

Acquisition of Constituent Order Under Delayed Language Exposure

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1. Introduction

How is the course of language acquisition affected when first language input is delayed for over five years? Are early stages of syntactic development under delayed input like those under normal input? Questions such as these, and more generally, the nature of sensitive period effects on first language acquisition have been topics of philosophical interest for decades. Currently, Deaf children exposed to a first language later in childhood provide a rare and unique opportunity to study possible limits on the human capacity for language acquisition.

Deaf children exposed to American Sign Language (ASL) from birth acquire it in much the same manner as spoken languages are acquired. However, many Deaf children are born into hearing families with no knowledge of sign language. The age at which these children are exposed to their first accessible language may vary considerably. Currently, in the US such children typically begin receiving some kind of linguistic input by the age of three. However, occasionally Deaf children receive no linguistic input (in speech or sign) until a later age. Our project is examining the course of acquisition of ASL by Deaf children whose exposure to ASL was delayed well past their fifth birthdays.

In native language acquisition, word order is acquired early. Both in languages with relatively fixed (such as English) and relatively variable (such as Turkish) surface orders, children in the early twos generally show evidence of early mastery of the adult options. Basic or canonical order also apparently poses few problems for second language learners. Is this, then, an area of grammar which might be spared from possible effects of delayed linguistic input?

According to Newport's (1990) study of Deaf adults who had experienced exposure to ASL at varying ages through childhood, comprehension of its basic S (subject) V (verb) O (object) is unimpaired by delayed linguistic input. However, this study did not examine whether later learners correctly understand

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or produce the variety of modified word orders which the grammar of ASL allows. Chen Pichler's (2001) study of the acquisition of ASL by children with native exposure finds that both canonical and derived orders are produced at an early age, similar to findings for spoken languages.

The previous research therefore sets the stage for our developmental study of the acquisition of canonical and derived word orders under conditions of delayed input. The possibility exists that basic and varied word orders will be acquired with a delay but not a qualitative difference between native and later learners. On the other hand, delayed linguistic input may be more detrimental, affecting even this core part of any grammar.

In the present study we have been able to address questions of potential sensitive period effects on the production of basic and modified constituent order in ASL by observing two Deaf children with delayed input, MEI and CAL, in naturalistic language and play environments. Our analysis of the language produced by MEI and CAL suggests that the course of acquisition under delayed input has both similarities and differences to that with native input. Even word order is affected by delayed input. The word order patterns produced by MEI and CAL are both more conservative and more error-prone than those of native signers.

2. Background

2.1 Delayed linguistic input

Case studies of children isolated from language and community have been presented as evidence for a sensitive period for first language acquisition (Davis, 1947; Curtiss, 1977, among others). However, due to the severe abuse suffered by these isolated children, it is not straightforward to tease apart effects of the isolation on language development versus potential effects of the abuse.

Studies have been conducted with Deaf adults to see how a delay in language exposure affects the ultimate attainment of the language. Newport (1990) hypothesized that language acquisition occurs under internal, maturational constraints, operating successfully only during a maturationally bounded period. She examined word order and complex morphology of ASL using elicited production and comprehension tasks with 3 groups: Native, Early (exposed to ASL from 4 -6 years old), and Late (exposed to ASL from 12 years old and up). She found that 1) there was no effect of age of acquisition on comprehension of ASL basic word order; and 2) there were consistent effects of age of acquisition on ASL morphology;

Mayberry (1994) discusses a series of three experimental studies of Deaf adults, who acquired ASL at varying ages, but for whom ASL had been the primary language for at least 40 years. These experiments were used to show the potential relationships between the age at which Deaf individuals first acquire sign language and their ability to process it later as adults. Results from these experiments suggest that when ASL is acquired later in childhood (after age 5

years) there are problems with language decoding and memory, as opposed to difficulties with language encoding.

Emmorey, Bellugi, Friederici, and Horn (1995) conducted an experiment examining verbal morphology with adult signers who had been exposed to ASL at different ages, ranging from native to 20 years. Their data suggest that "late exposure to a primary language affects the on-line integration of verb agreement information within a sentence, but does not affect sensitivity to semantic distinctions encoded by aspect morphology."

