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The First Words Acquired by Adolescent First-Language Learners: When Late Looks Early

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1. Introduction

What does language acquisition look like when it begins for the first time in adolescence? This question is difficult to answer because virtually all hearing children are exposed to spoken language from birth. Unlike the acquisition of spoken languages, however, the acquisition of signed languages is frequently delayed. In the USA, about 90% of deaf children are born to hearing parents who do not know any sign language (Schein, 1989). Because most deaf infants do not have access to early linguistic input, they are at risk for language delay. In rare cases, deaf individuals are cut-off from all linguistic input until adolescence due to anomalies in their upbringing combined with a number of societal and educational factors. The question that the current study explores is how these extremely late learners begin their linguistic journey once they are immersed in a language that is fully accessible to them, in this case American Sign Language (ASL). Can they use their cognitive maturity and previous non-linguistic communicative experience to leapfrog the initial stages of language acquisition? Or must they move through the well-documented set of early linguistic milestones in a manner analogous to children?

Sign languages are natural languages that are expressed with the hands and face and understood through the eyes. Decades of research have demonstrated that sign languages are linguistically equivalent to spoken languages and are structured at the level of syntax, semantics, morphology, and phonology (Klima and Bellugi, 1979; Stokoe, Casterline, and Cronneberg, 1965). Cross-linguistic studies demonstrate that, when begun at birth, the acquisition patterns for sign languages generally parallel those for spoken languages (Anderson and Reilly, 2002; Mayberry and Squires, 2006). Deaf infants born to deaf parents produce manual babbling at 6 to 12 months, which corresponds to the age of onset of

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vocal babbling in hearing infants (Petitto and Marentette, 1991). First signs are typically produced around the age of 10 months, and by their second birthday deaf children who are exposed to sign language can produce about 50 signs (Anderson and Reilly, 2002).

Although signed languages do include an element of iconicity in some signs, it is important to note that children's first signs are semantically similar to first words produced by hearing children acquiring spoken languages, mostly denoting objects and people closely related to the child's experience (for example, words for toys, people, foods and animals). Signs that exhibit an iconic relationships between the meaning and phonological form represent less than a third of children's early vocabularies, suggesting iconicity does not play a substantial role in early sign acquisition (Mayberry and Squires, 2006).

Further evidence for similarities between the acquisition of sign and spoken languages comes from a normative study of ASL acquisition conducted by Anderson and Reilly (2002). This study, which considered 69 deaf children of deaf parents, demonstrates that early ASL vocabularies are qualitatively and quantitatively similar to those of hearing children acquiring English. As in English (Bates et al, 1994), children's early ASL vocabularies exhibit a noun bias, which begins to disappear as more predicates enter the lexicon. In both ASL and English, grammatical words are acquired after a critical mass of content words has been learned. Negation and question words, for example, appear around the age of 18 to 24 months, after 100 words have been acquired. In ASL, as in English, the first multi-word combinations occur after the child can reliably produce 50-100 signs. Vocabulary size predicts utterance length in both languages, showing that lexical and syntactic development occur in parallel from the very early stages independent of language modality (Bates et al, 1994; Anderson and Reilly, 2002).

The early acquisition milestones in ASL are thus comparable to those of English when ASL is acquired from birth. However, for 90% of deaf children in the USA, ASL acquisition begins at a range of ages after birth, depending on a number of educational, cultural, and familial factors. In rare cases, deaf individuals are linguistically isolated until adolescence; they cannot hear spoken language and, due to social and other factors, they have not been exposed to any kind of sign language. The current study considers three such cases; our participants were "discovered" around the age of 14 years to have very little or no knowledge of any language, spoken or signed, and were illiterate. At that time, they began receiving special services and acquiring ASL, their first language (L1), through immersion. Because they are young teens and have used idiosyncratic gesture to communicate, the question is what their initial ASL acquisition looks like.

