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# 17 SUSAN CURTISS

# Developmental Dissociations of Language and Cognition

There are a few questions in linguistic theory which are of particular interest to me and which are, in my opinion, of central importance. Two of these questions are (*a*) is the human mind innately endowed with knowledge about language, and if so, what is the character of that knowledge, and (*b*) are there language-specific learning mechanisms? The innateness question and the language-specificity question are closely bound together, for it is difficult to imagine what language-specific learning mechanisms would be or how they would operate without innate knowledge about the possible form of human language or innate predispositions to process linguistic input in highly specific ways. However, it is possible that there is innate knowledge that is implicated in the learning of language that is nonetheless NOT specific to the learning of language. Thus the two questions are separate issues, and attempts can be made to answer each question separately, keeping in mind that the answer to one will probably have direct bearing on the answer to the other.

In this chapter I will address the second of these two questions: Are there language-specific learning mechanisms? This question can be broken down into at least three component questions:

1. Is language acquisition simply one instance of the general cognitive development of the child?
2. Does language acquisition co-occur in development with certain nonlinguistic cognitive attainments (or, are they correlated) because they are based on the same cognitive principles?



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3. If there is such a thing as general intelligence, can the multipurpose learning mechanisms which account for its ontogenesis learn language?

The data I will present come from cases of abnormal language acquisition, cases which manifest a noteworthy dissociation of language from nonlanguage function. Although these cases represent striking divergencies from normal development, such cases of language–nonlanguage dissociations can help to clarify the connections and interdependencies between language and other aspects of mental development in the normal child. They can aid in teasing out those relationships which are necessary from those which may look so, but may instead be artifacts of general maturation. I discuss only three cases here because of space limitations, but we have other, comparable data and are in the process of collecting still more (Curtiss, Yamada, & Fromkin 1979; Curtiss, Kempler, & Yamada 1981).

## Genie

The first case is that of Genie, a case of first language acquisition in adolescence. Much has been written about this case and I will not rehash what can easily be found elsewhere (Curtiss 1977; Curtiss, Fromkin, Krashen, Rigler, & Rigler 1974; Fromkin, Krashen, Curtiss, Rigler, & Rigler 1974). For those who are unfamiliar with the case, Genie underwent extreme isolation and deprivation until she was 13½ years of age. Never having had sufficient exposure to language to learn language as a child, she faced the task of first language acquisition as a teenager. Despite her severely limited life experience, however, she had not been asleep during her years of confinement; and in some areas Genie had apparently developed beyond the level of a child beginning to learn language. There are, as a result, aspects of this case which are particularly relevant to the questions at hand.

Genie's language development has been notably abnormal. For one thing, the majority of her utterances are noun phrases, a reflection of her fixation on static visual images, past and present, and possibly the result of her restricted sensorimotor experience. For another, she is very limited in using language as a communicative device. For example, she produces no vocatives or grammatically marked questions and has no topicalization or focusing devices save repetition (c.f. Curtiss 1977; Bennett 1978). This is in striking contrast to her effectiveness, indeed power, as a nonlinguistic communicator. She has, for example,

well-developed use of gesture, facial expression, eye gaze, attention-getting devices, and turn-taking knowledge. The most important aspect of her language development for the issues of concern here, however, is the disparity between her lexical semantic, and thematic or relational semantic knowledge on the one hand, and her syntactic abilities, including her ability to map thematic relations onto syntactic structures and to subcategorize lexical items, on the other. This disparity between the aspects of language Genie has readily acquired and those she still has not mastered can perhaps best be generalized as one between conceptual content and grammatical form, a disparity which has been present from the onset of Genie's speech.

The area of language best mastered by Genie, it would appear, is lexical semantics. Genie's early vocabulary acquisition revealed a cognitive sophistication not found in the early vocabularies of children during first language acquisition. For example, children's early vocabulary appears to function both in comprehension and production as narrowly specified subportions of the equivalent adult terms (Clark 1977; Reich 1976; Saltz, Dixon, Klein, & Becker 1977). Naming errors tend to be overdiscrimination errors, although overgeneralizations in word use are frequently reported. Such overgeneralizations, however, probably result mainly from a child's overextending his or her vocabulary to communicate about topics that would otherwise be beyond what his or her small vocabulary would allow (Saltz, Soller, & Siegel 1972; Clark 1975). Genie, however, did not appear to underspecify or overspecify the semantic domain of words in the ways seen with normal children. For example, although she spoke in one-word utterances for several months, at no time did she appear to overextend semantic reference. In contrast, she appeared to seek out vocabulary to differentiate between similar objects which she knew to be different along some parameter—visual, functional, or otherwise, even if it interrupted a communicative interchange. Second, vocabulary in the early stages of language acquisition normally consists of lexical items for general, basic classes (e.g., chair), not superordinate or subordinate terms (e.g., furniture, or rocking chair) (Rosch, Mervis, Gray, Johnson, & Boyes-Braem 1976). Even at the single-word stage, however, Genie learned and appropriately used superordinate, subordinate, and general class terms (e.g., *lion, tiger, cat, dog,* etc. and *animal; coat, jacket, blouse, sweater,* etc. and *clothes*). Fourth, normal children first talk only about the here-and-now (Brown 1973; Gesell 1940; Greenfield & Smith 1976; Weisenburger 1976). But even during Genie's one-word period she often spoke of nonpresent people or objects. Thus in her earliest use of words, Genie displayed elaborate,

**TABLE 17.1**
**Examples of Thematic Relations in Genie's Speech**

| Utterance | Date | Relations expressed |
|---|---|---|
| *Spot chew glove.* | 12/71 | Agent–action–object |
| *Miss F. have blue car.* | 12/72 | Possessor–state–object |
| *Play gym.* | 1/72 | Action–Location |
| *Genie bad cold live father house.* | 10/73 | Experiencer–state–time |
| *Mama people not hit big wood.* | 5/74 | Agent–agent–negation–action–instrument |
| *Father hit Genie big stick.* | 8/74 | Agent–action–patient–instrument |
| *Go doctor house tomorrow.* | 9/77 | Action–location–time |

adult-like classificatory schemes and the ability to represent the nonpresent in thought and language. From that early point on, Genie has readily acquired new vocabulary, following the path familiar to all of us of continually learning new words that correspond to and represent new nonlinguistic mental knowledge and ever-finer semantic differentiations.