All of these studies suggest lasting problems resulting from later exposure to a first language, at least in terms of language processing and potentially also in grammatical knowledge. However, while these studies are of great importance in providing information about language acquisition with delayed input after many years of language use, they are not longitudinal, developmental studies, and cannot provide information about the course of language acquisition in this situation.

Our project, of which the current study is one part, examines the early course of delayed language acquisition once input has begun. Most Deaf children receive some kind of linguistic input by toddlerhood, at least in the United States. We have been observing two children who are in a special situation, in that they were not exposed to a first accessible language until approximately 6 years of age, but once exposed, they were fully immersed in American Sign Language.

"MEI" was initially misdiagnosed as low-functioning mentally retarded. By age 4 1/2 years she was correctly diagnosed as profoundly deaf and not mentally impaired. Between the ages of 3 - 5 years she was enrolled in a Head-Start program three times per week, for four hours per day. There was also a part-time intermediate unit for language development. However MEI's mother reports that due to the misdiagnosis, only crayons and paper were given to MEI, and there were only minimal attempts to communicate with or engage MEI.

At age 5;9, MEI completed an intake evaluation at a residential school for Deaf children, and the school psychologist noted in her chart that "MEI's overall performance indicates that she has some well developed nonverbal cognitive abilities". She was able to produce 15-20 gestures, consisting mostly of communicating basic needs, e.g. "food", "eat", "drink", "sleep", etc. MEI was first exposed to ASL at age 6;1, upon starting school.

"CAL" was correctly diagnosed with profound deafness by the age of 3 years, but was not exposed to an accessible first language until later, due to personal problems at home. Between the ages of 3 and 5 years, he was in a county children's partial hospital program for behavioral problems. He then had a home tutor to teach him signed words. His mother reports that the tutor, herself, did not know more than 20 signs.

At age 5;9, CAL completed an intake evaluation at a residential school for Deaf children, and the school psychologist noted in his chart that "CAL's performance on the K-ABC Nonverbal Scale suggests he is functioning within average range of nonverbal intelligence". He was reported to know between 20-

25 gestures, consisting mostly of communicating basic needs, e.g. "bathroom", "eat", "drink", "sleep", "sit", etc. CAL was then first exposed to ASL upon starting school at that time. However there were only 2 months until the end of the academic year, and then a 3 month summer break, during which time no exposure to ASL was provided.

We began recorded language development observations in March of 1999, when MEI was age 6;7, and CAL was age 6;10. Our study as a whole is designed to examine the time course of morphological and syntactic development under delayed linguistic input. We have found both similarities and differences in the acquisition of ASL by MEI and CAL as compared with Deaf children with native input. Most relevant to the current study is our finding that MEI and CAL go through a two-word stage much like that of native-signing children (Berk and Lillo-Martin, 2002; in prep). Although the content of these 6- and 7-year-old's utterances is more sophisticated than that of 2-year-olds, the two-word stage in MEI and CAL has many of the expected structural characteristics. Here we focus on the development of word order during this phase of language acquisition.

2.2 Word order and ASL

Word order in ASL is of major interest, in part due to the flexibility of word orders allowed by the language. Although the canonical word order is S (subject) V (verb) O (object), it is not necessarily the most frequent order observed. This basic order, S V O, is used in pragmatically neutral contexts. There are variations on the basic order, some of which are associated with particular discourse/pragmatic contexts, and these other orders are linguistically marked in various ways.

The variations on basic order are often observed in adult and child ASL signing. (S) V S is permitted when the post-verbal subject is a pronoun. This construction is known as Subject Pronoun Copy (Padden, 1983). O V word order is permitted when the verb is morphologically marked, with, for example, aspect, location, or a handling classifier (Liddell, 1980, and others). There are also certain lexically specified verbs that permit pre-verbal objects, e.g. HAVE and WANT. Another variation on the basic word order arises due to topicalization of a constituent, resulting in the order TOPIC, Sentence. Topics are marked non-manually, generally with a brow raise and a prosodic break.