Previous research demonstrates that delayed exposure to linguistic input severely affects the ability to acquire and process language at an older age. Studies on deaf signers with varying ages of onset of language acquisition have found a negative correlation between age of L1 exposure and morpho-syntactic ability as well as narrative comprehension (Mayberry and Eichen, 1991;

Boudreault and Mayberry, 2006; Newport, 1990). Further, Mayberry and Eichen (1991) show that age of acquisition (AoA) effects also apply to lexical processing. In a sentence recall study, native learners produced mostly lexical errors associated with meaning and syntactic structure independent of the phonological form of signs. With increased AoA, semantic errors decreased, but errors related to the phonological form of signs increased. These results suggest that language processing becomes dissociated from meaning and tied to the perceptual form of words as acquisition begins at older ages. Importantly, AoA effects are not limited to syntactic processing, but are evident across several domains of linguistic structure, including the lexicon.

The existence of a negative relationship between age of onset of language acquisition (AoA) and ultimate language attainment has been confirmed by case studies of social isolation. Victims of social isolation who were exposed to language before the age of 7 are reported to have overcome their delays and have eventually developed a linguistic competence that was comparable to their peers (Koluchova, 1972; Fujinaga et al, 1990). On the other hand, children who were not exposed to language until after puberty have been reported to follow a different course of linguistic development. The most well known case in this category is Genie, who was physically isolated from the outside world until she was 13;7 (Curtiss, 1976). Genie was reportedly able to use limited vocabulary to form basic sentences, but exhibited inconsistent and atypical grammatical structure, even 8 years after her rescue (Curtiss, 1976). Unfortunately, not much is known about Genie's early acquisition of vocabulary. While her syntactic development was studied in great detail, the size and composition of her lexicon were not measured systematically, and it is unclear whether her language acquisition was abnormal in terms of the content and sequence of early linguistic milestones.

Another source of information on first-language (L1) AoA effects is provided by case studies of deaf individuals born to hearing parents who were, due to familial, social, or educational factors, not exposed to linguistic input until adolescence, when attempts to teach them sign language were undertaken. Morford (2003) observed the linguistic development of two deaf teens who began to acquire ASL, their L1, at age 13. Unlike Genie, these two individuals had not suffered any deprivation or abuse, and had used home-sign to communicate with their families prior to ASL acquisition. After less than 3 years of exposure, both individuals had replaced most of their gestural communication with ASL signs. Comprehension tests after 7 years, however, showed significant deficits. Unfortunately, no assessments of their vocabulary were made. Emmorey et al (1994) studied the linguistic abilities of a deaf adolescent named Anna who was first exposed to ASL at age 16 years. Before Anna had enrolled in a deaf education class, she stayed at home and communicated using a home-sign system, which started disappearing from her utterances as she began acquiring ASL. At the end of the study, after 9 months of exposure, Anna's vocabulary was estimated to consist of over 500 signs,

which is comparable to a 3 year old typically developing deaf child (Anderson and Reilly, 2002).

Together studies on deaf signers with variable AoA, case studies on linguistic isolates, and case studies of extremely late learners of sign language suggest that, when begun past infancy, language processing is severely affected and ultimate attainment is poor. What is currently unknown is how the process of language acquisition begins when this happens for the first time at an older age. What kinds of words do adolescent learners acquire at the beginning of their linguistic journey? Are their lexicons quantitatively and qualitatively similar to those of young children? Do adolescents move through the same set of linguistic milestones as do children, or do they follow a different sequence of vocabulary acquisition? Research on the effects of AoA on the early stages of language acquisition, especially the acquisition of early vocabulary, is lacking. Understanding the patterns of early lexical development at an advanced age could provide additional insights into the nature of the syntactic deficits that have already been described (for example, Curtiss, 1976; Morford, 2003).

The current study is our initial attempt at describing the early lexicon of three adolescent L1 learners of ASL. We ask whether they exhibit similar patterns of vocabulary acquisition, and how their vocabulary compares to that of typically developing deaf children of deaf parents. We seek to answer these questions by measuring the size and composition of the adolescents' lexicons using the MacArthur Communicative Developmental Inventory for ASL (Anderson and Reilly, 2002). The current study is part of a larger research project in which we use a variety of observational and experimental measures to assess language comprehension and production in adolescent L1 learners.

2. Methods

2.1. Cases

Participants in this study are three deaf adolescents who have, at age ~14 years, just begun to acquire ASL, their L1. They were given pseudonyms Shawna, Cody, and Carlos to maintain confidentiality. Background information (Table 1) was collected in form of a questionnaire filled out by the social worker who knew them well.

