The Development of Language from Non-native Linguistic Input

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Many studies of acquisition have suggested that young children are predisposed to acquire languages in certain regular ways, even when the input does not provide a full model of linguistic structures (Bickerton, 1984; Senghas, 1995; Singleton & Newport, 1994). The present study further investigates the circumstances under which this process occurs, the developmental course of this process, and the potential circumstances under which it may *not* be possible.

Background

There are several types of research which have shown that children acquire structures in languages which are not fully part of the input they receive. One often cited example in normal language acquisition is called "overregularization," which occurs in the acquisition of the English past tense (Cazden, 1968; Ervin, 1964; Kuczaj, 1977; Marcus et al., 1992). Children begin this process by producing regular (e.g. *walked*) and irregular (e.g. *caught*) past tense forms of verbs correctly. Shortly after, they begin to produce some of the irregular forms incorrectly (e.g., *catched* instead of *caught*), extending or overregularizing the regular past tense form. Finally, they produce past tense forms correctly.

Another example is found in creolization studies, which have shown that children who receive only pidgin input[1] nonetheless grammaticize this input to develop a more complex and regularized grammar (Bickerton, 1984; Senghas, 1995). These studies provide some of the strongest evidence that children go beyond their input in the process of acquiring a native language.

A third kind of study has been performed by Singleton & Newport (1994). They studied a profoundly deaf child they call "Simon," who has deaf parents. Simon's parents did not learn American Sign Language (ASL) until their mid to late teens. Thus while Simon is a native signer (that is, he was exposed to ASL from birth), his parents are non-native signers of ASL. Simon's language environment was very rare because his parents provided him with his *onl*y linguistic model of ASL. He attended a school where no ASL was signed, and he had no contact with children who knew ASL.

Singleton & Newport (1994) examined Simon's production of ASL at age 7:11. They found that by this age, Simon had surpassed his parents' input and become a native-like signer of ASL. However, very little is known about how such a process might occur: what its developmental course looks like, or what the underlying mechanism for such a process might be. In the interest of addressing some of these questions, the present study investigates the developmental pattern of Simon's acquisition of ASL verbs of motion morphology from the ages of 2;6 to 9;1 years.

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The important questions of the present study are, first, how does Simon develop his native-like proficiency compared to children with native input, and how readily does this pattern emerge? Further, because not all of these processes appeared to be complete by the age of 7;11, we examine whether he continues to develop after this time.

The Present Study: Developmental Course

We know from the data of Singleton & Newport (1994) that Simon's input from his parents for the morphemes of ASL verbs of motion was quite inconsistent: as shown in more detail below, Simon's parents produced each of these ASL morphemes correctly in only about 50 to 70% of their obligatory contexts; in the remaining contexts, they either omitted the required morphemes or replaced them with various ungrammatical forms. Given this degree of inconsistency and error in his input, how did Simon proceed to acquire native-like proficiency on most morphemes? Before examining the actual data,

Figure 1 (a). Idealized Native Learning Curve.

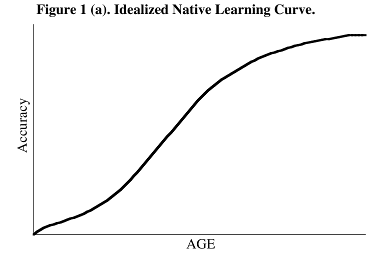


Figure 1 (b). Delayed acquisition

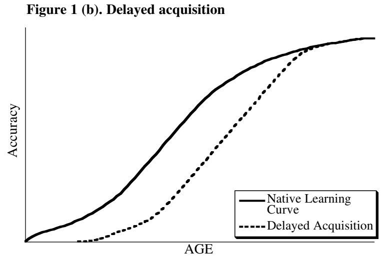


Figure 1 (c). Disrupted acquisition

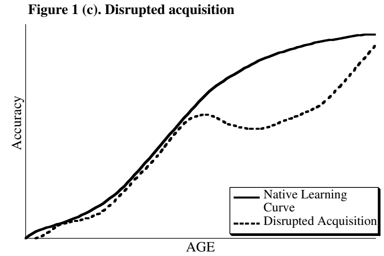


Figure 1 (d). Native acquisition

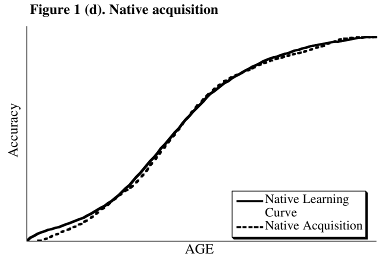
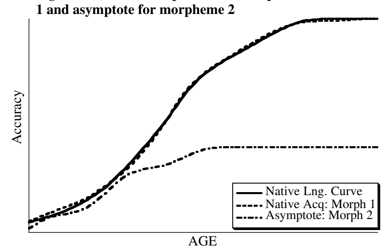