From the range of Genie's vocabulary, her use of vocabulary, and her continuing acquisition of vocabulary, one can conclude that Genie is not impaired in the acquisition of lexical semantics, and that her lexical entries contain adult-like semantic feature specification.

There is one other aspect of language that Genie performs quite well—the expression of combinations of basic semantic (thematic) relations. Examples are presented in Table 17.1.

Genie expresses a substantial range of thematic relations and in some instances has also learned grammatical devices to mark certain relations overtly; namely, adverbials and locative and directional prepositions as seen in Table 17.2.

**TABLE 17.2**
**Examples of Overtly Marked Semantic Relations**

| Utterance | Date | Relations expressed |
|---|---|---|
| *See Mama Friday.* | 9/72 | State–patient–time |
| *Mama wash hair in sink.* | 1/73 | Agent–action–object–location |
| *Get out baby buggy.* | 3/73 | Action–direction–location |
| *After dinner use mixmaster.* | 1/74 | Time–action–object |
| *You draw standing Mama on stair.* | 9/77 | Agent–action–action–agent–location |
| *Think about D. swim in ocean.* | 11/74 | State–agent–action–location |
| *At Woolworth big huge truck.* | 10/73 | Location–object |

TABLE 17.3

| Utterance | Date | Approximate gloss |
|---|---|---|
| *Applesauce buy store.* | 4/72 | ('I want you to buy applesauce at the store'.) |
| *Father house live father Genie bad cold.* | 10/73 | ('When I lived at father's house, I had a bad cold'.) |
| *Spool wind thread.* | 12/76 | ('One winds thread around a spool'.) |
| *Water think swim think swim.* | 8/77 | ('I'm thinking about swimming in the water'.) |
| *Tummy water drink.* | 8/77 | ('My tummy drank the (swimming) water'.) |
| *Sick people lady driving ambulance.* | 9/77 | ('A lady is driving sick people in the ambulance'.) |
| *Hot dog eat, eat the hot dog, eat hot dog.* | 11/77 | ('I ate the hot dog'.) |
| *I want I want big Mama toy.* | 10/77 | ('I want a big toy from Mama'.) |

Thus we can see that Genie's grammar must contain not only the sense or meaning definitions of words, but also a list of at least potential arguments for verbs and a specification of the semantic relations between arguments. Occurrence restrictions of elements such as articles and progressive marker /-ing/ in Genie's speech indicate that the syntactic category of a word is also included in its stored representation, although /-ing/ is not used consistently or unambiguously to mark progressive aspect.

Note, however, the sentences in Table 17.3. Utterances such as these suggest the absence of subcategorization information and the absence of consistent rules for mapping thematic relations onto subcategorization features or grammatical relations. The "sentences" in Table 17.4 (as well as Table 17.3) indicate the additional absence of other gram-

TABLE 17.4

| Utterance | Date | Approximate gloss |
|---|---|---|
| *Angry burn stove.* | 1/72 | ('Grandma was angry at me and said I'd get burned if I stayed by the stove'.) |
| *I supermarket surprise Roy.* | 4/74 | ('I was surprised to see Roy at the supermarket'.) |
| *Live father house smell washcloth.* | 10/73 | ('When I lived in my father's house I used to smell the washcloth he used'.) |
| *Father house live father Genie bad cold.* | | ('When I lived at my father's house, I had a bad cold'.) |
| *Genie cry ride.* | 10/77 | ('I cried when I was on the ride'.) |

matical devices or operations for signalling syntactic relations or other than thematic semantic structure (e.g., subordinating conjunctions, tense markers, complementizers). It is worth noting that despite the ill-formed character of many of Genie's utterances, their semantic intent and content is remarkably clear, especially in context. The gap, then, between conceptual/semantic content and grammatical form in Genie's utterances is quite striking. One is led to try and account for such a selective difference between the aspects of language Genie has acquired and those she apparently has not been able to master.

Perhaps Genie's markedly uneven profile is reflective of either a general intellectual deficit or of specific cognitive impairments, i.e., perhaps a nonlinguistic cognitive impairment has prevented her from developing beyond this point linguistically. It is hard to imagine how a general intellectual deficit could account for such a selective linguistic deficit. One should imagine, for example, that the one area of language which might be most affected by or tied to intellectual level would be vocabulary, but that is the area of language most developed in this case. Nonetheless, to address the hypothesis that language development can be accounted for (i.e., learned) by the same mechanisms that account for the development of general intelligence, it is important to determine whether or not Genie might be limited from learning language by her general intellectual level.

