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THE LINGUISTIC DEVELOPMENT OF GENIE

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This paper discusses the linguistic development of Genie, an adolescent girl who for most of her life underwent a degree of social isolation and experiential deprivation unparalleled in the reports of scientific investigation. This case touches on questions of profound interest to psychologists, philosophers, and linguists, including the relationship between cognition and language, the interdependence or autonomy of linguistic competence and performance, the mental abilities underlying language, proposed universal stages in language learning, the critical age for language acquisition, and the biological foundations of language.*

Interest in cases of children reared in environments of extreme social isolation can be traced back at least to the 18th century. At that time the interest was stimulated by the debates concerning the theory of innate ideas and the struggle between the 'geneticists' and the 'environmentalists'. In 1758, Carl Linnaeus first included *Homo ferus* as a subdivision of *Homo sapiens*. One of the defining characteristics of *Homo ferus*, according to Linnaeus, was his lack of speech or overt language. All the cases in the literature attest to the correctness of this observation.

The most dramatic cases of children reared under severe conditions of social isolation and stimulus deprivation are those described as 'wild' or 'feral' children, children who have reportedly been reared with wild animals or have lived alone in the wilderness. Two such children, Amala and Kamala, found in 1920, were supposedly reared by wolves. Information on the prior history of these children is lacking (Singh & Zingg 1966). A more celebrated case is that of Victor, the 'wild boy' of Aveyron, discovered in 1798 (Itard 1962). The study of Victor was limited by methods available at the end of the 18th century, as well as by a limited understanding of the nature of language. But Itard's anecdotal account of Victor's training and development has provided useful insights into language acquisition, as well as other areas of perceptual and cognitive development.

There are also reported cases of children whose isolation has been associated with congenital or acquired sensory loss (e.g. Howe & Hall 1903, Dahl 1965, Fraiberg & Freedman 1964). In addition, there are cases of children whose isolation resulted from deliberate efforts to keep them from normal social intercourse (Von Feuerbach 1833, Mason 1942, Davis 1940, 1947, Freedman & Brown 1968, Koluchova 1972). The present paper deals with a child in this category.

Nowhere in modern scientific literature is there a systematic study of the effects of very long-term isolation in childhood. The only cases comparable to the one re-

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ported here are those of Victor (Itard) and Caspar Hauser (e.g. von Feuerbach), which date back about a century and a half. All the other children reported had been isolated for much shorter periods and emerged from their isolation at a much younger age. Even in these cases, the opportunity for careful observation was lacking; and in the earlier cases, the reports omit information on just those questions of interest to linguists.

The case of Genie assumes even more importance, then, because of its unique character, and because, from the time she emerged from isolation, a team of psychologists, psychiatrists, neurologists, and linguists have been working with this amazing child. In this paper we shall discuss only questions of linguistic concern, with emphasis on Genie's acquisition of phonology and syntax.

1. CASE HISTORY. Genie was born in April 1957. When we first encountered her, she was 13 years and 7 months old—a painfully thin child who appeared six or seven years old. When hospitalized for malnutrition, Genie could not stand erect or chew food; she was not toilet trained; and she did not speak, cry, or produce any vocal sounds. The reconstruction of her previous life presents a bizarre and inhuman story. From the age of 20 months, Genie had been confined to a small room under conditions of apparently increasing physical restraint. In this room she received minimal care from a mother who was herself rapidly losing her sight. She was physically punished by her father if she made any sounds. Most of the time she was kept harnessed into an infant's potty chair; otherwise she was confined in a homemade sleeping bag in an infant's crib covered with wire mesh. She was fed only infant food.

The details of her discovery are not pertinent to this discussion, nor is speculation concerning the psychotic reasons behind the parents' actions. We have little information on the nature and extent of Genie's linguistic input during her isolation. The father's intolerance of noise is known, and there was no television or radio in the home. The periods of any human contact during the day were extremely limited. We know that her father and older brother did not speak to her, but at times barked at her like dogs. For the most part, hour after hour, day after day, year after year she was alone and constrained in her prison.

When Genie was discovered, she was taken into protective custody by the police and admitted into the Children's Hospital of Los Angeles. During her stay in the hospital she showed remarkable development. Physically she improved dramatically. She rapidly gained weight and height, and breast development signaled oncoming sexual maturation. Her cognitive growth was quite rapid. In a seven-month period, her Vineland score (a non-verbal cognitive development test) increased from 15 to 42 months; six months after admission, on the Leiter scale (another such test) she passed all the items at the four-year level, two at the five-year level, and two out of four at the seven-year level. Genie's emotional growth was reflected not only in her changing relationships with things and people, but also in her increasing capacity for emotional expression.

In July 1971, Genie left the hospital to live with a foster family, of which she now functions as a member. In all aspects of her life—psychological, physical, mental, and linguistic—Genie continues to develop.

2. HAD GENIE ACQUIRED ANY LANGUAGE? When Genie was first admitted to the hospital, there was little evidence that she had acquired any language; she did not speak. Furthermore, she seemed to have little control over the organs of speech. Even for non-speech functions, she showed great deficits in muscular control when chewing, swallowing etc. In the earliest period it was almost impossible to determine the extent of her comprehension of spoken language. In the absence of detailed information on her earlier linguistic input, either before or during her period of isolation, no meaningful predictions could be made concerning her linguistic development.

One of the first questions which required an answer was whether Genie's inability to speak represented merely a 'performance' deficit. It was thought that, if she was able to comprehend spoken language, this would reflect some linguistic knowledge of language, even though physiological and psychological factors were preventing her from using this knowledge to produce speech. If this were the case, whatever linguistic development occurred would be less a process of acquiring the basic linguistic system than of learning to utilize her knowledge. But if Genie did not comprehend spoken language, she was faced with the task of first-language acquisition, a task normally completed before age five.

The attempt to determine the extent of her linguistic competence (specifically, comprehension) was full of difficulties. Her lack of responses did not necessarily mean that she failed to understand what was said to her. On the other hand, when she did respond, it was not always easy to determine whether or not her understanding depended primarily on extra-linguistic cues. There were some clues, however, all pointing toward lack of comprehension of language beyond the domain of a few single words; e.g., she often responded to words clearly out of the context of their environment—and, at the other extreme, failed to respond to simple commands. It appeared, therefore, that Genie was a child who did not have linguistic competence; i.e., who had not yet acquired language. Any controlled comprehension tests, however, had to wait until Genie was willing and able to participate and respond.

On 3 March 1971, Genie was visited by Ursula Bellugi-Klima and Edward Klima. Their report of this visit states: '(Genie) seems to understand a good deal more than she says of language, but it is not always clear what cues she is using to respond to sentences.' They recommended 'the use of tests and games [to establish] how much and what aspects of spoken language she understands and responds to [which would be] a far better index of her knowledge of language than the handful of words she uses spontaneously.' Furthermore, to distinguish between her understanding which depended on 'tone of voice, gestures, hints, guidance, facial and bodily expressions' and her understanding based on linguistic knowledge, they suggested that, 'In the situations reserved for testing and evaluating her understanding of spoken language alone, all these [extra-linguistic cues] must be eliminated.'

A number of comprehension tests and games were developed and administered to Genie each week. It was clear from the outset that Genie's comprehension of language was only slightly in advance of her speech production. Systematic testing of her comprehension did not begin until October 1971, however, and Genie had already begun to acquire language by then.

3. COMPREHENSION DEVELOPMENT. The tests which were constructed to evaluate Genie's progress in learning to use grammatical information in the comprehension of language, and their results, are presented in Appendix 1, below. The results of these tests show that Genie is acquiring language. She has learned (though not by imitation or by prescribed 'rules') to process or understand constructions involving negation, coördinating conjunctions, many prepositional relations, pluralization of nouns, modification, possessives, the comparative and superlative, and several relational adjectives.

Several of these tests have revealed continual comprehension of the particular aspect of syntax being tested. Such tests include a negative/affirmative sentence test (with or without relativization, and with or without contraction of the negative element), a conjunction test with *and*, tests on the comprehension of *next to* and *beside*, a test of the comprehension of the possessive in both its syntactic forms, and tests concerning modification (as well as the comprehension of the comparative and superlative, which, however, were not tested before January 1972).