While interesting in a theoretical syntax sense, the investigation of word order is just as important to language acquisition researchers. Of particular interest is when and how the various ASL word orders are acquired by young children. It has been reported that children acquiring ASL use SVO word order at an early age (Newport and Meier, 1985; Lillo-Martin, 1999). However, the consistency of SVO order has been questioned. Schick (2002) found that the twelve 24-month-old Deaf children she investigated were not consistent in placement of 'agents' or 'themes' vis-à-vis the verb. She suggests that children "are working with the assumption that word order is relatively free in ASL."

Alternatively, she offers the possibility that the children are beginning to understand that variations in word order reflect pragmatic and discourse notions in ASL.

Consistent with the latter notion, Chen Pichler (2001) found that children's diverse early word orders can generally be accounted for by attributing to them both the canonical SVO order and several order-changing operations. Children's productions are largely adult-like when canonical orders are combined with correctly-marked derived orders. The derived orders include instances of Subject Pronoun Copy and morphologically-complex verbs sanctioning OV order.

Researchers have uniformly reported that young children do not use the adult non-manual marker to indicate sentential topics. Thus, manipulating order through topicalization might be a later development, unlike the other operations. However, Chen Pichler did find that one child used some kind of prosodic break between the object and verb in many of her OV utterances. These may be proto-topics, not yet marked by the full adult non-manual. The full time course of the development of topics is yet to be determined.

In the current study, we examine the development of canonical and derived word orders by MEI and CAL during their two-word stage. Samples from two Deaf children with native input in the two-word stage (both of whom were among the participants studied by Chen Pichler) are used as comparison. We ask: How does delayed linguistic input affect the course of acquisition of word order?

3. Participants

The participants in the current study include MEI and CAL, two Deaf children who were not exposed to an accessible first language until after the age of five, as summarized in section 2.1. For this paper, we report on five sessions with MEI, in the age range of 6;6.26 to 7;1.5, and three sessions with CAL, age range 6;10.6 to 7;4.6. More detailed information for each session is given in Table 1. This information includes age (years; months. days); time since exposure (months) began; time in school (months); total number of child utterances; child's MLU in words; child's MLU in morphemes.

Table 1. Participants – delayed exposure

Session	MEI 1	MEI 2	MEI 5	MEI 6	MEI 12	CAL 1	CAL 2	CAL 10
Age	6;6. 26	6;7. 29	6;8. 24	6;9. 01	7;1. 05	6;10. 06	6;11. 06	7;4. 06
Expos	10	11	12	12	16	14	15	20
School	6	7	8	8	10	10	11	14
# Utts	140	83	157	118	55	123	90	94
MLU Words	1.6	1.6	1.85	2.3	2.1	1.6	1.5	1.7
MLU Morph	1.9	1.8	2.1	2.6	2.5	1.7	1.7	2.4

The other set of participants, the comparison group, consists of 2 Deaf children with early input in ASL from Deaf parents. Observations of each of these children at 2 different sessions are reported here. Additional information is provided in Table 2.

Table 2. Participants – native exposure

Session	SAL 7	SAL 8	ABY 35	ABY 40
Age	1;11.23	2;1.30	2;1.27	2;4.9
#Utts	296	317	104	100
MLU Words	1.5	1.5	1.7	1.9
MLU Morph	1.6	1.7	1.9	2.0

4. Procedures and methods

The sessions used for this study from MEI and CAL are part of our larger developmental study of the effects of delayed linguistic input on language acquisition. Our project utilizes primarily naturalistic language sampling methods, with specific supplemental experimental “games” targeting different aspects of language development. Both children were observed and video- taped twice per week during the school year for 15 – 30 minute sessions. Each child interacted individually with a Deaf signer and a bag of toys. The Deaf signer is a woman who regularly works in the dorm with the children as a language/Deaf culture role- model. The sessions were filmed in a child-familiar dorm living room area, by a hearing, fluent signer.

The sessions used for the comparison group are also part of a larger developmental study of native linguistic input and early acquisition of ASL. This project utilizes similar naturalistic language elicitation and sampling methods. The sessions for these comparison group children were filmed with the child interacting individually with a Deaf parent and/or researcher at home with toys and books. The sessions were filmed by a (different) hearing fluent signer.