Table 17.5 presents Genie's performance on standardized intelligence tests from the time she was first found until the time she was last tested. There are two major points to be made regarding these data. (Genie's performance on these tests is considered in greater detail elsewhere. See Curtiss 1979). First, both her verbal and nonverbal intelligence have developed "normally" in the sense that for every year of chronological age increase since her discovery, there has been a concommitant mental age increase. The difference between the two areas appears to lie primarily in the degree of knowledge or development Genie began with when she emerged into our world. After seven years of "human" social experience, starting with essentially no linguistic knowledge or experience, Genie achieved a mental age of approximately 6 years; and after seven years of new life experience starting with, perhaps, a 4 or 5-year-old level of nonlinguistic ability, Genie attained a mental age of approximately 12 years. Secondly, in both areas she has surely demonstrated sufficient intellectual ability to support a full linguistic system. That is, children with a comparable mental age have language. It appears, then, that Genie's selective linguistic deficits cannot be attributed to lack of sufficient intelligence, and more importantly for the

TABLE 17.5
**Intelligence Tests Administered to Genie**

| Test | Date | M.A. | I.Q. | Score | Other quantification of performance |
|---|---|---|---|---|---|
| Preschool Attainment Record (PAR) | 11/70 | (0–2) | | | Mean for 13 months; range from 0–24 months |
| Vineland | 11/70 | 1.05 | | | |
| Leiter | 1/71 | (5.2) | 38 | | Mean for 4.9; range 3 yrs. to 5.9 yrs. |
| PAR | 7/71 | 4.5 | | | |
| Vineland | 7/71 | 5.2 | | | |
| French Pictorial Test of Intell. | 10/71 | (4–9) | | | Picture Vocab. 4.6; Info and Comp. 5.0; Size + Number 4.6 (short form); Form Discrim. 7.0; Similarities 4.6 (short form, Immed. Recall 9.0 |
| Vineland | 1/72 | 5.6 | | | |
| Leiter | 4/72 | (7.5) | 53 | | |
| WISC | 6/72 | (6–9) | | | Picture Arrangement 6.2; Block Design 9.6–9.10; Object Assembly 8.6–8.10 |
| Columbia Mental Maturity Scale (CMMS) | 9/72 | 5.11 | 38 | 55 | |
| Vineland | 10/72 | 5.7 | | | |
| Leiter | 5/73 | 8.3 | 53 | | |
| Bender-Gestalt | 5/73 | 5.6 | | | |
| WISC | 5/73 | | | | Below norms verbal; Performance IQ 50; Full scale below norms |
| CMMS | 5/73 | 6.1 | | 57 | |
| Stanford-Binet | 5/73 | 5.8 | 38 | | |
| PAR | 6/73 | 5.8 | | | |
| Leiter | 2/74 | 9.7 | 65 | | |
| Raven Coloured Progressive Matrices | 1/75 | | | 29 | 25% of 10-yr-olds attain a score of 29 or more |
| Raven (RCPM) | 3/77 | (10–11) | | 32 | 95th percentile for 10-yr-olds; 75th–90th percentile for 11-yr-olds |
| Leiter | 10/77 | 12.6 | 74 | | |

questions at hand, that the mechanisms by which Genie's general intelligence developed were not able to mediate the learning of certain aspects of language.

Perhaps, even though Genie's linguistic profile cannot be accounted for by a general intellectual deficit, it can be tied to her failure to develop certain specific cognitive abilities. According to classical Piagetian theory, language emerges from and is rooted in general sensorimotor intelligence and is only one instance of the semiotic function, which is attained at the end of the sensorimotor period (Inhelder, Lezine, Sinclair & Stamback 1972; Piaget 1980; Sinclair 1975). More recent developmental psycholinguistic work, however, has proposed that the ties between language and nonlanguage cognition are more specific, that particular abilities are prerequisites to language, or share a common cognitive basis with language; e.g. means–ends knowledge (Bates, Benigni, Bretherton, Camaioni, & Volterra 1977; Snyder 1978), drawing (Goodenough 1926; Harris 1963), symbolic play (Hulme & Lunzer 1966; Lovell, Hoyle, & Sidall 1968; Nicolich 1977), knowledge that other people can serve as agents (Bates, Benigni, Bretherton, Camaioni, & Volterra 1979), the attainment of object permanence (Bloom 1973; Corrigan 1978 but cf. Corrigan 1979), classificatory skills (Sinclair 1970), and nesting ability and hierarchical construction ability (Greenfield 1976; 1978; Greenfield & Schneider 1977). Since the bulk of the grammar is normally acquired during the preoperational years, we might also consider a general demonstration of preoperational intelligence as a necessary concommitant to grammar acquisition.

Genie's performance on a variety of relevant tasks is presented in Table 17.6. (See Curtiss 1979 for a more complete description of the material covered in Table 17.6.)

As Table 17.6 indicates, Genie's performance on relevant tasks places her within the stage of concrete operations (i.e. beyond preoperational intelligence). It further indicates a dissociation between some of the very abilities hypothesized to be linked to language and her linguistic disabilities. The small range of semantic abilities Genie demonstrates may be tied to general conceptual level and/or to specific cognitive attainments, but the aspects of language Genie lacks do not evidence this tie. This case, then, supports the hypothesis that there are language-specific learning mechanisms and suggests that these mechanisms may be responsible for the learning of syntax in particular.

If there are language-specific learning mechanisms for the acquisition of certain aspects of language and these same aspects of language are not tied to nonlinguistic cognitive development, it should in principle be possible to find children who show an opposite profile to Genie's—i.e.,

TABLE 17.6

| Test/task | Genie's performance level |
|---|---|
| Drawing (spontaneous)[a] | approximate 6–7-year-old level |
| Logical sequencing (Curtiss & Yamada, unpublished) | 8½–9-year-old level; at ceiling of test presented |
| Conservation[b] | 6–7-year-old level (conserves area and length; number questionable) |
| Classification (Curtiss, unpublished) | 8-year-old level; at ceiling |
| Spatial operations (Laurendeau & Pinard 1970) | 12-year level; appears to have all concrete operational spatial operations. |
| Nesting (Greenfield, Nelson, & Saltzman 1972) | at ceiling |
| Hierarchical construction (Greenfield 1976; 1978; Greenfield & Schneider 1977) | able to copy all models, regardless of internal complexity; at least 11–12-year level performance. |
| Auditory Short Term Memory (I.T.P.A. Kirk, McCarthy, & Kirk 1968) | 3.0 year level |

[a] Drawing assessed by criteria per Goodenough (1926); Kellogg (1969); Goodnow (1977).