Other tests show inconsistent or incorrect responses, indicating Genie's lack of comprehension of the syntactic feature or rule being tested. Her performance on the active/passive test and on the 'WH-question' test has been totally inconsistent. Both are tests of word order to some extent. This is peculiar and confusing, since Genie has used consistent and correct word order (in terms of the adult model) to indicate SVO relations, as well as modification and possessive relations, in her own productive speech.

Some of the tests reveal acquisition of syntactic features or rules which were totally lacking at the onset of testing. The 'conjunction test' reveals this. All along, Genie's test performance has indicated knowledge of the conjunction *and*. But for the first year, 1972, she responded to *or* and *and* as if they were identical. She showed neither hesitation nor confusion when presented with a sentence in which two nouns were conjoined by *or*, responding to such a sentence in the same manner as if *and* were used. In August 1972, Genie began to respond differently to the test items with *or*. Now, after a long delay, she responds by doing a number of different things (e.g. piling up all the test items, or manipulating the objects mentioned in the sentence in a strange way); her gestures and facial expressions reveal confusion, uncertainty, and, at times, great frustration. It seems clear that Genie is now aware that *or* does not mean *and*, but she does not yet know its meaning. The acquisition of the concept of disjunction may in any case be more reflective of logical development than of language acquisition per se (see Furth 1966).

Genie acquired the ability to distinguish between singular and plural count nouns during the period of testing. Until July 1972, she made no consistent responses to indicate comprehension of this distinction; her test performance was never better than chance. In July, one of us (Susan Curtiss) embarked on a program to teach her this distinction.

Because Genie had so many physical and psychological problems associated with speaking, we decided early in our work to try the visual/written mode as linguistic input, in addition to the speech mode. We introduced printed words on 3 × 5 index cards used with a pocket-board. We aimed at teaching her to recognize printed words and to use them to form syntactic constructions. In teaching Genie the

plural, test pictures were used along with printed words designating the pictured nouns; in addition, a large red *S* and the numbers 1, 2, and 3 were used. A game was played in which Genie learned to match the test pictures with a string of the following sort: 1+N, 2+N+S, 3+N+S, where N was the printed word signifying one of the objects in the pictures. From there, Genie learned to construct such a string as a match to the spoken phrase only: Curtiss would say *Three dishes*, and Genie would construct the string *3 dish S*. In both tasks, the following pluralization rule was taught: 'If there is more than one, you need an *S*.' Articulation of the regular plural morpheme (in its three phonetic variants) was also practiced. A final step was to introduce nouns other than those on which Genie was drilled, as the oral stimuli to which she would respond with written strings. In three weeks (5 lessons), Genie had mastered the plural concept, and since that time her performance on this test has been perfect.

The motivation for designing such teaching methods, to help Genie learn language, is to aid her in her social relations with the world in which she lives. Children learn such structures at an early age. At sixteen, Genie has constructed some rules on her own; but where this process can be aided, we believe it is our responsibility to do so.

4. PHONOLOGICAL DEVELOPMENT. Genie's phonetic and phonological output has been complicated by both psychological and physiological factors. As stated above, it appears that she was punished for making sounds, and thus learned early in life to repress any sound production. After her emergence, Genie had to learn to acquire control over her vocal organs as part of her learning to articulate the different sounds which represent the phonological elements of spoken language. Many of her early utterances (both imitative and spontaneous) were produced as 'silent' or whispered articulations; and her strange voice quality was noted by all the consultants who visited her. She still has enormous difficulty in controlling air volume, air flow, glottal structures, and glottal vibrations.

In normal quiet breathing, only the inspiratory muscles are utilized; but in speaking, both inspiration and expiration involve muscular controls. Since speech is an 'overlaid function' (in Sapir's terms), we learn very early in life to use the respiratory mechanism simultaneously for speaking as well as breathing. Maintaining the proper air pressure across the glottis, to permit vocal-cord vibration, requires that we learn to control air flow and air volume. But Genie's lack of speech during the many years of her isolation prevented her from learning these necessary controls. In fact, it would appear that what she learned was to prevent sound production rather than to produce sounds. This conditioning prevented any sound whatever from being made even in her tantrums, during uncontrolled thrashing and scratching. Her lack of pitch control, and the body tension which is observed when she attempts to control the expiration of air during speech, are therefore not surprising.

There has been some improvement in Genie's ability to produce speech, although her speech production is still far from normal. The intensity of the acoustic signal is very low; there is little variation of pitch (fundamental frequency); her general pitch level is very high.

Many researchers have concluded that children learn the intonation contours of the language prior to the non-prosodic segmental speech sounds (Weir 1962, Miller & Erwin 1964). Bever, Fodor & Weksel (1965: 479) claim: 'It is widely accepted in the literature that the child effectively masters the intonation pattern of his language BEFORE HE HAS LEARNED ANY WORDS AT ALL' (their emphasis). While Braine 1970 suggests that evidence is lacking for the claim that intonation (as a linguistic feature) is controlled before speech, it is certainly the case that even during the babbling stage a wide variation in pitch contours is noted. This has not been the case for Genie, for the reasons given above. Auditory tests and impressionistic observations show that the problem is not her inability to perceive different pitch changes or pitch contours. Rather, it is her inability to control pitch variations in her own speech production. Further tests are being conducted to determine her ability to respond to grammatically determined differences in intonation contours.

Genie's supra-glottal articulatory abilities show more normal development. Here too, however, there are ups and downs in her ability to produce intelligible utterances. For her segmental inventory, see Appendix 2, below.

Genie's first basic 'words' were monosyllabic consonant-vowel sequences; the consonant was a non-aspirated labial or dental stop, and the vowel a monophthong. Her first disyllabic words differed from what some researchers have considered to be the second stage of phonological development. E.g., Moskowitz 1971 suggests that the first disyllabic utterances are 'reduplications' of the whole CV syllable. But Genie's first disyllabic words did not follow this pattern; instead they closely paralleled the adult forms in the consonants and vowels appearing in both syllable positions.

For a number of months, her basic syllable structure was of the form (C)(L)V(C). The vowel could be either short or long. The initial consonant (when there was no following liquid) was any of the possible initial consonants found in Standard American English, except the affricates. As of June 1972, however, the voiced and voiceless interdental fricatives, [θ] and [ð], were used only in imitations, and the affricates [č] and [j] varied with the corresponding stops. In this period, more often than not she deleted final consonants; but since this was not consistent, the internal representation of the words and syllables must have included these consonants, and her grammar must have included an optional rule deleting final consonants. One could say that at this stage she had not yet learned to 'suppress' the natural syllable structure (Stampe 1972). When a final nasal was 'unpronounced', its presence was often shown in the nasalization of the preceding vowel. Since the nasal was sometimes present, rule 1 includes nasal as well as oral consonants:

- (1) (optional) C → ∅ / ____\$ (where \$ = syllable boundary)

Since a word like *can* was pronounced either as [kæn] or [kæ̃], one might conclude that Genie's grammar included a constraint such that, in lexical representations, all vowels preceding nasal consonants were redundantly nasal. But this does not seem to be the case, since Genie would sometimes substitute a non-nasal consonant for the nasal, and in such cases the vowel was not nasalized. E.g., at times *funny* was pronounced [fʌ̃n:ɪ] and at other times as [fʌtɪ]. If the vowel were basically

nasal, one would expect *[fãti]. It appears, then, that vowel nasalization occurred as a rule (or process, cf. Stampe), that all vowels were phonologically oral, and that the replacement of nasals by oral consonants blocked the vowel-nasalization rule.

Initial voiceless stops were produced with or without aspiration, more often unaspirated. But when the initial consonant corresponded to an *s*-stop cluster, the stop was always unaspirated. This would make it appear that aspiration was not 'applied by rule', but stored as a feature of the segments; otherwise one might expect the voiceless stop corresponding to /sp sk st/ to be randomly aspirated or unaspirated. Although the initial consonant could be any of those listed, the medial and final consonants in words produced by Genie have been more restricted: [t] has substituted for medial [n], and for medial and final [k] and [s]. Only recently have final [k] and [s] emerged with consistency.