Table 1: Background characteristics

Case	Age	Hearing loss	AoA*	Prior Linguistic knowledge	Mos ASL
Shawna	15;7	Profound	14;7	No ASL signs, illiterate, no spoken English	12
Cody	16;2	Moderate-severe	14;8	Few ASL signs, illiterate, no spoken English	18
Carlos	15;8	Profound	13;8	Few ASL signs, illiterate, no spoken English	24

*AoA: age at onset of ASL acquisition, equivalent to age at ASL immersion.

The information regarding the cases' schooling in childhood is limited. Upon first receiving special services in sign language, their knowledge of ASL signs was either extremely limited or non-existent, they had no knowledge of any spoken language, and were illiterate. Shawna was reportedly home schooled, but her guardians were hearing and did not use any sign language. By the time she received special services at age 14;7, she had attended school for a total of 16 months, during which time she switched between a number of deaf and hearing schools. Prior to learning ASL, she relied solely on behavior and very limited use of gesture to communicate. Cody lived with his legal guardian who was hearing and was not exposed to any sign language until the age of 5 when he began to attend school, but the type of his school program (hearing or deaf) is unknown. It is also unknown how he communicated with his guardian or his teachers. Upon receiving special services at age 14;8 Cody knew only a few basic ASL signs, and relied primarily on pointing and some use of gesture to communicate. Carlos was born in a foreign country and lived there until the age of 11 years with his parents who were hearing. He attended a deaf school in his home country, but only for a short period of time because the school was of poor quality according to parental report. At age 11, he immigrated to the United States, and was placed in a classroom for mentally retarded children where the use of sign language was limited. Upon receiving special services at age 13;8 his use of ASL was very limited, and he relied on pointing and some gestures to communicate.

Little is known about the participants' communicative strategies prior to their immersion in ASL. We do not know whether any of them had ever developed a home-sign system to communicate with their caregivers. However, the professionals (deaf proficient signers) who have worked with our participants since their initial receipt of special services believe that this was not the case. Unlike some other late L1 learners discussed in the literature (for example, Morford, 2003; Emmorey et al, 1994), our participants were not raised in typical nuclear families, and did not have stable interlocutors for extended periods of time prior to special school placement. At the time of testing, the three participants had been fully immersed in ASL both in and out of school for periods of 1 year (Shawna), 1;6 years (Cody), and 2 years (Carlos).

2.3. Language Measures and Analyses

Participants' language skills were assessed using the MacArthur Communicative Developmental Inventory for ASL (CDI) (Anderson & Reilly, 2002). The CDI is a parental report language assessment tool used with children between ages 8 and 36 months that has been shown to be a reliable resource in estimating the size and composition of early vocabularies in a number of different languages, including ASL (Fenson et al, 1994; Anderson and Reilly, 2002). In the ASL version of the CDI (Anderson and Reilly, 2002), a list of 535 words divided into 20 semantic categories is provided, and parents check the

words that their child produces. The form is intended to sample the vocabulary of the child so that it can be compared to the normative data for other children of the same age.

For the purposes of the current study, the checklists were filled out by the social worker who was most familiar with participants' ASL skills. It should be noted that the CDI is designed for use with children, and thus is limited in size and range of vocabulary that it tests. Since our participants are adolescents, this is an obvious limitation of the current study; however, the CDI is currently one of the only available standardized measures of early ASL vocabularies. By using the CDI we attempted to assess how adolescents' initial vocabularies compare to those of children who have received comparable amounts of ASL exposure starting at birth.

