

For
Susie,
thanks for
all your help
and support,
♥, Jeni

UNIVERSITY OF CALIFORNIA

Los Angeles

The Independence of Language: A Case Study


A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Linguistics

by


Jeni Ellen Yamada

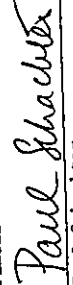
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The dissertation of Jeni Ellen Yamada is approved.

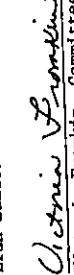

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1983

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TABLE OF CONTENTS

	Page
LIST OF TABLES	vii
LIST OF FIGURES	viii
ACKNOWLEDGMENTS	ix
VITA	xii
ABSTRACT	xiv
CHAPTER I	
1.0 Background	1
A. Historical Perspective	5
B. Empirical Studies	22
CHAPTER II	
2.0 Case History and Family Background	28
2.1 Developmental Milestones	29
2.2 Language Milestones	29
2.3 Later Development	30
2.4 Standardized Tests	32
2.5 Medical Problems	35
2.6 Environment	36
2.7 Appearance and Affect	37
CHAPTER III	
3.0 Assessment	40
3.1 Test Procedures	40
3.2 Language Assessment	42
3.4 Nonlanguage Assessment	46

For Phil and Aaron

	Page
APPENDIX I: Description of Language Tasks	219
APPENDIX II: Description of Nonlanguage Tasks	231
APPENDIX III: Transcriptions of Marta's Speech	245
BIBLIOGRAPHY	249
ADDENDUM	279

	Page
CHAPTER IV	
4.0 Language	55
4.1 General Comments	57
4.2 Syntax	59
4.3 Morphology	73
4.4 Semantics	78
4.5 Pragmatics	96
4.6 Productivity	113
4.7 Phonology	120
4.8 Summary of Language Performance	123

	Page
CHAPTER V	
5.0 Nonlanguage Cognition	132
5.1 Tests Based in Piagetian Theory	133
5.1.1. The Relationship between Language and Cognitive Stage	134
5.1.2 Summary of Performance on Piagetian and Other Stage-	155
linked Tasks	155
5.2 The Correlational Hypothesis	160
5.3 Neuropsychological Testing	185
5.4 Summary of Performance on Cognitive Tests	194
5.5 Summary of Performance of Neuropsychological Tests .	196

	Page
CHAPTER VI	
6.0 General Summary	198
6.1 Prospects	210
6.2 Conclusion	212

LIST OF FIGURES

Page
 Figure 1. Marta's Spontaneous Drawing 153

LIST OF TABLES

Page
 Table 1. Results of Standardized Tests 3/69-6/78 33
 Table 2. Subtest Scores on WISC-R (June 1975). 34
 Table 3. Language Assessment Measures 44
 Table 4. Nonlanguage Assessment Measures 48
 Table 5. Syntax: Comprehension Test Results 68
 Table 6. Morphology: Comprehension Test Results 79
 Table 7. Semantics: Comprehension Test Results 94
 Table 8. Performance on Conditional Tasks 110
 Table 9. Performance on Stage-Related Tasks 158
 Table 10. Performance on Tasks Tapping Putative 159
 General Abilities
 Table 11. Hypothesized Relationship of Selected 177
 Nonlanguage Abilities to Language
 and Indication of Whether Marta's
 Case Supports or Refutes...
 Table 12. Performance on Neuropsychological Tasks 186

ACKNOWLEDGMENTS

So many people have contributed to this project in significant ways. I want to express my gratitude to an incredibly supportive and patient committee which made finishing from afar much less traumatic than it could have been. In spite of all the headaches of mailing drafts transcontinentally (Express Mail has never had a more loyal patron), the dedication and vigilance of several committee members assured me of crucial feedback. I want to especially thank Victoria Fromkin, my committee chair, who has been inspirational and encouraging (and brilliant with her editing pencil) throughout. She always seemed to have time to fit me (and "Marta") into her terribly overcrowded schedule, no matter how burdened she was. My deepest thanks also go to Susan Curtiss, mentor as well as colleague and friend. I have benefited immeasurably from her insights, and from her careful reading and critiquing of the manuscript at its various stages. Susie and I collaborated on much of the early testing of Marta.

Many thanks too, to Eran Zaidel, who originally referred this fascinating case to Susie and me. Eran provided the dichotic listening tape and test for this study and made key comments on the data and discussion presented here. I also want to express my appreciation to Pam Munro for helpful criticisms --- the language data are presented more clearly and in a more consistent format thanks to her input. Paul Schachter and Evelyn Hatch also offered useful, cogent comments.

Then, there have been other crucial people. I thank Dan Kempler

for stimulating discussions on language and automatic speech and innumerable other topics, and for his abundant humor and wit. I am forever indebted to him for taking on the burden of pushing the dissertation through the filing stages for me. Other people in our research group have helped out in innumerable ways, offering comments and suggestions where needed, and carrying out library work, typing, and whatever else needed doing --- Thank you Cathy Jackson, Jan Scott, Delores Crawford, and Mark Abelson. I also want to thank Judy Reilly for helpful discussion on conditionals and for loaning me her testing materials.

Discussions with Diana VanLancker, Jennifer Buchwald, Peter Taniguchi, and Cathy Dent on such topics as hemispheric specialization, memory, schizophrenia, and classification (respectively) have also been extremely useful. Many of the topics I discussed with these people could not be fully addressed in this dissertation, but will be extremely relevant to subsequent studies of Marta. A word of appreciation must also go to Breynne Moskowitz for first introducing me to the area of child language, and to Christiane Baltaxe for getting me excited about the hybridization of theoretical linguistics and the field of communicative disorders.

I would be remiss to fail to mention Marta's various teachers, speech therapists, and caretakers. All of these people were wonderfully cooperative, offering information regarding her behavior and functioning, and doing everything possible to facilitate my research with Marta. Marta's parents were also marvellously supportive and involved. They offered crucial facts regarding Marta's early life

and were often able to interpret some of their daughter's more mystifying utterances. Marta's father asked so many pertinent questions; he was really my seventh committee member.

I am also indebted to Charlotte Mansfield for her skillful typing of this manuscript, and for pushing herself to the limit to get it done.

I extend a very special thank you to my husband, Phil Hanff, for his extraordinary support. In order to aid and abet me in completing this project he has taken on numerous extra roles: personal advocate, sounding board, proofreader, library assistant, and gofer, in addition to his regular roles as scientist, father, and husband. He excels at all of them.

I am also beholden to my family, especially my parents, Yosh and Mitsu Yamada, and Phil's mother, Edith Hanff for their unflagging encouragement and help. Mitsu and Edith logged in many hours of day-care for our son Aaron so that I could do data collection, analysis, and writing. Aaron, of course contributed to this project in his own way, providing a sometimes maddening, usually joyous distraction and diversion from all of this.

Ultimate thanks of course, must go to Marta herself, for simply being herself.

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The use of simultaneous communication in a language intervention program for an autistic child: A case study. UCLA Working Papers in Cognitive Linguistics, 1.

ABSTRACT OF THE DISSERTATION

The Independence of Language: A Case Study

by

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This study explores the language and nonlanguage cognitive abilities of a mentally retarded young woman, "Marta," who may be called "hyperlinguistic" or "hyperverbal" in that she presents a performance profile of advanced linguistic abilities alongside markedly depressed nonlinguistic cognitive abilities, with her testable IQ in the low 40s.

Documentation of Marta's language and nonlanguage cognitive capacities provides the opportunity to address key issues regarding the relationship between language and other mental functions and the relationship among language components.

Marta's profile indicates that language can develop despite extremely limited nonlinguistic cognitive abilities, some of which have been hypothesized to be prerequisite to language or to reflect underlying principles necessary for both nonlinguistic and linguistic development. Her performance also supports the notion that various aspects of language are separable and indicates that they may be

differentially linked to nonlanguage functions. The computational or structural aspects of her language are superior to and relatively more independent of her cognitive level, while the conceptual aspects (e.g., pragmatic, referential, thematic, etc.) more closely correlate with her general cognitive level. Thus, Marta's profile refutes claims that language can be fully accounted for by nonlinguistic, cognitive, perceptual, and social developments, and suggests that there are cognitive principles unique to language.

Chapter I gives some theoretical perspective and background for the investigation. Chapter II details Marta's case history and behavioral description. Chapter III outlines the methodology used in assessing her abilities. Chapters IV and V detail Marta's language and nonlanguage capacities, respectively. Chapter VI discusses the implications of this profile for views of the language/cognition relationship and for a theory of language acquisition.

CHAPTER I

1.0 Background

While there has been much debate and speculation, the mechanisms involved in language learning still remain very much a mystery. However, it is clear that elucidation of the relationship between language and other mental functions is critical to our understanding of the cognitive principles underlying language. Of primary interest is whether language is in any sense an independent, unique cognitive system or whether it can be wholly accounted for by general nonlinguistic cognitive, perceptual and social factors.

This study addresses these basic questions through exploration of the language and nonlanguage cognitive abilities of a mentally retarded young woman, "Marta" (a pseudonym), who may be called "hyperlinguistic" or "hyperverbal" in that she presents a performance profile of advanced linguistic abilities alongside markedly depressed nonlinguistic cognitive abilities, with her testable IQ in the low 40s.

Marta's High Language/Low Cognition profile is not one which is usually associated with the retarded. Generally the literature

i.e., High Language/Low Nonlanguage Cognition. The term High Language/Low Cognition is used for brevity; I do not intend to infer that language is not a type of cognition.

indicates that as the level of retardation increases, so does the incidence and degree of language handicap (e.g., Jordan, 1967; Wing, 1975; Spreen, 1965a; Blount, 1968; Schiefelbusch, 1963; Graham and Graham, 1971). Quantitative analyses of the speech of mentally retarded children have revealed that such children often exhibit impoverished vocabularies and less complex sentence structure. A relationship between sentence length and mental age (Goda and Griffith, 1962; Mechem, 1955; Schienger, 1954) and between size of vocabulary and mental age (Mein and O'Connor, 1960; Wolfensberger, Mein, and O'Connor, 1963) have been described. While some have noted an inverse relationship between IQ and language delay (e.g., Karlin and Strazulla, 1952), others have found chronological age and attainment of motor milestones to be better predictors of linguistic capacity (Lenneberg, 1967; Lenneberg, Nichols, and Rosenberger, 1964). The possibility that language and cognition (in the retarded) are separable has also been noted (O'Connor, 1975), although it is assumed that in cases of a discrepancy, nonlinguistic cognitive capacity will be relatively more intact than language.

Marta is unusual in that she has the converse High Language/Low Cognition profile. To be sure, few individuals with this profile have been identified and described. Miller, Mackenzie, and Chapman (1981) in their review of individual differences in language acquisition of the retarded, found no cases with profiles similar to Marta's. In the literature on "idiot savants", individuals born with apparently selectively intact abilities in memory, music, computation, and art

have been documented (Hill, 1978; Selfe, 1977; Morishima and Brown, 1976), but there have been no recorded cases of idiot savants with isolated language abilities. However, cases implying a hyperverbal profile have been mentioned in passing in the literature. Schienger (1957) for example, speaks of the "almost compulsive garrulousness" of a girl with an IQ of 38. Wing (1975), in her study of language impairments in severely retarded children, found many with an "across-the-board" low performance profile, but also noted that some children had extremely poor language relative to other abilities while others, like Marta, had fairly good language relative to their nonverbal skills. While it is acknowledged that such profiles suggest a complex relationship between language and intelligence (e.g., Jordan, 1967), the implications of the High Language/Low Cognition profile have not been dealt with in depth. A hyperverbal profile has also been associated with hydrocephalus (Swisher and Pinsky, 1971; Tew, 1979) and Turner's syndrome (Money and Alexander, 1966; Silbert, Wolff, and Lillenthal, 1977; Waber, 1979). Recently, the High Language/Low Cognition profiles of a Turner's syndrome girl (Yamada and Curtiss, 1981) and a mentally retarded boy (Curtiss and Yamada, 1981) have been described. However, Marta's case is notable in several respects.

First, this investigation is more comprehensive and detailed than previous studies to date. A great deal of data were collected over a protracted period of time to obtain as valid and reliable an estimate of Marta's abilities as possible. Thus, I was able to

minimize the possibility that the discrepancy between Marta's language and nonlanguage functions was simply due to performance factors.

Second, Marta's linguistic ability, particularly her syntactic ability, is much more advanced than that of many previous subjects studied, especially relative to her overall linguistic level. Thus, the discrepancy between her linguistic and nonlinguistic capacities is especially marked. Third, Marta, nearing the end of adolescence during the study, was no longer making significant developmental changes in either language or nonlanguage domains. Because she had already attained the apex of her linguistic and cognitive development, it was possible to examine linguistic potential in the face of severe cognitive deficits.

