Lillo-Martin & Berk, 2003). In this longitudinal study of two children aged 5;6 – 6;0 when first exposed to ASL, language acquisition unfolded in the same sequence as in children who experience typical early exposure to language (a one sign stage followed by a two sign stage followed by the expansion of morphology etc.).

Previous research has documented developmentally impaired signing in individuals with additional impairments (e.g. Atkinson, Woll & Gathercole, 2002; Morgan, et al, 2002; Woll & Grove, 1996). In general across these individuals impairments outside of the language faculty have produced atypical sign language development. Current work is focusing on cases of atypical development stemming from impairments within language rather than with associated systems.

In a series of clinical case studies we are developing a battery of tests for sub-types of sign language developmental impairments. Up to now these tests are based on our experience with different language disorders in children acquiring spoken languages. We maintain a clinic, which receives referrals of deaf and hearing signing children with apparent problems in BSL grammar (Morgan & Herman, 2002), sign processing, pragmatic difficulties and expressive sign disfluencies (Morgan & Herman, in prep). The goal of this research is to understand how atypical sign language development can be measured and explained. This involves the development of tests, which can accurately pinpoint where the specific language problem lies (sign phonology, morpho-syntax, pragmatics etc). These tests need to be based within standard developmental scores for non-impaired signing children. Using data from adult signing, normal acquisition and atypical cases we are building a model of normal sign language processing in order to arrive at some understanding of the origins of different sign impairments.

As an example of this work, some preliminary findings are presented for a child with problems in BSL and English grammar. The child (JA) is a hearing male aged 5;11 at testing. He communicates at home in BSL with his deaf mother and deaf father. He was referred for an assessment because of reported difficulties with English and poor behaviour at school. JA's English was assessed using the Clinical Evaluation of Language Fluency (CELF). He scored poorly in the comprehension of sentences in English with spatial prepositions, tenses and pronouns. His expressive skills and single word vocabulary were

relatively strong. We assessed JA's signing abilities using the BSL Reception Skills Test (Herman, Holmes & Woll, 1999). The assessment involves watching an adult signer on video, sign short sentences after each item the child has to point to a corresponding picture from a choice of four (involving both semantic and phonological distracters). The sentences cover a range of grammatical constructions including: negation; pluralisation through the use of lexical signs and classifiers; different verbs of movement and location again involving different types of classifiers and their sentential predicates. This test is the only published BSL assessment battery available at present. Results can be compared with age-normed standard scores for children between 3 and 12 years. In the BSL test JA scored appropriately on single vocabulary items as in the English assessment but he scored at very low on signed sentences which contained BSL grammatical information for encoding plurality, negation and sentences involving classifiers.

What marked JA's poor performance out as atypical was the erratic profile of passes and fails on test items. His performance did not follow a typical pattern either for a child of his age or for a non-native signing child with a language delay (i.e. a performance like a child from a younger age-group). He failed several early items in the test (which are designed to be linguistically simple) and passed several of the more difficult items. We concluded from this assessment that JA's patterns of problems in language are: a) similar in English and BSL; and b) not like those found in normal development or typical second language processing problems. Some current research on spoken language SLI in bilinguals has shown that impairments appear in both the children's languages (Paradis, Crago, Genesee, Rice, 2003). Because BSL and English differ in how they encode grammatical rules it is not possible to say that JA's performed poorly on exactly the same linguistic items in both languages but the areas in which he had difficulty were comparable.

Sign language impairments and implications for SLI

The fact that an impairment surfaces in a hearing signing child in both modalities and in similar linguistic domains is evidence for difficulties with more abstract features of language than those based in auditory processing. We are currently investigating what might underlie language impairment in BSL. Perhaps what links SLI in signed and spoken language is a difficulty with the processing of speeded sequential stimuli. Rather than being modality-specific, the stimuli may be either visual or sound based. Explanations of SLI based on a processing deficit

argue that poor processing or problems with language segmentation prevent the child from forming robust phonological representations. This has consequences throughout the system into higher hierarchical units e.g. morpho-syntactic structures. This difficulty might not be unique to sound. Children with a problem in laying down sign language phonological representations because of a visual processing deficit (specific to the patterns and frequencies common to language) would also be at a disadvantage in their development of sign grammar. A difference between the modalities argues against this explanation. The transition between phonological contrasts in sign language is much slower (about 6-7 times as slow) than in spoken languages (Emmorey, 2002) which means that if an impairment lies at the level of speed of processing it would be circumvented by the sign modality.