In the last few months, Genie has begun to produce words with initial *s* followed by stop, inserting an epenthetic shwa-like vowel to break up the cluster. Since English reduced vowels are for the most part 'shwa-like', her use of [ə] as the epenthetic vowel may show her increasing knowledge of English phonology: she could just as well insert an [a] or [ɪ] or a copy of the first vowel. One might also suggest, however, that the [ə] is the universally unmarked neutral vowel.

Genie can pronounce many sound sequences in imitation which she does not use in spontaneous speech. It is clear that her output is more constrained by her own phonological 'realization' rules than by her inability to articulate the sounds and sound sequences of English. This shows that, even in an abnormal case of language acquisition, one must differentiate between a child's phonological system and phonetic ability.

A child's phonological development does not proceed totally separate from syntactic development. This is particularly clear in the area of morphophonemic alternations; e.g., plurality is expressed both syntactically and morphologically. On 20 October 1971, Genie was tested for the first time on her comprehension of simple singular vs. plural nouns. Two pictures were presented to her, one with a single object and the other with several similar objects. The items were balloons, turtles, and pails, all objects which she knew, could recognize and point to, and even name. The investigator said each time: 'Point to the ____', with the blank filled by either the singular or the plural form. Of twelve responses, seven were incorrect, showing a random response.

This singular-plural test was administered regularly in the months which followed. Three additional objects were added—noses, dishes, and horses—but the same random responses resulted. Although Genie could appropriately use and understand utterances including numbers and *many* or *lots of*, she could not distinguish plurality by linguistic means, either by the addition of the plural morpheme (/z/: [z] [s] [ɪz]) or by the plural form of the copula (*are* vs. *is*).

In July 1972, however, she began to show that she had acquired the linguistic plural. In eight tests her responses were 100% correct. This 'learning' resulted from specific 'teaching' techniques as explained above.

5. SPONTANEOUS 'SENTENCE' PRODUCTION. About five months after Genie's admission to the hospital, she began to use single words spontaneously. Her early

vocabulary included mainly color words, numbers from 1 to 5, the noun *mama*, and the verb forms *stop it* and *spit*. Already at this stage one can note a difference between this inventory of words and the first words of a normal child, which are typically nouns, plus particles like *up* and *down* (Velten 1943). In none of the descriptions of the early child's vocabulary does one find items as cognitively sophisticated as color words or numbers.

Genie's vocabulary grew rapidly and steadily; by the time she began combining two words, she had learned and was producing close to two hundred words. Again one may note the size of Genie's vocabulary, before two-word sentences appeared, as compared with that of normal children's vocabulary (about 50 words) at this same stage. Genie's vocabulary approached the dimensions found in aphasic children before they begin to construct two-word sentences (see Eisenson & Ingram 1972).

Genie's two-word 'grammar' emerged around June 1971. There was never a point at which these utterances could be described adequately by a Pivot-Open system (Braine 1963, Miller & Ervin). Braine observed, in the children he studied, that 'a few individual words are singled out and used in a particular utterance position in combination with a variety of words ... The words singled out have been called PIVOT WORDS ... the words that are combined with the pivots also occur as single-word utterances, whereas the pivot words themselves may not occur alone.' No stage in Genie's development parallels this; but perhaps Braine's generalization fails to apply to many normal children as well (see Bowerman 1973: 68-70). In Genie's grammar (at that stage) one would be hard pressed to decide what was 'pivot' and what was 'open'. Furthermore, a Pivot-Open grammar would fail to capture the semantic and syntactic relations clearly involved in her two-word utterances. When the two-word 'sentences' are analysed as to their specific semantic and syntactic structures, Genie's knowledge of different semantic and syntactic relations is revealed. In addition, even words that seem to be good candidates for 'pivots' occur alone, and have more than one possible position in Genie's utterances—e.g. *Hurt cat* and *Cat hurt*, or *No more father* and *Father no more*. This differs from the utterances noted by Miller & Ervin which ended with either *on* or *off*, and those which began with *this*, *that*, *more*, *a*, *the*, or *other*, with these 'pivot' words used in a fixed position.

Bloom 1970 discusses the various relations which may be expressed by a two-word sentence. In Genie's case, a verb + noun construction may express a verb-object or subject-verb relation, as in *Want milk* (verb + object) vs. *Hurt hospital* (verb + subject). But from June 1971 to September 1971, Genie's two-word utterances were primarily *modifier* + *noun* or possessive constructions of *noun* + *noun*. The modifier, in the modifier + noun constructions, could be either a number, or an adjective of size, quantity, or emotional quality. The last type was combined only with animate nouns. Sample utterances are:

- (2) a. yellow balloon, wet blouse, big feet, bad boy(s).
- b. Butler shampoo, Dave back, Curtiss chin, Marilyn bike.

The possessive constructions manifested, in every instance, fixed word order: N₁ was the possessor, and N₂ the possessed item, as shown in 2b.

In September 1971, Genie began to produce two-word utterances with verbs: subject + verb, verb + object. First-person subjects never appeared in surface sentences. Examples are:

- (3) SV
 a. Dave hurt 10/11/71
 b. Mark paint 10/27/71
 c. Curtiss come 11/24/71
- (4) VO
 a. love Marilyn 10/8/71
 b. like powder 10/14/71
 c. shake hand 11/24/71

Sentences of the form noun + predicate adjective followed shortly:

- (5) a. stocking white 11/4/71
 b. Curtiss sick 12/15/71

In November 1971, Genie was observed on rare occasions to produce sentences of three or four words. These sentences were of various types: subject + verb + object; subject + object, with a complex NP as either subject or object; three- or four-word noun phrases; and predicatives of the form NP + NP. The first-person subject, always omitted in two-word utterances, now appeared in some of these longer strings:

- (6) Genie love Curtiss [cf. earlier *Love Curtiss.*]

Also, two-word strings which had earlier been complete sentences now served as NP's in longer sentences:

- (7) a. Want more soup [earlier *More soup.*]
 b. Mark mouth hurt [earlier *Mark mouth.*]

An interesting aspect of this stage of development is that Genie's three- and four-word NP's seem to display a cognitive complexity normally not found in early child speech. The following examples illustrate this:

- (8) a. Valerie mother coat
 b. Valerie mother purse
 c. Little white clear box.

Another important characteristic of these utterances is that a number of the complex NP's display obvious non-imitative order, i.e. order not heard in the adult model. Two examples of these are:

- (9) a. small two cup
 b. little bad boy.

Such utterances provide clear evidence that Genie, like normal children, is not learning language by imitation alone. They also reveal that the length of Genie's utterances does not directly reflect her syntactic capabilities. That is, given the fact that she does on occasion produce utterances of more than three or four morphemes, the infrequency of such utterances may be explained by her difficulties—both physiological and emotional—in producing speech, rather than by limitations of her linguistic competence. Thus, when Genie fails to communicate her message with

one- or two-word utterances, she can expand the sentences, revealing a more extensive syntactic system than usually appears on the surface.

In February 1972, negative sentences emerged (it should be noted that Genie was able to comprehend negative sentences much earlier). Such sentences consisted of the negative element *no more* affixed to either a noun or a noun + verb. In July, negative sentences with *no more* attached only to a verb appeared:

- (10) a. No more father.
 b. No more take wax.
 c. No more have.

Locative sentences emerged at the same time, consisting of either noun + noun or verb + noun. Only nouns denoting locations were used:

- (11) a. Cereal [in] kitchen.
 b. Play [in] gym.

In July 1972, the first examples of an expanded verb phrase were observed, initially of the form verb + VP:

- (12) a. Want go shopping.
 b. Like chew meat.

Later, around October 1972, these strings were expanded to include complex NP's and more complex VP's:

- (13) a. Want buy toy refrigerator.
 b. Want go walk [to] Ralph[s].

In all the above constructions, Genie used only one mechanism for expressing grammatical relations—that of word order. In November 1972, her first grammatical markers emerged, when she began to use the preposition *on*:

- (14) Question: Where is your toy radio?
 Genie: On chair.

It is possible that, in this period, *on* was used (or understood) to mean either 'on' or 'in'; it is not clear that Genie was aware of the distinction. Except for *no more*, this use of the preposition is the first example of what may be called grammatical morphemes.

Genie has now also begun to use the progressive aspect marker *-ing* with verbs:

- (15) a. Genie laughing.
 b. Curtiss coughing.
 c. Tori eating bone.