The validity of utilizing a single case to make generalizations might, of course, be questioned. While large scale population studies are of value, they cannot provide the type of data necessary for resolution of the issues mentioned above. In order to observe the relationship between language and other cognitive functions and between aspects of language, the interaction of the relevant abilities in a given individual (or cognitive system) must be examined. In an individual subject the effects of absence or disruption of an ability can be observed through in-depth examination of abilities across all domains. Is a particular deficit always linked to improvement in some other domain? Or can a given ability emerge and develop selectively without the support of other cognitive systems? Large population studies can tell us how common a particular profile is, or what

percentage of subjects scored high or low in various areas. Such studies cannot, however, tell us in the way that case studies can, what effects the absence or impairment of an ability have upon the general system.

A. Historical Perspective

Over the course of the past century, views regarding the relationship between language and cognition have fluctuated markedly, as have views regarding language acquisition. The two issues are not unrelated; theories regarding the language/cognition relationship can influence theories of language acquisition and conversely, theories of language acquisition can bear on conceptions of the links between language and cognition.

While the behaviorist model in the early 1900s (Watson, 1925) addressed the issue of learning in general, it was assumed to provide an adequate explanation of the principles involved in language acquisition as well. In this framework only observable and accessible behaviors were considered appropriate objects of study. The individual was seen as an essentially passive organism that learns through imitation, reinforcement, and generalization. It was assumed that language, an observable behavior, was also learned via these principles. Children were presumed to acquire language by hearing and imitating speech sounds, learning to form the proper sounds, words, and structures, through selective reinforcement. Thought was considered dependent upon language, consisting of subvocal speech

which could be detected in laryngeal movements (an assumption later found to be erroneous).

The view that thought is dependent upon language was also embodied in the theory of "linguistic relativity," or "linguistic determinism," which emerged shortly after the behaviorist model. In this framework, discussed in separate writings by both Benjamin Whorf (1952) and Edward Sapir (1949), language was felt to shape one's thought processes and to affect the way the world is perceived. In their view, we are in effect, "prisoners" of our language (Whorf, 1952; Sapir, 1949; Mandelbaum, 1949, 1961; Carroll, 1956). Others have also maintained that language is instrumental to thought, that it facilitates attainment of certain concepts (Bruner, 1964, 1966) and serves a mediating function in problem-solving (Kendler and Kendler, 1962; Kendler, 1963, 1972).

In recent years, however, the tendency has been to focus on the primacy of cognition and to view language as dependent upon cognition. The constructivist theory of Piaget (1926; 1951; 1954; 1980) is an example of such a view and illustrates the influence of theories of cognitive development upon theories of language acquisition and theories of the language/cognition relationship. Piaget's comprehensive account of cognitive development was not designed as an explanation for language learning, but is quite relevant to the issue. In Piaget's view, cognitive attainments of the first two years of life lay the foundation for language. Language is simply part of a more general cognitive capacity; it emerges out of sensorimotor

intelligence and is but one expression of the semiotic function. Piaget opposed the behaviorist views of learning, choosing not to see the child as a passive organism upon which the environment impinges, but rather as a dynamic being that acquires knowledge through active interaction with the environment. Piaget posed no innate capacities save those of a very general nature (Inhelder, 1978).

Others have also described language as but one expression of more general cognitive capacities (Sinclair, 1975b; Bates, Benigni, Bretherton, Camaioni, and Volterra, 1977; Bates, 1979).

"We are suggesting that there is a Great Borrowing going on, in which language is viewed as a parasitic system that builds its structures by raiding the software packages of prior or parallel cognitive capacities." (Bates, 1979, p. 6)

However, some have argued that sensorimotor intelligence (attained by about age 2) may account for only the earliest stages of language acquisition, surmising that later cognitive developments may be prerequisite to later linguistic attainments (Sinclair, 1971, 1975b; Ingram, 1975). Among this group there has been some difference of opinion as to which cognitive abilities are prerequisite to language (cf. Bates et al., 1977; Snyder, 1975) and just how much cognitive knowledge is necessary (e.g., Stage V or VI sensorimotor intelligence?) Some do not necessarily embrace the notion of cognitive stages, or believe that general cognitive levels are associated with language, but do feel that specific cognitive attainments may be prerequisite to specific linguistic attainments (e.g., Ferrero, 1971). These views predict that the purported

prerequisite cognitive abilities will emerge prior to or at least concomitantly with certain linguistic abilities. Attainment of a given linguistic behavior prior to its putatively prerequisite cognitive ability would not be predicted. While some believe that cognitive attainments are both necessary and sufficient for language acquisition (strong form of the "Cognitive Hypothesis"), others believe that while cognitive abilities may not be sufficient, they are at least necessary (weak form of the "Cognitive Hypothesis").

Another position is similar but differs with regard to the notion of cognitive prerequisites. In this view specific cognitive abilities themselves are not claimed to be prerequisite to language. Rather, manifestations of abilities across domains are seen as reflections of a third, shared underlying governing mechanism (the "Correlational Hypothesis"). The underlying mechanism or mechanisms governing language and other forms of cognition are seen to be identical. It is this common underlying mechanism that is prerequisite to language. Piattelli-Palmarini (1980), in his discussion of the debate between Chomsky and Piaget, describes this view as a "compromise" position, attributing it to Putnam and others. Cromer (1974b, 1976a) and Bates and her colleagues (Bates et al., 1977; Bates, 1979) have also suggested this possibility. For example, the abilities to classify, categorize, induce or abduce rules, and construct hierarchical relationships may be general abilities which manifest themselves in various cognitive domains, including language (e.g., Maratsos and Chalkley, 1980; Piaget and Inhelder, 1959;

Sinclair (de Zwart), 1971, 1973; Greenfield, Nelson, and Saltzman, 1972; Goodson and Greenfield, 1975). Such general abilities purportedly account for such abilities as the capacity to see word class relationships, to concatenate elements, and to form complex linguistic structures. The abilities across domains are not simply analogous, but homologous, i.e., derived from and governed by a common underlying mechanism. The child is viewed as a hypothesis generator where the rules and hypotheses to be learned are general in nature rather than specific to one knowledge domain.

Maratsos and Chalkley (1980) for example, describe language learning as an expression of a general human inductive capacity which enables the individual to draw generalizations from the distributional properties of grammatical classes and categories. In acquiring language the child performs a semantic/distributional analysis of the linguistic data. Earlier Bloomfield had also viewed language learning as a matter of learning the set of analogies that hold for one's language, with less emphasis on semantics (1933). However, mathematical and computer-based research has shown that "The algorithm that we need does not exist" (Pinker, 1979). It is impossible for any learner to observe a finite sample of sentences and always produce a correct grammar for the language. Thus far, mathematical and computer-based research has shown that inductive capacities in a given domain must be innately and uniquely adapted to that domain and that constraints upon the system must operate for learning to occur (Pinker, 1979; Wexler and Culicover, 1980).

In the correlational view cited above, nonlanguage cognitive behaviors and language behaviors are not predicted to emerge in an invariant order. Of course, if the two abilities across domains are commonly linked, they should both appear within a relatively short period of time (Bates et al., 1977).

Correlational studies have provided the bulk of the data supporting the "cognitivist" positions cited above. Much research has been devoted to linking both early and later linguistic attainments with cognitive developments (e.g., Bates et al., 1977; Corrigan, 1978; Bloom, 1973; Nicolich, 1977; Bates, 1976; Beilin and Lust, 1975; Ingram, 1975, 1978; Beilin, 1975; Tremaine, 1975; Sinclair and Ferreiro, 1970). By purportedly showing that cognitive and linguistic developments are linked, cognitivists further assume that explanations for cognitive development likewise account for language. However, as has been pointed out elsewhere (Bowerman, 1978; Cromer, 1976a, 1981; Pinker, 1979; Wanner and Gleitman, 1982), accounting for conceptual development does not automatically provide an explanation of language learning mechanisms. There is still the problem of explaining how or why the child discovers the formal devices to express linguistically what she/he may already know nonlinguistically. For example, accounting for conceptual development fails to account for why a child develops increasingly more complex ways of linguistically expressing the same conceptual ideas. In addition, it fails to account for the child's capacity and propensity to learn formal linguistic features and structures that do not seem functionally or semantically motivated

(e.g., particle shift).

Some compelling research in the past decade has centered around the search for "formal parallels" across cognitive domains. Studies have been done to illustrate that analogs to language processes exist in other domains, the implication being that formal parallels constitute evidence that there is one set of cognitive principles which manifests itself in different domains. Some areas thus far examined are language and action (i.e., constructive-praxic activity) (Greenfield, 1978; Greenfield, et al., 1972; Greenfield and Schneider, 1977; Goodson and Greenfield, 1975), language and perception (Neil, 1980), and language and mathematical abilities (Pullman, 1981). If language and certain nonlanguage cognitive domains are indeed reflections of the same, common set of cognitive principles, certain commonalities should be apparent in the form of say, common constraints upon systems in two different domains. However, data thus far collected are not extremely convincing. For example, some seem to assume that the use of similar terminology in two domains constitutes sufficient evidence that an analogy (or homology) truly exists. In Greenfield et al.'s (1972) study for instance, the child's use of linguistic actor-action-object structures was likened to her/his cup manipulations where the placement of one cup into another was viewed as an actor-action-object structure with the first cup labeled the "actor," the movement labeled the "action," and the second cup labeled the "object." However, it would have been just as appropriate to label the child as "actor," the first cup as "object" and the second

cup as "location" (Curtiss, Yamada, and Fromkin, 1979). There is no predictable, one-to-one relationship between events and language. Apparent "formal parallels" can be contrived by the verbal labels used to mark the events.

Another problem with specifying formal parallels has been that cross-linguistic and cross-cultural factors have not been taken into account. For example, the child's use of SVO word order has been paralleled to early object manipulation. However, SVO word order is not universally adhered to by children acquiring language. Again, the apparent "formal parallel", does not stand up under scrutiny. This is not to say that formal parallels do not exist, but if there are common constraints on systems in different domains, they have yet to be identified.

A view opposed to the cognitivist views above is that of Chomsky (e.g., 1980), who sees language as an independent cognitive system that is based on domain-specific structural principles. In the late 1950's, in reaction to the behaviorists' views (Skinner, 1957), Chomsky set forth a revolutionary theory of language, Transformational Generative Grammar (Chomsky, 1957). His theory has since been revised and reworked but his general viewpoint is referred to as the "nativist" or "innatist" position, in which the child is not viewed as an empty organism who comes to the language acquisition task with a "blank slate," but rather is assumed to tackle language learning equipped with an innate complex of abilities specifically designed to learn language (Chomsky, 1975, 1980). This innate knowledge is

claimed to provide cues as to what constitutes a possible natural language and to direct the child to consider only a very limited class of grammars as she or he sets out to acquire language. Evidence for this innate capacity is that even though not all language phenomena are "observable," all normal children readily acquire language within an astonishingly brief period, internalizing a finite set of rules with which to produce an infinite set of well-formed utterances. Behavioral principles like imitation and reinforcement cannot account for such an ability.

In this view, the mechanisms involved in language acquisition are universal. All languages draw from the same universal set of principles (the Universal Grammar (UG)), and while a given language may not contain the exact same set of constraints and rules as another, the rules it does have are all members of the universal set. In the acquisition process the child is assumed to deduce those rules that her or his particular language possesses. The child is seen as a hypothesis generator, innately gifted with the capacity to extract the rules of her or his language from only a limited set of data. Thus, the child's task is not one of "rule induction", but rather "rule abduction," or "rule extraction." The language acquisition process requires only minimal input or stimulation to be triggered into action. While environmental and interactional factors play a role in language learning, they do not wholly account for it. Chomsky's theory has had a strong impact on notions of language and profoundly affected the fields of both psychology and linguistics.

that either language or cognitive developments can emerge and/or function in the absence of the other, since the two are expressions of independent systems.

Research arising out of Chomsky's work has taken several directions. Through development of a hypothetical learning device, Wexler and others have focused upon the issue of "learnability" (Wexler and Hamburger, 1973; Hamburger and Wexler, 1973, 1975; Wexler and Culicover, 1980). This group posits language-specific learning mechanisms and has contributed evidence to show that constraints upon language operations are indeed necessary for language to be learnable.

Another approach involves the notion of "parameter setting" and incorporates some of the more recent revisions of Chomsky's theory, focusing less on the learning of transformational operations and more on a set of innate principles or schema (for the Core Grammar rules) which the child brings to bear on the language learning task. Roeper (1978, 1981; 1982), for example, has based his recent work on such an approach. He accepts the concept of a Universal Grammar but rejects the Chomskian "instantaneous model" (IM) of language acquisition proposing a "principled interaction between DG and other faculties of the mind," which takes place over time. Roeper is thus able to account for intermediate stages of acquisition. Language acquisition in his view, is accomplished by a hypothesis generator that limits the number of hypotheses that need to be addressed, that does not exceed "maturational limits on performance", and that uses other mental

While Chomsky did not address the language/cognition relationship per se until more recently (Chomsky, 1975, 1980; Platelli-Palmarini, 1980), he sees language as an autonomous cognitive system. In some respects Chomsky's position seems consonant with those of earlier scholars like William James (1890) and Vygotsky (1962) who also believed that language and thought are separable. James noted that while we often use language in organizing our thinking processes, language and thought are separable. He based his view in part on the observation that the deaf, despite their apparent lack of language, are capable of complex, rational thought. Vygotsky suggested that while thought certainly affects language in development, the two entities have different genetic roots and develop independently up to a certain point.