Alternatively what may unite sign and spoken language SLI is the existence of an impaired amodal linguistic module (e.g. for computing grammatical dependencies). Whatever we find as a plausible cause of sign SLI we suggest that these studies of developmental sign language impairments will show that the general role of auditory processing in SLI is overstated.

Conclusions

Language acquisition can be explored from different perspectives when shifting from the study of children exposed to sound-based languages to the study of languages perceived through the eyes and articulated through movements of the hands and face. The remarkable similarities in the way language emerges and is acquired in signing and speaking children points to robust internal forces as driving a set of language dedicated processes. However, across the areas of phonology, grammar and language impairment, the patterns of acquisition are not identical across modalities. As with any cross-linguistic comparison, language-specific features come to bear on the nature of children's rule-governed errors and their speed of mastery of specific linguistic structures. The phonology and grammar of BSL coupled with specific perceptual limitations in the visual spatial domain influence how children act on the available evidence. At the start of language use, at around one year, we see that children simplify handshape and movement parameters in rule-governed ways. Currently however we know very little about how infants perceive sign language and how they visually segment the sign-

stream in order to isolate cues to syntactic structures. Our preliminary research into SLI in child users of sign language has revealed that impairments in the acquisition of grammar are not modality specific. The more work we do on normal and atypical sign language acquisition the more subtypes of impairment we will be able to document and the more able we will be to understand universal features of acquisition and impairment across modalities. By identifying the origins and explaining the specific impairments in atypical sign language development, this work can provide a means to deciding what is the biological contribution to SLI (is it auditory processing or the computation of grammatical dependencies). Therefore the study of normal and atypical sign language acquisition is more important than ever for understanding what is so special about children's most amazing developmental achievement.

References

Allen, S.E.M. (1996). Aspects of argument structure acquisition in Inuktitut. Amsterdam: John Benjamins.

Atkinson JA, Woll B, & Gathercole S. (2002) The Impact of Developmental Visuo-Spatial Learning Difficulties on British Sign Language. Neurocase 8:424-441.

Bakker, D. (2003). The development of the handshape parameter in British Sign Language: a dependency phonology approach. Unpublished Masters dissertation. University of Amsterdam.

Lillo-Martin, D. & Berk, S. (2003) Acquisition of constituent order under delayed language exposure. In B. Beachley, A. Brown & F. Conlin (eds.) Proceedings of the 27th annual Boston University Conference on Language Development. Cascadilla Press, 484-495.

Bishop, D.V.M. (1992). The underlying nature of specific language impairment. Journal of Child Psychology and Psychiatry, *33,* 1-64.

Bowerman, M. (1982). Evaluating competing linguistic models with language acquisition data: implications of developmental errors with causative verbs. Quaderni di Semantica, 3, 5-66

Brentari, D (2002). Modality differences in sign language phonology and morphophonemics. In R. Meier, K. Cormier & D. Quinto (eds.) Modality and Structure in Signed and Spoken Languages. New York: Cambridge University Press

Cheek, A., Cormier, K., Repp, A. & Meier, R.P. (2001). Prelinguistic gesture predicts mastery and error in the production of early signs. Language 77: 2, 292-323

Chomsky, N. (1995). The Minimalist Program. Cambridge MA, MIT Press
Emmorey, K. (2002). Language, Cognition, and the Brain: Insights from Sign Language Research. Lawrence Erlbaum Associates.
Emmorey, K. (2003). Perspectives on classifier constructions in sign language. Erlbaum: Mahwah, NJ.
Fisher, C. (2002). The role of abstract syntactic knowledge in language acquisition: A reply to Tomasello (2000) Cognition, 82, 259-278.
Goldin-Meadow, S (2003). The Resilience of Language: What Gesture Creation in Deaf Children can Tell Us about how all Children Learn Language. Psychology Press: New York.
Herman R., Holmes, S. & Woll. B (1999) Assessing British Sign Language Development: Receptive Skills Test. Forest Bookshop. Gloucestershire, UK.
Jusczyk, P. W. (1997). The Discovery of Spoken Language, MIT Press, Cambridge, MA
Kegl, J. (2002). Language emergence in a language-ready brain: Acquisition. In G. Morgan & B. Woll (eds). Directions in sign language acquisition. Amsterdam, Philadelphia : Benjamins. pp. 207-254
Leonard, L. (1998). Children with specific language impairment. Cambridge, MA: MIT Press.
Mayberry, R.I., Lock, E. & Kazmi, H.(2002). Linguistic ability and early language exposure. Nature 417, 38.
Meier, R.P. (2002). The acquisition of verb agreement in ASL: pointing out arguments for the linguistic status of agreement in signed languages. In G. Morgan & B. Woll (eds.) Directions in sign language acquisition, pp. 115 - 142. Amsterdam: John Benjamins.
Morford, J.P. & Mayberry, R. (2000). A reexamination of "early exposure" and its implications for language acquisition by eye. In C. Chamberlain, J.P. Morford & R. Mayberry (eds) Language acquisition by eye. Mahwah, NJ : Erlbaum. pp. 111-127
Morgan. G., N.V. Smith, I-M. Tsimpli & B. Woll. (2002). Language against the odds: the learning of British Sign Language by a polyglot savant. Journal of Linguistics. 38:1-41.
Morgan, G & Herman, R. (in prep). Stuttering into sign language. Manuscript. City University, London.
Morgan, G & Herman, R. (2002). Specific Sign Language Impairment: Deprivation or Disorder? Paper presented at IASCL Madison, July 2002.
Morgan, G., R. Herman & B. Woll (2002). "The development of complex verbs in British Sign Language." Journal of Child Language 29: 655 – 675

