Language Creation and Language Change

edited by Michel DeGraff

Creolization, Diachrony, and Development

The MIT Press
Cambridge, Massachusetts
London, England

Chapter 6

Reduced Input in the Acquisition of Signed Languages: Contributions to the Study of Creolization

Elissa L. Newport

Many researchers have been interested in the possibility that creolization processes and the processes of normal language acquisition are related (see particularly Sankoff and Laberge 1973; Bickerton 1975, 1981; Slobin 1977). For example, Sankoff and Laberge (1973) suggested that certain crucial parts of the grammaticalization of the future-tense marker in Tok Pisin were performed by the children acquiring Tok Pisin as a native language; Slobin (1977) suggested that creolization, historical change, and child language acquisition shared many common phenomena as well as underlying mechanisms; and, most notably, Bickerton (1975, 1981) has hypothesized that the radical and sudden changes of grammatical structure found in many instances of creolization from a young, ill-formed pidgin are due to the innate tendencies of native language learners to impose linguistic principles on their input. At the same time, however, creolization processes most commonly occur in circumstances where a number of situational factors appear together, and it is therefore impossible to assign structural outcomes decisively to the influence of one of these factors over the others. Creole languages emerge in circumstances where several native languages, sometimes with common structural characteristics, surround the pidgin/creole, and where the language's functions expand concurrently with its acquisition by children. Thus the fascinating phenomena involving expansion and regularization of grammatical devices may be due to the inherent nature of native language acquisition, but they may as well be due to expansion of functional needs and/or to borrowing from surrounding superstrate and substrate languages. (For discussion, see Sankoff and Brown 1976; Sankoff 1979; Bickerton 1984; and the commentaries and reply to Bickerton 1984.)

In view of this problem, it is possible that studies in which some of these factors occur without the others may help to shed light on the effects of such factors individually. A number of researches have therefore begun to examine phenomena within the acquisition of signed languages that in some regards (notably, acquisition from reduced input) are like creolization, but that in other regards (for example, the presence of multiple surrounding languages) are clearly *not* like creolization. In this chapter I will review several of these studies, focusing particularly on those conducted by myself and my collaborators. To the extent that the outcomes we have observed are the same as, or similar to, those occurring in creolization, our results may help to reveal the extent to which native language acquisition processes could in principle be the underlying cause of structural changes in creolization.

Before turning to the details of particular studies, I will first give a brief background to the varied circumstances surrounding the acquisition of signed languages, and therefore why these acquisition processes (rather than the more commonly studied acquisition of spoken languages) have appeared to be a fertile area for understanding creolization.

6.1 The Acquisition of Signed Languages

Extensive linguistic research in the last 30 years has focused on signed languages that have evolved spontaneously within communities of deaf users. These are generally considered "natural" signed languages and therefore have been of interest to investigators studying natural language structure and its acquisition.[1] Because much of this research has been conducted in the United States, it has concentrated heavily on one particular language, American Sign Language (ASL), which is used by the Deaf community of the United States and parts of Canada. However, researchers have also begun to investigate other natural signed languages of the world, including Nicaraguan Sign Language (Kegl, Senghas, and Coppola, this volume), Japanese Sign Language, Swedish Sign Language, British Sign Language, and many others. Taken together, this research has shown that, in each of the regions of the world where there are communities of interacting deaf people, there is a rich and grammatically complex signed language that is structurally distinct from the surrounding spoken language (and that is also structurally distinct from, and mutually unintelligible with, the signed languages of other regions). In this sense, then, natural signed languages are apparently entirely equivalent to natural spoken languages, and they offer precisely the same opportunities for linguistic study as do spoken languages of the world.

However, there are some important and pertinent differences between spoken- and signed-language communities that make the latter unusually relevant to creole studies. In spoken-language communities, most individuals are native speakers of the surrounding language, and most children are exposed to native speakers from birth. Native language acquisition from native linguistic input is thus the norm; opportunities for studying the effects of late acquisition, and especially for studying the effects of native acquisition from reduced linguistic input, are very rare and almost never occur in the absence of confounding factors (particularly the presence of other languages). In contrast, these relative proportions are reversed in signed-language communities: very few users of signed languages are native signers with native-signing parents; most are late learners; and a small but substantial minority are native learners who have acquired the language from late-learning parents.

Because of the varied genetic and adventitious causes of deafness, most deaf children (90%) are born in hearing families where no one signs; only 5% of deaf children are born in families with two deaf parents and therefore in a home in which there is a surrounding signed language from birth (Schein and Delk 1974). (The remaining 5% of deaf children have one deaf parent.) Since the parents have also been born in families assorted by the same factors and proportions, only a tiny percentage of the

members of any Deaf community has acquired a signed language by native acquisition from native linguistic input. However, because they are the usual linguistic norm, this tiny population of native signers with native signing parents is the group on which most of the linguistic work on signed languages has been performed. It is from these quite rare individuals that we know that the structure and acquisition of signed languages are comparable to those of spoken languages (Stokoe, Casterline, and Croneberg 1965; Klima, Bellugi, et al. 1979; Newport and Meier 1985; Supalla 1995).

However, it is the remaining, and more numerous, members of signing communities who offer opportunities for observing the structure of languages that have been acquired under circumstances ordinarily almost impossible to find. Because 90% of deaf children are born in families where no one signs, their eventual acquisition of signed language occurs at highly variable ages (through contract with other deaf children or adults outside the home) and has been studied by a number of researchers investigating the effects of age of exposure on the acquisition of a primary language (Emmorey 1991; Emmorey and Corina 1990; Mayberry, Fischer, and Hatfield 1983; Mayberry and Fischer 1989; Newport and Supalla 1980; Newport 1988, 1990). These studies have shown that deaf individuals who have acquired ASL late in life show quite variable control over the grammatical structure of the language, with reduced complexity and/or high degrees of inconsistency in both the morphology and the syntax. Most pertinent to the present topic, many of the deaf children born to deaf parents have late-learning parents as their only input to ASL. It is thus these children, exposed to the language from birth, but only from a simplified and grammatically unstable source, who may provide an approximation to some of the circumstances of creolization (Fischer 1978; Newport and Supalla 1980; Newport 1982; Singleton and Newport 1994).