[b] Conservation assessed by a series of tasks modelled after Beard (1963); Goldschmid & Bentler (1968); Elkind (1961); Elkind (1966); Lovell, Healey, & Rowland (1962); Wallach, Wall, & Anderson (1967); Wohlwill & Lowe (1962).

one of mastery of the linguistic system (at least those aspects Genie lacks) despite cognitive deficits even in those areas hypothesized to be linked to language. Such children would in a sense have selectively "intact" linguistic function.

We have been studying several children who appear to fit this description and I will discuss two of them in the following paragraphs. Before doing so, two caveats must be mentioned.

Such cases have been difficult to locate. There are, it seems to me, at least two reasons why this has been so. First, children who "speak well" (fluently, in sentences, but not necessarily communicatively or meaningfully) but who are mentally deficient are an enigma to many professionals. It is assumed by many educators and psychologists that children who "speak well" cannot truly be mentally retarded and so are not labelled as such. The consistent deficient performance of such children on I.Q. tests and in classrooms is attributed to underlying emotional disorders, behavioral disorders, or both. Often these children are placed in special classes or schools with the continual expectation that they will snap out of their social/emotional disorder and their academic performence will improve remarkably, finally matching their linguistic performance. What often results is terrible frustration shared

by all concerned, and very few children are considered to fit our description, especially since such children usually develop strategies to compensate for their deficits, strategies based on linguistic and social cunning. Consequently, few children who fit this profile are referred to us.

Second, such children are difficult to locate because they are probably rare. A first step toward extracting meaning from speech input, and a prerequisite, one would think, to seeking and finding structural regularities in this input, would be the acquisition of words, one of the abilities apparently tied strongly to nonlinguistic conceptual development. If a child is mentally retarded, word acquisition will be retarded; and we expect the rest of language acquisition to follow in kind, since without an interpretation of the content words in a sentence, no hypotheses regarding their organization or constraints on their organization could be tested. It is no surprise, therefore, that severely retarded individuals generally develop little language, regardless of whether or not there may be language-specific learning mechanisms, or whether these mechanisms might even be intact.

We have nonetheless found children who are retarded (I.Q.'s from 30–60) whose knowledge of linguistic structure appears to far outstrip almost every other mental ability, in some cases including some of those semantic abilities preserved in Genie.

## Antony

The first such child to be discussed is Antony.[1] (See Curtiss and Yamada 1981 for a more detailed description of this case.) Antony was a child of 6–7 years of age when we studied him. Antony's I.Q. estimates range from 50–56 and mental age less than one year prior to our study was 2.9. Surprisingly, parental report of speech onset is one year, with "full sentences" reported at three years.

Antony's language was quite complex in terms of morphological and syntactic structure, although Antony made errors not untypical for his age, suggesting that he was still mastering some grammatical rules, providing evidence also that his language was productive and creative and not simply formulaic echoing. See, for example, the sentences in Table 17.7. His speech includes Wh-pronouns, demonstratives, third person pronouns, anaphoric pronouns, complex complementation,

[1] These data were collected in collaboration with J. Yamada, University of California at Los Angeles.

**TABLE 17.7**
**Some Examples of Antony's Speech**

*I told somebody be quiet.*
*I would not have an ice cream.*
*Whyn't you make her hair like that?*
*Because I want to hate her.*
*I say you wash your face like that.*
*I don't got friends, I got my brother named David.*
*That clock says it's time to get some prizes.*
*Jeni would you help me draw pictures of Susie?*
*Didn't ate this one.*
*I doed this already.*

relativization, and close to the full range of auxiliary elaboration—all features absent from Genie's speech.

Despite the degree of morphological elaboration and structural complexity, however, in context, Antony's language is often confusing. First of all Antony's lexical choice is frequently inappropriate or incorrect as illustrated in Table 17.8. It is not only the sense definitions of lexical items in Antony's speech that cause confusion, however. In part, communication with Antony is difficult because despite his fluent productive language, he has substantial comprehension problems with individual words as well as larger structures, e.g.,

(1) A: *We sew this.* (referring to a spool)
J: *You sew with that, right.*
A: *No, **I** don't sew with that.*
J: *Other people do.*
A: *No, my Mom do.*

**TABLE 17.8**
**Some Examples of Lexical Errors in Antony's Speech**

*We saw them on the **birthday.*** (for 'cake')
*He has a **batman.*** (for He has a 'basket')
*He's **cutting** the mail.* (for he's putting a stamp on the letter)
***Watering** it.* (for 'washing it')
***Drum*** (for 'horn')
*A **pie.*** (for 'pear')
***That's** tying his shoe.* (for 'He's' tying)
*Goes **to** the fish.* (for 'with' the fish)
*Goes **in** the broom.* (for 'with' the broom)
*A **grass**, that we drink with it.* (for 'glass')

(2) J: *Draw a picture of Vivian.*
A: *No. It's not Vivian's, it's mine.*
S: *Draw a picture of Mrs. W.*
A: *No. It's not Mrs. W's.*
S: *Draw a picture of Antony.*
A: *That's not me.* ***This*** *is me* (pointing to himself).

(3) J: *Does your Daddy stay home all day and cook?*
A: *Nope. He was not comin home.*

and he does not control or grasp presupposition or implicature in his own speech, e.g.,

(4) A: *Do you got a brother?*
J: *Uh huh, I have two brothers.*
A: *What's his names?*
J: *My brothers' names are Stephen and Douglas, Steve and Doug.*
A: *What's your sister's name?* (assuming J. has a sister without knowing)
J: *My sister's name is Hedi.*
A: *What's your other sister's name?*
J: *I only have one sister. I have two brothers and one sister. How 'bout you?*
A: *I got two sisters. I got David and Vicky and Ann Margaret.*

In addition, his use of deixis i.e., articles, tense, pronouns, demonstratives, and Wh-words, is often inconsistent and ill-formed, as illustrated in (5)–(9).