In every case she has appropriately used the progressive marker to denote ongoing action. It is interesting to note that Brown, Cazden & Bellugi 1969 have found *on* and *-ing* to be among the earliest grammatical markers in normal language acquisition.

Genie has produced a few sporadic plurals (e.g. *bears*, *noses*, *swings*); but the fact that she still simplifies final clusters may account for the general lack of overt plurals in [s] and [z]. She also now imitates the past-tense forms of strong verbs such as *gave* and *fell*, and on a few occasions has incorporated them into her spontaneous utterances:

- (16) a. Grandma gave me cereal.
b. Took off.

It is not clear, of course, whether these forms represent the past tense.

Genie has also begun to use the prepositions *in, at, behind, front, and after*:

- (17) a. Like horse behind fence.
b. Like good Harry at hospital.
c. I like wheelchair in hospital.
d. Marilyn front.

She also produces possessives which are phonologically marked:

- (18) a. Joel's room.
b. Mark's room.
c. I like Dave's car.

All these markers are used appropriately, being affixed only to the 'correct' word category, and are used in an appropriate semantic context.

Besides the emergence of individual prepositions, Genie now uses prepositions in adverbial phrases:

- (19) a. In hospital, shot hurt arm.
b. After dinner have cookie.

She still speaks in shorter strings than she is capable of constructing, and thus often deletes these items; but the syntactic markers are appearing more frequently in her spontaneous speech.

In addition, Genie has begun to use the vocative, and to produce imperative sentences. The vocative (or 'nominative of address') is present very early in normal child language, and it is of interest that it remained absent from Genie's speech for so long. Its appearance is probably more the result of emotional development than of syntactic acquisition. Perhaps the syntactic structures emerge only when the necessary psychological factors are present: in order to request or demand something from specific individuals, the speaker must have enough of a self-concept to feel she has the power and right to so address people and to make direct demands. We now find sentences like those below as part of Genie's everyday speech:

- (20) a. Go way, Joel, finish story!
b. Get out baby buggy!

Verb particles are now used, as shown by regularly occurring utterances like *Get out, Take off, Put down, and Put back*. Indirect objects also appear in recent sentences:

- (21) a. Curtiss give me valentine.
b. Give valentine Mr. James.
c. Grandma gave me cereal.
d. Grandpa give me cookie chew.

Another addition to Genie's grammar is a determiner category. She often imitates the definite article, e.g. *In the hospital, In the backyard*; and she frequently uses the determiner *another*:

- (22) a. Another house have dog.
b. Another house blue car.

No definite–indefinite distinction has appeared.

As stated above, in the discussion of the two-word sentence stage, Genie produced ‘genitive’ constructions at an early period. These show her continuing syntactic development. As mentioned, she now uses the possessive marker, and has also begun to use the possessive pronoun *my*:

- (23) a. Willie slap my face.
 b. My house.
 c. My pennies.

Such utterances exemplify her advancement from using word order alone to express syntactic relations to the use of explicit and appropriate grammatical formatives. More recently, possession is expressed by the verb *have*:

- (24) a. Bears have sharp claw.
 b. Bus have big mirror.
 c. Bathroom have big mirror.
 d. Curtain have flower.
 e. Father have flower curtain.

She has also added *no* and *not* as negation elements to her earlier *no more*. The three now seem to be used appropriately:

- (25) a. No more have.
 b. No more ear hurt.
 c. No like hospital.
 d. No stay hospital.
 e. Not have orange record.
 f. Not good fish tank.

There is still no movement of the NEG into the sentence; in fact no movement transformations of any kind are revealed in her speech to date.

Further syntactic complexities are revealed by Genie’s use of compound NP’s. In talking about cats and dogs, she said *Cat hurt*, then *Dog hurt*, and then *Cat dog hurt*; when asked what was in a snapshot, she replied *Curtiss, Genie, swimming pool*, naming the three important features of the picture. Prior to December 1971, she would name only one thing at a time, and would have to be asked *What else?* before providing an additional word.

Genie has begun to give consistently appropriate answers to *when*-questions:

- (26) a. Q: When do you see Mama?
 Genie: Friday.
 b. Q: When does Curtiss come?
 Genie: Monday.

In addition, Genie seems now to comprehend *why*-questions; e.g., when Curtiss was ill and unable to see her at the regular time, Genie said: *Disappointed*. Her foster mother asked *Why?* and Genie replied: *Curtiss sick*.

Genie comprehends questions with *who*, *what*, *where*, *whose*, and *how*, although there are no WH-words in her own utterances. It would seem that she has the ability to ‘decode’ the syntactic structures of WH-questions (but note the test in Appendix 1).

A recent development (December 1972) is her comprehension of personal pronouns and her own use of *I*. This pronoun seems to be limited to co-occurrences

with the verbs *want* and *like*, but it is definitely present in strings with these verbs, and even receives stress (reflected by greater intensity and duration).

At the beginning of December, Genie produced a sentence with greater syntactic complexity than those exemplified above. Curtiss and Genie were accidentally locked out of Genie's foster home, and had to wait until someone arrived with a key. When her foster family arrived, Curtiss said to Genie: *Tell them what happened*. Genie said: *Tell door lock*, as she nodded knowingly and pointed to the door. It seemed quite clear that the sentence meant 'Tell them that the door was locked, huh.' If this is indeed how the sentence is to be interpreted, it would seem that Genie now has a recursive property in her grammar, as shown by this sentence and by the combining of the two sentences *Cat hurt* and *Dog hurt* to produce *Cat dog hurt*. If this is so, she has acquired the two essential aspects of syntax that permit the generation of an infinite set of sentences: the ability to combine a finite set of linguistic elements in new combinations, and the ability to generate sentences consisting of more than one base sentence.

6. COMPARISON OF GENIE'S SYNTACTIC DEVELOPMENT WITH THAT OF NORMAL CHILDREN. The language development to date is encouraging, but it is important to note some of the differences which exist between Genie's development and that of normal children. The size and nature of her vocabulary is different. For one thing, her vocabulary is much larger than that of children at the same stage of syntactic development. She learns new words rapidly, and seems to be able to add constantly to the store of words in long-term memory. This illustrates the distinction between storage of lists of elements and rules of grammar.

The rate of Genie's syntactic acquisition, however, is much slower than normal. The two-word stage, which normally lasts from two to six weeks (see Eisenson & Ingram), lasted for more than five months in Genie's case. In addition, negative sentences (which, along with affirmative active-declarative sentences, constitute the only types occurring), remain in the earliest stage of development, i.e. NEG + S (see Brown, Cazden & Bellugi 1969, Klima & Bellugi-Klima 1966). This is despite the fact that negative sentences have occurred in Genie's speech for more than a year and a half. In fact, as noted above, there are as yet no movement transformations of any kind in Genie's grammar; nor are there any question words, demonstratives, catenatives, rejoinders (*yes, no, please* etc.), or pronouns of any kind other than first-person pronouns.

Yet there are areas where Genie's language appears to be more sophisticated, cognitively, than is found in normal language acquisition. The inclusion of color words and numbers in her early vocabulary was noted above (see Castner 1940, Denckla 1972). Normally, children's vocabularies are expanded a great deal before colors or numbers are learned. Moreover, Genie's use of vocabulary items has never involved the kind of semantic over-generalizations found in the speech of very young children (Clark 1973). But phonological extension is present; e.g., she often uses gestures to accompany her verbalization of certain words, stooping to a sitting position when she says *sit* and also when she says *sick*. She does not abstract specific semantic features; i.e., the name for some round object like *moon* is not used for other round objects, as described by Clark. But she is able to extend generic

features correctly; thus, when she learned the word *dog*, she used it appropriately for all dogs, and never for a cat or a horse. But except in such generic terms there is no semantic extension.

Genie's comprehension of all the WH-questions is also of interest. Normal children ordinarily learn *how*, *why*, and *when* questions much later than *who*, *what*, and *where* questions, despite the fact that syntactically they present identical problems (Brown 1968, Ervin-Tripp 1970). One may hypothesize that this disparity can be attributed to non-linguistic cognitive asymmetries rather than linguistic rules: the former group appears to require more sophisticated inferences about the way objects and events are to be understood or integrated. The fact that Genie is able to understand all these questions shows a more developed cognitive ability than is found in children whose grammars are more highly developed, but whose cognitive age is below hers. This is also revealed by Genie's ability to comprehend the comparative, the superlative, and the differences between *more* and *less* (see Appendix 1) —all this, of course, without any WH-words or comparative or superlative markers in her own speech. These indications of cognitive sophistication, in the absence of linguistic (especially syntactic) development, suggest a possible independence of cognition and linguistic development, and perhaps also the independence of semantics and syntax.