In the present chapter I will review a set of studies of the acquisition of ASL under these circumstances. Similar to creole learners, the ASL learners on whom my colleagues and I have focused are exposed from birth to an input language that is not a full and grammatically regular linguistic system. The children we have observed have no exposure to ASL except from their parents, who are themselves nonnative users of the language. The parents vary in the complexity of ASL that they produce to their children. In the most detailed of our studies thus far, the parents are deaf signers who first acquired ASL as teenagers and who therefore control well only the simplest structures of the language. More complex structures (e.g., complex combinations of inflectional morphemes, and various topicalization structures in syntax) either are omitted altogether in their use of the language or are produced with high degrees of inconsistency and sometimes frank violations of both the grammatical principles of ASL and the grammatical principles of natural languages in general. Observation of the ASL acquired by their child thus permits us to determine whether native learners are indeed capable of rectifying such input and reassembling from it a natural language of the usual sort. In our most recent and still ongoing studies, the parents are hearing signers who first acquired ASL shortly after the birth of their deaf child and who therefore have even more limited control of ASL. The input these parents

offer their children perhaps more closely approximates the input circumstances of children learning quite young pidgins. In both types of cases, because we have available to us information about the full range of linguistic input the children receive, we can more confidently interpret where the children's own structures may come from than is typically the case in studying spoken-language creolization.

At the same time, there are certain crucial ways in which these cases differ from creolization. First, because there is no surrounding multilingual community and no antecedent pidgin formed as a contact language, many of the circumstances of creolization are absent. This difference has the scientific advantage that, to the extent that the resulting acquisition phenomena are similar to those found in creolization, such results cannot in our cases be assigned to such factors as borrowing from surrounding languages or transfer from the simultaneous acquisition of these languages along with the emerging creole.[2] Perhaps more clearly than children forming a creole language, the children we observe in the studies reported here are solely dependent for their learning on the degraded input they receive and their own internal capacities for structuring this input into a native language. Thus, although the results of studies like ours cannot show whether creole languages *in fact* arise from acquisition rather than from other factors, they can show whether creole languages could *in principle* arise in this way.

On the other hand, there are other differences between these cases and creolization that may contaminate such comparisons and therefore must be considered with caution. All of our studies involve signed rather than spoken languages, and in some cases users who are more fluent and whose structures are more complex than those of pidgin speakers. Either or both of these factors could conceivably produce different, and perhaps more linguistically complex, outcomes than might be the case for spoken-language creolization. In subsequent sections I will hold aside these concerns and will try to describe what I think, most optimistically, our studies can say about creolization issues. In section 6.5, however, I will return to considering the ways in which our results might be influenced by differences in modality and in complexity of the input.

6.2 The Acquisition of ASL from Reduced Input: A Case Study

Jenny Singleton, Danielle Ross, and I have been closely examining the longitudinal progress and final outcome of ASL acquisition in a single child, Simon (Singleton and Newport 1994; Singleton 1989; Ross and Newport 1996). Simon is the only congenitally deaf son of two deaf parents and has acquired ASL as his native language. The unique features of Simon's case for our research were that Simon's *only* input to ASL came from his parents and that his parents were both late learners of the language. Both parents were first exposed to ASL in their late teens, but since that time have used it as their primary language, with each other and their friends, and (then later) with Simon. We videotaped Simon and his parents, both in spontaneous interactions and in elicited tests of production and comprehension of a variety of grammatical structures of ASL, from the time Simon was 2 years old until he was 9.

We therefore have extensive samples of the input Simon received, as well as the outcomes he achieved, in his acquisition of ASL.

When Simon was very young, he spent his time at home interacting with his parents. At school age, in addition to continuing to interact with his parents, he attended a day school where none of the teachers or other students knew ASL; the school communicated in a form of Signed English that does not contain the morphology or syntax of ASL that we have studied in Simon. Moreover, research on other children's acquisition of this Manually Coded English has shown that it is not a natural language, and its grammatical devices are therefore not acquired by children (Supalla 1991; Schick and Moeller 1992). Although this research raises other important issues for language acquisition, for present purposes it suggests that Simon's exposure to an artificial Signed English system at school was unlikely to have played a significant role in his acquisition of the morphology and syntax of ASL. All of the teachers in Simon's school were hearing and did not know ASL. All of the students in the school, other than Simon, had hearing parents who did not know ASL. Simon's parents' friends were also nonnative learners of ASL and did not interact substantially with Simon. In short, then, Simon's only input to ASL came from his parents.

As I describe below in more detail, Simon's parents' use of ASL (like that of other late learners we have studied) varied across the different structures we have examined. With regard to the simplest constructions of ASL (e.g., basic word order), his parents (and other late learners) looked reasonably consistent. However, with regard to the use of ASL morphology and various aspects of complex ASL syntax, his parents were quite inconsistent, or they omitted structures found in the output of native signers. These differences have permitted us to investigate the effects of these types of input on Simon's own acquisition. As I will show, in each of these cases Simon succeeded in constructing a form of ASL that was architecturally quite distinct from his parents', though clearly derived from their input.