In order to be able to compare our results with normative data for deaf children of deaf parents, we closely followed the procedures outlined in Anderson and Reilly (2002). We counted the total number of signs that each participant produced in each of the 20 semantic categories, and then determined the number and proportion of nouns, predicates, closed class items, and other signs. As in Anderson and Reilly (2002), nouns included the following CDI categories: Animal Names, Clothing, Furniture and Rooms, People, Food and Drinks, Places to Go, Outside Items, Small Household Items, Toys, and Vehicles. The total number of nouns on the CDI is 277, which is 52% of the list. The category of predicates included Action Signs, Helping Verbs, and Descriptive Signs. The total number of predicates is 163, which is 30.5% of the list. The category of Closed Class included Connectors, Prepositions, Pronouns, Quantitative Signs, and Question Signs. The total number of items in this category was 53 (10% of the checklist). The category "Other Signs" consisted of Games and Routines, and Signs about Time, which together consist of 42 items (7.5% of the list). We asked two main questions: first, how many words on the CDI do the adolescents reliably produce? Second, what is the composition of adolescents' CDI lexicons in terms of proportions of words by syntactic category?

3. Results

3.1. Vocabulary Size

Figure 1 shows our cases' vocabulary sizes as measured by the CDI. There are three main points to consider with regard to these data. First, Shawna's vocabulary size (250 words) is much lower than Cody's or Carlos' (401 and 419 words respectively), which is most likely a consequence of her shorter exposure to ASL compared to the other two adolescents. Second, vocabulary acquisition of the three participants seems to be faster than in young children, particularly in the early stages. As indicated by Figure 1, the data points corresponding to adolescents' vocabularies are consistently above the line denoting the normative trend for ASL learning children between ages 8 and 36 months.

The third observation about the data in Figure 1 pertains to the rate of increase in vocabulary size in the adolescent learners. While Shawna's vocabulary size is well in advance of child learners with comparable length of linguistic exposure, Cody's and Carlos' vocabularies are much closer in size to those of young deaf children with comparable ASL exposure lengths. This suggests that the rate of vocabulary acquisition by adolescent L1 learners may become slower with time, a pattern uncharacteristic of child language learning, which is characterized by linear growth. It is important to note that Cody and Carlos have not yet acquired 100% of the CDI checklist. Their total vocabulary counts of about 400 words comprise approximately 75% of the words on the list. The obvious question is whether vocabulary acquisition in adolescent learners in fact reaches a developmental plateau, or whether this discrepancy between the normative data and the adolescent L1 learners is simply an artifact of using the CDI with older participants. Additional studies are necessary to further investigate how adolescents' vocabulary size changes with time of exposure to linguistic input.

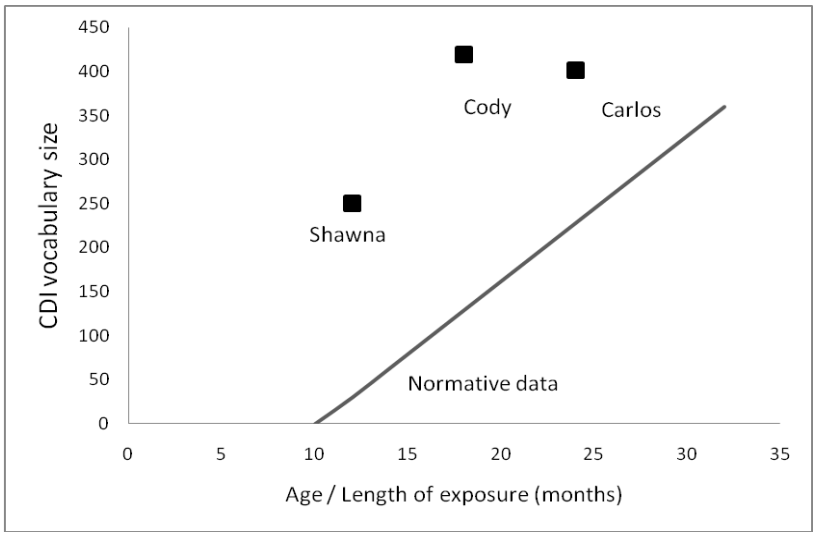

Figure 1: Vocabulary size as measured by the MacArthur Communicative Developmental Inventory (CDI) for ASL (Anderson and Reilly, 2002). Normative data are based on deaf children acquiring ASL from birth (Anderson and Reilly, 2002).