(5) A: *He's taking a boy. He's taking the boy.*

(6) A: *He shot him. He shoot him. The police shoot Lucan.*

(7) M: *That's who?*
A: *Our father.* (meaning 'his' (Lucan's) father).

(8) Miss C. enters Antony's class and stands within full view of Antony.
A: *You guys, lookit who's in our class. I want to see who's in that class.*
S: *Who's in what class?*
A: *No, in ours.*
S: *Everybody's here!*
A: *Not Miss C.*

(9) A: *Where I took?* (for 'What'd I take?')

It appears that Antony has learned grammatical devices and operations separate from the semantic complexities mapped onto sentences by these very devices. What has resulted is a system in which substantives are usually combined in a structurally well-formed manner, but well-formed often only when abstracted away from context. Thus, although basic sentential and semantic relations appear to be systematically expressed through SVO word order, one is tempted to call Antony's full-blown set of devices at least a partially autonomous syntax.

A look at Antony's nonlanguage functioning illustrates once again a dissociation of grammatical ability from general intelligence and from specific cognitive abilities hypothesized to be linked to language.

Antony's general intelligence is difficult to measure. He has a markedly short attention span and was extremely difficult to test. Many tasks successfully administered to two-year-old children by the same experimenters were found to be too difficult for Antony to grasp. One's impression of Antony's general intelligence is that he is substantially mentally deficient, and that his real intelligence belies his scorable I.Q. This is in marked contrast to one's impression of Genie which is that she is considerably more intelligent than most tests and her scorable I.Q. reflect.

An examination of Antony's specific abilities is consistent with the impression that he is a very low-functioning child, and points again to a separability between language development and development of at least some of the specific cognitive abilities hypothesized to be linked to language development. See Table 17.9.

Antony is severely delayed in every area except language and auditory short term memory. His play, drawing, copying, and general problem-solving behavior place him approximately in sensorimotor

**TABLE 17.9**
**Antony's Nonlanguage Profile**

| Ability | Antony's performance |
|---|---|
| Auditory short term memory | 7-year level |
| Drawing and copying | prerepresentational |
| Nesting | 28–32 months |
| Hierarchical Construction | less than a 2-year level |
| Conservation | couldn't administer, even à la Gelman |
| Logical sequencing | 2-year level |
| Classification | unable to perform at all; below 2 years |
| Play | 1–2 year level |

stage VI (20–24 months), possibly just beyond. It is important to note that Antony was functioning at this low level during the period of our case study, when he was already 6½–7 years of age, and when he had already attained considerable linguistic mastery. How much had Antony developed beyond the cognitive level of his early years when he reportedly was learning language? And because his vocabulary seemed quite limited in comparison to the structural richness of his speech, one must ask with what even more limited vocabulary was he able to abstract the linguistic regularities and principles of English grammar?

These are questions we do not have answers to. But Antony's case nevertheless bears suggestively on the question of language-specific mechanisms. Like Genie's case, Antony's profile indicates clearly that the acquisition of grammar is not simply one instance of general cognitive development. Like Genie's case, Antony's profile suggests that certain linguistic abilities (i.e., syntax) are unrelated to many of the specific cognitive abilities which have been hypothesized to be based on shared cognitive principles. And like Genie's case, Antony's profile demonstrates that the mechanisms by which syntax is acquired are not general purpose learning mechanisms underlying the development of a general intelligence.

## Marta

The second case of "selectively intact" linguistic ability is that of Marta. Marta is the subject of a dissertation in progress (Yamada, forthcoming. See also Yamada 1981 for a more detailed description and analysis of the linguistic and nonlinguistic data on this case.) Only a portion of the data I will discuss was collected jointly, and I am grateful to J. Yamada for allowing me to include some of her data here.

Marta ia a mentally retarded adolescent (I.Q. 44) who has been studied since October, 1979. She is in a sense "hyperverbal," and because she is apparently no longer acquiring language, she offers a rare opportunity to study the nature of and extent to which language can be acquired in the face of severe cognitive deficits.

Marta's lexical abilities appear moderately well-developed, although recent vocabulary assessment (Peabody Picture Vocabulary Test) places her vocabulary at only a 3.11 year level. She occasionally demonstrates word-finding difficulties as illustrated in (10) below, although her word-finding difficulties are most often manifested in attempts to use proper names.

(10) Marta is being asked to name pictures. She is shown a picture of a bed and asked to identify it.
M: _____ (no response)
S: *Go to _____. It's time to go to . . .*
M: (Gestures sleeping.)
S: *That's right. But what's another word?*
M: *Zonk out.*
S: *Right.*
M: *Or sack out.*
S: *But what's this called? What do you get on?*
J: *Does anybody ever say, Don't jump on the _____? What is this?*
M: _____

Marta's syntactic and morphological abilities are richly developed as illustrated in Table 17.10. She produces sentences involving full noun phrase and verb phrase morphological elaboration, and an adult range of syntactic operations (e.g., subject-auxiliary inversion, relativization, pronominalization, complementation, passivization, and extraposition). Marta also uses an abundance of sentence adverbials and semantically rich and sophisticated lexemes, but these are often used inappropriately as are tense markers and pronouns, as illustrated in Table 17.11.

The syntactic devices and operations in Marta's sentences appear not to be tied to the semantic structures normally being mapped onto them, suggesting, as with Antony, what might be considered a partially independent or autonomous syntax, reminiscent of cases of mixed transcortical aphasia and senile dementia whose performances have been interpreted as evidence for an autonomous syntactic filter (Davis, Soldi, Gardner & Zuriff 1978; Whitaker 1976).