6.2.1 Simon's Acquisition of Morphology from Inconsistent Input

One of the structural domains we have analyzed most closely concerns the morphology of verbs of motion in ASL. In native ASL, verbs of motion are morphologically quite complex, with as many as 7 to 15 morphemes required to form a single verb. Simon's parents used almost all of the morphemes in this domain, but not always correctly: on elicitation tasks, they each correctly used each of the morphemes we tested in 40% to 75% of the obligatory contexts; the remaining usages involved omitting a required morpheme or replacing it with an ungrammatical form. Their verbs of motion thus probabilistically exemplified the ASL morphological structure but failed to exemplify its rule-governed nature. This input thus allowed us to ask how Simon would acquire the morphology, in an arena where the morphemes and the verb structure are language-specific but where the general architecture of a morphological system should universally be quite different from that of Simon's input. (We know of no natively acquired natural language in which morphemes are present on a truly probabilistic basis, with no linguistic factors conditioning the pertinent variation. See section 6.2.1.3 for further discussion.)

6.2.1.1 The Structure of ASL Verbs of Motion Descriptions of events of motion in ASL typically consist (at minimum) of a subject noun referring to the theme, followed by a verb describing the motion of this theme through space (e.g., a doll moving from one place to another). The verb of motion itself is morphologically quite complex, including a root morpheme for the path of motion (e.g., straight, arc, or circular), additional morphemes for the manner of motion along this path (e.g., bouncing, rolling), and classifier morphemes that classify the subject noun in terms of its semantic category or its size and shape (e.g., human, vehicle, or long + thin). If there is a secondary (ground) object with respect to which the moving object moves (e.g., a doll moving toward a *tree*), the verb of motion also includes a set of classifier morphemes for this noun, as well as a set of morphemes for the placement and orientation of the ground object with respect to the path of the moving object (in this case, morphemes indicating that the tree is at the end of the path). A full description of the structure of these verbs can be found in Supalla 1982.

Presumably because it is so complex, the morphological structure of these verbs is acquired over quite a long period by native-signing children, as is the case for morphologically complex forms in spoken languages, and with many errors by late learners of ASL (Supalla 1982; Newport 1982, 1990; Newport and Meier 1985). It therefore seemed to be an interesting domain for examining the nature of input and outcome for Simon. In order to elicit a full range of data on the use of the relevant morphemes, we presented Simon and his parents with an elicitation task designed for studying the production of verbs of motion (Supalla et al., in press). The task consisted of 120 short filmed events of people and objects that move along varying paths and in varying manners of motion. Each event should elicit a sentence containing a single verb of motion, whose morphemes have been specified by previous linguistic analyses as well as elicitation data from a large number of adult and child native signers. This task was given to Simon and his parents, mixed with other elicitation tasks and with extensive spontaneous conversational interactions, every six months throughout the time we studied Simon's family. Our analyses are performed on the responses to this task but are fully in accord with the spontaneous usage Simon and his parents exhibit in conversational interactions as well.

6.2.1.2 Simon's Input and Output Our question concerned Simon's acquisition of morphemes for which his input was inconsistent. To answer this question, we compared Simon's input (his parents' use of the morphology of verbs of motion) with his own production of these morphemes, both at the end of his acquisition (at ages 7 and 9) and in the course of development (see Singleton and Newport 1994 for the full data on Simon's performance at age 7, and Ross and Newport 1996 for the longitudinal data from age 2 to age 9). Our analyses examined each elicited morpheme separately. Since the 120 items in the task included multiple items testing each morpheme, we were able to determine not only whether Simon and his parents used the correct ASL morphemes at all, but also how consistently they used these forms over a number of obligatory contexts.

Overall, Simon's parents used the correct ASL morphemes most of the time; but, like other late learners, they often made mistakes, either replacing correct morphemes with forms that were incorrect in that context or omitting the correct morphemes altogether. Moreover, because their alternative forms appeared to be errors rather than the result of alternative rules, they occurred probabilistically, with no conditioning linguistic context that we could discern and with little similarity between the two parents in when they occurred or what form they took. Simon's parents thus provided him with a troublesome input from which to learn ASL morphology, one in which each morpheme was distributed over a set of linguistic contexts entirely probabilistically: for every set of contexts (e.g., for all the events involving a straight path of motion), one morpheme was used in a majority of instances, but several others were each used unpredictably. This situation allowed us to ask whether Simon would acquire these morphemes by mirroring the probability distributions of his input, or rather by forming a set of deterministic rules that, although they did not govern his input, would be architecturally more characteristic of natural languages.

Simon's input, and his resulting output, fell into two different categories. One large set of morphemes was produced by his parents with a moderate degree of consistency: these morphemes were produced correctly, using the obligatory ASL forms, in approximately 60% to 75% of their required contexts. This level of consistency was found for morphemes marking the path, manner, and other aspects of movement of the moving object. (These morphemes are also acquired relatively early by native-signing children and are acquired relatively well by late learners in general.) Although this level of consistency is nowhere near native performance, it was apparently an adequate base on which Simon could build a more deterministic set of morphological rules. For these morphemes, Simon far surpassed his input, and he regularized every morpheme to which he was exposed. His own usage of each of these morphemes was correct in over 90% of the required contexts and was entirely comparable to that of children of the same age who have been exposed to native-signing parents. He did not acquire any of the inconsistent errors that his parents produced. An example of the parents' usage, compared with Simon's, is presented in (1)–(4). Because our analyses focused on the morphology of the verb of motion, rather than the structure of the sentences in which these verbs occurred, the examples show only the verb of motion (morphemes are indicated in English glosses and connected by hyphens).[3] The path and location morphemes within each verb are underlined.

Event: female doll moving in a straight path, passing a stationary dog

(1) Correct ASL verb: HUMAN-LINEAR-MID-ANIMAL

(2) Mother's verb: Ztip-LINEAR

(3) Father's verb: HUMAN-LINEAR-WALK

(4) Simon's verb, age 7: HUMAN-LINEAR-MID-FLAT

A somewhat different result occurred for the morphemes that Simon's parents produced with much less consistency. Simon's parents used classifier morphemes

correctly only about 40% of the time (native learners acquire the same morphemes last). For these morphemes, Simon still surpassed his parents quite a bit in regularity, but at ages 7–9 he appeared to have locked into a morphological system that was not as complex as that of native ASL and that no longer improved with age.[4] (See (1)–(4) for Simon's parents' and his own usage of classifier morphemes; these are the morphemes that, in native ASL, should be HUMAN and ANIMAL.) Finally, where Simon's input presented no examples of particular morphemes, Simon omitted the same morphemes altogether.