Chomsky (1980) has specified that there are two components of language, namely the conceptual and the computational. Whereas the conceptual component refers to those aspects of language that are linked to object reference, thematic relations, pragmatic factors, and real-world knowledge, the computational component refers to the grammar, i.e., the rules of phonology, syntax, morphology, and semantics. The two components must, of course, interact in normal language development, but the computational component is seen as governed by cognitive principles unique to language. Language acquisition is viewed as the process and product of an internally-driven, maturationally based mechanism that is triggered and nurtured by interaction with the environment. His theory predicts

faculties in generating and confirming hypotheses. Thus, while the child comes to the language acquisition task equipped with innate knowledge, other mental faculties and external as well as internal factors serve to "trigger" language abilities (Roeper, 1982).

Influenced by Chomsky's theoretical focus on syntax, language acquisition studies in the 1960's focused primarily upon syntactic development (e.g., Braine, 1963; Menyuk, 1963; Miller and Ervin, 1964; Brown and Bellugi, 1964). Those working within a Chomskian framework (e.g., Roeper, 1978; Goodluck, 1978; Wexler and Culicover, 1980) in attempting to specify a set of universal constraints on an innate language acquisition device, concentrate upon the structural aspects of language.

However, many scholars, linguists included, feel that examination of only the structural aspects of language is too narrow a focus, and that to account for language acquisition, more attention must be paid to cognitive and social factors. Whereas Chomsky's theory has markedly influenced psychology and psycholinguistics, the increased emphasis on cognitive and social factors seems to reflect the counter-influence of certain cognitive developmental notions on linguistics.

One outgrowth of the view that nonlinguistic abilities are primary to language is the notion that language acquisition consists primarily of learning how to express linguistically what one already knows nonlinguistically (Schlesinger, 1971; Slobin, 1973; Nelson, 1973, 1974). One such view is that language learning is simply a

mapping on of form onto meaning (Bloom, 1970; Bowerman, 1973ab; Brown, 1973; Schlesinger, 1971, 1974). The child's mapping of semantic notions onto conceptual ones is seen as her/his "way into" the linguistic system. Grammar then, is considered semantically based and syntax is seen as essentially dependent upon semantics. Slobin (1966), for example, suggested that grammatical categories are based on semantic categories which are probably acquired through experience. Such a view predicts that acquisition of particular syntactic structures will always follow acquisition of the semantic relationships embodied by that structure. Semantic theories have been closely associated with cognitively-based theories. However, as some recent research has shown (Carey, 1978; Bohme and Levelt, 1979) it is possible to have conceptual/perceptual concepts without having mastered the corresponding semantic concepts and it is possible to acquire linguistic terms without possessing the putatively correspondent conceptual knowledge. The fact that cognition is not equivalent to semantics is further exemplified by cross-linguistic variability in semantic categorization. For example, both the English-speaking child and the Japanese-speaking child likely perceive the same conceptual/perceptual distinction between "singularity" and "plurality," but this knowledge is not marked identically in both languages. The English-speaking child must learn that plurality of nouns is often marked on the noun itself (-s plural) while the Japanese-speaking child need not mark the conceptual distinction this way. Similarly, it is only the Japanese speaking child who must learn

large, speech to young children is slower, clearer, more accurate and simpler than had earlier been assumed. Much recent research has focused on such issues as the quality of caretaker speech ("Motherese") (Newport, Gleitman, and Gleitman, 1977), the role of social rituals in teaching discourse conventions, and the nature of prelinguistic communicative functions and how linguistic forms are subsequently mapped onto these functions (Bates, 1976). Communicative interaction is assumed to play a role not only in the learning of vocabulary and of conversational rules, but also in the learning of linguistic structures (Givon, 1979; Bates and MacWhinney, 1979, 1982). Such an approach predicts that a child's communicative abilities are correlated with her or his linguistic abilities and that impairment of communicative function should result in a likewise impairment of linguistic functions.

While there is no doubt that social/interactive factors play some role in acquisition, there is serious question as to whether such factors provide an explanation of language development. Recent research shows that mothers do not seem to "tune their syntactic complexity to the growing language competence of their children through this crucial age of syntax acquisition, the period from one to two and a half years" (Newport et al., 1977, pp. 123-124), indicating that Motherese functions to teach communicative but not necessarily structural knowledge. Cromer (1981) argues that while the focus on social/interactive factors have increased our knowledge of aspects of communication, it has failed to elucidate the processes responsible for acquisition of linguistic structure.

that in counting items, different suffixes must be used depending upon what class of nouns is being counted (e.g., long, narrow objects, animate objects, etc.). Thus, while there may be universal constraints on concept formation (Rosch, 1978; Rosch, Mervis, Gray, Johnson, and Boyes-Braen, 1976), there is variability in the way we divide up our world linguistically. Various languages do so in varying ways and the child must learn her/his own language's distinctions. Accounting for conceptual development does not predict or determine how a given language will divide up the world semantically, nor does it explain how or why we have the capacity to do so. The fact that cognition is not equivalent to semantics then, brings us back to the argument that it is impossible to account for language acquisition on the basis of describing nonlinguistic developments.

The sentiment that interaction with the environment crucially affects and shapes language development is also found in social/interactive approaches to language acquisition (Snow, 1972, 1977; Snow and Ferguson, 1977; Dore, 1974; Bruner, 1974, 1975; Ochs and Schieffelin, 1979; Zukow, Reilly, and Greenfield, 1979), where social and communicative functions are seen as the basis for language structures and features (Givon, 1979; Bates and MacWhinney, 1978). Researchers working within this type of framework maintain that the importance of the quality of input to the child and of the social environment were previously greatly underestimated. Whereas the nature of the input had earlier been assumed to be impoverished, complex, and imperfect, in the 1970s, studies revealed that by and

One approach to knowledge acquisition which should be mentioned is the characterization of the human mind as an information-processing system, i.e., a complex system of interacting, synergistic processes which takes in, transforms, organizes, codes, stores, and generates information. As with other approaches mentioned above, such a conceptualization of cognitive development is not specifically designed as a model of language acquisition, but is relevant to this issue, since language is one knowledge system which such approaches have addressed. Computer programs have been written in attempts to simulate language acquisition (Kelley, 1967; Anderson, 1975; Klein, 1976). The information-processing approach assumes that such factors as perceptual, attentional, and memorial processes play a crucial role in the taking in and transforming of information, e.g., "Learning . . . can be viewed as the process of adding to or modifying the human memory system" (p. 4) (Klatsky, 1975). The capacity to understand and produce lengthy and syntactically complex utterances, for example, has been linked to processing and memory factors. According to this view, difficulties or deficiencies in short-term memory should result in syntactic deficiencies.

There are many views regarding the nature of language learning and the relationship between language and other mental abilities, indicating that the issues are still far from being resolved. With regard to the various theories of language, the many approaches are not necessarily mutually exclusive; some researchers' names appear in association with more than one viewpoint. Most of the approaches do not constitute true theories of acquisition,

but rather descriptions, and partial descriptions at that. The Indian metaphor of six blind men attempting to describe an elephant, perhaps best captures the current situation. Each individual, groping and feeling a different part of the large creature, concludes that he has achieved an understanding of the animal. Each is correct to some degree, but having explored only a portion of the whole, fails to gain full knowledge of the entity being studied. Surveying the various approaches to language acquisition one gets a similar feeling. Like the six blind men, the different perspectives on language acquisition are all correct to some extent, but many, having focused upon only selected aspects of the metaphorical "elephant," fail to address and explain the whole. Pinker (1979), in surveying formal models of language learning, alludes to this state of affairs, stating that while there are six conditions² which a theory of language acquisition

²The six conditions on a theory of language acquisition are as follows (Pinker, 1979):

- the Learnability Condition: A theory should account for the fact that languages can be learned.
- the Equipotentiality Condition: A theory should posit mechanisms broad enough to account for acquisition of any human language.
- the Time Condition: A theory should posit mechanisms allowing the child to acquire language within a reasonable time frame--about three years for "the basic components of language skills."
- the Input Condition: A theory should involve mechanisms that require information available to the child as input.
- the Developmental Condition: A theory should make predictions about intermediate stages that are consonant with empirical findings of child language development.
- the Cognitive Condition: A theory should posit mechanisms that are consistent with "what is known about the cognitive faculties of the child" (e.g., perceptual, conceptual, memorial, and attentional capacities).

should meet, "no current theory of language learning satisfies or even addresses itself to all six conditions." (p. 218)

As stated earlier, our understanding of the language/cognition relationship is extremely relevant to our ultimate understanding of language acquisition. Empirical data contribute crucial evidence.

B. Empirical studies

1. Normals: Study of normal individuals has often been used as empirical evidence for theories regarding the relationship between language and cognition. For example, it is suggested that the simultaneous emergence of abilities across domains in normal children supports the notion that particular abilities are meaningfully linked. Correlational studies showing that one or another nonlinguistic ability is correlated in development with some aspect of language have often been used as evidence of dependencies (Bates, 1976). However, as has been pointed out previously (Curtiss, Kempler, and Yamada, 1981) studies of normal development have definite limitations. Since many developments co-occur within a brief time period in the normal individual, dependency relationships can be easily obscured. The emergence of abilities across domains (e.g., language and action), may or may not reflect actual underlying bonds or commonalities. The correlations may be simply due to common maturational timetables in two simultaneously developing but essentially independent systems. For example, in development, positive correlations among apparently unrelated abilities are readily observable, e.g., the relationships of height, early dentition or clothing size, to language development.

2. Non-normals: To explore the relationships between language and nonlanguage cognitive functions it is useful and perhaps crucial to look beyond the normal populations and normal context of development. Much knowledge has been gained from so-called "experiments of nature," where, as a result of unfortunate genetic or environmental circumstances, scientists have had the opportunity to study individuals with selective impairments. Such study enables us to observe what effects specific deficits have upon intact functions. It is particularly revealing to study individuals who have been impaired from birth since in them it is possible to observe the extent to which it is possible for particular abilities to emerge, develop, and function in isolation of other abilities. The degree to which language can emerge independently of other cognitive systems can be a crucial indicator of whether and to what extent language development is dependent upon other cognitive developments.

a. The separability of language and cognition

Empirical evidence from previous studies has already offered insights into the language/cognition relationship. Studies of particular populations and individuals have given us the opportunity to consider the effects of deprivation or disorder, and enable us to support or refute various theories. For example, the claim that cognition is dependent upon language has been refuted effectively by data from various sources. Developmentally aphasic children and non-signing deaf individuals have shown that general cognition can proceed in the absence of language development. Further evidence

comes from "Genie," a young girl cruelly abused and isolated from the age of 20 months to 13 1/2 years (Curtiss, 1977, 1979). Genie was reported to have developed considerable nonverbal intelligence despite the extreme deprivation she was forced to endure. Although she had not developed language at the time of her release, she showed some conceptual knowledge and awareness. Her nonlinguistic cognitive abilities consistently outstripped her linguistic abilities. It is revealing that following acquisition of some language she apparently was able to talk about feelings and experiences which dated from the period of her confinement (Curtiss, personal communication). In addition, there are anecdotal reports from parents who note that young children sometimes verbalize experiences that date back to a prelinguistic period.

b. The High Language/Low Cognition profile

In considering whether language and cognition are inextricably linked or whether dissociations can occur, researchers have generally assumed that a dissociation would take the form of cognition in the absence of language. Sinclair (1975b) articulates the sentiment thusly,

"Language and cognition can be clearly separated only in one sense; intellectual development is possible without language, but language acquisition is bound to the elaboration of cognitive structures in general" (p. 225).

Recently however, data refuting this viewpoint have begun to accumulate both in normal and nonnormal studies. The development of linguistic knowledge in advance of cognitive knowledge is now being

documented. Leonard (1975), and Bloom (1973) discuss cases where children began using semantically empty forms to produce/construct two-word utterances, reflecting incipient syntactic abilities in advance of purported prerequisite semantic or conceptual abilities. Bohme and Levelt (1979) found that children acquiring German acquire knowledge of grammatical gender prior to conceptual gender.

Evidence that language or at least aspects of language may develop independently of nonlinguistic cognition has also been suggested by studies of developmentally impaired individuals from varying populations such as Turner's syndrome females, hydrocephalics, and mentally retarded individuals. Subsets of these groups have shown relatively intact linguistic ability alongside substantial cognitive deficits (Money, 1964; Money and Alexander, 1966; Carron, 1970; Silbert et al., 1977; Tew, 1979; Schwartz, 1974; Swisher and Pinsker, 1971; Yamada and Curtiss, 1981; Curtiss and Yamada, 1981). For example, in recent case studies of a nine year old Turner's syndrome girl (Yamada and Curtiss, 1981) and of a six year old retarded boy (Curtiss and Yamada, 1981), both were found to possess grammatical abilities which far outstripped their nonlinguistic abilities. While both children were easily able to produce fairly complex linguistic structures, neither was able to perform many of the putative "parallel" tasks in the action domain (with blocks, sticks, and nesting cubes). Thus, both cases provide evidence against the Cognitive Hypothesis, which does not predict the High Language/ Low

On the basis of previous evidence and my own findings, it is my position that language is an independent cognitive system. I make this argument not as one which is opposed to various views that cognitive, perceptual, social, or processing factors play a role in language learning, but one which simply argues that consideration of just these factors does not explain the "whole elephant." While nonlanguage cognitive and other systems may account for various aspects of language, certain aspects remain unaddressed. Marta and other selectively impaired individuals with a High Language/Low Cognition profile provide empirical evidence that language cannot be fully accounted for by nonlinguistic factors be they cognitive, social, perceptual, or otherwise, and suggests that cognitive principles unique to language must be posited.