The difference between Genie's linguistic competence (her grammar) and her performance is sharply apparent in the differences between her comprehension and production. But this is not too different from what is found in normal language acquisition. Even at the earliest stage, between 18 and 24 months, children appear to comprehend structures greater in complexity than those which they produce. In a number of experiments concerned with comprehension, C. Smith 1970 has shown that children aged approximately 18 months to 2 years 'apparently handle only the high-stress content words that they utter themselves'. She suggests that 'perhaps their listening is mainly an attempt to "find" words they know', and that 'The linguistic competence of these children does not differ markedly from their performance' (118). But older children (aged 2½) already display a competence which differs greatly from their speech behavior: these children attend to 'function words', even though they do not use them in spontaneous speech. Children from 3 to 4 years show an even greater difference between the spontaneous utterances they produce and the structures which they are able to decode.

Right from the start, Genie appeared to understand words which she did not produce herself. This, of course, does not refer specifically to a difference between competence and performance, since 'comprehension' is also performance. But what is most evident in Genie's language is that she does indeed have greater abilities than she frequently displays, as shown by her sentence expansions when she had to go beyond two-word utterances in order to be understood.

It has been suggested that a speaker's linguistic competence includes the knowledge of what strings are well-formed, i.e., what are 'grammatical' sentences in the language. It is clear that one cannot ask Genie to separate grammatical from non-grammatical sentences; one can't do this with normal children, either, or in many cases with mature speakers, although Fischer 1971 has noted that children of 7 years may respond to ungrammatical strings by giggling. One incident, however, seems

to show that Genie, despite her slow development and overly-simple grammar, does know the meaning of grammaticality. This was revealed in a session where printed words were being used. In February 1973, we decided to work with the written mode to help Genie learn to ask and understand WH-questions. Prior to this time, when she attempted to construct sentences with the 'word cards', she frequently produced blatantly ungrammatical strings and seemed entirely satisfied with her efforts, expecting to be praised in all cases. During the session under discussion, the first WH-question that Genie constructed was *What is under?* She sat back, read it to herself, then said *Silly!*, and added the NP object *the green box*, thereby changing her ill-formed string to a grammatical question. In constructing the answer to that question, she first replaced the question mark with a period, and then removed the WH-word, leaving, *is under the green box*. Again she read it to herself, again said *Silly*, and added *the orange box*, to form the grammatical string *The orange box is under the green box*. It is true that, semantically, the uncorrected sentences have no content, and Genie's corrections may merely reflect this cognitive awareness; but the order of all the words was in keeping with her knowledge of 'well-formedness'. The fact that she can form questions in printed words, but not in speech, may, then, not only show a competence/performance distinction, but may also show that she is learning what constitutes a well-formed string.

7. CRITICAL-AGE HYPOTHESIS AND LANGUAGE LATERALIZATION. Genie began to learn language when she was close to fourteen years of age. As stated above, she was already pubescent. Thus she has been learning her 'first language' at an age beyond the 'critical age for first-language acquisition' proposed by Lenneberg 1967. The critical period concept does not pertain solely to language acquisition. The concept itself derives from experimental embryology, but has been generalized by ethologists to apply to the development of certain animal behaviors. The term refers to innately determined behavior, the appearance of which is dependent upon environmental facilitation during some developmentally critical period. Whether critical periods exist for human beings is a matter of controversy. There is, of course, no question but that certain environmental conditions are necessary for the acquisition of certain knowledge and behavior. But crucial evidence is not available, since no one today would attempt to replicate the apocryphal experiments conducted by Psammetichus or King John to determine the language used by children when all linguistic input is cut off. One reason for the controversy about critical periods in man is the difficulty of adequate definition of the innate behavior to be elicited, and the time and nature of the required environmental facilitation.

One of the clearest statements about critical periods in man concerns the emergence of language. Lenneberg suggests that language is an innately determined behavior dependent upon certain neurological events, but obviously also dependent upon some unspecified minimal exposure to language at a certain stage in the child's development. According to him, language acquisition is precluded when lateralization of cerebral function is complete, which he believes occurs about the time of puberty. Hence the critical period for language acquisition is presumed to be during some period prior to onset of puberty; subsequent to this time, primary language by 'mere exposure' is hypothesized to be impossible. On the other hand, Krashen

& Harshman 1972 argue that the development of lateralization of language is complete well before puberty, and suggest that lateralization and language acquisition may go hand in hand. If this is so, we would expect a greater left-hemisphere lateralization in Genie as she progresses with language.

In an effort to establish whether or not lateralization was complete, specially devised dichotic listening tests (Kimura 1967) were administered to Genie. In such tests the subject hears simultaneous differing stimuli, one to each ear. In right-handed normal subjects, the right ear excels for verbal stimuli (nonsense syllables, words etc.), the left ear excels for certain non-verbal stimuli (musical chords, environmental sounds etc.) Genie is right-handed; hence, if lateralization for language had already occurred, it was anticipated that verbal stimuli presented to her right ear would be 'preferred' to those received by the left ear.

Two sets of stimuli were used.¹ The 'verbal' type consisted of 15 pairs of 'point to' words; i.e., each pair of words was preceded by the binaural instructions *Point to the ____*. Genie pointed to toys or pictures representing the words, which were familiar to her: *baby, boy, car, mirror, table, and pig*. The non-verbal tape consisted of pairs of environmental sound stimuli recorded from Genie's actual environment (piano chords, car horn, water running, telephone ringing, squeal of toy chimp). She responded by pointing to snapshots of the sound source.

In monaural testing of all stimuli, Genie scored 100%. The results of these tests are surprising, since her verbal dichotic scores show an extreme left-ear advantage; this points to right-hemisphere dominance for language, unusual in a right-handed subject. The right ear performed at a chance level. Such extreme ear differences have been found only in split-brain and hemispherectomized subjects (Milner, Taylor & Sperry 1968, Curry 1968). The results of the dichotic tests using environmental sounds also show a left-ear advantage, but only to a degree found in normal subjects. This 'normal' result shows that Genie is not simply one of those rare individuals with reversed dominance, but instead is one in whom all auditory processing currently appears to be taking place in the right hemisphere. (For more detailed description of these tests, see Krashen, Fromkin & Curtiss 1972; Krashen & Harshman 1972; and Fromkin et al. 1974.

One tentative hypothesis to explain this performance is that inadequate language stimulation during her early life inhibited or interfered with language aspects of left-hemisphere development. One may speculate as follows: At the time of her confinement, Genie was developing into a 'normal' right-handed, left-dominant speaker. The confinement and resulting lack of linguistic stimulation prevented the language areas in the left hemisphere from developing further. In learning language, Genie is utilizing a right hemisphere that is already developed and specialized for other things. (It should be noted here that Genie is very proficient in what are considered right-hemisphere functions, e.g. gestalt pattern-recognition, spatial perception etc.) What occurred may be described as a kind of functional atrophy of the usual language centers, brought about by disuse or suppression. This left-hemisphere atrophy may be 'blocking' right-ear stimuli, preventing them from

¹ Stimuli were prepared with the assistance of Sarah Spitz at the UCLA Phonetics Laboratory, using PDP-12 computer programs developed by Lloyd Rice.

reaching language centers in the right hemisphere, thus accounting for the low right-ear score.

If this hypothesis is true, it would support to some extent the 'critical age' position. The implication would be that Genie's capacity for language acquisition is limited and that it will cease at some point in the near future, as seems to be the case in the few adult patients who have suffered left-hemisphere damage.

A. Smith 1966, studying a left-hemispherectomized man who incurred a left lesion during adulthood, reports that the mature right hemisphere can attain some propositional language. This patient, however, remained severely aphasic eight months after surgery (see also Bogen 1969). Similarly, Hillier 1954 reported a left hemispherectomy on a 14-year-old boy and found early progress; after 19 months, however, there was a stable deficit. Adult left-hemispherectomies, however, have a head start over Genie—namely, the limited but definite linguistic competence of the right hemisphere (simple nouns, verbs, positive-negative distinction etc. in visual comprehension; see Gazzaniga 1970).