The sessions analyzed here were transcribed verbatim in a FileMaker Pro system which assigns each utterance to a separate record. Information about the signed utterance, non-manual markers, and contextual information are all included in the record. Transcripts were either initially completed or reliability checked by a Deaf signer.

A detailed analysis was performed on all of the 2- or more word utterances from the above-mentioned sessions. Transcripts were examined in conjunction with reviewing the signed utterances on videotape. Utterances were described according to the order of elements, and then categorized as canonical or derived. Derived orders were judged to be correct if they met the criteria for derived orders described in section 2.2. To summarize, post-verbal subjects were counted as correct if they were pronominal. Pre-verbal objects were counted as correct if the verb was morphologically complex or one of the lexically-specified verbs which permit pre-verbal objects. Pre-verbal objects non-manually marked as topics would also be considered correct, but like native signers, MEI and CAL did not use the adult topic non-manual marker. Locative objects were separately coded and treated similarly to direct objects.

The null hypothesis is that MEI and CAL are not statistically different from SAL and ABY in usage of canonical vs. derived, and correct vs. incorrect (derived) orders. Since the sample sizes are so small, we treat each child as a case study. Having many more utterances from SAL than ABY, SAL was used as the single comparison for both MEI and CAL. Binomial Exact Probabilities were calculated comparing each of MEI and CAL with SAL separately.

5. Results

Figure 1 presents the overall use of canonical, correct derived, and incorrect derived orders for CAL, MEI, SAL, and ABY. CAL and MEI are different from SAL and ABY in the overall proportion of canonical orders used. For CAL, the statistical comparison with SAL is only marginal (Binomial Exact $p = .10$), but for MEI it is highly significant ($p = .004$). Likewise, CAL is marginally different from SAL in the proportion of errors in derived word order attempts ($p = .06$), but for MEI the difference is highly significant ($p < .001$).

We turn now to examine the results for S/V order (Figure 2) separately from V/O (Figure 3). Again we find differences between the later and native learners. With respect to the ordering of subject and verb, MEI and SAL are highly significantly different in their use of canonical orders and in their error rates (Binomial Exact $p < .001$ for both comparisons).¹ For object/verb ordering, MEI is not different from SAL with respect to the proportion of canonical orders out

1. Because only MEI's results on the overall comparison were significant, we do not report further statistical results for CAL, pending analysis of additional data. Note that fewer sessions have been analyzed for CAL, most likely contributing to the marginal statistical result.

of the total (Binomial Exact $p = .95$), but is highly significantly different with respect to the number of errors ($p < .001$).