Cognition profile.

Empirical studies have also disputed the claim that social/interactive factors can wholly account for language learning. Blank, Gessner, and Esposito (1978) report on a study in which a child was able to learn the structural aspects of language but failed to use language communicatively. Additional evidence that grammatical knowledge can exceed pragmatic knowledge (or emerge in its absence) comes from mention of certain high level autistics who exhibit syntactic ability but use language in an inappropriate or limited fashion pragmatically (Ricks and Wing, 1976; Tager-Flusberg, 1981). This type of High Language/Low Social Functions profile challenges the hypothesis that language emerges in the service of communicative functions and can be wholly accounted for by reference to these functions.

Studies of such selectively impaired individuals also add to evidence already provided by aphasia research and research on dementia (Schwartz, Marin, and Saffran, 1979; Irigaray, 1967; Bayles, 1979; Whitaker, 1976) that the various components of language are separable. In the studies of hydrocephalics, Turner's women, and retarded individuals, it has been found that not all aspects of language are equally enhanced. While syntactic ability may be quite developed, semantic ability is reported to be more limited. The term, "cocktail party speech" has been applied to both Turner's women and hydrocephalics to describe their fluent and verbose speech, which often conveys little meaning.

CHAPTER II

2.0 Case history and family background

When I first met Marta's parents in October 1979, they described Marta, then sixteen years old, as an enigma. She had always been developmentally delayed, and despite years of special schooling and tutoring, was generally functioning at a prekindergarten level. Marta, they said, could not read, tell time, give her age, count, or do simple problem-solving. Her language, however, was rather well developed. In fact, she could talk a "veritable blue streak", and often did, very loudly and inappropriately. In public it was difficult for the family to be unobtrusive. Marta would speak loudly, frequently about some seemingly irrelevant point, repeating the same thing over and over, interrupting the flow of conversation among her parents and three older sisters.

Many of Marta's problems were evident from an early age, according to her parents who have provided extensive details of their daughter's past and present behaviors and functioning. Information regarding Marta's childhood has also been obtained from diary notes made by Marta's mother dating from when Marta was one and a half to nearly eight years old. Still other information has been taken from extensive medical and educational records which document Marta's early development.

Marta was born on September 12, 1963, following a normal, relatively problem-free pregnancy, the fourth and youngest daughter of a university professor and a preschool educator. Her mother recalls that during labor she hyperventilated and "went numb all over", but that the attending physician said nothing of any problems in the baby at birth. The mother described Marta as "trembly" at birth, and recalled that later Marta was a limp, floppy, quiet infant, almost "too good." Both parents noticed developmental delays within the first year ("She seemed the same each day"), and became concerned when Marta was not yet sitting up at nine or ten months. At about one year, Marta was diagnosed by a pediatrician as mentally retarded/developmentally delayed and cerebral palsied (although the latter diagnosis was later considered erroneous). Marta had no other serious problems during infancy except for a febrile convulsion at eighteen months and several episodes of gastroenteritis.

2.1 Developmental milestones

Marta sat alone at about fifteen months, stood at twenty months, and walked at about two years. Toilet training was completed when she was nearly four years old. Developmental Quotients of 50 were obtained when Marta was 10, 20, 30 and 41 months old.

2.2 Language milestones

When Marta was twenty months her mother wrote in the diary that Marta understood a few words (hand, foot, mouth, bath, milk, and a few

cylinders which she used for people while she verbalized aloud." It further states that Marta could sight read 15 words, knew many letter sounds, and all her colors, noting that "the area of number concepts is the most difficult for her ... her attention span is short--and she will constantly talk of things unrelated to the material at hand."

Marta's mother made a similar observation in her diary at this time, noting that Marta could engage in conversation, but generally in her own loud, perseverative fashion.

When Marta was six years old her mother wrote that she "talks, demanding replies--all the time, often about the same subjects, over and over ..." An occupational therapist also complained of Marta's "incessant" talking, "rarely about what we are doing", of Marta's tendency to "ramble from subject to subject" and of the difficulty in getting her to pay attention to therapy. During this period Marta's mother apparently worked on relational concepts with her daughter such as same/different, little/big, and one/more-than-one, but had no success. Counting also continued to be difficult for Marta.

In educational records Marta's tendency to be very verbal is frequently mentioned. Verbal ability was noted all along to be her strongest area, while abstract reasoning, number concepts and operations, and visuo-motor skills were among her weakest. When Marta was eight years old the family spent a year in France where she attended a school for the educationally retarded. Her parents report that during this time she developed a fairly good French vocabulary of at least 100, and possibly up to 200 words. However, limitations in

others) and that she had used the word "cracker," ((gaka/)) for some time but had stopped. She also wrote that Marta "often goes off, seems quite unfocused and unfocusable ... and it's very hard to chat away to her when she responds so little."

By the time Marta was 2:11, her mother noted that she could say about fifteen words, and a developmental specialist's report written when Marta was 3:5 states that, "It would appear she is very eager to talk. Her parents feel there are twenty words they hear recurrently and that she has used as many as fifty words. Most of the time, she uses jargon." The same specialist again saw Marta when she was 4 1/2 and wrote of her being very mobile and well-liked by the teachers. In commenting on her language development, he wrote, "She now talks very much in sentences using plurals and pronouns. She uses few adjectives." He reported that she talked a great deal and during her visit with him named various items in the room as well as trying to name a few colors. He judged her to be at the 34 month level in language and social areas.

2.3 Later development

When Marta was 4:5 her mother wrote of Marta's representational play with clay. During a given play period Marta reportedly transformed the clay from a "snake" to a "dead snake" to a "dead fish" to a "fish" to "cooking", as indicated by her verbalizations.

A teacher's report written when Marta was 5 1/2 states that Marta engaged in "imaginative play usually with hand objects such as

her language abilities are often mentioned in various reports. Echolalia and excessive, incessant talking (often irrelevant to the topic at hand) were noted as characteristic of her speech.

One therapist noted that while Marta was strongest in the verbal areas, her capacity in the language domain was limited to a very concrete level. The therapist observed that Marta was able to "label and parrot easily", but when asked to describe pictures, she could not discuss them other than by one word or short phrases. When Marta was 8;5 a school psychologist noted that Marta's mother commented that Marta "has difficulty thinking with her language in the sense that she gives the impression that she knows and thinks more than she really does. This is so because she often repeats what she has heard without understanding the substance of what has been stated..." Yet another examiner suggested the possibility that Marta might be "idiot savant", cautioning against inflated expectations of Marta's potential.

2.4 Standardized Tests

The results of standardized intelligence tests administered to Marta in the past reflect the striking discrepancy between her verbal and nonverbal abilities that persists to this day (see Table 1).

The spread of at least twenty points between Marta's performance IQ and verbal IQ on the Wechsler tests, for example, reveals her relative strength in the verbal area, at least in vocabulary. Moreover, considering that the Wechsler verbal subtests include an arithmetic portion, Marta's verbal and performance levels may be even

Table 1

Results of Standardized Tests 3/69 - 6/78

Date	Age	Test	Performance
3/20/69	5 1/2	WPPSI*	VIQ: 61 PIQ: 44 FSIQ: 48
2/16/71	7	Stanford-Binet	CA: 7-5 MA: 4-4 IQ: 55
10/3/72	9	WISC**	VIQ: 63 PIQ: 0 FSIQ: 45
6/17/75	11 1/2	WISC-R***	VIQ: 58 PIQ: 0 FSIQ: 44
11/28/75	12	PPVT****	CA: 12-3 MA: 8-11 IQ: 79
6/9/78	14 1/2	WISC-R	VIQ: 52 PIQ: 32 FSIQ: 41
6/9/78	14 1/2	PPVT	CA: 14-9 MA: 6-1 IQ: 53

*Wechsler Preschool Scale of Intelligence

**Wechsler Intelligence Scale for Children

***Wechsler Intelligence Scale for Children-Revised

****Peabody Picture Vocabulary Test

more disparate than her WISC scores indicate. Subtest scores for the WISC administered in June 1975 reflect this (see Table 2).

2.5 Medical Problems

Table 2
Subtest Scores on WISC-R (June 1975)

Subtest	Verbal		Performance	
	Raw	Scaled	Raw	Scaled
Info	8	3	Pic Comp 2	1
Sim	0	1	Pic Arran 0	1
Arith	1	1	Block Des 0	1
Vocab	24	6	Obj. Ass 6	1
Comp	10	5	Coding 0	$\frac{1}{5}$
		$\frac{16}{16}$		

VIQ: 58 PIQ: 0

Marta's performance has often perplexed educational professionals as to the appropriate course of action to take with regard to her schooling. When she was eight, Marta was classified as learning disabled, even though physicians had previously told the parents she was retarded. She attended regular classes with daily tutoring for learning disabled children, and then a private school for the learning disabled. At age 11 1/2, Marta was re-classified as mentally retarded and placed in a class for the trainable mentally retarded. In an educational system that often correlates linguistic sophistication with intelligence, or at least with academic competence, Marta never seemed to fit neatly into any particular category. When placed in programs paced to her academic and cognitive abilities, she has usually been linguistically far ahead of the others.

Medical problems noted have been mental retardation (etiology unknown), hyperkinetic behavior, hypothyroidism, ocular muscle dysfunction (alternating exophoria) with resultant impairment of depth perception and coordination, and precocious puberty (with secondary sexual characteristics appearing at age eight).

Marta had one EEG at age nine which revealed some abnormalities. A report states that the entire EEG was "poorly organized for the age of nine years with much disorganization in the form of high amplitude, irregular, slow waves, the amplitudes varying up to 150 or 200 microvolts." A tendency toward mild, generalized, paroxysmal activity was also noted. An EEG done in May 1980 showed spikes in the right temporal region, and an additional EEG obtained in June 1980 was also mildly abnormal due to "generalized slowing of the record during the waking stage." However, Marta's most recent EEG in September 1980 was normal, and a non-contrast CT scan done in July 1980 was also normal.

When Marta was nine, she began to show some emotional disturbance, and received psychotherapy for two years. Then, in May 1980, approximately six months after I began to see her, Marta had to be hospitalized due to what were termed "psychotic" behaviors. Her preoccupation with certain themes (e.g., death, vomiting), an increase in unresponsiveness, and her use of seemingly free associative speech, as well as a decrease in her self-help skills, resulted in a diagnosis of schizophrenia. However, it is important to note that the apparent psychotic behaviors which have appeared in the past have always been

2.7 Appearance and Affect

Marta is of small stature (5'1"), but is sturdily built. She can be unresponsive and lethargic, responding to comments and questions in grunts or monosyllables, or she can be exuberant, almost hyperactive, smiling, clapping her hands, and talking rapidly, sometimes incomprehensibly. Generally she seems to perk up when on outings, while in task-oriented settings she is much quieter and subdued. Even on outings, however, her level of awareness is somewhat limited. She often seems relatively oblivious of her surroundings, walking stoop-shouldered, arms crossed, head down. During periods of particular unresponsiveness, her eye contact is poor, and requests to "Look up", or "Look at me" result in furtive, rapid, sidelong glances. At other times when she is more alert, her gaze is quite steady and sustained.

Marta has good self-help skills and while she must be prompted constantly, can shower and dress herself, comb her hair, brush her teeth, tie her shoes, etc. However, left to her own devices it is doubtful that she would attend to these personal tasks. She is also able to rollerskate and ride a two-wheel bicycle. Behavioral observations indicate that Marta is predominantly right-handed.

Marta is somewhat abnormal in her demonstration of emotion. I have sometimes seen her laugh, but rarely in response to a humorous event or comment. Usually she laughs or chuckles when she herself is talking about some past event, showing exaggerated affect and emotion, although the source of the humor may not be at all evident. At other

viewed as secondary, not primary to Marta's retardation. Marta has been given various medications in the past to treat her behavioral problems and hypothyroidism (e.g., Mellaril, Stelazine, dextro-amphetamine tartrate (Obotan forte)).

2.6 Environment

Marta lived at home with her family until she was 15 years old. Thus, for the duration of her childhood and early adolescence she benefited from an enriched family environment. Marta's parents report that Marta's three older sisters played an active, loving role in the raising of their younger sister, taking her on outings, teaching her, and generally aiding in providing her with a rich and varied range of life experiences. The family traveled extensively, both for business and pleasure, and Marta was always included on such trips.