**TABLE 17.10**
**Examples of Marta's Utterances**

*The police pulled my Mother an' so I said he would never remember them as long as we live!*
*And another home, with the, our second home, now this my (in) fact third home I've ever have lived in.*
*I was like 15 or 19 when I started moving out o'home.*
*Well, we were taking a walk, my Mom, and there was this giant, like my Mother threw a stick.*
*I haven't shown you my garage yet, but Dad would be really hard.*
*We should go out an, um go out, and do other things.*
*Maybe I could play with a friend!*
*I have like second friends, . . .*
*. . . Somebody had his bangs trimmed in Iceland.*

**TABLE 17.11**
**Examples of Inappropriately Used Adverbs, Tense and Aspects Markers, and Pronouns.**

*And that's my regular friend, who normally will live by us, I think.*
*And she asked me out about a month.*
*And what hot air is rosen it, the air, she rise;*
*And air, air if you're really are innocent air, . . .*
*A third year I've ever been a student I've gotten, well, a ticket.*
*One's got married a week.*
*And I'vell'm nevers!*
*After awhile I gotten tried of it.*
*I like livin' away from home an' met friends.*
*I have like second friends an' now when I'm 18 or 19 I start moving out of, I think I wasn't, . . .*

Marta's general intelligence and nonlinguistic cognitive performance stand in marked contrast to the level of her linguistic knowledge. Like Antony, Marta's general intelligence is difficult to assess, partly because of Marta's limited attention span and frequent failure to grasp the requirements of a task. Like Antony, Marta sometimes fails to understand or perform tasks readily and successfully performed by two-year-olds; like Antony, Marta's overall level of capacity appears to be close to, perhaps just beyond sensorimotor Stage VI; like Antony, Marta's scorable I.Q. belies her observed level of capacity.

Table 17.12 presents a profile of Marta's functioning in more specific cognitive areas. Marta cannot copy anything more complex than a simple bridge structure, draws at a preschool level, cannot count to 5, does not know her own age, cannot successfully attend to tasks involving three or more different items in an array. Once again we find a dramatic and striking contrast between performance on a range of

**TABLE 17.12**
**Marta's Nonlanguage Profile**

| Ability | Marta's performance |
|---|---|
| Auditory short term memory | 3-year level |
| Drawing | preschool level |
| Copying | preschool level |
| Classification | 18-month level |
| Nesting | 28-month level |
| Hierarchical construction | 2-year level |
| Counting | cannot count to five; does not have one–one principal |

cognitive tasks and linguistic performance, a contrast reflective of a dissociation between these areas.

Marta's case perhaps even more than Antony's illustrates the separability of those mechanisms responsible for the learning of syntax from those underlying the development of general intelligence and specific nonlinguistic functions. Like Genie and Antony, Marta's case suggests the existence of learning mechanisms specific to the learning of syntax.

## Discussion

Obviously, in normal development, language unfolds in the context of social–communicative development and conceptual–cognitive development. This obvious phenomenological link between linguistic, social, and cognitive development has provided the impetus for the theoretical positions on language development prevalent today—the social/interaction model (Ervin-Tripp & Mitchell-Kernan 1977; Nelson 1977; Newson 1978; Snow 1972; 1977; Snow & Ferguson 1977; Trevarthan & Hubley 1978; Zukow, Reilly & Greenfield in press) and cognitive models (Bates *et al.* 1977; 1979; Corrigan 1978; Cromer 1976; Ingram 1978; Schlesinger 1974). How do data such as those just described bear on these models of language acquisition?

In the interaction model, there have been two major tenets. First, primary linguistic input to children learning language has a number of special properties. It is a greatly reduced, simplified, and repetitive version of the adult system; it is modified to correspond to (or be slightly in advance of) the linguistic level of the language-learner; it serves as an ideal model for presenting the structural regularities of the system to the child; it focuses particular attention on linguistic distinctions which may be difficult to discriminate. Second, the use of the simplified code in the context of familiar and frequently repeated social interactions and routines serves to focus attention on the communicative underpinnings of the code, provides abundant opportunities for imitation and rehearsal, and ties the use of the linguistic code to conversational settings from which to learn the basic principles of speech acts.

This model has typically placed the burden of acquisition on the environment, on factors external to the child which might facilitate the acquisition process for the child. As Bates, Bretherton, Beeghly-Smith, & McNew (in press) point out, however, "the identification of 'social' with 'external' is not logically necessary [p. 21]." The specialized

language-learning environment may indeed provide an ideal model for language acquisition, which is nevertheless a child-driven rather than an environmentally-driven process. Since the mechanisms by which the child makes use of this specialized input have not been made explicit in this line of research to date, however, the question of whether there might be language-specific mechanisms at play is left unaddressed.

Cognitive models, in contrast, do address the question of language-specific learning mechanisms. The strongest position holds that there are no language-specific learning mechanisms, that language being simply one instance of the semiotic function is a direct outgrowth of sensorimotor intelligence and is explainable on that basis (e.g., Piaget 1980; Sinclair 1975). All three of our cases, as well as considerable other data, such as data from language impaired children and childhood hemidecorticates demonstrate the untenability of this position.

In a somewhat different cognitive model of language-learning, language is seen as formally parallel and therefore analogous to a number of other cognitive areas, for example, action and interaction schemes (Bruner 1975; 1977; Greenfield 1976; 1978). Here, too, the mechanisms by which the child learns grammar are never made explicit, but the implication is that he or she does so by analogy. Analogy-making, however, involves first recognizing that two systems are similar and then either constructing analogous schemes to represent these systems or mapping one set of schemes onto a formally parallel set of schemes. But to imply that language can be learned by a general learning mechanism of analogy without characterizing or specifying how a child constructs analogies between systems whose similarities are hardly direct or transparent merely begs the question of language-specific mechanisms.[2] Furthermore, our three cases and others like them suggest an underlying independence of action and communicative interaction abilities from the acquisition of syntax, suggesting that the cognitive principles subserving these domains are distinct from one another and require separate mechanisms to account for their development. Thus the "formal parallels" position neither explains nor is supported by our data.