One cannot tell what is meant in these brief reports by 'progress in propositional language'. Genie has already gone beyond the stages reported in the literature for such cases. Her comprehension of WH-questions, relative clauses, singular-plural distinctions, negatives etc., and her production of complex NP's, sentence conjunctions etc. provide evidence that there is steady if modest progress in first-language acquisition.

Genie's continuing linguistic development may show that language acquisition, or at least language input, is a prerequisite for lateralization, and that language acquisition and lateralization do not go hand in hand; or it may show that hemispheric specialization is prerequisite to language. Should we find that the degree of lateralization changes as Genie acquires more language—i.e., if she begins to use the left hemisphere for language processing—this would be strong evidence that it is man's genetic language mechanisms which 'trigger' hemispheric specialization. There is much evidence that the left hemisphere is specialized for more than language (Efron 1963, Carmon & Nachson 1971, Papçun, Krashen & Terbeek, 1971). If we find that Genie is 'left lateralized' for other cognitive functions, but not for language, this may reveal the independence of the language mechanism from other cognitive functions. We are just now attempting to find ways to investigate other aspects of behavior which may be left-lateralized for Genie.

This paper is a progress report on Genie's linguistic development. Her language acquisition so far shows that, despite the tragic isolation which she suffered, despite the lack of linguistic input, despite the fact that she had no language for almost the first fourteen years of her life, Genie is equipped to learn language and she is learning it. No one can predict how far she will develop linguistically or cognitively. The progress so far, however, has been remarkable, and is a tribute to the human capacity for intellectual achievement.

APPENDIX 1. COMPREHENSION TESTS

The words used in all the tests were nouns, verbs, and adjectives used in Genie's own utterances. The response required was principally 'pointing'—a gesture familiar to Genie before the onset of testing. At first, each test was specifically made very short, requiring only 6 or 8 responses, so that all the stimuli could be presented, and so that the testing session could be as

long or short as Genie's particular mood suggested. At a later period, revisions were made—tests were lengthened, made more complex, added, or dropped. A summary of the tests and test results follows.

(1) SINGULAR-PLURAL DISTINCTION IN NOUNS. Pairs of pictures were used—a single object on one picture, three of the same objects on the other. The test sentences differed only by absence or presence of plural markers on the nouns. Genie was asked to point to the appropriate picture.

Sample item: Point to the $\left. \begin{array}{l} \text{balloon.} \\ \text{balloons.} \end{array} \right\}$

Words used: *balloon(s)*, *pail(s)*, *turtle(s)*, *tree(s)*, *umbrella(s)*, *nose(s)*, *box(es)*, *rose(s)*, *horse(s)*, *dish(es)*, *pot(s)*, *book(s)*, *cup(s)*, *carrot(s)*, *jacket(s)*, *hat(s)*.

Results: Test administered 34 times—10/71 to 10/73.

	Correct	Incorrect
10/71-7/72	80	74
8/72-10/73	338	0

(2) CONJUNCTION. Five familiar objects were placed in a row in front of Genie. She was asked to point to one or more of them in response to the test sentences.

Sample items: Show me the fork and pencil.

Show me the crayon or the knife.

Show me either the spoon or the crayon.

Results: Early responses to *or* conjunction treated same as *and* sentences. Later responses to *or* showed differentiation between *and* and *or* but non-comprehension of meaning of (*either*)/*or*.

10/71-12/73	Correct	Incorrect	Unanalysable responses
<i>and</i> sentences	100	3	0
<i>or</i> sentences	7	51	6

(3) MORPHOLOGICAL NEGATION WITH *un*. Pairs of pictures depicting objects in opposing states were presented. Genie had to point to the picture corresponding to the item specified in the test sentence. There were two forms of this test: without relativization and with relativization. Both forms were presented at each test session. In addition, the revised version also tested responses to the same pictures with *not* used instead of *un*.

Sample items: Show me the tied shoe.

Show me the untied shoe.

Show me the box that is wrapped.

Show me the box that is unwrapped.

Show me the box that is not wrapped.

Results:

		Correct	Incorrect
with <i>un</i>	11/71-9/72	30	32
	7/73-9/73	25	11
with <i>not</i>	7/73-9/73	34	2

(4) PREPOSITIONS *in*, *into*, *on*, AND *under*. A dish, a button, a pencil, and two small glasses, one turned upside-down, were laid on a flat surface. Genie was instructed to manipulate the objects.

Sample items: Put the button into the glass.

Put the button on the glass.

Results: Comprehension only of *in*.

		Correct	Incorrect
11/71-3/73	<i>in</i>	37	8
	<i>on</i>	25	23
	<i>under</i>	28	21

A logistics problem (one of manipulating and moving the particular objects involved) may have affected her performance. This test, along with all other preposition tests, was replaced by Test 21.

(5) **NEGATIVE VS. AFFIRMATIVE STATEMENTS.** Four pairs of pictures identical except for the presence or absence of some element were presented. Genie had to point to the picture corresponding to the test sentence. There were four forms of this test: (a) without contraction or relativization, (b) with relativization only, (c) with contraction only, (d) with relativization and contraction.

- Sample items: (a) Show me 'The girl is wearing shoes.'
 Show me 'The girl is not wearing shoes.'
 (b) Show me the bunny that has a carrot.
 Show me the bunny that does not have a carrot.
 (c) Show me 'The girl is wearing shoes.'
 Show me 'The girl isn't wearing shoes.'
 (d) Show me the bunny that has a carrot.
 Show me the bunny that doesn't have a carrot.

Results: Performance on this test was 100% correct at all times, regardless of the test form. A more complex negation test was then substituted for it; see Test 25.

(6) **ACTIVE VS. PASSIVE.**

Part (i): A set of three pictures with the same elements in different relationship to each other was presented. Genie had to point to the appropriate picture. There were two forms of this test: (a) with progressive aspect (*be + ing*), and (b) with simple present.

Part (ii): The revised version added another picture set and the box task from Test 15, to which Genie was allowed to point.

- Sample items: (a) Point to 'The boy (is) pulling the girl.'
 (b) Point to 'The girl is pulled by the boy.'
 (c) What is $\left\{ \begin{array}{l} \text{the blue box on?} \\ \text{on the blue box?} \end{array} \right\}$.

Results: Totally inconsistent performance. Most of the time no better than a chance level of correct responses; at times all incorrect responses.

	Correct	Incorrect
11/71-7/72	59	52
10/72-10/73	37	38

(7) **PREPOSITIONS I: *beside, in front of, behind, next to.*** A set of three pictures in which the same items appeared in different arrangements was presented. Genie had to point to the appropriate picture. The test had two forms: (a) without relativization, and (b) with relativization. Form (b) was usually the one presented.

- Sample items: (a) Show me 'The tree (is) behind the house.'
 Show me 'The house (is) beside the tree.'
 (b) Show me the house that is next to the tree.
 Show me the house that is in front of the tree.

Results: Inconsistent responses to *behind* and *in front of*; clear comprehension of *beside* and *next to*. The test was replaced by Test 21.

		Correct	Incorrect
11/71-3/73	<i>behind</i>	14	22
	<i>in front</i>	15	19
	<i>beside</i>	31	0
	<i>next to</i>	4	0

(8) **MODIFICATION.** In first version, red plastic circles, squares, and triangles of three different sizes each were arranged in rows in random order. In later version, yellow circles, squares, and triangles are added to the array. Genie's task was to point to the named object.

- Sample items: Point to the $\left\{ \begin{array}{l} \text{big} \\ \text{little} \end{array} \right\} \left\{ \begin{array}{l} \text{red} \\ \text{yellow} \end{array} \right\} \left\{ \begin{array}{l} \text{circle.} \\ \text{triangle.} \\ \text{square.} \end{array} \right\}$

Results:

	Correct	Incorrect
11/71-12/71	40	25
1/72-5/72	26	10
5/72-12/73	144	0

(Genie's response to the modifier *little* was to select the medium-sized object, indicating that for her a size adjective without a superlative or comparative marker had an absolute, rather than a relative, meaning. She would point to the smallest-sized object only when the word *tiny* was substituted for *little* in the test presentation.)