From the home environment, Marta went to a residential facility at the suggestion of a social worker. She remained at this placement for one and a half years, attending a special school during the day. She resided in a hospital setting the following year, after which she was moved to another residential setting where she now resides. She attends a school for the educational handicapped during the day. Marta's family continues to take an active interest in her welfare. She goes home on weekends and for vacations, and family members visit her regularly.

feelings appropriately, behaviorally and verbally. Marta sometimes cries at her residential setting because she misses her parents. However, in her interaction with them she often behaves in a detached, unemotional fashion.

times she may smile absently as if she were thinking of something funny. However, she has never been able or willing to discuss the reasons for her smiling. When there really does seem to be a reason to laugh due to some event or remark, Marta often remains serious, apparently unaware of the humor.

In addition, I have never seen Marta respond empathetically to the misfortune or sadness of another person. Once when she was at my home I left her in the living room with my then infant son for a few moments. I was interested to see how aware she would be of his needs. When he began to cry, she showed no response at all. She simply remained seated on the couch, arms folded, apparently oblivious to his discomfort. Marta often refers to events which she says make her feel sad, but it is almost as if she has heard someone else say they were sad and she knows she should feel sad too. When John Lennon was killed for example, Marta mentioned this fact repeatedly and would say she was sad, but the tone of her voice and the expression of her face did not at all convey genuine sadness. Years ago a teacher at her school claimed that Marta used to be able to call for help if say, someone fell off a bike, and would seem to show much concern. It is difficult to say whether at these times Marta's actions were learned responses to an event (i.e., call the teacher when someone is hurt) and to what extent she was really capable of empathizing with the injured individual.

There is no doubt of course, that Marta does feel emotions. However, she seems to have difficulty knowing how to express her

CHAPTER III

3.0 Assessment

Marta's language and nonlanguage abilities were evaluated through formal testing and informal observation. An extensive number and range of tasks were administered to obtain a comprehensive picture of her mental abilities. Testing and observation date from October 1979 when Marta was 16 to July 1982 when she was 18 1/2.

As a result, a vast amount of data was collected. Tables 3 and 4 include most, but not all tests administered. This extensive data collection over a protracted period was done to obtain as true and accurate a picture of Marta's abilities as possible. This was crucial to any theoretical arguments I might want to make based on the data. For example, in order to use these data to argue that language can emerge in the absence of putatively prerequisite cognitive abilities, I needed to establish beyond a reasonable doubt that the nonlanguage abilities were indeed absent. The comprehensive set of tasks using varying methodologies was administered to assure that the profile obtained was reflective of Marta's competence, and was not just due to performance factors. Most, but not all test results will be discussed.

3.1 Test procedures

Task-oriented sessions generally lasted for approximately 60

minutes, depending upon Marta's attention span and cooperation. Except for the month of June 1980 just after her admission to the hospital when she was non-communicative, Marta was generally cooperative.

She was usually able to perform at least a few tasks during a given session. Generally when she agreed to attempt a specific task her performance on that task was fairly consistent from day to day. That is, although she may have been relatively alert one day and not on another, her level of performance on the same tasks usually did not differ greatly, the main difference being that on the better day she may have shown more enthusiasm or responsiveness and a shorter response latency. In cases where Marta's score on a given test or tasks was discrepant over several administrations I have assumed the higher score to be a more accurate reflection of her capabilities. When initial success on a task appeared to be totally fortuitous, I re-tested.

Much verbal praise and prompting were given during each test. At times a particular methodology for a standardized test had to be modified to accommodate Marta's need for constant prompting. In addition, tangible reinforcements were used to keep Marta motivated and attentive. Small food rewards, pictures of the Beatles (her "favorite group"), playing of audiotapes of Beatle music, and small token gifts were used to help motivate her. Marta also responded to delayed reinforcement, e.g., the promise of a walk or a drink at the session's end. At times Marta showed pleasure and pride that she was doing well. Praise and rewards were given for attention and effort

rather than for correct answers.

In addition to conducting working sessions with Marta seated at a table in fairly prototypical task-oriented contexts, I saw her at her parents' home, in her residential settings, in the hospital (where she resided for one year), and at my home. Together we have gone to coffee shops, restaurants, shopping malls, on walks, and to the zoo. On one occasion Marta spent a night at my home. Thus, I had the opportunity to view her in a wide range of contexts, interacting with close loved ones, and with teachers, fellow students, roommates, strangers, and babies. These various means of contact and interaction broadened our relationship and gave me a clear idea of how Marta functions in naturalistic as opposed to task-oriented settings.

Audiotape recordings of each session were made on a Sony TC-142 and transcripts of some of these tapes were used as the data base for the spontaneous language and conversational analyses. Notes recorded in a journal provided contextual as well as additional data. An audiotape made by Marta's parents featuring a family dinner conversation (with Marta included) was also transcribed and analyzed.

3.2 Language assessment

In order to evaluate her language abilities, Marta was given a comprehensive battery of language tests and tasks. A list of the language measures used is presented in Table 3.

A. Comprehension

Marta's comprehension was tested through administration of the Curtiss-Yamada Comprehensive Language Evaluation-Receptive Battery (CYCLE-R), the Token Test (DeRenzi and Vignolo, 1962), and the Peabody Picture Vocabulary Test-Revised (PPVT) (Dunn and Dunn, 1981). The CYCLE-R covers many structures and features in the areas of syntax, morphology, semantics, and phonology. The battery includes many subtests, some of which are appropriate to use with children as young as 1 1/2, and others which are appropriate to use with children 8 years old or older. Subtests given and a description of the receptive battery are presented in Appendix I. Brief descriptions of the Token Test and the PPVT are also included in Appendix I.

B. Production

Marta's language production was evaluated by analysis of her performance on imitation tasks as well as of her elicited and spontaneous speech.

1. Imitation tasks: Imitation tasks have been given to children (Slobin and Welsh, 1973) and to adult aphasics (Whitaker, 1976) and have been found to be a useful means of assessing linguistic knowledge. Such tests provide a means of testing the upper limits of an individual's linguistic competence; children have been observed to be unable to imitate utterances beyond their competence (Slobin and Welsh, 1973, but cf. Bransford and Mitsch, 1978). The imitation battery included items described by Haiganoosh Whitaker (1976) as well as items I designed myself. Stimuli included sentences and phrases

Table 3

Language Assessment Measures

Comprehension measures

Curtiss-Yamada Comprehensive Language Evaluation
Receptive Battery (CYCLE-R)

Phonology subtest
Syntax subtests
Morphology subtests
Semantics subtests

Token Test (DeRenzi and Vignolo, 1962)
Peabody Picture Vocabulary Test-Revised (Dunn and Dunn, 1981)

Production measures

Curtiss-Yamada Comprehensive Language Evaluation
Elicitation Battery (CYCLE-E)
Curtiss-Yamada Comprehensive Language Evaluation
Spontaneous Speech Analysis (CYCLE-S)

Spontaneous Speech Analysis

Developmental Sentence Scoring (DSS)
(Lee, 1974; Lee and Canter, 1971; Lee and Koenigsknecht, 1974)
Sentence repetition battery (Whitaker, 1976; Yamada, unpubl.)

Other evaluation measures used

Conditional tasks (Reilly, 1982)

Easy to see/Hard to see tasks (Chomsky, 1969)

Illinois Test of Psycholinguistic Abilities (ITPA)
(Kirk, McCarthy, and Kirk, 1968)
Auditory Closure
Auditory Reception
Auditory Association
Grammatical Closure

which were either well-formed or ill-formed syntactically, morphologically, semantically, or phonetically. Marta's task was simply to repeat the utterances.

2. Elicitation test: The elicitation battery (the CYCLE-E) was developed to parallel the receptive battery. The CYCLE-E taps many of the features tapped by the CYCLE-R as well as additional areas, e.g., conditionals and modals. The parallel in the receptive and elicitation batteries makes it possible to assess both comprehension and production of the same features using the same stimuli. Syntax, intellectual and derivational morphology, lexical and relational semantics, and phonology are covered. See Appendix I for a description of test format and a list of areas included.

3. Spontaneous speech: Transcriptions of sessions and visits with Marta provided the basis of the extensive spontaneous speech sample collected. In addition, an audiotape made by Marta's parents of a dinner-time conversation was also transcribed and added to the spontaneous language data base. The transcriptions have been analyzed with attention paid to the type and range of structures used, productivity, and appropriateness in context.

In addition to this qualitative analysis, a quantitative analysis was performed based on Curtiss-Yamada Comprehensive Language Evaluation--Spontaneous Speech Analysis (CYCLE-S) procedures. The CYCLE spontaneous speech analysis was used as a supplemental aid in the spontaneous analysis, offering a means of quantifying the range of structures used, their degree of complexity, and their appropriateness

must pass: the sensorimotor stage, the pre-operational stage, the concrete operational stage, and the formal operational stage. Tests associated with the first three stages were administered to Marta to assess her level within this theoretical framework.

Other abilities which purportedly show developmental progression (e.g., memory, number concepts, hierarchical construction) were also given to determine Marta's performance relative to proposed norms. Many of the nonlanguage abilities which were examined are hypothesized to be prerequisite to or otherwise linked to language.

In addition, numerous neuropsychological tasks were administered to determine whether Marta's pattern of abilities could be accounted for along neuropsychological or hemispheric parameters, i.e., attributable to deficits associated with a localized area of the brain. Tests tapping abilities theorized to be governed by one or the other hemisphere or which are claimed to provide some indication of hemispheric dominance (e.g., dichotic listening) were thus also included in the nonlanguage battery. The specific nonlanguage tasks, both developmental and neuropsychological, are listed in Table 4. The rationale for inclusion of each test is presented in Chapter V along with Marta's performance.

in context. The semantic content of Marta's speech was also evaluated, including her use of specific lexical items and her capacity to express complex or abstract semantic notions and relationships.

In addition to the CYCLE-S analysis, Marta's data were assessed using the Developmental Sentence Scoring technique (DSS) (Lee and Canter, 1971; Lee, 1974; Lee and Koenigsnecht, 1974).

4. Other tests: Additional tests administered to tap Marta's knowledge of more complex structures were a conditional test (Reilly, 1982), C. Chomsky's Easy to see/Hard to see tasks (Chomsky, 1969), and a nonsense morphology test (Yamada, unpub.).

5. Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, and Kirk, 1968). Particular subtests of the ITPA were given (see Table 1) to further add to the data base.

3.3 Nonlanguage assessment

Marta was also given a comprehensive battery of nonlanguage tests. The particular nonlanguage cognitive tasks included in the battery were selected for several reasons. First, it was important to obtain as clear an idea of Marta's cognitive level as possible. One means of doing this was to give tasks tapping abilities that have been described in age or stage related terms.

One main theory of intellectual development in the field of cognitive psychology is the structuralist theory of Jean Piaget. Piaget proposed specific invariant stages through which each child

Table 4 (cont.)

Nonlanguage Assessment Measures

Table 4

Sensorimotor abilities (Uzgiris and Hunt, 1975)
 Means-ends 2/7/80*
 Object permanence 12/12/79

Conservation (Egelman, 1970)
 Length (Lovell et al., 1962) 10/19/79 1/19/81 3/19/81 4/18/82
 Mass (Elkind, 1961; Uzgiris, 1964) 1/19/81 3/19/81 4/18/82
 Liquid (Wallach et al., 1967; Beard, 1963) 1/19/81 3/19/81 4/18/82
 Weight (Elkind, 1961) 4/18/82
 Number (Wohlwill and Love, 1964) 4/18/82

Stereognosis (Laurendeau and Pinard, 1970) 5/8/80

Copying
 Piaget and Inhelder (1967) 3/26/80 10/15/80 2/20/80
 Benton Visual Retention (Form C) (Benton, 1965) 1/19/81

Classification (Inhelder and Piaget, 1964; Lovell et al., 1962)
 4/30/80 9/29/80 10/30/81

Classification- (Semantic conceptual) (Curtiss, unpub.)
 Male/female 10/19/79
 Edible 2/20/81
 Ruman 3/19/81

*Dates indicate dates of test administration.