Morgan, G., Barriere, I. & Woll, B. (2003). First verbs in British Sign Language development. Working Papers in Language and Communication Science, vol. 2 pp 57-66
Morgan, G., Barriere, I. & Woll, B. The influence of typology and modality in the acquisition of verb agreement in British Sign Language. In press. First Language.
Newport, E.L. (1990). Maturational constraints on language learning. Cognitive Science 14, 11-28
Newport, E.L. & Supalla, T. (1980). The structuring of language: Clues from the acquisition of signed and spoken language. In U. Bellugi & M. Studdert-Kennedy (eds). Signed and spoken language: Biological constraints on linguistic form. Dahlem-Workshop. Weinheim : Verl. Chemie. pp. 187-212
Newport, E. & Meier, R. (1985). The acquisition of American Sign Language. In D. Slobin (ed). The crosslinguistic study of language acquisition. Volume 1: The data. pp 881-938. Hillsdale, NJ: Lawrence Erlbaum Associates.
Newport, E.L., Bavelier, D. & Neville, H. J. (2001). Critical thinking about critical periods: perspectives on a critical period for language acquisition. In E. Dupoux (ed) Language, brain, and cognitive development : Essays in Honor of Jacques Mehler . Cambridge, Mass. : MIT Pr. pp. 481-502
Paradis, J. & Crago, M., Genesee F., & Rice, M. (2003). French-English bilingual children with specific language impairment: How do they compare with their monolingual peers. Journal of Speech Language and Hearing Research, v.*36,* pp. 113-127
Petitto, L. (1997). In the beginning: On the genetic and environmental factors that make early language acquisition possible. In M. Gopnik (ed) The inheritance and innateness of grammars. pp. 45-69. Oxford: Oxford Univ. Press.
Petitto, L.A., Katerelos, M., Levy, B., Gauna, K., Tétrault, K. & Ferraro, V. (2001). Bilingual signed and spoken language acquisition from birth: implications for the mechanisms underlying early bilingual language acquisition. Journal of Child Language 28: 2, 453-496
Pinker, S. (1989). Learnability and cognition: the acquisition of argument structure. Cambridge: CUP.
Senghas, A. (2003). Intergenerational influence and ontogenetic development in the emergence of spatial grammar in Nicaraguan Sign Language. Cognitive Development 18: 511-531
Stoneham, H. (2003). Phonological processes in the acquisition of British Sign Language: a case study. Unpublished MSc dissertation. City University, London: UK.

Sutton-Spence, R.L. & B. Woll. (1999). An Introduction to the Linguistics of BSL. Cambridge: Cambridge University Press
Tomasello, M. (2000). Do young children have adult syntactic competence? Cognition 74, 209-253.
van der Lely, H.K.J., Rosen, S., McClelland, A. (1998). Evidence for a grammar specific deficit in children. Current Biology, (8), 1253-1258
Woll, B. & Grove, N. (1996). On language deficits and modality in children with Down Syndrome: A case study of twins bilingual in BSL and English. Journal of Deaf Studies and Deaf Education 1: 4 pp. 271-278
Woll, Morgan & Herman (2003). Sign Language Acquisition: Typical and Atypical Development. Paper presented at SRCD Pre-conference, Tampa, FL, April 2003.