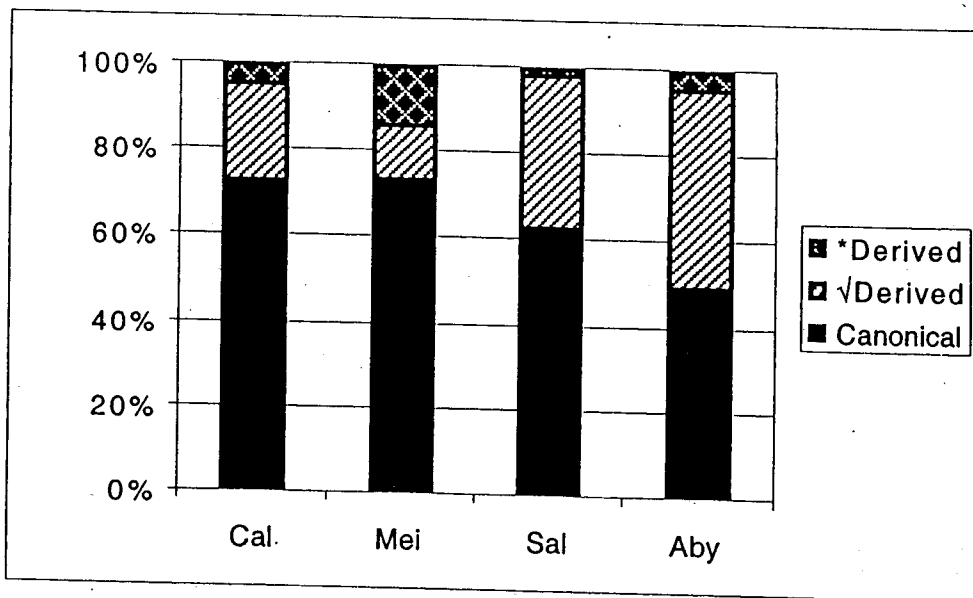


Figure 1. Later vs. Native Learners: Overall Word Order

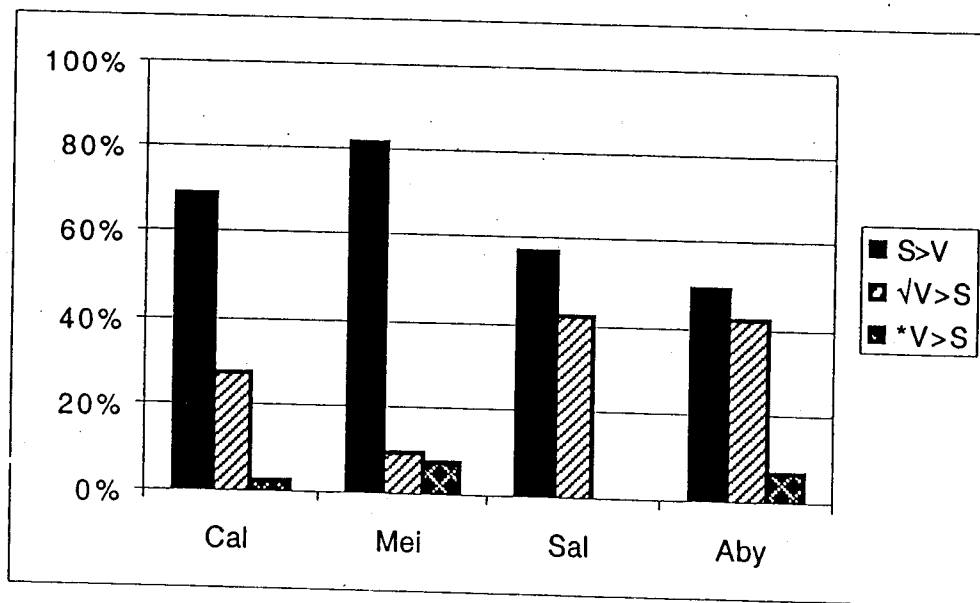


Figure 2. Later vs. Native Learners: S+V

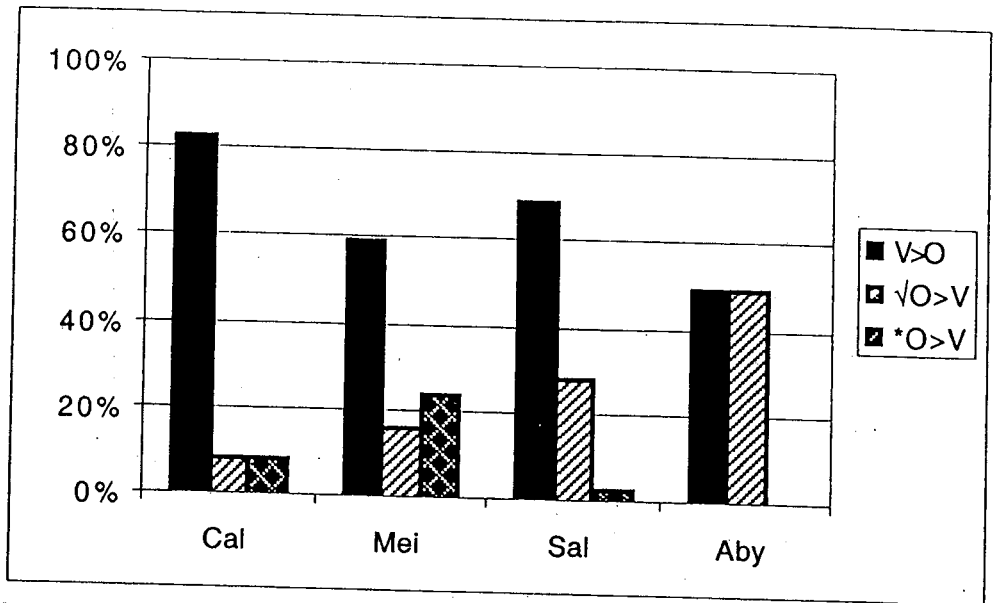


Figure 3. Later vs. Native Learners: V+O

Some examples of the children's correct canonical and derived orders are given in (1)-(2).