Taken together, these results suggest that, in a highly language-specific arena, Simon based his learning heavily on his input, but reorganized this input to form a cleaner, more rule-governed system than the one to which he was exposed. Rather than reproducing the probabilistic structure of his parents' usage, Simon altered the language, producing his own version of ASL whose structure was more like that of other natural languages. Where his input was adequate, Simon's resulting morphology matched that of native ASL; where his input was less adequate, Simon nevertheless moved toward native ASL and stopped short of a full native system only as the disorder of the data he received, and his own maturational processes, intervened.

6.2.1.3 Probabilistic Rules I have suggested that Simon failed to acquire the probabilistic structure of his input and instead changed it into a more deterministic rule system. Before we consider Simon's performance on other constructions, it may be important to clarify how this finding fits into the literature on the nature of rules in natural languages.[5]

Although much of the literature on natural languages describes morphological (and phonological) rules as deterministic, there is an extensive literature on sociolinguistic variation, historical change, and creolization that describes rules as distributed in continua over communities and as being used in a variable or probabilistic fashion by individuals (Kroch 1989; Labov 1989, 1994; Rickford 1987). If these phenomena occur in natural languages, it must be the case that children are capable of acquiring such rules. Why, then, does Simon not acquire the probability distributions of his parents' morphological usages, and why does he instead change them into a more discrete and deterministic set of rules?

At least part of the answer to this question may lie in the substantial differences between Simon's input and the nature of rule variability found in natural languages. As noted above, Simon's parents' usages are probabilistic in several quite unusual ways. First, for any morphological context, one form is used in a majority of instances, while numerous other forms are each used very infrequently. This particular statistical distribution (as compared with the more typical variable rule, a statistical alternation between two forms, each used with relatively high frequency) may be especially unstable from the point of view of learning. Second, Simon's parents' incorrect forms do not agree with one another; the parents typically accord with one another only in their common use of the correct ASL forms. Third, as far as we can discern, because the incorrect forms are errors, they do not have conditioning linguistic contexts. Any or all of these factors may figure crucially in Simon's tendency to reorga-

nize. Put differently, Simon may "reorganize" his language simply by failing to learn the numerous low-frequency, inconsistent, unpredictable alternations of his parents.

If this argument is correct, it suggests that examining the quantitative details of variability may be important for understanding language change, and particularly for understanding when a child will change a language rather dramatically.

6.2.2 Simon's Acquisition of the Architecture of Morphological and Syntactic Rule Systems from No Input

So far I have described Simon's acquisition of morphology that his parents had acquired approximately correctly and therefore for which the relevant input was present but inconsistent. In other domains, Simon's parents' usage was more reduced, permitting us to investigate whether certain types of rule systems, particularly those with stronger universality in natural languages, can be acquired *without* pertinent input (Singleton 1989; Singleton and Newport, in preparation). One of these concerned the inflectional morphology of ASL for marking aspect and number on verbs. In native ASL, morphemes for continuous aspect and for dual and multiple plural occur individually in appropriate contexts; when contexts are more complex and involve both aspect and number, these morphemes must be combined. For example, for an event in which *repeated* action is performed *twice*, both an aspect morpheme and a number morpheme are required. As with verbs of motion, we examined the production of this morphology in an elicitation task and then compared the obtained data with spontaneous conversational use. Our elicited production task (Supalla et al., in press) presented 36 short filmed events in which a person performed an action once, twice, repeatedly, or with more complex combinations of aspect and number (e.g., blowing out several candles on cake 1, then blowing out several candles on cake 2). For native signers we have tested previously, these events elicit verbs that are, respectively, uninflected, marked with a DUAL inflection, marked with a REPEATED inflection, and marked with both a REPEATED and a DUAL inflection.

However, Simon's parents did not exemplify all of this structure. When only one of these inflections was required, Simon's parents used the required inflection at a middling level of consistency, as in the morphology of verbs of motion described above. However, when the context required a combination of two morphemes, the parents virtually never produced such combinations. Instead, they produced one inflection and represented the other meaning periphrastically (e.g., with an adverbial phrase). Two examples are presented here.

Event: person blowing out many candles on cake 1, then on cake 2

(5) Correct ASL verb: [BLOW-REP]-DUAL

(6) Mother's verb phrase: BLOW-REP, NEXT, BLOW-REP

Event: person blowing out one candle on cake 1, then one on cake 2, then one on cake 1, then one on cake 2, and so on

(7) Correct ASL verb: [BLOW-DUAL]-REP

(8) Mother's verb phrase: BLOW-DUAL BACKandFORTH

The input Simon's parents provided to him thus could be viewed as involving an exclusionary rule that blocked the appearance of an inflection in contexts in which another inflection appeared. Natural languages do not generally display this type of rule; rather, inflections generally appear when their contexts require them to, regardless of the presence of other inflectional processes (thus automatically resulting in two inflections when two inflectional contexts occur).

Simon was tested on these structures at age 9. Interestingly, Simon did not acquire the exclusionary pattern of his parents, but rather freely combined two inflections. (When two morphemes were required, Simon produced them 100% of the time, compared with 25% and 0% for his mother and father, respectively. Simon's responses on the test items exemplified above were identical to the correct ASL forms listed in (5) and (7).) This outcome suggests that although Simon learned the individual inflections from his parents' usage, he imposed on them a combinatorial architecture that did not come from his input.