A third differently formulated cognitive model of language acquisition holds that specific cognitive abilities are related to specific linguistic developments not by analogy, but by homology, i.e., an underlying source common to them both (Bates *et al.* 1979; Edwards 1973; Ingram 1978). To some extent, specific proposals made by

[2] There is an additional problem with this position in that research suggests little theoretical basis for the putative formal parallels in question (Curtiss, Yamada, and Fromkin 1979).

proponents of the second view (Greenfield 1978; Greenfield *et al.* 1972) correspond to this third view as well. (For example, formal parallels may exist as a reflection of a shared cognitive basis.) The question of general purpose versus domain-specific learning mechanisms is not specifically addressed in this model; but the implication of the position is that since language and related nonlanguage developments both depend on a third, shared principle, then the mechanism responsible for the acquisition of the shared principle could not be domain-specific.

Our findings support and refute different aspects of this view. The specific ties which have been proposed between language and nonlanguage developments include the nonlanguage sensorimotor achievements of object permanence, means–ends relations, knowledge that others can serve as agents, and use of communicative gestures, and the language milestones of acquisition and use of first words and word combinations. In all of our cases the individuals involved have, at the time we studied them, displayed both the language and the hypothesized related nonlanguage sensorimotor abilities. To this extent our findings are consistent with the claim that sensorimotor achievements may co-occur in normal development with specific language milestones because they depend on shared cognitive principles. The three cases discussed previously suggest nevertheless, that there was a possible dissociation in time between their acquisition of first words and first word combinations and their achievement of the sensorimotor knowledge found to correlate with these linguistic developments (i.e., those previously listed). However, since in two of the three cases we did not work with the children during language acquisition, and in the third case the delay in language acquisition was socially imposed, this potential refutation of the claim cannot be demonstrated by our data. What can be refuted by our data are claims of ties between these same sensorimotor abilities and syntax; claims of links between other nonlanguage abilities (e.g., drawing, symbolic play, classification skills, and general representational ability) and the acquisition of syntax; and claims of ties between action abilities such as nesting and hierarchical construction and syntax. In all three of our cases there are clear dissociations between development in these nonlanguage areas and syntax ability. And the dissociations are manifest in both directions.[3]

[3] It might be argued that the cases I've described are simply individuals with "blockage" in one domain, not children with truly independent development of language or nonlanguage function. If so, none of these cases would provide evidence against the hypothesis that there is a common cognitive basis for grammar and nonlanguage abilities. But if two areas are governed by the same cognitive principles, blockage must involve not

Our findings can be viewed as partial support for this third position. Our findings can also be viewed as refuting it in part, and irrelevant to other aspects of the position. In either summation, our findings suggest that the ties between linguistic and nonlinguistic development are principally those tying certain aspects of semantics to nonlinguistic cognitive development. The proposed ties, supported or not, leave the acquisition of syntax unexplained.

This conclusion is, in general, consistent with still another model of language acquisition—the "autonomous linguistic" position (Wexler & Culicover 1980; Roeper 1972; Chomsky 1975; 1980). This position holds that correlations in development between language and nonlanguage acquisitions do not preclude the possibility that language may be learned by principles unique to it. Correlations may be artificats of cortical maturation; i.e., both sensorimotor intelligence and first words and word combinations may reflect a certain state of brain maturation without one system being dependent on the other or otherwise nontrivially related to the other.

The anecdotal reports of the acquisition of first words by six months and first word combinations by 9–12 months in American Sign Language (McIntire 1977; Mindel & Vernon 1971; Schlessinger & Meadow 1972), if supported by systematic investigation, support a view in which language acquisition is tied to brain maturation rather than to sensorimotor developments; i.e., earlier maturation of visual cortex (Bay 1975) permits the earlier onset of language development in a visual modality. The only other explanation for these data would be if the proposed prerequisite or linked sensorimotor abilities are actually attained at a considerably earlier point in development than is widely assumed. Some recent findings (Bower 1974) suggest that this latter explanation may be correct. If this is so, however, none of the current formulations of cognitive models of language acquisition can be correct.

Regardless, our data cannot decide between the third cognitive model and the Autonomous Linguistic model. Our data fall somewhere between the two. While consistent with the autonomous linguistic

underlying capacity or cognitive knowledge, but domain or channel-specific factors or emotional factors affecting performance in only one of the areas. In each area examined, however, our subjects demonstrated an ability to perform up to a certain level of difficulty and not beyond. It seems unlikely that channel-specific or emotional factors could affect performance involving only a certain degree of complexity. Coupled with the fact that none of the subjects evidenced any central or peripheral impairments such as blindness, hearing loss, vocal musculature problems, apraxis, or obvious neuromotor impairments, it appears that the critical element affecting their performance in each area was cognitive complexity.

position regarding the potential independence of syntax in development, our data suggest that not all aspects of language are autonomous or independent from nonlanguage development. Certain aspects of semantics at least, in particular, the acquisition of lexical semantics and case relations, appear to be conceptually based and fundamentally tied to nonlinguistic cognitive development.

Our data, therefore, suggest language-specific learning mechanisms limited to and specialized for the acquisition of syntax and perhaps phonology and some complex aspects of semantics. Additional data from our work taken together with other recent findings suggest two additional features to these mechanisms: (*a*) they are tied to the left cerebral hemisphere in most individuals, and (*b*) they are operative only during a "critical period" in development—before 10 years of age.