Figure 1 (e). Native acquistion for morpheme 1 and asymptote for morpheme 2



we first consider several hypotheses as to what the course of Simon's development might look like. Figure 1a shows an idealized curve of a normal increase in accuracy as a function of age; this curve is what we might expect for the acquisition of morphemes by children receiving native input. Figures 1b to 1e show some possible learning curves for Simon, as compared with this one.

One possible developmental course for Simon (see Fig. 1b) is that his acquisition might have been delayed in the early stages, due to the inconsistency of his input. Eventually, however, once he discovered the regularities, his development could have accelerated, allowing him to catch up and attain native proficiency. Another possibility is that his course of development could have been disrupted in various ways. For example (see Fig. 1c), he may have followed a normal course of acquisition at first, and then either plateaued or declined in accuracy, when his linguistic requirements became more complex. Subsequently he may have caught up and attained native proficiency. A third possibility (see Fig. 1d) is that his course of development may have paralleled perfectly that of children with native input, throughout acquisition. Finally (see Fig. 1e), he may have paralleled children with native input through some time period or on some part of the system, attaining native proficiency for certain morphemes and incomplete acquisition for others.

We next present the actual developmental data for Simon, in comparison with 16 children who have received native input to ASL. After presenting these data, we will consider what they tell us about the acquisition process.

Method

Subjects

As described above, Simon is a congenitally and profoundly deaf child acquiring ASL as his native language. His parents, who served as his only known input to ASL, were also deaf but spent their early years in oral training; they were first exposed to ASL from friends at ages 15 and 16. ASL was the primary language of communication between Simon and his parents. Beginning at school age Simon attended a day school in which all the teachers were hearing users of Signing Exact English. (Signing Exact English is an artificial signing system which does not contain any of the linguistic structures we examined in this study. It has been shown to be quite poorly acquired by children (S.Supalla, 1991; Schick & Moeller, 1992).) None of the teachers or other children in the school had deaf parents or knew ASL. Simon's acquisition of ASL was observed through regular home visits, involving videotaping of spontaneous interactions with his parents and also elicited production and comprehension tasks, from the time Simon was age 2;6 until he was age 9;1.

We compare Simon's development to that of 16 deaf, age-matched, native-signing children, who were observed and tested in the same ways as Simon. These control children have parents and grandparents who are also deaf, native signers, exposed themselves to ASL from birth. Therefore, unlike Simon, the input of these control children is fully native in its complexity and consistency. Henceforth these children will be referred to as the "native input children".

Table 1 shows the ages at which Simon and the native input children were tested on their production of ASL morphology, and the number of native input children tested at each age. Note that while Simon's data is *longitudinal*, that of the control subjects is *cross-sectional*.

Table 1. Ages and Number of Native Input Children

Age at testing	2;6-2;8	2;9-2;11	3;7-3;9	4;6-4;8	7;11	9;1
NI Children	3	2	3	3	3	2

Materials and Procedure

All children were tested by a native signer on the morphology of verbs of motion in ASL, using an elicited production task designed to assess the child's control over individual morphemes in the system.

ASL verbs of motion are highly multimorphemic. We focus on two kinds of morphemes of this type of ASL verb: movement morphemes and classifier morphemes (for further details, see T. Supalla, 1982). Movement morphemes consist of five morpheme classes: Path morphemes mark the shape of the movement from point A to point B. Manner morphemes mark how the object moves along the path. Direction morphemes mark the orientation of the path. There are also two Location morphemes, which mark the relative position of a secondary, stationary object with respect to the path of the moving object.

Classifier morphemes are morphemes which agree with the semantic or size and shape classes of their antecedent nouns (Allen, 1977; T. Supalla, 1982). There are two kinds of classifiers in ASL verbs of motion: Central object classifiers mark the semantic or size and shape class of the central or moving object. Secondary object classifiers mark the semantic or size and shape class of the secondary or stationary object.