3.2. Vocabulary Composition

Our next goal was to study adolescent vocabulary composition and compare it to that of deaf children with comparable vocabulary sizes and comparable lengths of exposure to ASL. Anderson and Reilly (2002) found that children's

early ASL vocabularies are strongly biased towards nouns, which peak at 63% of total vocabulary during the acquisition of the first 100 words, and decrease to 51% after 101-200 signs are attained. Predicates show a slow and steady linear increase as the total vocabulary increases to 400 signs, after which their proportion reaches 33% and is above the 30.5% CDI ceiling. Closed class items show a steady increase across the vocabulary range and continue to increase after the vocabulary reaches 400 signs. Our study asked two main questions with regard to adolescents' CDI vocabulary composition: do they exhibit a common pattern of vocabulary composition in terms of proportions of words by syntactic category? Are their vocabulary compositions like or unlike those of young deaf children?

Results indicated that the participants' vocabularies exhibited a highly consistent composition pattern. For example, all three adolescents show a preponderance of nouns, which comprise between 51% and 54% of their CDI vocabularies. The nouns are followed by predicates (32% to 33%), with closed class signs comprising only between 5% and 8% of the checklist total. Importantly, these vocabulary composition patterns are very similar to the normative data for deaf children of deaf parents (Anderson and Reilly, 2002). As indicated by the right-most bar in Figure 2, an average vocabulary of a two-year old deaf child acquiring ASL from birth exhibits a similar proportion of nouns, predicates, and closed class items as our participants' vocabularies. It should be noted that this composition trend is also characteristic of the CDI itself, and one could argue that the results are simply a reflection of the structure of the checklist. This might indeed be the case to a certain extent, which is why it is important to cross-validate the current results using a different method. However, it is important to note that our participants' vocabularies are not yet at the CDI ceiling, which means that their proportions by syntactic category could theoretically be different than those of the list. It is also noteworthy that very similar proportions of signs in each syntactic category were found in Shawna's vocabulary of 250 signs, as well as in Cody's and Carlos' vocabularies which were significantly larger. This suggests that acquiring a language in adolescence is not an atypical process, but requires following a specific pattern with regard to the kind of words acquired.

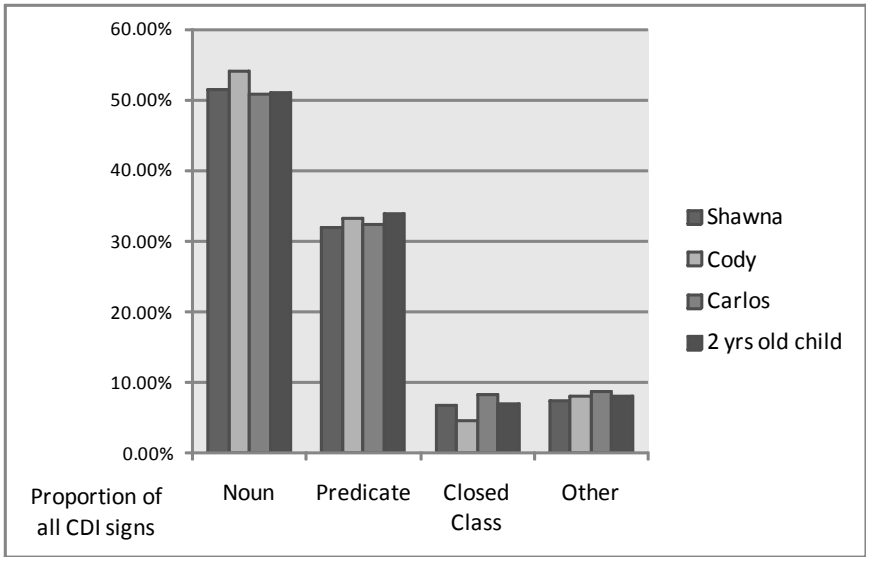

Figure 2: Vocabulary composition in three adolescent L1 learners (Shawna, Cody, and Carlos) in comparison with an average vocabulry composition of a 2 year-old deaf child acquiring ASL from birth (data from Anderson and Reilly, 2002).

4. Discussion

The current study asked what the process of language acquisition is like when it begins for the first time in adolescence. Previous research has shown that delays in onset of L1 acquisition result in poor language attainment and processing deficits across all domains of linguistic structure. Our goal here was to discover how adolescent learners begin their linguistic journey. We focused on the acquisition of vocabulary because it is one of the earliest stages of language learning in children and, as such, most likely constitutes an important building block in the process of adolescent language acquisition as well. We thus studied the vocabulary size and composition in three adolescent L1 learners using the CDI, which is a standardized procedure typically used with deaf children. Although the use of the CDI presents some limitations, the current results are meaningful.