(9) SUPERLATIVE I. Five white buttons (all small and similar in size) and three strips of paper all the same width, each varying approximately $\frac{1}{2}$ inch in length from the next in size, were presented. Genie's task was to point to the appropriate object.

Sample items: Point to the $\left\{ \begin{array}{l} \text{biggest} \\ \text{smallest} \end{array} \right\}$ button.

Point to the $\left\{ \begin{array}{l} \text{longest} \\ \text{shortest} \end{array} \right\}$ paper.

Results:

	Correct	Incorrect
11/71-1/72	14	6
8/72-12/72	11	2

(10) SUPERLATIVE II. Same test procedures as in 8, usually administered directly after or in conjunction with Test 8. (Since Genie consistently selected the medium-sized shape in response to the word *little*, her responses to the word *littlest* would clearly indicate whether or not she comprehended the superlative morpheme *-est*.)

Sample item: Point to the $\left\{ \begin{array}{l} \text{biggest} \\ \text{littlest} \end{array} \right\}$ red $\left\{ \begin{array}{l} \text{circle.} \\ \text{triangle.} \\ \text{square.} \end{array} \right\}$

Results: Consistently correct responses. Clear comprehension of the relational adjectives used and the function and meaning of the superlative marker.

	Correct	Incorrect
12/72-12/73	84	0

(11) COMPARATIVE. Two white buttons, with small difference in size, and two strips of paper with slight length difference were presented. Genie had to point to the appropriate item.

Sample items: Which button is $\left\{ \begin{array}{l} \text{bigger?} \\ \text{smaller?} \end{array} \right\}$

Which paper is $\left\{ \begin{array}{l} \text{shorter?} \\ \text{longer?} \end{array} \right\}$

Results: All responses correct.

	Correct	Incorrect
1/72-3/73	20	0

(12) COMPARATIVE AND SUPERLATIVE. Seven circles of different sizes were lined up in unsorted order and pasted to a piece of colored paper. Tester pointed to a circle and told Genie: 'Point to one that's bigger/littler.' In the case of the superlative, Genie was told: 'Point to the biggest/littlest circle.' (The circles were not aligned by size).

Results 10/73-1/74:

	Correct	Incorrect
Comparative	24	0
Superlative	6	2

(13) POSSESSIVE. First two different sets of pictures were presented. Set 1 showed (a) a cat missing one foot, (b) a human foot, (c) a cat's foot. Set 2 showed (a) a wagon missing one wheel, (b) a wheel much too large for the wagon, (c) a wheel that would fit the wagon. Later three more picture sets were added. Genie had to point to the appropriate picture.

Sample items: Point to the cat's foot.
Point to the foot of the cat.

Results:

	Correct	Incorrect
1/72-2/72	4	4
3/72-9/73	41	0

(14) PRONOUNS. Pictures of children sitting and eating or being fed were used. Genie had to point to the appropriate picture. The test included reflexive and reciprocal pronouns as well as simple personal pronouns.

Sample items: Show me 'The boy is feeding himself.'
Show me 'He is feeding himself.'
Show me 'He is feeding him.'
Show me 'He is feeding her.'

Results:

	PN's correct	Incorrect
9/72-8/73	35	54
10/73-2/74	46	27
(same sentences with nouns)		
9/72-8/73	24	6
10/73-2/74	22	11

(15) WH-QUESTIONING OF SUBJECT VS. OBJECT. Picture task: two pictures were presented—(a) a boy pulling a girl in a wagon, (b) a girl pulling a boy in a wagon. Box (object) task: four plastic boxes of different sizes were used, including two red boxes, one blue box, and one white box. The boxes were arranged so that one was either *in* or *on* another.

Sample items: Picture task: Who is the girl pulling?
Who is pulling the girl?
Box task: What is on the red box?
What is the red box on?

Results: Performance inconsistent. Genie was usually unable to respond at all, even though she had been answering various types of WH-questions for more than a year. The responses she did give did not reveal any consistent strategy. This test was discontinued because the verbal responses caused too many problems for Genie.

(16) PREPOSITIONS II: *under, over, in, on, behind, in front of*. Buttons and plastic boxes of different colors and sizes were used. Genie's task was to manipulate the buttons and boxes in accordance with the instructions.

Sample item: Put the red box behind the blue box.

Results 10/72-8/73:

	Correct	Incorrect
<i>on</i>	36	9
<i>in</i>	37	4
<i>over</i>	11	2
<i>under</i>	17	7
<i>in front of</i>	20	6
<i>in back of</i>	7	3
<i>next to</i>	7	1
<i>behind</i>	12	5

(17) *Yes* AND *no*; *in, on, AND under*. This test was devised because Genie frequently gave no response to 'yes/no' questions. At times the questions were answered by appropriate head gestures, but often simply by repetition of the last word(s) of the question.

Part (a): The words *yes* and *no* were printed on index cards and set before Genie. Genie was asked to answer questions by pointing to one of the two cards.

Results: Consistently correct responses.

Part (b): Using the same cards as in (a), Genie was asked to respond to questions with the prepositions given above.

Sample questions: Is the button on my hand?
Is the button in my hand?
Is the red box in the white box?

Results: Consistent correct responses. In the few isolated cases where she gave wrong responses, she seemed to be teasing.

	Correct	Incorrect
<i>yes</i>	12	4
<i>no</i>	8	2

(18) *Come here vs. Go there.*

Part (a): Two circles, both large enough for two people to stand in, were drawn on the floor. An adult stood in one circle telling Genie either *Come here* or *Go there*.

Results: In every case except one, Genie went into the empty circle.

Part (b): Two circles were drawn in a row, some distance from each other. One adult stood in each circle. Genie stood in the middle between the two circles. The adults, in turn, instructed Genie to *Go there* or *Come here*.

Results: In all cases, Genie joined the adult who had issued the instruction, treating *Go there* identically with *Come here*.

Part (c): Same circles as in (b). Genie was not in line with the circles. An adult stood in one circle; the other circle was empty. The adult in the circle told Genie to *Go there* or *Come here*.

Results: Genie joined the adult in the circle each time.

Part (d): Same circles; no one in circles; one adult stood closer to one circle than the other; Genie stood several feet away, equidistant from both circles. Adult issued same requests as above.

Results: Genie in every instance went to circle farthest from the speaker.

Results of all four test situations: no comprehension of *here-there* distinction.

(19) *More AND less.*

Part (a): A different number of buttons (sometimes almost equal) was placed in each of Genie's hands. Genie was asked to look at each hand and point to the one that had *more* or *less* buttons.

Results: Correct responses with no difficulty or hesitation.

Part (b): Plastic shapes of different size and thickness were used. Different combinations of sizes and numbers of these shapes were put into each hand. Genie had to point to the one containing more or less. (Triangles were always matched against triangles, etc.)

Sample item: Which hand has $\left. \begin{array}{l} \text{more?} \\ \text{less?} \end{array} \right\}$

Results 8/73-12/73:

	Correct	Incorrect
<i>more</i>	21	0
<i>less</i>	21	0

(20) *Some, one, all.* Five plastic circles, 5 plastic squares, 8 plastic triangles were placed on a table, which also held an empty box and a tin dish. Genie had to follow the instructions in the test sentences.

Sample items: Put $\left\{ \begin{array}{l} \text{some} \\ \text{one} \\ \text{all} \end{array} \right\}$ of the $\left\{ \begin{array}{l} \text{triangles} \\ \text{circles} \\ \text{squares} \end{array} \right\}$ $\left\{ \begin{array}{l} \text{in the dish.} \\ \text{in the box.} \\ \text{on the table.} \end{array} \right\}$

Results:

	Correct	Incorrect
<i>some</i>		
10/73-11/73	5	4 interpreted as <i>all</i>
1/74	5(?); 4 of these were <i>one</i> responses.	1 <i>all</i> response
<i>all</i>		
10/73-1/74	15	0
<i>one</i>		
10/73-1/74	11	1

(21) PREPOSITIONS. Plastic boxes of different sizes and colors were used. Genie had to manipulate them according to the prepositional relation expressed in the test item (40–50 test items in all).