The Verbs of Motion Production test (VMP) is one part of T. Supalla et al.'s (in press) ASL Test Battery. The subject watches 120 short, animated video clips of objects moving through space. For young children, this test is presented as 20 items per session over several months. After each video clip, the subject is asked to describe what happened. Each item requires a multimorphemic verb of motion. Each response is coded by a native signer, morpheme by morpheme.

Results

Prior Results from Singleton & Newport

As background to the present results, the results of Singleton and Newport (1994) are summarized first. Table 2 presents the percentage of correct morphemes produced in the VMP by Simon's parents, and by Simon at age 7;11. Simon's parents' signing represents his input. As the table shows, Simon's input was only moderately consistent for movement morphemes, averaging about 70% correct. His input was even less consistent for classifier morphemes, averaging about 45% correct. Note that *correct* here is synonymous with *consistent*: when morphemes were produced correctly, form and meaning were consistently mapped onto one another. Simon's parents' errors were scattered among a variety of forms, with no consistent form-meaning mappings.

Singleton and Newport (1994) then asked what happened to Simon's language by age 7;11. Table 2 also shows that, for movement morphemes, Simon's output was comparable to both native adults and children. For these morphemes he surpassed his own input quite substantially, and at age 7;11 equalled children whose input was fully native. Singleton and Newport suggested that Simon achieved this level of performance by discovering the most consistent forms in his input, and boosting the frequency of, or overregularizing, those forms. He did not incorporate his parents' errors in his system.

In contrast, he did not compare as well on classifiers. At age 7;11, Simon only slightly exceeded the performance of his parents, and had not achieved full acquisition of the ASL classifier system. However, classifier morphemes are late-acquired by all children, and Simon's acquisition may have continued beyond the bounds of their study. In the present study we therefore examine not only Simon's development from ages 2;6 to 7;11, but also his proficiency at age 9;1.

Table 2. Simon's Input and Output (Singleton & Newport, 1994)

Movement	Classifiers
Mother: 75%	Mother: 42%
Father: 69%	Father: 45%
(Native Adults: 94%)	(Native Adults: 82%)
Simon: 88%	Simon: 50%
(Native Children: 81%)	(Native Children: 69%)

Results from the Present Study

Here we ask how Simon achieved these outcomes, by examining the course of his morpheme acquisition throughout development. Given the results of Singleton & Newport, we examine movement and classifier morphemes separately.

Movement morphemes. Figure 2 shows Simon's development of movement morphemes, summed over the morpheme classes Path, Manner, Direction, and Location, in comparison with the native input children.[2] Simon's developmental curve closely parallels that of the native input children. He remains within, very near, or above the error bars of the control children throughout development. Remember that Simon's parents provided him with only somewhat consistent input for these morphemes, averaging about 70% correct. Nonetheless, his developmental course appears to be remarkably unaffected by this inconsistency. Like the native input children, he steadily increased his use of these morphemes from 2;6 to 7;11, and attained almost 90% correct at ages 7;11 and 9;1.

Figure 2. Percent correct for MOVEMENT morphemes for Simon and the Native Input Children

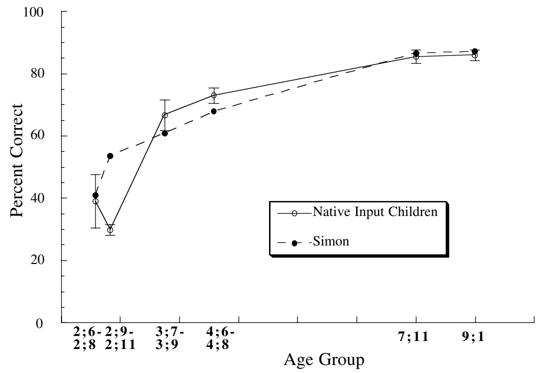


Figure 3. Percent Correct for PATH Morphemes for Simon and Native Input Children

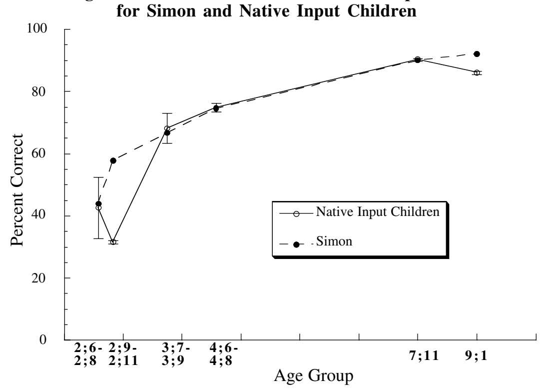


Figure 4. Percent Correct for MANNER morphemes for Simon and Native Input Children