- | | | |
|--------|--|--------|
| (1) a. | FROG LOOK-UP-AND-AROUND LOOK-DOWN | S>V |
| | 'The frog looks up and around, then down.' | CAL 10 |
| b. | LOSE YOU | V>S |
| | 'You lose!' | CAL 2 |
| (2) a. | TELL BEAR | V>O |
| | '(She) told the bear.' | MEI 6 |
| b. | FIVE HAVE HOME | O>V |
| | '(I) have five (of those) at home.' | MEI 2 |

During the period investigated, there is no systematic change over time in the use of canonical, correct, or incorrect derived orders for MEI and CAL. They are clearly, however, increasing the length of their utterances. MLU rises, as shown in Table 1 above. The proportion of multi-sign utterances also increases.

All three children produced 3-constituent utterances in addition to the 2-constituent ones, and occasional longer strings. The most common multi-sign utterance orders are listed in Table 3. While MEI and CAL use a different set of orders more frequently than do SAL and ABY, little can be concluded from this given the overall small numbers of utterances, especially for the native signers. The grammaticality of the various orders listed below depends on factors such as pronominal subjects and morphologically-marked verbs, as discussed earlier.

Table 3. Three-Constituent Utterances

	MEI	CAL	SAL	ABY
SVO	11	5	2	1
SLV	5	0	0	0
LSV	3	2	0	1
SOV	3	0	3	0
OSV	3	0	0	0
SVL	1	1	3	0
VOS	0	0	3	0

MEI also produced occasional multiple-constituent forms with complex word order errors. These are unlike word orders produced by the native signers. Some examples are given in (3).

(3) a. ME FROG HOME I-WATCH
'I watched a frog at (my) home.'

MEI 2

b. MOTHER BEAR SEE STAND
'Mother sees the bear standing.'

MEI 6

The results suggest that MEI and CAL are more restricted in their use of non-canonical word orders than native signers, and they make more errors with these orders.

6. Discussion

When we began recording them, with half a year to a year of exposure to ASL, MEI and CAL were in a two-word stage. They produced many one- and two-word utterances, with a few longer ones thrown in. Over time, their MLU expanded. From this point of view, then, their language acquisition appears similar to that of 2-year-olds with native input.

However, even 2-year-olds largely seem to have acquired the adult grammar with respect to word order. They use both canonical SVO order and appropriate derived orders. MEI and CAL are different from native learners in this respect.

MEI and CAL use the canonical SVO order most of the time. It is reasonable to conclude that they have an understanding of the basic word order of ASL. However, they have not yet mastered the conditions for use of variations in word order. They do not attempt derived orders as often as native signers, and when they do, they are often incorrect.

These results indicate that under delayed exposure some aspects of language acquisition may be prolonged. In contrast to native signing two-year olds, MEI and CAL do not begin using the full extent of order-changing operations in appropriate syntactic contexts soon after combining signs.

MEI and CAL may be conservative in their use of derived orders in part because of incomplete knowledge of the morphological system. OV orders are sanctioned by overt morphological markers on the verb. MEI and CAL do make use of these markers sometimes, but it remains to be seen whether they are consistently used correctly (cf. Berk, in prep, on verb agreement). Errors in the use of the morphological markers which license order changes may result in fewer and more error-prone attempts at word order variations. This would not explain the results with subject-verb orderings, however, since verbal morphology is irrelevant to the licensing of post-verbal subjects.

There are some preliminary conclusions that can be drawn from these results. The course of acquisition under delayed input has similarities and differences to that with native input, even for the fundamental property of word order. While basic order may be spared, order variations are not mastered as quickly as they are for native signers. Some differences which may arise between later and native learners (such as a more sophisticated content to two-word utterances) may be due to competition between a more advanced cognitive level and their more restricted linguistic abilities. However, other differences observed may reflect different competence grammars at this stage. Our future studies will help us to pinpoint more clearly the effects of delayed input on the human capacity for language acquisition.

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