Simon's comprehension of topicalized structures in ASL similarly showed an architectural constraint that, although universal to natural languages, did not appear in his input. In native ASL, SVO sentences can undergo topicalization as long as the relevant topics observe *structure dependence*. That is, either the subject NP, the object NP, or the entire VP may be topicalized, a process that involves moving the topic phrase to the front of the sentence and marking it with a topic facial expression that extends throughout the phrase (resulting in sentences of the form S,VO, O,SV, or VO,S, where underlining indicates the presence of the topic marking) (Liddell 1980). However, in spontaneous conversation Simon's parents produced only one of these forms of topicalization, namely, S,VO. An example is shown in (9). Since they did not produce any of the other forms, their input never exemplified the structure-dependent constraint on this process.

(9) Simon's father: SIMON'S TEACHER, LIKE POINT$_{\text{at Simon}}$
(English translation: 'As for Simon's teacher, she likes him.')

Our elicitation task for this construction involved comprehension rather than production. The task (Supalla et al., in press) contained 36 items, 9 for each of 4 types of sentences: SVO (with no topicalization), S,VO (with a topicalized subject), O,SV (with a topicalized object), and VO,S (with a topicalized verb phrase). The sentences were signed by a native ASL signer on videotape and presented, in random order, one at a time. Each sentence was accompanied by two pictures, which illustrated (a) the subject noun acting on the object noun and (b) the object noun acting on the subject noun. The observer was asked to point to the picture that corresponded to the sentence.

Simon's parents' performance on this task showed that, when asked to comprehend sentence types they did not produce, they consistently violated structure dependence. Both parents responded perfectly to SVO and S,VO sentences, demonstrating that they understood the basic word order of ASL to be SVO. (They also displayed this basic word order and, as shown above, the topicalized subject

construction in their spontaneous production.) However, the parents consistently *mis*interpreted the sentences involving topicalized objects or verb phrases, suggesting that their analyses of complex sentence structure in ASL did not observe structure dependence. For example, on 8 out of 9 trials, Simon's mother interpreted VN,N sequences as VS,O, an order that cannot be derived from a basic SVO order by any single phrasal movement rule. Simon's father responded in the same way (i.e., incorrectly) on 7 out of 9 trials. Nevertheless, in the same comprehension task administered at age 9, Simon interpreted the same sequences in perfect accord with structure dependence (e.g., comprehending VN,N sequences as VO,S on all 9 trials).

In sum, Simon presumably learned certain aspects of this construction from his input: that the basic word order of ASL is SVO, and that certain facial expressions may mark a topic. But his parents' productions did not exemplify the types of word sequences to which this process might be generalized, and their comprehension of such sequences suggested that they did not themselves follow an identifiable natural language principle. That Simon's topicalization rule accords with structure dependence thus appears to be due not to his input, but to his own tendencies to bring the phrasal structure of sentences in line with their extension into more complex constructions.

In both of these cases, then, Simon appears to have used his input for information on the basic forms of morphological and syntactic rules; but he has gone beyond his input in the way these rules are organized, imposing universal principles of rule architecture that his parent's usage does not illustrate or observe. All of these examples demonstrate the capacity of native learners to restructure an input language.

6.3 The Acquisition of ASL from Extremely Reduced Input: Ongoing Studies

When our previous studies began, deaf children were only exposed to signed languages from other deaf adults or children; hearing families virtually never provided any source of input to ASL, because almost no hearing parents signed. However, partly because of the spread of linguistic findings on ASL to the educational and medical communities, and partly because of more widespread changes in the political climate surrounding deafness and signed languages, in recent years hearing parents with deaf children have more often begun to learn signed languages themselves. These events have opened new research possibilities, namely, the study of children acquiring native languages from *extremely* simplified and reduced input. Danielle Ross and I have begun to observe deaf children learning to sign in the home, from hearing parents who are still learning to sign themselves. It is much too early in these children's development for us to be able to report any outcomes; but the nature of these studies promises to reveal much more information about precisely how well a child can do when linguistic input is simplified and reduced in this way. In addition, because the families vary in how well they sign, comparisons among them may help to delineate the types of input that are needed for various types of grammatical structures to emerge in the child learner.

6.4 What Constrains the Native Learner?

Our results to date demonstrate two things: First, the findings I have reviewed show that native language learners are capable of surpassing reduced or disordered input, and constructing from it a more complex and well-structured grammatical system. Second, implicit in our findings on the late-learning parents is that, unlike native learners, they are apparently not capable of the same reconstruction. Indeed, our findings in other studies (Newport 1990; Johnson and Newport 1989, 1991; Johnson et al. 1996) have shown that adult learners do not succeed in acquiring well-structured grammars even from normal linguistic input. Together, these results show rather strongly that there must be innate tendencies in young language learners to perform these sorts of learning processes and that these tendencies change and decline with maturation.

What is the nature of the innate constraints? Within linguistics, the widespread view is that the pertinent innate constraints are the principles of Universal Grammar (Chomsky 1965, 1981, 1986; Bickerton 1984; and many others). This view is certainly consistent with our results: Simon may well have acquired the language he did because he, like all native language learners, knows innately that languages must have deterministic rules, structure-dependent movement processes, and the like. However, there is an alternative interpretation that, although much less well specified, is also consistent with our results. Relatively little research has investigated whether phenomena like those that Simon demonstrates in language acquisition may also occur in nonlinguistic learning by children, and therefore whether the constraints in question might be more general than simply constraints on language, or more indirectly specified than a formulation in terms of grammatical principles might suggest. Although it is common for theorists to claim that phenomena such as the ones we study are unique to language, surprisingly little research has been conducted on this issue. Therefore, one of the lines of ongoing research in our laboratory focuses on this question.