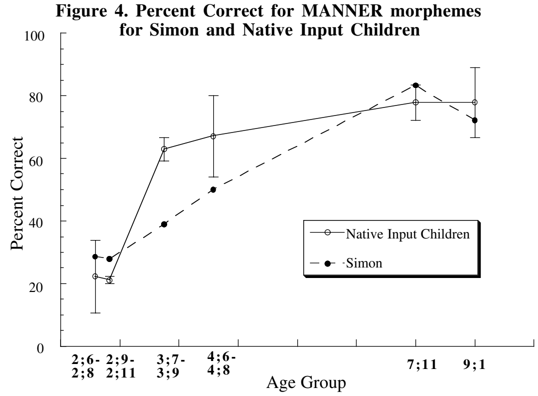


Figure 5. Percent Correct for DIRECTION Morphemes for Simon and Native Input Children

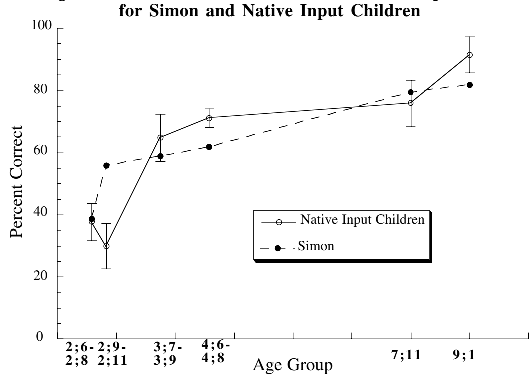
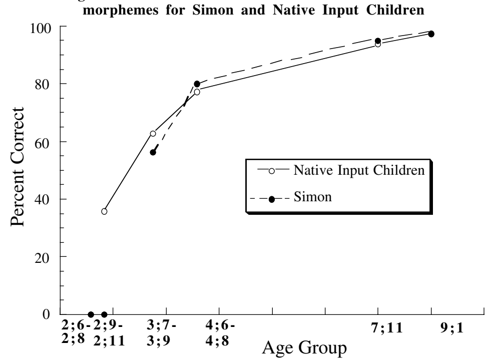


Figure 6. Percent Correct for LOCATIVE POSITION morphemes for Simon and Native Input Children



Figures 3 through 6 show the comparable data for each of the movement morpheme classes separately (Path, Manner, Direction, and Location). Although these developmental curves are not as smooth as the overall movement figure (due to the smaller number of responses scored for each morpheme class), Simon still clearly follows an approximately native course of acquisition for each.

Simon also demonstrates several general principles commonly reported in native language acquisition. First, as we have seen, he shows a steady increase of correct responses over time, and he overgeneralizes or boosts the frequency of regularities in his input. Second, in the early stages of acquisition, his errors are the same as those characteristic of native input children. For example, in acquiring any language, children produce some morphemes and omit others. Figure 7 represents the percentage of omitted direction morphemes as a function of age. Simon again remains within or near the error bars of the native input children throughout development, with frequent omission of morphemes at younger ages and relatively few omissions as he matures. Third, another typical child error found in the early stages of acquisition involves replacing a marked form with an unmarked form. Figure 8 represents the percentage of unmarked path morphemes that replaced marked path morphemes (in this case, using a linear path morpheme instead of a more complex, nonlinear path) as a function of age. Once again, Simon's developmental pattern closely resembles that of the native input children, with unmarked replacements frequent at younger ages but disappearing over time. Importantly, these are not the characteristic errors of Simon's parents, but rather those characteristic of children.