Class Inclusion (after Inhelder and Piaget, 1964; Lovell, Mitchell, and Everett, 1962) 10/30/81 4/18/82
 Seriation (after Piaget and Inhelder, 1959; Inhelder and Piaget, 1964; Lovell, Mitchell, and Everett, 1962) 10/6/80 10/27/80 12/1/80

Play (Knox, 1974; Takata, 1974; Florey, 1971; Gesell, 1940; Gesell and Amatruda, 1940) 2/24/81

Drawing (Kellogg, 1970; Seife, 1977; Harris, 1963; Vereecken, 1961)

Number concepts (after Gelman and Gallistel, 1978; Gelman, 1972, 1980)
 Counting 4/30/80 12/14/80
 Infinity 10/13/80 4/23/81
 Magic Show 10/15/80
 Recognition 6/11/81

Hierarchical Construction (after Greenfield, 1978; Greenfield and Schneider, 1977; Greenfield, Nelson, and Saltzman, 1972)
 Blocks 10/27/80 11/10/80 12/8/80 10/30/81
 Cups 10/19/79 10/13/80 3/5/81 4/23/81
 Sticks 10/19/79 10/13/80

Rule abduction

MAP (Muma Assessment Program, Muma and Muma, 1979) 4/4/80
 Simple Rule Acquisition (after Furth, 1966) 3/26/81 4/23/81 7/14/82

Conceptual Logical Sequencing 2/24/81 3/12/81 10/9/81

Memory

Auditory Memory Span Test (Wepman-Morency, 1973) 4/25/80 4/18/82

Auditory Sequential Memory (ITPA) 1/24/80 1/5/81

Auditory Sequential Memory for familiar words (Yamada, unpub.) 12/1/80

Memory for Auditory Nonverbal Stimuli (MANS) 10/31/81

Knox Cubes Test 3/19/81 3/26/81

Corsi Blocks 4/4/80 12/8/80

Visual Sequential Memory (ITPA) 1/24/80

Memory for Designs (Graham and Kendall, 1960) 3/19/81

Memory with verbal mediation task (after Morris, 1975) 5/28/81

Metamemory task (Kreutzer et al., 1975) 4/18/82

Table 4 (cont.)

Neuropsychological Tests:			
Figure/Ground and Gestalt Perception			
Southern California Figure/ground perception test (Ayres, 1966)	3/20/80	12/14/80	
Preschool Embedded Figures Test (Coates, 1972)	2/10/81		
Perceptual Integration Test (Elkind, et al., 1964; Elkind, 1978)	10/6/80	10/13/80	12/14/80
Mooney Faces, (Mooney, 1957)	4/30/81		
Visual Closure (ITPA)			
Dichotic Listening (Zaidel, no date)	10/23/81		
Facial Recognition Test (Benton et al., 1973)	5/16/80	12/8/80	
Voice Recognition Task (Yamada, unpub.)	11/6/81	4/18/82	
Familiar Sounds Recognition (Van Lancker, unpub.)	7/14/82	10/9/81	

A. Sensorimotor abilities

Two knowledge domains were investigated, object concepts and means-ends behavior. The tasks given are briefly described in Appendix II.

B. Representational abilities

1. Play: Play skills were evaluated informally according to measures described by Takata (1974), Knox (1974), Florey (1971), Gesell (1940), and Cesell and Amatruda (1940).

2. Drawing: Spontaneous drawings were analyzed according to criteria discussed by Kellogg (1970), Harris (1963), Seife (1977), and Vereecken (1961).

C. Spatial abilities

1. Copying: a series of 21 geometric designs (Piaget and Inhelder, 1967) was presented to copy. The designs tap knowledge of

topographical and Euclidean spatial concepts. This task has been normed on children from below 2 years of age. In addition, Form C (a copying version) of the Benton Visual Retention Test (Benton, 1965) was administered.

2. Stereognosis: The Stereognosis test (Laurendeau and Pinard, 1970), which tests knowledge of spatial concepts and relationships in a tactile-visual modality, was given. There are norms for children between 3 and 12 years old. A brief description of the task is given in Appendix II.

D. Concrete-operational abilities

Marta was also given various tasks associated with the concrete operational stage in order to determine just how far beyond the sensorimotor period she is functioning. (See Chapter V for a description of the concrete-operational period).

1. Conservation: Standard Piagetian conservation tasks for length (Lovell, Healey, and Rowland, 1962), mass (Elkind, 1961; Uzgritis, 1964), liquid (Wallach, Wall, and Anderson, 1967; Beard, 1963), weight (Elkind, 1961), and number (Wohlwill and Lowe, 1962) were administered (Fogelman, 1970). Minor modifications of the tasks were made where possible and necessary, to increase her attention span and motivation, e.g., foodstuffs were used in the number conservation task. For brief task descriptions see Appendix II.

2. Seriation: The seriation task was adapted from Piaget and Inhelder (1959), Inhelder and Piaget (1964), and Lovell, Mitchell, and Everett (1962). See Appendix II for a task description.

3. Classification: Several tasks were administered, including a) tasks for classification and class inclusion developed by Inhelder and Piaget (1964) using a methodology designed by Lovell, Mitchell, and Everett (1962) and b) tasks designed by Curtiss (unpublished) to assess "semantic classification. These tasks are described briefly in Appendix II.

E. Number concepts

Number concepts were assessed in several ways. First, she was given the "Magic Show", a means of assessing number concepts in pre-school children, developed by Gelman (1972, 1980). Second, she was given a counting task and an infinity task modelled after tasks described by Gelman and Gallistel (1978). Third, she was asked to do a number recognition task. See Appendix II for a task description.

F. Hierarchical construction

Block models and stick models of increasing hierarchical complexity were shown to Marta who was asked to build identical structures (Greenfield and Schneider, 1977; Greenfield, 1978). She was also asked to nest a set of seriated cups of various colors (Greenfield et al., 1972).

G. Rule abduction

To assess ability to abduct a rule or rules from limited available data, a Rule/Nonrule Governed Learning test (Muma and Muma, 1979) and a Simple Rule Acquisition test (inspired by Furth, 1966) were given. Appendix II contains a brief task description.

H. Logical sequencing

On logical sequencing tasks Marta had to sequentially organize a scrambled set of 2-6 pictures to create a story. She was encouraged to verbalize the story created by the picture sequences. One set of stimuli (Set A) featured drawings of simple action sequences (e.g., a shoe being tied, a trip to the store) while another set of stimuli (Set B) featured photographs of simple action sequences (e.g., a man making breakfast). Curtiss and Yamada have collected norms (for both Sets) from children from ages 2 to 5.

I. Memory

To evaluate auditory short term memory Marta was given the Wepman-Morency Auditory Memory Span test (Wepman and Morency, 1973), the Auditory Sequential Memory Span test from the ITPA (Kirk, McCarthy, and Kirk, 1968), the Memory for Auditory Nonverbal Stimuli (MANS I) (Curtiss, Kempler, and Yamada, unpublished), and a nonstandardized word span test consisting of words particularly salient to Marta to increase her motivation and attention (e.g., Beatles, fat, cake).

To assess visual short term memory Marta was given the Knox Cubes test, the Corsi Blocks test (described in Milner, 1971), the Visual Sequential Memory test from the ITPA (Kirk et al., 1968), and the Graham and Kendall Memory for Designs test (Graham and Kendall, 1960). As mentioned above under copying, she was also given the copying version of the Benton Visual Retention test (Benton, 1965). Metamemorial abilities were assessed by asking Marta several

questions modeled after Kreuzer, Leonard and Flavell's interview study (1975), e.g., "Would it be easier to remember five things or one thing?"

A memory test designed by the author (after Morris, 1975) was also given to see whether Marta could use verbal mediation (specifically rhyming) to facilitate recall. This task is described in Appendix II.

J. Neuropsychological tests

1. Disembedding

This ability, also known as figure/ground perception or field independence, was assessed by administration of the Southern California Figure/Ground Perception Test (Ayres, 1966) and the Preschool Embedded Figures Test (Coates, 1972).

2. Gestalt perception

Gestalt perception abilities were examined through administration of the Mooney faces test (Mooney, 1957), the Perceptual Integration Test (Elkind, 1978, Elkind, Kogler, and Go, 1964), and the Visual Closure Test of the ITPA (Kirk, McCarthy, and Kirk, 1968).

3. Other tests

A dichotic listening task (Zaidel, no date), a familiar sounds recognition task (VanLancker, unpublished), a familiar voice recognition task (Yamada, unpub.), and the Benton Test of Facial Recognition (Benton et al., 1975) were also given.

CHAPTER IV

4.0 Language

This chapter discusses the extent of Marta's language knowledge. How complex or complete is her grammar? What is the relationship between her language comprehension and production? Are all or only selected aspects of her language and/or linguistic performance enhanced?

Section 4.1 gives some general comments about Marta's language. Sections 4.2 and 4.3 discuss Marta's syntactic and morphological knowledge, respectively. Section 4.4 discusses her semantic knowledge, Section 4.5 details her pragmatic knowledge, and Section 4.6 presents evidence of the productive nature of her language. Section 4.7 briefly discusses her phonological knowledge. Section 4.8 gives a brief summary of Marta's language performance.

As stated in Chapter III, Marta's linguistic knowledge was investigated through administration of formal comprehension tests, elicitation tests, sentence repetition tests, and spontaneous language analysis.

It should be noted at the outset that Marta was not an easy subject to test. She seemed wary of the task-oriented setting and was often very lethargic during testing. Marta was cooperative to the extent that she pointed to pictures and gave responses, but often

markers, and pronouns), while failing to show comprehension of the same forms on receptive tests, I have assumed in certain cases that poor test results are somewhat misleading. In other cases it appears that Marta's production actually exceeds her comprehension.

In each section, findings from productive measures (i.e., sentence repetition task, elicitation test, and spontaneous language analysis) are given first, followed by presentation of findings from comprehension measures (i.e., receptive language tests).

While the results of specific language tests are listed in particular sections, some tests are not exclusively syntax, semantics, or morphology tests. However, generally a given test highlights or focuses upon a particular aspect of language. For example, Simple Negation tests knowledge of the meaning of the negative marker not, rather than knowledge of where the marker is placed in the sentence structurally. Thus, results of this test are included under the semantics discussion. The Complex Negation test, however, focuses on whether, on the basis of negative marker placement, the subject is aware of which clause is negated. Thus, this test focuses more on syntactic knowledge and is included in the syntax section.

4.1 General Comments

Before discussing specific aspects of Marta's linguistic abilities it would be useful perhaps, to comment upon the overall quality of Marta's speech. As mentioned above in section 2.7, Marta

her responses were perseverative and she seemed to be just "going through the motions" without really attending to the task at hand. Only through administering tests several times could I be assured of obtaining test results truly reflective of Marta's capabilities.

Marta was also given alternate forms of some of the tests, forms which involved object manipulation rather than picture pointing responses. While there are as yet no norms for these alternate versions of the tests, this enabled me to explore whether problems with the test methodology might have affected her performance, e.g., the possibility that the picture arrays were too complex for her.

For a subject like Marta, who is so limited conceptually (see Chapter V), the possibility that task-taking demands were responsible for poor test performance must be considered. Low performance can result from a lack of comprehension of the linguistic structures or from overwhelming task-taking demands (e.g., perceptual, motivational, or attentional). The two factors are not, of course, mutually exclusive. For example, poor comprehension can result in attentional problems or conversely, attentional problems can result in poor comprehension; both play a role. In Marta's case, informal observation and analysis of spontaneous speech and interaction seemed to be a better indicator of her level of functioning than formal testing. Indeed, the strongest evidence of Marta's sophisticated language ability comes from the expressive language measures. Since she was observed in spontaneous speech to appropriately and seemingly meaningfully use certain grammatical forms (e.g., passives, plural

can be lethargic and noncommunicative, or exuberant and logorrhetic. Her moods did not seem to be governed by the presence or absence of medication; she exhibited both behavioral patterns whether on or off medication. Often a change in affect occurred within a given session. Marta would be relatively noncommunicative, responding only perfunctorily, when something (sometimes unseen) would suddenly seem to trigger a "flood" of speech. Most of the complex structures I refer to in the following sections occurred during these lengthy, verbose stretches of speech which I will term, "spiels." While individual sentences might be well-formed, connections between utterances are often unclear. Many utterances are ill-formed or uninterpretable. There are many false starts and hesitations, and the speech is punctuated by unintelligible words and phrases (see section 4.6 for additional comments re "spiels"). This is important to keep in mind as one reads through the examples of Marta's speech in the following syntax and morphology sections. I have pulled many examples from the transcriptions which out of context, make it seem as if Marta is thinking at a fairly complex level. An examination of Marta's transcripts often reveals however, that utterances which look fine in isolation do not always look quite so fine in context, and may not in fact mean what they seem to mean. This will be discussed further in section 4.4. Generally, this is the kind of speech Marta produces when she is being talkative. There are times when she seems a little more intelligible and comprehensible, but the volume of speech is much reduced; the speech does not have that rushed,

headlong quality that it does during the "spiels". Some excerpts from Marta's transcripts are included in Appendix III.

4.2 Syntax
 4.2.1 Production - Syntax

Marta reveals an extensive knowledge of English syntax in her language production. Her responses on Sentence Imitation tasks reflect her ability to distinguish between syntactic well-formedness and ill-formedness. For example, she was able to repeat well-formed sentences as in examples 1 and 2 below.

- 1) J: An apple was eaten by Jeni.¹
 M: An apple was eaten by Jeni.
- 2) J: Marta fed Aaron the apple.
 M: Marta fed Aaron the apple.

In contrast, when presented with sentences containing syntactic anomalies Marta usually responded by making a change toward a more grammatical string or refused to respond altogether. It is evident that such "sentences" seemed strange to her, as reflected by the fact that her responses were often very delayed, hesitant, and mumbled under her breath.