As a preliminary example, Boris Goldowsky (1995) has completed a study in which young children and adults are presented with a nonlinguistic pattern-learning task modeled formally on Simon's inconsistent input for learning morphology. In this task the perceptual dimensions of visual objects (their size, shape, and color) map onto the dimensions of their movements across a screen (their path, manner, and direction of motion). In the crucial condition of the experiment, the mappings over example stimuli are imperfect and probabilistic, just as is Simon's linguistic input for morphology (i.e., the mappings are represented in 70% of the stimuli, rather than in 100%). Surprisingly, children perform very differently in this task than do adults. Adult learners are simply impaired in their learning by the inconsistency of the input data; on average, they perform somewhat more poorly than what the learning literature calls "probability matching" (i.e., somewhat worse that the 70% probabilities they are exposed to). In contrast, child learners tend to form mapping rules that are much more systematic than (and in fact sometimes quite different from) the data they see. Some of the children regularize their input, acquiring almost perfect mappings

from the 70%-consistent data; other children perform equally regularly, but on mappings that are not the ones most common in the data. It would be premature to claim that children show the same phenomena in nonlinguistic learning that are so characteristic and surprising in language learning. Nonetheless, the results of the study do raise this possibility and urge further research.

6.5 What do these Studies Contribute to Creolization?

These results clearly suggest that many of the phenomena reported in pidgin/creole studies—greatly reduced and simplified systems used by adults, but sharply expanded and more linguistically natural systems acquired by children—could in principle result from the differential abilities of adults and children to learn languages. As I stated at the outset, one cannot, of course, determine from studies like ours whether the mechanisms of language acquisition are in fact the only or even the prime cause of genuine pidgin and creole languages; the actual circumstances of pidginization and creolization include many more potential contributing factors than do our studies, and it is always possible that similar results may arise from different causes. Nevertheless, because we have had the opportunity to record the actual input our learners receive and to compare this with the actual outcomes achieved, we can offer more evidence than is usually available in studies of creolization about the contributions the child learner makes to the languages acquired. In this sense, then, our results are consistent with some of the general claims made by Bickerton (1975, 1981, 1984), Slobin (1977), and others, that differences between pidgins and creoles may arise from innate differences in their learners.

At the same time, our results may give a somewhat different flavor to these claims and may thereby bring them into better accord with claims by creolists of a different persuasion (see the commentaries to Bickerton 1984; Muysken and Smith 1985), who have been concerned with the presence during acquisition of surrounding languages, which may offer input pertinent to the structures children acquire. The contrasts between Simon and his parents are in certain ways less extreme, and more reorganizational, than might be suggested by the Language Bioprogram Hypothesis. When we look closely at Simon's input compared with his output, he does not appear to be creating an entirely new language from his own innate specifications; rather, he appears to be following the predominant tendencies of his input, but he sharpens them, extends them, and forces them to be internally consistent. His most striking innovations occur not where input is merely absent, but where input patterns conflict. His late-learning parents are apparently content to use several local processes that do not work together: simple sentences organized in terms of phrase structure, but complex sentence constructions that do not observe these constituent phrases; inflectional processes that occur individually, but never combine. In contrast, Simon changes the architecture of these processes to create a more uniform grammar. He thus creates rules out of tendencies, and coherent systems of rules out of conflicting processes. Similarly, creolizing children may not ignore their inconsistent and ill-formed input, but may apply their organizational biases to the predominating

tendencies of this input. Because most studies of creole languages cannot offer quantitative data on the usages that surround the child, the distinction I am attempting to draw may often be impossible to make. But studies like our own, combined with detailed observations of ongoing creolization (see Kegl, Senghas, and Coppola, this volume), may offer the opportunity to clarify the mechanisms employed by children in changing languages.

I noted in section 6.1 that I would discuss potential concerns about our studies. One question concerns whether children like Simon are indeed learning ASL only from their parents or whether (as in the case of creolizing children) there are also surrounding languages from which the structures they acquire might be borrowed. In Simon's case we believe it is extremely unlikely that the surrounding languages could possibly be the source for the structures he produces in ASL. Because Simon lives in a U.S. city, the only language around him (other than his parents' ASL) is English. The people who live around him and teach at his school are hearing people who speak oral and Manually Coded English, and of course as he gets older he is learning to read English in school. Does his knowledge of English have any possible effects on his acquisition of ASL? For two reasons, we believe it does not.

First, the particular grammatical devices we have analyzed in Simon's ASL do not appear in English, so it is not a possible source of transfer in any superficial way. English verbs do not have the morphology of verbs of motion or the morphology of aspect and number that we have examined in ASL; and English syntax (except perhaps occasionally in certain colloquial dialects Simon is unlikely to be exposed to through print or signing) does not permit the kinds of topicalization processes we have examined in ASL. Moreover, the broad typology of ASL that underlies these structures (i.e., the quite complex morphological system and the extreme frequency of topicalization) is not the typology of English. Is it possible that Simon instead has transferred more abstract principles from English to ASL—for example, the general property of having rules or the principle of structure dependence? Although this is possible, it seems extremely unlikely, because the literature on language acquisition in the deaf makes quite clear that profoundly and congenitally deaf children do not readily acquire much English through oral, manual, or written methods. The central concern of deaf education, from its origins to the present, has been the failure of most congenitally and profoundly deaf children to master English (or any other spoken language). Population data have consistently revealed that 88% of deaf high school graduates read below the fourth grade level and do not control any of the complex structures of English (see Wilbur 1987, for a review). These data have not been changed by modern educational methods (Holt 1993) and appear to result from the difficulty of acquiring a language without natural exposure and immersion. Therefore, the possibility that Simon, as a deaf child, could have acquired English to a better degree than he could acquire ASL from his parents seems extremely remote.