Figure 7. Percent Omitted DIRECTION Morphemes for Simon and Native Input Children

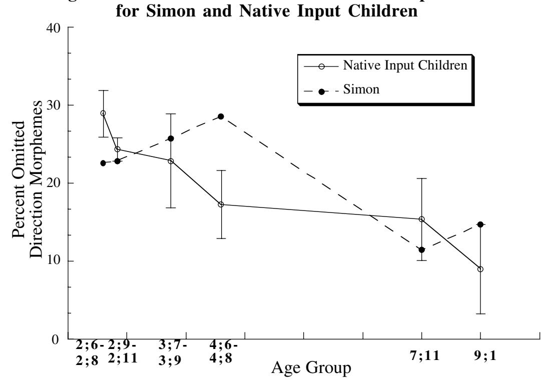
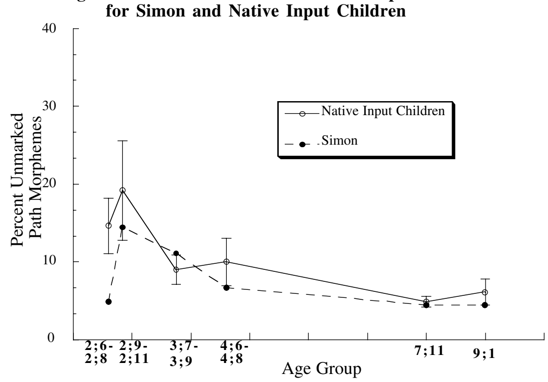


Figure 8. Percent Unmarked PATH Morphemes for Simon and Native Input Children

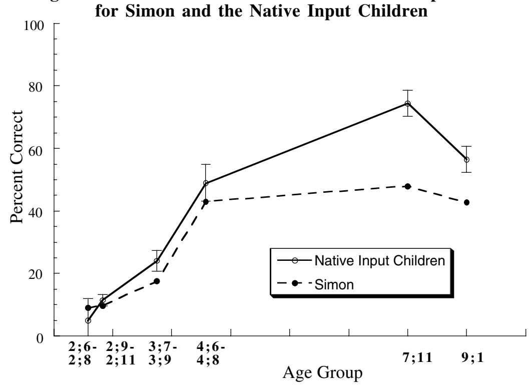


Summarizing the results for movement, Simon clearly followed the same course of development as the native input children. He did not appear to be either delayed or disrupted in his acquisition by the inconsistency of his input. This finding suggests that language learners are remarkably unaffected by noisy input data, at least within the range presented by the movement morphemes. However, for classifiers, given that his input is so much more inconsistent, one of the other possibilities illustrated in Figures 1(b) to 1(e) may be more likely.

Classifier morphemes. Figure 9 presents Simon's acquisition of classifier morphemes for the same developmental period, summed over central and secondary object classifiers, in comparison with native input children. This figure shows a quite different pattern than that seen for movement morphemes. Here Simon clearly follows a native course of steady increasing accuracy until age 4;6, at which point his acquisition appears to asymptote. His performances on classifier morphemes at ages 4;6, 7;11, and 9;1 are all almost precisely equal. In contrast, native input children improve after 4;6 to substantially higher levels of performance at ages 7;11 and 9;1 (though they do not show perfect performance at these older ages; acquisition of ASL classifiers has been reported to continue until well beyond this age (Kantor, 1980)).

Recall that this is the part of the morphology where Simon's input is least consistent; his parents produce only 42-45% accuracy on these morphemes. Simon is not able to improve upon this input. Singleton & Newport (1994), observing Simon's equivalent performance at age 7;11, suggested that perhaps he would surpass this performance at older ages. However, the present data reveal that he maintained the same low level of performance at ages both younger and older than those that Singleton & Newport observed. His final level of achievement falls between his parents' low scores.

Figure 9. Percent Correct for CLASSIFIER Morphemes for Simon and the Native Input Children



Summarizing the overall results, where Simon receives input that is moderately consistent (that is, for movement morphemes), he clearly follows the same course of acquisition as the native input children. Where he receives input that is far less consistent (for classifier morphemes), he follows the same course of acquisition as the native input children until approximately age 4;6, and thereafter ceases to improve, at least until age 9;1.

Discussion

Importantly, we ask how Simon improves upon his input for movement. First, movement morphemes are earlier acquired than classifier morphemes for all children (T.Supalla, 1982; Kantor, 1980). This seems to suggest that it is an easier system to analyze, even when input is highly consistent (see below for further discussion of this point). Second, while Simon's input for movement morphemes is not native, it is moderately consistent, providing him with some regularities to be discovered and regularized. Singleton & Newport (1994) have proposed that child learners innately tend to search for these regularities and boost their frequencies, while simultaneously disregarding inconsistent errors.