Sample items: Put the $\left. \begin{array}{l} \text{yellow} \\ \text{blue} \\ \text{green} \\ \text{white} \\ \text{orange} \end{array} \right\}$ box $\left. \begin{array}{l} \text{under} \\ \text{over} \\ \text{in} \\ \text{on} \\ \text{behind} \\ \text{beside} \\ \text{next to} \\ \text{in front of} \\ \text{in back of} \end{array} \right\}$ the ____ box.

Results 9/73–2/74:

	Correct	Incorrect
<i>in</i>	40	0
<i>on</i>	31	5
<i>over</i>	15	11
<i>under</i>	13	14
<i>in back of</i>	18	8
<i>in front of</i>	22	3
<i>behind</i>	11	9
<i>beside</i>	20	0
<i>next to</i>	10	0

(22) POSSESSIVE PRONOUNS. A picture of a boy and girl was used. Genie had to point to named items either on the picture or on the tester's body.

Sample items: Point to his hand.

Point to your mouth.

Point to my chin.

Results 10/73–12/73: Correct, 26; Incorrect, 31.

(23) *Before* AND *after*. Genie had to touch parts of her body according to instructions.

Sample items: $\left. \begin{array}{l} \text{Before} \\ \text{After} \end{array} \right\}$ you touch your ____, touch your ____.

Touch your ____ $\left. \begin{array}{l} \text{before} \\ \text{after} \end{array} \right\}$ you touch your ____.

Results 10/73–2/74:

	Correct	Incorrect
Before you touch ____, touch ____.	3	18
After you touch ____, touch ____.	17	0
Touch ____ before you touch ____.	24	3
Touch ____ after you touch ____.	21	6

(24) TENSE AND ASPECT. Genie was shown 6 picture sets, 3 pictures in a set, depicting action sequences. She had to point to the picture (one of the three) described by the test sentence. The test sentences varied only with respect to the tense/aspect of the verb. (The sets were randomly presented, so that process of elimination did not enter as a variable.)

Sample items: Point to 'The girl will open the umbrella.'

Point to 'The girl opened the umbrella.'

Point to 'She is pouring the juice.'

Point to 'She is going to pour the juice.'

Results 10/73–1/74:

	Correct	Incorrect
Future with <i>will</i>	3	15
Future with <i>going to</i>	17	1
Progressive (<i>-ing</i>)	10	8
Past	9	9

(25) COMPLEX NEGATION. Four pictures were presented: (a) a red book on a chair, (b) a red book on a table, (c) a blue book on a chair, (d) a blue book on a table. Genie had to point to the picture described by the test sentence.

Sample items: The book that is on the table is not red.

The book that is not on the table is red.

Results 10/73–12/73: Correct, 59; Incorrect, 1.

(26) COMPLEX SENTENCE PROCESSING. Two sets of pictures were used: (a) a boy sitting on a chair looking at a girl who is also looking at him; a boy sitting on a chair, turned away from a girl also turned away from him; a girl on a chair looking at a boy facing her; (b) a smiling boy looking at a frowning girl turned away from him; a smiling girl looking at a frowning boy facing her; a frowning girl looking at a smiling boy turned away from her; a frowning boy and a smiling girl turned away from each other. Genie had to point to the picture described by the test sentence.

Sample items: The girl who is sitting is looking at the boy.

The boy who is smiling is looking at the girl.

Results:

	Correct	Incorrect
11/7/73	18	10
11/14/73	21	7
12/5/73	11	3

APPENDIX 2. GENIE'S PHONOLOGICAL AND PHONETIC INVENTORY.

VOWELS

/i/	[tʰi] 'teeth', [síbə] 'zebra'.
/ɪ/	[fɪ] 'fish', [pɪ] 'pig'.
/e/	[kəréy] 'crayon', [tey] 'stay'.
/ɛ/	[le] 'lets', [sfyərə] 'cigarette'.
/æ/	[ræbi] 'rabbit', [bæ] 'bath'.
/u/	[yu] 'you', [tu / tʰu] 'tooth'.
/ʊ/	[bu] 'book' (also [bux], imitation).
/o/	[no] 'no', [to] 'stove'.
/ə/	[hə / hær] 'horse', [də] 'dog', [mə / mər] 'more'.
/a/	[kʰa: / ka:] 'car', [har] 'hard'.
/ʌ/	[ba] 'bus', [bál] 'bubble', [wər] 'word', [pʰər] 'purse'.
/ay/	[ray] 'right', [fáydə] 'Friday', [láyō] 'lion'.
/æw/	[hæwə] 'house', [æw] 'out' ([æwət], imitation).
/əy/	[bəy] 'boy'.

NASALIZED VOWELS

[ĩ]	[gəĩ] 'green'.
[ĩ]	[jĩ] 'gym'.
[õ]	[kõ / kõm] 'comb'.
[ẽ]	[pʰẽsɪ] 'pencil', [détʰɪ] 'dentist'.
[æ̃]	[kʰæ̃ / kæn] 'can', [pæ̃] 'pants'.
[ã]	[gã] 'gun' (also [gãd / gãn:ə]), [tʰã / tã] 'tongue'.
[ã]	[bõnãnã] 'banana'.
[ũ]	[pũ] 'spoon'.
[ẽ]	[gẽ] 'game'.

CONSONANTS

/b/	[br:] 'big', [ba] 'bus'.
/p/	[pʰɪ / pɪ] 'pig', [pũ] 'spoon', [sup] 'soup'.
/d/	[dátə] 'doctor', [də] 'dog'.
/t/	[tʰiy] 'teeth', [to / sətó] 'stove', [bæ:ət] 'basket'.
/g/	[gi] 'give', [go] 'go', [dóəy] 'dog'.
/k/	[kʰar] 'car', [málki] 'monkey', [ku] 'school', [bux] 'book'.
/s/	[saʔ] 'sock', [su] 'soup', [suzæ̃] 'Susan', [səpú / pũ / pũn] 'spoon'.

/z/	[suzæ] 'Susan' (cf. [síbə] 'zebra').
/š/	[šər] 'short', [šápi] 'shopping'.
/θ/	[tʰλ] 'thumb' ([θλ] imitation).
/f/	[fō] 'phone', [fr] 'fish'.
/v/	[vfkʰi:] 'Vicki' (or [ffkʰi:]).
/m/	[mǎki] 'monkey', [mar] 'Mark', [mə:l] 'small'.
/n/	[no] 'no', [báni] 'bunny'.
/ŋ/(?)	[dǎŋkǐŋ] 'thinking' (imitation).
/j/	[ji/ji] 'gym', [dʰi] 'jeans'.
/č/(?)	[tʰi] 'cheek', [tʰe] 'chair'.
/r/	[rǎbi] 'rabbit', [har] 'hard', [brē] 'bread'.
/l/	[láyǎ] 'lion', [élbo] 'elbow', [lay] 'like', [bál] 'bubble'.
/w/	[wər] 'word', [wa/wā] 'want'.
/h/	[har] 'hard', [hər] 'horse', [hæw] 'how'.
/y/	[yu] 'you'.

CONSONANT CLUSTERS (reduced, produced, broken-up)

/st/	[to / sətó] 'stove'.
/sp/	[pu / sǎpú] 'spoon'.
/sk/	[ke·ʔ] 'scale'.
/sm/	[mə:l / s·mə·] 'small'.
/sn/	[neyt / s·ney] 'snake'.
/sl/	[sǎló· / slo·] 'slow'.
/sw/	[sǎwét] 'sweat'.
/bl/	[bley] 'blade'.
/gl/	[gǎlé] 'glass', [sǎglǎt] 'sunglasses'.
/br/	[brē] 'bread'.
/gr/	[grǐ] 'green'.
/dr/	[drǐ] 'dream', [dǎrǎ] 'drum'.
/fr/	[frǎ] 'friend'.
/kr/	[krey / kǎréy] 'crayon'.
/tr/	Absent?
/pr/	[prayz] 'surprise'.
/skw/	[gwe / sǎgwéw] 'square'.
/str/	[tǎrétʰ] 'stretch'.
/gl/	[gǎlé] 'glass'.
/kl/	[kla:] 'clock', [tla] 'closet'.
/pl/	[édǎplǎ] 'eggplant'.
/kw/	[kwétʰǎma·r] 'question mark'.

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