Is it possible that differences between Simon's circumstances and those of creole learners could make it inappropriate to apply an account of Simon's acquisition of ASL to creolization? Here one might consider two factors. First, Simon is acquiring a signed language, whereas most creolization has involved spoken languages. Insofar

as there may be modality differences in the structure or acquisition of spoken and signed languages, these modality effects might intrude on comparisons between Simon's case and creolization. Second, Simon's input is not a pidgin, but a late-acquired full language. Might it be that Simon's input is therefore much more complex than that received by creolizing children, thus rendering his case irrelevant for understanding creolization?

The short answer to these concerns is that they require further research; in the meantime they must be kept in mind. Most of the research on signed languages has focused on the structure and acquisition of one signed language, ASL (but see Kegl, Senghas, and Coppola, this volume, for acquisition research on signed languages in Nicaragua). The ASL data have shown without question that it is, in both its structure and its acquisition process, much like spoken languages of the world. Many investigators have therefore expected that there will be no significant modality differences in the two types of languages and that the range of linguistic universals and variation will be precisely the same for signed as it is for spoken languages. However, research on the many other signed languages of the world is only beginning, and early results do raise the possibility that, at least in the area of morphophonology, signed languages might be more similar to one another in typology than are spoken languages (Supalla 1995; Supalla and Webb 1995). This in turn raises the possibility that linguistic universals in signed languages (at least in morphophonology) might be more extensive than those in spoken languages, and it might slightly change the picture of innate factors in acquisition within the two modalities.

It is also possible to argue that Simon acquired ASL as well as he did at least in part because of the richness of his input. Although his parents clearly did not produce native ASL, as late learners of a full language they have much more extensive control over complex structures than would be the case for pidgin speakers, and therefore their input may have provided Simon with more extensive materials for building a complex language than would be available to most creole learners. Thus, although we believe the data that Simon has provided offer important information for language acquisition theories, his circumstances may not be precisely enough like creolization processes. We hope that our ongoing research involving deaf children with hearing parents will provide more information on the outcome of acquisition from much more restricted input (in a related vein, see Kegl, Senghas, and Coppola, this volume; Henry and Tangney, this volume).

In summary, we are quick to acknowledge the differences between the acquisition of ASL under the circumstances we have observed and the development of creole languages. In some regards we believe that these differences are beneficial for shedding new light on creolization processes: where real creoles emerge in the presence of many factors, our paradigms allow close examination of some of the factors alone and permit us to ask whether children's acquisition mechanisms are in principle adequate to explain language reorganization. Here we believe the answer is a strong yes. At the same time, because of differences between Simon's circumstances and those of creole learners, these parallels can only be drawn in principle, and the empirically adequate accounts of creolization must be left to studies of creolization. We

hope that the case of Simon and his parents, with the quite striking evidence it provides for the child's ability to build a language out of limited input, contributes to this endeavor.

Notes

The research reported in this chapter is supported in part by NIH grant DC00167. I would like to thank my collaborators on the studies described here: Ted Supalla, Jenny Singleton, Danielle Ross, and Boris Goldowsky. Thanks are due also to Jenny Saffran for helpful comments on an earlier draft, and to Michel DeGraff for stimulating discussion throughout the writing of this chapter.

1. There also exist several artificial gestural languages or codes (e.g., Signing Exact English, Seeing Essential English), which have been invented by particular individuals to represent as closely as possible the morphology and syntax of a spoken language, and which are typically used by teachers and in instructional settings, rather than in spontaneous interactions among communities of users. However, because these artificial codes have neither a natural evolution nor a natural acquisition process, they are typically kept separate from the natural signed languages in theoretical research concerned with natural language structure and its learning.

2. But see Kegl, Senghas, and Coppola, this volume, for a somewhat different scenario for the emergence of a signed language in Nicaragua via what may count as a prior pidginization stage and with the possibility of (limited) transfer from Spanish.

3. The following notation is used for these morphemes: HUMAN = classifier for human; ANIMAL = classifier for animal; Ztip = tip of the index finger tracing the path; FLAT = classifier for flat object; LINEAR = movement in a straight, or linear, path; MID = secondary object at midpoint of path; WALK = walking manner.

Note that in these examples, as in the corpus as a whole, Simon's parents often omit obligatory morphemes. In many cases, including these, his parents use periphrastic means to convey information ordinarily marked by verbal morphemes. The full sentences they produced in these cases are

(2) Mother's sentence: WOMAN PASS DOG Ztip-LINEAR

(3) Father's sentence: GIRL HUMAN-LINEAR-WALK PASS DOG

In contrast, Simon at age 7 produces much more of the correct ASL morphology and therefore exhibits less lengthy periphrastic sentence constructions.

(4) Simon's sentence: GIRL HUMAN-LINEAR-MID-FLAT

4. See Ross and Newport 1996 for a discussion of the limits on Simon's acquisition of classifier morphemes. The developmental pattern for these data suggests that either the quality of Simon's input, or his reaching age 7–9 without having completed his learning, has limited his outcome. Ongoing analyses of other children are aimed at disentangling these factors.

5. I am indebted to Bill Labov and Michel DeGraff for reminding me to consider these very interesting issues and for engaging me in important conversations about their resolution.

References

Bickerton, D. 1975. *Dynamics of a creole system*. Cambridge: Cambridge University Press.

Bickerton, D. 1981. *Roots of language*. Ann Arbor, Mich.: Karoma.

Bickerton, D. 1984. The Language Bioprogram Hypothesis. *Behavioral and Brain Sciences* 7, 173–221.

Chomsky, N. 1965. *Aspects of the theory of syntax*. Cambridge, Mass.: MIT Press.

Chomsky, N. 1981. *Lectures on government and binding*. Dordrecht: Foris.

Chomsky, N. 1986. *Knowledge of language*. New York: Praeger.

Emmorey, K. 1991. Repetition priming with aspect and agreement morphology in American Sign Language. *Journal of Psycholinguistic Research* 20, 365–388.