With regard to classifiers, the primary question is why Simon cannot compensate for his parents' input, when he is able to do so for movement. We have considered several hypotheses. One possibility is that movement morphemes are more iconic than classifier morphemes, and that Simon's regularization process is based on this iconicity. However, this does not appear to be the correct account (Singleton & Newport, 1994). First, in the acquisition of other ASL morphemes, such as person and number agreement, iconicity has no effect on acquisition (Meier, 1987); iconic agreement markers are not learned earlier or more easily than non-iconic agreement markers. Secondly, some classifier morphemes are actually iconic, while others are not. However, there is no difference between them in how they are acquired; both show the patterns of acquisition reported for classifiers overall. Further, if one hypothesizes that Simon takes advantage of the iconic features of movement morphemes in order to learn the system natively, then one wonders why his parents failed to do so.

A second possibility (Singleton & Newport, 1994) is that there is a threshold degree of consistency in input, below which fully native acquisition is not possible. On this hypothesis, Simon may have surpassed his input for movement morphemes but not for classifier morphemes due to the fact that his parents used the movement morphemes substantially more consistently than the classifier morphemes.

As a third possibility, the complexity of the classifier system in ASL verbs of motion is of particular interest. T. Supalla (1982, 1986) has described multiple ways in which objects can be classified. For example, when using an ASL verb of motion to describe a car turning, one can use a classifier that classifies the object as a vehicle, or one can alternatively use a less marked direction classifier (with the same movement morphemes), which does not classify the object but rather marks the object as one which moves in a particular (usually complex) direction. For a native signer, which of these classifier types is used depends on what is being emphasized. This kind of multiple classification system is also common in spoken classifier languages. In addition, some of the forms across these different classification paradigms are homonymous. The B FLAT classifier in ASL (a flat open palm), for example, can either specifiy a wide, flat object, or it can mark direction (for example, turning). In contrast, movement morphemes generally have a one-to-one mapping between form and meaning, which may make these morphemes easier to acquire (see Slobin, 1973, and Karmiloff-Smith, 1979, for evidence from spoken languages that morphemes are more easily acquired when they have one-to-one rather than multiple mappings between form and meaning). The complexity of the ASL classifier system is most likely why native input children acquire it the latest. In accord with this complexity, we find that Simon's errors consist of some object classifiers, some direction markers, and some errors that are typical of native input children much younger than he is.

In sum, not only is the classifier system Simon must learn extremely complex, but he also gets only highly inconsistent input for discovering its regularities. One additional factor may also be that by age 7;11 to 9;1 Simon is approaching the end of the critical period for language acquisition, and if he continues to be exposed to only inconsistent input, his ability to improve upon this input may cease or become more limited.

Conclusions

To summarize some broader conclusions, the data from Simon's acquisition of movement indicate that under certain conditions, children naturally creolize non-native input. However, the classifier data provide evidence that the child's natural ability to creolize non-native input may be limited. This limitation can occur even at a young age, depending on the complexity of the target system and the consistency of the input.

Previous creolization studies have not been able to trace the influence of non-native input longitudinally in comparison to the development of age-matched controls, or to compare the acquisition of structures for which the consistency of input or the complexity of the target system vary. By examining these questions in the present study, we have found developmental patterns which suggest some boundary conditions on the appearance of creolization phenomena. We consider three factors, perhaps in interaction with one another, to be potentially significant: the degree of input consistency, the clarity or simplicity of the structure of the target system, and the resulting age at which the child begins to analyze its structure. Future studies will be required to disentangle these factors, to determine which of them is critical and how they interact. Nonetheless, by observing these factors in the present study, we believe we have contributed to our understanding of the nature of the child's biases in language acquisition.

Although there is still more to be discovered, what we have found in this study is that, while children are able to creolize non-native input under certain circumstances, the complexity of parts of the target language, the consistency of the input, and perhaps the child's biological maturation may combine to limit his/her ability to do so under *all* conditions.

Endnotes

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1. A pidgin is a contact vernacular lacking complex morphology and syntax (Bickerton, 1984; Sankoff & Laberge, 1973).
2. Recall that the solid line outlining the native input children's developmental course represents cross-sectional data averaged over two to three different children per data point, whereas the dotted line outlining Simon's developmental course represents longitudinal data from Simon only.

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