In our work with Genie, we have found from experimental neurolinguistic testing, that Genie, a right-hander, appears to be using her right hemisphere for both language and nonlanguage cognitive functioning (Curtiss 1977; Curtiss, Fromkin & Krashen 1978; Fromkin *et al.* 1974). Behavioral measures have bolstered these experimental findings (Curtiss 1979). In direction and degree of asymmetry, in level of performance as well as style of performance (including error types), and in receptive linguistic abilities, Genie closely resembles the disconnected adult right hemispheres of split-brain subjects (Curtiss 1979; Zaidel 1973; 1976; 1978; Zaidel & Sperry 1974). Since Genie has two otherwise functioning cerebral hemispheres, and since she has developed intellectually and linguistically to a considerable degree since her discovery, we hypothesize that those aspects of language that Genie has not acquired are learned by mechanisms tied to the left hemisphere (in right-handers), while other cognitive abilities are not. This hypothesis tying language-specific (or syntax-specific) learning mechanisms to the left hemisphere but not other learning mechanisms is consistent with data from childhood hemidecorticates.

Dennis and her colleagues (Dennis 1980a; 1980b; Dennis & Kohn 1975; Dennis & Whitaker 1976; 1977) as well as others (Day & Ulatowska 1979; Rankin, Aram & Horwitz 1980) have demonstrated that the two cerebral hemispheres are not equipotential for language; even in cases of infant hemidecortication or hemispherectomy, the two hemispheres are equivalent in linguistic ability only with regard to phonological knowledge and the comprehension and production of lexical semantics and semantic relations (Dennis 1980a; 1980b). In all other semantic and syntactic abilities tested, the left hemisphere outperforms the right hemisphere. This is so despite the fact that the two hemispheres are equivalent in both verbal and nonverbal intelligence and

cognitive stage. Other recent work (Grossman 1978; Kraft, Mitchell, Languis & Wheatley 1980; Read, personal communication; Risse 1978) also indicates that general intelligence and Piagetian cognitive abilities are bihemispheric or interhemispheric in nature, and not the special attribute of either individual hemisphere.

The differences between Genie's linguistic abilities and the considerably greater linguistic abilities of the left-hemidecorticates may be partially explained by the presence of Genie's left hemisphere, which while it may be nonfunctional for the acquisition of language, may still be exerting inhibitory control over the right hemisphere. Cases of infantile hemiplegia, where the diseased hemisphere is not surgically removed early in life show lasting effects of the influence of that hemisphere over the healthy one. An additional explanation for Genie's more limited language ability than the childhood left hemidecorticates may lie in the notion that there is a critical period for language acquisition. Genie may have been beyond a critical period for language acquisition when she began learning language, whereas the childhood hemidecorticates were not.

The evidence that language-specific learning mechanisms may be functional only during a "critical period," a period tied to childhood before about 10, comes again primarily but not solely from Genie. Genie is the only extensively studied case of first language acquisition beyond 10. In her case we have strong evidence that despite a decade of language-learning, Genie is limited to grammatically unelaborated or grammatically uninflected word strings—what Givon (1979) describes as a "presyntactic" mode or a "pragmatic mode of discourse." Given her continually increasing level of intellectual functioning, we may hypothesize that the acquisition of those aspects of language she has not mastered are critically dependent on age, somewhat as Lenneberg (1967) hypothesized. Such an interpretation is supported by data on language development in cases of pre or perinatal unilateral lesions (Rankin *et al.* 1980) or recovery from aphasia (Hécaen 1976; Woods & Teuber 1978), anecdotal data from cases of first language acquisition of American Sign Language past puberty, and data from other cases of feral and isolated children (Curtiss 1981a; 1981b).

The hypothesis that language-specific or syntax-specific learning mechanisms operate only in childhood also provides a possible explanation for an unrelated body of data—the differences between a pidgin (a simplified linguistic system which is created from contact between two or more mutually unintelligible languages—a sort of hybrid, a reduced linguistic system which closely resembles Givon's

"pragmatic mode of discourse") and a creole (a full-blown linguistic system descended from a pidgin). (See Bickerton, this volume.)

A major difference between the two is that a pidgin has no native speakers, whereas a creole is (at least by many definitions) a native language for some community of speakers. A second major difference is the fact that a pidgin has greatly reduced morphology and limited syntactic devices, whereas in a creole such grammatical elements are richly exploited, although in a fairly invariant fashion, in contrast to establishment languages. Some prominent researchers on pidgins and creoles, for example, Bickerton (1977) and Naro (1973; 1979) have hypothesized that the source of difference between a pidgin and its corresponding creole is the involvement of a LANGUAGE FACULTY by the child acquiring the creole as a first language, and its unavailability for use by the adult pidgin-learner. What Naro and Bickerton refer to as the language faculty corresponds in part to what I am calling language-specific learning mechanisms. In its greatly reduced structural properties, pidgins look much like the simplified language systems produced by feral and isolated children older than 10 and Genie. Naro (1979) in fact has recently pointed out the substantial overlap between grammatical characteristics of pidgins and Genie's grammatical abilities. The implication is that the development of pidgins and "presyntactic" speech in general does not involve or require the utilization of language-specific learning mechanisms, or a separate language faculty.

## Conclusion

All of these data converge to suggest that if there are multipurpose learning mechanisms such as those which might underlie the development of general intelligence, they cannot learn language, at least not certain aspects of language. Language acquisition does not appear to be simply one instance of the general cognitive development of the child. Certain early developing semantic knowledge may be correlated with specific cognitive developments because they are based on common cognitive principles, but syntactic development does not seem to be tied to nonlanguage cognition in this fashion. There appear to be language-specific learning mechanisms, and a separate human faculty of language of which these play a major part in development. This separate faculty of mind can be impaired selectively in childhood or adulthood, and can develop selectively in childhood or be left selectively intact in adulthood. Given an intact language faculty, with

intact language-learning mechanisms and intact social and cognitive functioning, the human mind can do what so far no other form of intelligence can do: not only learn language but create language.

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