- 3) E: The horse ran gate through the
 M: The horse ran through the horse
- 4) E: Cake some here is still
 M: [softly] Cake some ...
- 5) E: I bacon eggs toast for breakfast
 M: I have toast for breakfast.
- 6) E: The apple was eaten by the
 M: [no response]

reversible and non-reversible agentive passives. The fact that Marta uses such structures indicates that she is at a fairly advanced syntactic level.

Additional evidence of the level of complexity of Marta's speech is her use of a wide range of complex sentence structures, i.e., structures involving the recursive operations of coordination and subordination. While the earliest forms of complex sentences begin emerging at age 2 (Limber, 1973; Bowerman, 1979) some structures are still infrequent at age 5.

In coordination several constituent sentences are linked by a coordinating conjunction (e.g., and, but, or). Marta uses and and but in her spontaneous speech.

10) We're really excited about school startin', and I love it myself.

11) ...and I enjoyed cooking, but it's not simple, I know.

12) They just went to a bar after the movie was over.

Cromer (1968) reports that before and after are uncommon even in 5 year olds.

In subordination there are several forms of embedding. The embedded structure can function to modify a constituent of the sentence, i.e., a noun phrase, verb phrase, or adjective. Let us first examine Marta's ability to modify phrase constituents, i.e., her ability to use relative clauses. While relative clause-like forms begin appearing fairly early (around age 3), it has been noted that the earliest forms do not include WH-relative pronouns, subject relatives, or any relative clause attached to the subject NP (Limber,

In spontaneous speech Marta produces a wide range of structures, many of which she failed to respond to correctly in the comprehension tests. For example, while Marta did not do well on comprehension tests dealing with order distinctions, in her own speech she consistently uses word order to mark grammatical relationships.

Marta's linguistic sophistication is also evident in her use of structures which are relatively late to be acquired in normal development. For example, Marta uses passives, full passives as well as truncated or agentless passives.

7) Last year at [name of school] when I first went there three tickets were gave out by a police last year.

8) [talking about her hair]

I got it cut already by a maid.

9) [talking about crocodiles at the zoo]

I don't want to get eaten by one.

The full passive has been reported to be a relatively uncommon,

as well as late-appearing structure (Baldie, 1976; Horgan, 1978; Crystal, Fletcher, and Carman, 1976). The full passive is not only infrequent in child language but also in adult language and adult language directed at children (Givon, 1979; Horgan, 1978; Harwood, 1959; Brown, 1973). Horgan (1978) states that even the 11 and 13 year old children in her study did not produce the full range of passives. For example, their non-reversible passives (i.e., passives where the action is unidirectional) did not include agentive passives even though agentive non-reversible passives are used by adults. It is of interest then, that Marta spontaneously produced both

necessarily implying that the structures are semantically or pragmatically well-formed. Indeed, Marta's utterances do not always seem to mean what the structural relationships imply (see Section 4.4).

Another form of embedding is complementation, where the embedded structure functions as a major constituent of the sentence. Marta generally uses object complementation in her spontaneous speech as in 17). No examples of subject complementation have yet been observed.

As illustrated below, Marta also uses infinitival complements.

- 22) Want me to help you?
 - 23) It was hard for me to do, but I did it.
- Marta also uses embedded clauses complements introduced by WH words ("headless relatives").
- 24) That's where my sister J. lives!
 - 25) I know what Monday is ...

She also uses complements containing participial forms, forms which have been reported to appear relatively later than infinitival complements (Lieber, 1973).

- 26) I love eating meals.
- 27) Did you hear about me not going to this school up in [name of city]?
- 28) I don't like him pu'in [i.e., putting] paper towels in my mouth?? When I cry, I cry in class.

Additional evidence of Marta's syntactic ability may be found in her frequent use of temporal adverbials.

- 29) During class, I told everybody.

1973). Marta is able to use WH-relative pronouns, true object relatives, subject relatives, and double function relatives (i.e., clauses where the co-referential NPs serve different, "non-parallel" functions in the main and embedded clauses, i.e., they bear different grammatical relations to the verb such as in 16). Notably, subject and double function relatives are late acquisitions.

- 13) She, does paintings, this really good friend of the kids who I went to school with last year, and really loved.
- 14) ...a really nice guy who I went to and I really loved him after a while
- 15) The cook who does it, um sometimes give us these good enchiladas an' oh, they're so good!
- 16) I'm very good friends of a girl that cuts [name]'s hair, that I'm working with.
- 17) He was saying that I lost my battery powered watch that I loved; I just loved that watch.
- 18) That's the number that I'm stayin' at.

The multiple-embeddings in many of Marta's sentences further attest to her sophisticated syntactic level.

Marta is also able to modify and elaborate the verb phrase through use of subordinating conjunctions of time, causality, etc.

- 19) I'm waiting until my hair grows out.
- 20) He's my third principal I've had since I've been here.
- 21) It makes me feel sad because they had to leave.

It is important to note that the sophistication I am referring to here is a syntactic, not semantic or pragmatic one. The examples in this section are intended to show that Marta uses such complex structures and that they are often syntactically well-formed, without

three constituent utterances (Bloom and Lahey, 1978).

- 38) E: Who has shorter hair?
M: I do.
- 39) M: Look, what is that? [showing her protruding stomach]
J: [teasing] That's a baby.
M: No, it isn't.
- 40) Yeah, my dad was all upset and so was I.

Marta also revealed that she is able to deal with and use grammatical ellipsis through her responses on the CYCLE elicitation battery.

- 41) E: This clown doesn't have a flower, but this clown _____
M: Does.

4.2.2 Summary of Production-Syntax:

It is evident that Marta can and does produce many complex structures. The structures are productive; many of them are certainly novel (even a bit unusual or bizarre). It is unlikely, for example, that Marta ever heard the sentence, "I don't like him pu'in paper towels in my mouth..." and is simply repeating a stored item. (A discussion with her teacher confirmed that this incident had actually happened to Marta.) Errors too, attest to the productivity and rule governed aspects of Marta's syntax, e.g., "It (i.e., a camera) was given a month (i.e., a month ago) by this friend." Some of the structures Marta uses, most notably the irreversible passive with agents, are used infrequently even by the normal older child. Thus, some aspects of Marta's expressive syntax are quite advanced, especially relative to her nonlanguage level of functioning, as will become evident in Chapter V.

- 30) After a while, I gotten tired of it.
- 31) And they said, "Well, we want her coming home once a month."
- 32) I'm going home for a little while.
- 33) I saw her an hour ago.
- 34) I got discharged a month ago, Sunday.

Marta is able to elaborate the noun phrase through the addition of modifiers or adjectives to the noun. She has been noted to use up to four modifiers.

- 35) very scary news.
- 36) a little round thing from the union
- 37) my good friend's second friend
- However, she tends to use few adjectives in her utterances and seems to use the same ones frequently. This will be discussed further below.

Marta's capacity to use elliptical utterances and to make the appropriate deletions reflects her development in another area of the grammar. Grammatical ellipsis involves the deletion of sentence constituents that are redundant within the linguistic and/or extralinguistic context. Ellipsis, it is claimed, provides cohesion in the flow of natural discourse, and the rules governing it must be learned. In addition to learning how to produce more "complete" utterances, the child must learn that shorter, more fragmented utterances are sometimes permissible and preferable. Ellipsis does not appear to be mastered until after the child has begun to use

4.2.3 Comprehension-Syntax: As shown in Table 5, Marta was given many tests exploring her knowledge of the syntactic structures of English. It is, of course, artificial to speak of "comprehension" of syntactic structures in isolation of semantics since the term "comprehension" itself implies an understanding of meaning. To determine whether or not an individual truly understands the semantic relationships embodied by a particular syntactic structure it is useful to use formal receptive tests which isolate the structure from contextual cues. On the other hand, while formal tests provide us with an efficient means of probing a child's linguistic competence, the task-taking situation sometimes conflicts with the very young child's or retarded individual's mode of interacting. The formal receptive language tests on the CYCLE were designed with the attentional and motivational limitations of the young child and cognitively deficient individual in mind. Tests are brief, arrays are as simple as possible, picture stimuli are designed to be interesting yet clear and only pointing responses are required. In the standardization which has been done thus far, young children aged 2 and even younger were found to attend to and succeed on selected tests. Thus, Marta should have had no trouble on the tests with regard to task demands.

Marta's overall performance on the battery of syntax subtests was quite poor. She showed mastery level performance on only two of 15 tests (for which there are norms), Double Embedding I, and Simple Modification. She performed at or below the 2 year level on 10 of the

15 tests. She did the same or worse on the object manipulation versions of the various tests (Active Voice Word Order, Passive Voice Word Order, Wh Questioning of Subject and of Object, and relativization tests). However, her responses on these tests did offer some insight into her performance. Often, in response to a test question, Marta would manipulate the objects, but perhaps only one of two objects mentioned in the test sentence. Her responses thus indicated that she was responding to only part of the test sentence. It is difficult to conclusively determine whether the above responses were due to failure to understand the linguistic structures tested, to processing limitations, or to motivational or attentional deficits. Possibly all these factors played a role. In cases where Marta gave a poor performance on the formal receptive test but showed the ability to use a structure appropriately and meaningfully in context, it was likely that task-taking limitations rather than linguistic ones were the source of the problems. However, if Marta did poorly on a given test and also was observed to use the structure in question inappropriately or without clear indication that she was using it meaningfully, the performance-exceeds-comprehension profile was considered.

Table 5 (continued)

	M's % correct*	M's perf.	level**	mastery***	Age of
Active Voice Word Order 2/28/80	63	3		4	
Active Voice Word Order (with objects) 5/14/81	60	no norms		no norms	
Be Passive Voice Word Order-- Nonagentive 6/11/81	40	less than 2		4	
Be Passive Voice Word Order-- Agentive 6/11/81	0	2		5	
Be Passive Voice Word Order-- (with objects) 4/19/81	0	no norms		no norms	
Get Passive-Nonagentive 3/13/80	40	less than 2		4	
Get Passive-Agentive 3/20/80, 4/4/80	40	no norms		no norms	
Clefting 4/4/80	0	less than 2		over 8	
Double Embedding I 6/11/81	80	4		4	
Double Embedding II 6/25/81	20	3		7	
Subject Relatives 6/11/81	60	2		4	
Subject Relatives (with objects)	0	no norms		no norms	
Subject Relatives ending in NV 6/11/81	20	4-5		8	
Object Relatives 6/11/81	40	2		8	
Object Relatives (with objects)	20	no norms		no norms	
Wh Questioning of Subject 12/23/80	60	2		4	

Table 5 (continued)

	M's % correct*	M's perf.	level**	mastery***	Age of
Wh Questioning of Object 12/23/80	20	less than 2		5	
Complex Negation 3/6/80, 1/5/81	40	2		4	
Simple Modification 2/21/80	100	4		2-3	
Complex Modification 2/21/80	60	2		4	
Wh Subject Relative Pronouns 4/9/81	80	no norms		no norms	
Wh Object Relative Pronouns 4/9/81	40	no norms		no norms	

*Marta was given a score for percent correct on each test given. Based on normative data, each score was then translated into an age equivalent score. On the most recent version of the test battery most subtests tap each target structure or feature 5 times. A score of 4 or 5 correct (80-100%) is considered evidence of "mastery."²

**Age level scores for specific subtests were assigned to Marta on the basis of the normative data. For example, if Marta attained 40% correct on a given test, the age at which the majority of children received 40% correct was considered her age level equivalence.³

***The "age of mastery" for a given structure is that age at which 80% or more of the normative population attained scores of 80% or better.

Easy to See/Hard to See Task:

To obtain an additional measure of the sophistication of Marta's grammar, she was tested for comprehension of structures which are reported to emerge only after age 5, i.e., 1) John is eager to see vs. 2) John is easy to see (Carol Chomsky, 1969). While both structures have similar surface forms, their underlying structures differ (see Task description, Appendix I). To understand this structure the child must become aware that in sentence 2), John is the object rather than subject of the main clause.

Chomsky and others have found that it is only after 5 that children come to understand referential relations in complement clauses lacking overt subjects. In the phrase, Julie is easy to see, the subject of easy to see is unspecified. The sentence can be roughly paraphrased as "Julie is easy for anyone to see." Young children typically assume that in the sentence Julie is easy to see, that Julie is the subject of see and that it is Julie who is doing the seeing. Thus, when shown a blindfolded or "sleeping" doll and asked if it is easy to see/ or hard to see, the young child will typically say, "hard to see," even though the doll is in plain sight. Other studies have replicated Chomsky's finding that children initially interpret Julie as the logical subject of the infinitive in the sentence Julie is easy to see (Cambon and Sinclair, 1974; Cromer, 1970, 1972, 1974c; Kessel, 1970).

Marta gave an interesting response on this test. When shown blindfolded doll and asked if it was easy to see or hard to see, she

answered, "hard to see." However, when asked to "Make her easy to see," Marta not only took off the doll's blindfold, but held the doll up very close to her own eyes.