Our results indicate that adolescent L1 acquisition is not deviant compared to child-language learning, but rather follows a consistent pattern which, in many ways, resembles that of childhood language acquisition. We did observe some important differences between adolescents and children, which we will address shortly; however, the similarities in types of early acquired words between our participants and the normative data for 8 to 36-month olds were striking. Adolescents, like children, exhibit highly consistent vocabulary

composition patterns, with a preponderance of nouns, and few closed class items. Despite being older and more cognitively mature, adolescent learners begin their linguistic journey by acquiring an initial lexicon that looks child-like.

Interestingly, Snedeker et al (2007) came to a similar conclusion in a study of spoken English acquisition by preschoolers adopted from China. These adoptees, who had begun learning a language in their country of origin, became monolingual English speakers upon adoption to the United States between ages 2;7 and 5;1. Snedeker et al (2007) found that adopted preschoolers followed the same language acquisition patterns with regard to sequence and content of early linguistic milestones as monolingual toddlers acquiring English from birth. Despite being older and cognitively more mature, adopted preschoolers learned the same types of words in the same order as did monolingual children who were significantly younger. Note that the adopted preschoolers, unlike our participants, were not linguistically deprived in early childhood, but had begun to learn an L1 at birth. Despite these differences, however, the similarities in patterns of early language learning between adolescents, preschoolers, and monolingual toddlers seem to suggest that the early stages of language acquisition are likely common to all L1 learning, independent of age.

In addition to the commonalities between childhood and adolescent L1 learning, we have also observed some important differences between our participants and the normative data for young deaf children. Importantly, adolescent initial vocabulary growth and development seems to be faster than in children. This was indicated by the fact that our participants' vocabulary sizes were consistently above the child normative data, particularly in the early stages of language learning. Interestingly, Snedeker et al (2007) found that adopted preschoolers were also initially faster in their acquisition of spoken English than toddlers acquiring English from birth. Both sets of results indicate that older language learners have an initial advantage and can pick up the word-to-world mappings faster than infant learners.

We have also observed that adolescent L1 acquisition, while fast in its initial stages, may not be characterized by the explosive growth patterns characteristic of childhood language acquisition. The obvious question is whether adolescent rate of vocabulary acquisition becomes severely slowed with time, and if so, what kind of impact such slowing would have on other domains of language learning (for example, the acquisition of syntactic structure). Research studies on typically developing children indicate that an average vocabulary of a normally developing six-year old child consists of 13,000 words, and that of an average high-school graduate consists of 60,000 words (Nagy and Anderson, 1984). If adolescent language acquisition indeed becomes slower with time, our participants may take much longer to acquire the same number of words, or may simply never reach the adult level. This hypothesis, however, requires further investigation through carefully designed longitudinal studies.

In conclusion, the current study asked whether language acquisition, when it occurs for the first time in adolescence, is like or unlike child language

acquisition. Results show that adolescent L1 learners follow a consistent language-learning trajectory, which is child-like in nature. Like children, adolescents begin the process of language learning by acquiring a set of base vocabulary, which is limited in number and type of words. It should be noted that a comparison between adolescents and children is not ideal because it does not account for the vast differences between them ranging from previous communication strategies, word knowledge, to level of maturation. Moreover, the three cases, despite the similarities in age, come from varying backgrounds, which should be taken into consideration when making generalizations about adolescent L1 acquisition. Despite these differences, however, our results support the idea that adolescent language acquisition, like child language acquisition, is a highly structured process.

The current study is the first attempt to describe the initial process of first language acquisition in an adolescent brain. Several questions await further research; for example, how does adolescent L1 acquisition unfold over time? When exactly and why do adolescent learners begin to lag behind children with comparable length of language exposure? Which components of linguistic structure are most affected by delayed exposure to linguistic input? While only longitudinal studies can answer these questions, we suspect that delayed and protracted development in adolescent first-language learners will be evident across all linguistic domains.

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