Emmorey, K., and D. Corina. 1990. Lexical recognition in sign language: Effects of phonetic structure and morphology. *Perceptual and Motor Skills* 71, 1227–1252.

Fischer, S. 1978. Sign language and creoles. In P. Siple, ed., *Understanding language through sign language research*. New York: Academic Press.

Goldowsky, B. 1995. Learning structured systems from imperfect information. Doctoral dissertation, University of Rochester.

Holt, J. 1993. Stanford Achievement Test—8th Edition: Reading comprehension subgroup results. *American Annals of the Deaf* 138, 172–175.

Johnson, J., and E. L. Newport. 1989. Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology* 21, 60–99.

Johnson, J., and E. L. Newport. 1991. Critical period effects on universal properties of language: The status of subjacency in the acquisition of a second language. *Cognition* 39, 215–258.

Johnson, J., K. Shenkman, E. L. Newport, and D. Medin. 1996. Indeterminacy in the grammar of adult language learners. *Journal of Memory and Language* 35, 335–352.

Klima, E., U. Bellugi, et al. 1979. *The signs of language*. Cambridge, Mass.: Harvard University Press.

Kroch, A. 1989. Reflexes of grammar in patterns of language change. *Language Variation and Change* 1, 199–244.

Labov, W. 1989. The child as linguistic historian. *Language Variation and Change* 1, 85–97.

Labov, W. 1994. *Principles of linguistic change*. Vol. 1, *Internal factors*. Cambridge, Mass.: Blackwell.

Liddell, S. 1980. *American Sign Language syntax*. The Hague: Mouton.

Mayberry, R., and S. Fischer. 1989. Looking through phonological shape to lexical meaning: The bottleneck of non-native sign language processing. *Memory and Cognition* 17, 740–754.

Mayberry, R., S. Fischer, and N. Hatfield. 1983. Sentence repetition in American Sign Language. In J. Kyle and B. Woll, eds., *Language in sign: International perspectives on sign language*. London: Croom Helm.

Muysken, P., and N. Smith, eds. 1985. *Substrata versus universals in creole genesis.* Amsterdam: John Benjamins.

Newport, E. L. 1982. Task specificity in language learning? Evidence from speech perception and American Sign Language. In E. Wanner and L. R. Gleitman, eds., *Language acquisition: The state of the art*. New York: Cambridge University Press.

Newport, E. L. 1988. Constraints on learning and their role in language acquisition: Studies of the acquisition of American Sign Language. *Language Sciences* 10, 147–172.

Newport, E. L. 1990. Maturational constraints on language learning. *Cognitive Science* 14, 11–28.

Newport, E. L., and R. Meier. 1985. The acquisition of American Sign Language. In D. I. Slobin, ed., *The crosslinguistic study of language acquisition*. Vol. 1, *The data*. Hillsdale: N.J.: Lawrence Erlbaum.

Newport, E. L., and T. Supalla. 1980. Clues from the acquisition of signed and spoken language. In U. Bellugi and M. Studdert-Kennedy, eds., *Signed and spoken language: Biological constraints on linguistic form*. Dahlem Konferenzen. Weinheim: Verlag Chemie.

Rickford, J. R. 1987. *Dimensions of a creole continuum*. Stanford, Calif.: Stanford University Press.

Ross, D., and E. L. Newport. 1996. The development of language from non-native linguistic input. In A. Stringfellow, D. Cahana-Amitay, E. Hughes, and A. Zukowski, eds., *Proceedings of the 20th Annual Boston University Conference on Language Development*. Somerville, Mass.: Cascadilla Press.

Sankoff, G. 1979. The genesis of a language. In K. C. Hill, ed., *The genesis of language*. Ann Arbor, Mich.: Karoma.

Sankoff, G., and P. Brown. 1976. The origins of syntax in discourse: A case of Tok Pisin relatives. *Language* 52, 631–666.

Sankoff, G., and S. Laberge. 1973. On the acquisition of native speakers by a language. *Kivung* 6, 32–47.

Schein, J., and T. Delk. 1974. *The deaf population of the United States*. Washington, D.C.: National Association of the Deaf.

Schick, B., and M. P. Moeller. 1992. What is learnable in Manually Coded English Sign Systems? *Applied Psycholinguistics* 13, 313–340.

Singleton, J. 1989. Restructuring of language from impoverished input: Evidence for linguistic compensation. Doctoral dissertation, University of Illinois.

Singleton, J., and E. L. Newport. 1994. When learners surpass their models: The acquisition of American Sign Language from impoverished input. Ms., University of Rochester.

Slobin, D. I. 1977. Language change in childhood and in history. In J. Macnamara, ed., *Language learning and thought*. New York: Academic Press.

Stokoe, W., D. Casterline, and C. Croneberg. 1965. *A dictionary of American Sign Language on linguistic principles*. Washington, D.C.: Gallaudet College Press.

Supalla, S. 1991. Manually Coded English: The modality question in signed language development. In P. Siple and S. D. Fischer, eds., *Theoretical issues in sign language research*. Vol. 2, *Psychology*. Chicago: University of Chicago Press.

Supalla, T. 1982. Structure and acquisition of verbs of motion in American Sign Language. Doctoral dissertation, University of California, San Diego.

Supalla, T. 1995. An implicational hierarchy in verb agreement in American Sign Language. Ms., University of Rochester.

Supalla, T., E. L. Newport, J. Singleton, S. Supalla, D. Metlay, and G. Coulter. In press. *Test battery of American Sign Language morphology and syntax*. San Diego, Calif.: Dawn Sign Press.

Supalla, T., and R. Webb. 1995. The grammar of International Sign: A new look at pidgin languages. In K. Emmorey and J. Reilly, eds., *Language, gesture, and space*. Hillsdale, N.J.: Lawrence Erlbaum.

Wilbur, R. 1987. *American Sign Language: Linguistic and applied dimensions*. Boston: Little, Brown.