Her response is thus ambiguous, since she treated the doll as both the subject and object of "easy to see," i.e., simultaneously made it easier for the doll to see by removing the blindfold, and easier for herself to see by holding the doll close to her own eyes. This response is reminiscent of the egocentric responses of 5 year olds cited by later studies of comprehension of these structures (cited by Karmiloff-Smith, 1979). Apparently children of this age have been found to interpret "easy to see" as "easy for me to see," while older children of about eight understand that "easy to see" means "easy for anyone to see." When Marta was asked, "Why was the doll hard to see before?" she said, "Because she had bad eyesight."

The task was also repeated using the same doll but without the blindfold. Researchers have found that the presence of the blindfold may steer the child toward the incorrect response simply because the blindfold is so salient. In the modified task the doll was placed on the table before Marta such that the doll's eyes were closed. The same set of test questions was asked. Marta again stated that the doll was "Hard to see," and when asked to make her "easy to see," Marta stood the doll up so that the eyes opened. She again cited "bad eyesight" as the reason for the doll being originally "hard to see." When asked, "What did you do to make her easier to see?" she cryptically responded, "Good eyesight."

Thus, Marta did not show particular sophistication in this area.

Token Test (De Renzi and Vignolo, 1962): This is considered to be a highly sensitive measure of auditory language comprehension and has been used with aphasic adults and normal language disordered children (see discussion, Whitaker and Selnes, 1978). This test assesses the ability to understand sentences of varying syntactic complexity without the benefit of nonlinguistic contextual cues (see Appendix I for task description). Norms are available from several abnormal populations (e.g., Zaidel, 1977; Swisher and Sarno, 1969; Tallal, 1975) as well as normal adults and children from age 3 to grade 6 (DiSimoni, 1978).

Marta did poorly on this test, scoring 17 out of 39. The mean score for children 3.0-3.5 was 19.55. De Renzi and Esiglioni (1978) have used a similar version of the Token Test to define four levels of impairment in aphasics, and Marta falls within the severely-impaired category, reflecting the low level of comprehension which she demonstrated on this test. Marta was able to do all the items in sections A and B but began missing items in section C. When asked to "Show me a large green square," for example, she pointed to the large green circle. Given that Marta showed knowledge of squares, circles and color and size words on the shorter, simpler A and B section items (see task description, Appendix I), it appears that it was the longer structure that posed a difficulty for Marta. As the

instructions became longer and complex, Marta had difficulty remembering exactly what she was instructed to do. Lesser (1976) has claimed that a reduction in auditory memory is a performance limitation characteristic in aphasics. Perhaps such processing limitations, i.e., a brief auditory memory (see Chapter V) also adversely affected her performance.

4.3 Morphology:

4.3.1

Production-Morphology: Marta produces many morphologically complex forms and shows knowledge of many grammatical distinctions signalled morphologically and lexically. Her performance on the CYCLE Elicitation test indicates that her grammar includes rules for marking singular/plural agreement on the auxiliary.

42) J: And here these sheep...
M: are jumping.

43) J: Now you tell me about the girl ...
M: She is jumping.

Her spontaneous correction of the omission of the auxiliary on the sentence repetition task also reflects this knowledge.

44) J: He thinking about you.
M: He's thinking about you.

Also, while Marta had some difficulty marking singular/plural agreement on the main verb (as compared to the auxiliary) on the Elicitation test (see 45-46), on the sentence repetition task she spontaneously corrected errors in subject-verb agreement marking on the main verb (see 47).

that she uses expressively are the tense/aspect markers -ing and -ed, using these forms correctly on the Elicitation test:

58) J: Now you tell me about the cat.
M: He is sleeping.

59) J: But here the girl already...[target word-painted]
M: walked away.

as well as in spontaneous speech.

60) [Just after we get out of the car we hear some people speaking a foreign language nearby.] They're speaking Spanish, can you hear it?

61) [We've given M. a prize for working with us and she goes upstairs to show it to her dad, then returns.] I showed my dad.

62) [We're ready to go to the zoo. J. says she has to get dressed.]
M: You can't go like that. They'll kick you out.

She has also shown knowledge and use of some complex modal auxiliary forms.

63) I've been there three years since I've been a student.

64) I should've brought it back.

65) Maybe I could play with friends.

66) ...and I didn't know how much money or/all the bank would let me take out of my account.

Marta seems to have sorted out the irregular present and past forms of be and have, correctly marking the verbs for person and tense.

67) I was 16 last year, now I'm 19 this year.

68) I'm really glad they're back here now.

69) I think that night we were going disco or something...

45) J: And every day this sheep...
M: Jump.

46) J: And every day these deer...
M: stands.

47) J: He wear his shirt.
M: He wears his shirt.

Examples from Marta's spontaneous speech further reflect her ability to mark agreement on verbs.

48) the girl arrives...

49) Santa comes in the roof

50) They know us...

51) They take trash up

In addition, she correctly used singular and plural noun forms on the Elicitation test.

52) J: Here are two ...
M: tubs.

53) J: But here is just one ...
M: cup.

54) J: Here are two ...
M: watches.

Marta also distinguishes singular and plural noun forms in her spontaneous speech.

55) They got this really nice gold thing, these things
In addition she appropriately uses the possessive "s" in her spontaneous speech.

56) ...That's my father's last name...

57) Head leader's friend

Marta also demonstrates knowledge of the auxiliary system. Morphemes

Linguistic forms from nonlinguistic and linguistic contextual cues is it possible to assess understanding of specific morphological elements. However, Marta's test-taking difficulties again made it difficult to judge whether her responses were due to comprehension difficulties or to task-taking problems.

Marta failed to achieve a level of mastery on many tests for morphological forms which she uses in her own speech. Of the 11 morphological forms examined through formal testing, Marta only attained mastery level on 2, comparative -er and tense/aspect marker -ing (see Table 6). Marta's 75% performance on the plural -s items of the Noun Pluralization test seems to indicate comprehension of this morpheme, but her 33% performance on 0-marked singular forms lends doubt to this assumption since she should have been able to score well on both singular and plural forms if she really understands the function of the -s marker. This performance contrasts with her spontaneous and seemingly appropriate expressive use of the plural -s marker.

One intriguing finding is that Marta performed better on the test for lexically marked verb phrase pluralization (single-plural marked in the auxiliary than on the test with inflectionally marked pluralization. Whereas she scored 80% for singular agreement on the auxiliary singular test, she scored only 20% for singular agreement on the verb singular test.

Marta's poor performance on comprehension tests of various morphological forms would seem to indicate that she has a limited

- 70) My dad was all upset.
 - 71) Just the second friend I've ever had.
 - 72) It has like three rooms.
 - 73) Be better if I had a little respect.
 - 74) She had the ruined watch.
- Marta did not ask many questions, but when she did, she appropriately inverted the order of the subject and auxiliary, (or copula), assigning tense to the auxiliary (or copula).
- 75) Did you know my dad's in the hospital?
 - 76) Are we going on an outing, today, [name]?
 - 77) Are you sick?
 - 78) Is it her day off?
 - 79) What should I do Memorial Day?
 - 80) What should I do this afternoon?
 - 81) What's the apple juice for?
 - 82) What are you doing Thanksgiving?

Developmental Sentence Scoring: Still additional evidence of Marta's sophisticated expressive language level in the area of syntax and morphology comes from her developmental sentence score (Lee, 1974) of 16.7 which places her above the 90th percentile of the 6:11 age level, the ceiling of the test.

4.3.2. Comprehension-Morphology: As was the case with testing syntactic comprehension, the ideal way to test morphological knowledge is through formal testing, since only by isolating the

knowledge of such forms. However, her spontaneous use of these forms implies otherwise. Perhaps the task demands of the comprehension tests simply were too much for her. It should be noted, however, that the 50 2- and 3-year old children we have tested have no trouble with these same task demands.

4.4 Semantics:

In addition to examining Marta's knowledge of rules governing the structural aspects of language, her knowledge of the meaning of certain linguistic features and structures was studied. Semantic knowledge refers to that cognitive knowledge which is expressed in linguistic terms (Bloom, 1973; Schliesinger, 1974; Bowerman, 1974; Dore, 1975).

It must be noted that the word "semantics" has been used in a variety of ways in the language acquisition literature. Some researchers define the term very broadly, seeming to equate semantic knowledge with conceptual knowledge. They go so far as to describe children at the prelinguistic stage or one word stage as expressing "semantic intentions" or "semantic functions," where nonlinguistic behaviors (e.g., eye gaze, reaching, pointing) and context can combine with single words or with one another to form so-called "semantic relationships" (Ingram, 1971; Antinucci and Parisi, 1973; Greenfield and Smith, 1976). Others hesitate to assign a relational semantic structure to a word on the basis of its occurrence in a nonlinguistic context (Bloom, 1973; Schliesinger, Dore, 1975).

Table 6

Morphology: Comprehension Test Results

	M's % correct*	M's age level**	Age of mastery***
Verb Singular/Plural (marked on main verb) 2/21/80	20	less than 2	5
Singular (-s) Plural	40	2	over 8
Verbal Singular/Plural (marked on auxiliary) 2/21/80	80	5	5
Singular (is) Plural (are)	40	2	over 8
Noun Pluralization 2/21/80	33	2	4
Singular Plural	75	2	4
Comparatives 3/19/81	100	4	4
Superlatives 3/19/81	0	2	4
Possessive's 5/16/80	50	4	7
Tense/Aspect	80	5	5
-ing	40	less than 2	6
-3d			

*Marta was given a score for percent correct on each test given. Based on normative data, each score was then translated into an age equivalent score. On the most recent version of the test battery most subtests tap each target structure or feature 5 times. A score of 4 or 5 correct (80-100%) is considered evidence of "mastery".2

**Age level scores for specific subtests were assigned to Marta on the basis of the normative data. For example, if Marta attained 40% correct on a given test, the age at which the majority of children received 40% correct was considered her age level equivalence.3

***The "age of mastery" for a given structure is that age at which 80% or more of the normative population attained scores of 80% or better.

The child's ability to sort pictures on the basis of certain perceptual or conceptual features (e.g., length vs. flatness) then, would not in and of itself be considered a semantic ability, but her/his demonstrated knowledge (e.g., as indicated by an ability to generate novel forms) that a particular noun classifier should be used with words for long things while another should be used with words for flat things would be considered to reflect semantic knowledge. As Bowerman (1976) puts it, "cognitive discriminations are not automatically also semantic ones. They assume significance only when they become linked to one or another aspect of language" (p. 110). As mentioned above, I have adopted this latter, more restricted use of the term "semantics".

4.4.1 Production-Semantics:

Marta's spontaneous productions reflect that she has correctly sorted out the meanings of many forms and can use them appropriately. For example, in English such concepts as gender, animacy,

person, and number are marked on pronouns. In using pronouns correctly, one must learn how to mark these nonlinguistic concepts in a linguistic way. Marta seems to have accomplished this task. She is able to use various subject pronouns appropriately, marking them for gender, number, person, and animacy.

83) [referring to her mother putting up Christmas stockings]
She would like [adverbial "like"] nail it.

84) [describing a picture of a man lifting a baby] He's lifting up somebody.

85) [re her sister and herself] Well, we walked on the beach a bit.

86) J: Oh gosh, you are so lucky.

M: That's what they said.

J: Who said that?

M: M' folks did.

Similarly, Marta seems to have sorted out the meanings of various object pronouns.

87) [Sneezes and needs a kleenex] Would somebody get me a kleenex?

88) [re a woman speech therapist] I saw her an hour ago.

89) [M. has just mentioned that she has gone to a doctor's appointment. J. mistakenly assumes that the physician is male.]

J: Did they, he look at your eyes?

M: No.

J: Your mouth?

M: [Pause] It was a her.

90) [re a phone call to her dad] I asked him about Thanksgiving.

91) [re looking for a new car with her parents]

And when we went looking around and this Victor guy found us um, this blue car.

Of course, in addition to reflecting semantic knowledge, such pronominal use reflects syntactic knowledge. Not only does Marta use the appropriate forms to mark various semantic features, she seems to be able to use the appropriate pronoun according to its syntactic role in the sentence (e.g., subject vs. object). Only occasional errors in pronominal selection were noted.

92) The air, air she rise ...

As with her pronoun usage, Marta uses generally possessive adjectives

possible range of events in her everyday experiences rather than of her knowledge of abstract semantic features (e.g., +/-animate, +/-edible, +/-human, etc.) per se. Of course, it is probable that most language-users are also not consciously aware of such abstract features.

Marta also seems to use negative markers appropriately in spontaneous speech, reflecting that she knows how to express negation linguistically.

102) I don't have a roomer. My roommate left. Alexandra left.

103) [re Halloween] I didn't dress up as anything. I just went to school as my regular self.

In addition, Marta appropriately and meaningfully uses certain lexically coded tense/aspect markers. Thus she seems aware of how to linguistically express the notions of past and future.

104) [has eaten all her lunch] I'm finished. I'm done.

105) (we're trying to get M. to draw her family)

S: I wanna see the rest of your family [i.e., wants M. to draw them]

M: [apparently thinking S. means "in person"] Oh, they're gonna be home. (unintellig.) fast.

106) [we're getting ready to go to the zoo]. J., still in her robe, says that she has to get dressed)

M: [amused] You can't go like that. They'll kick you out.

4.4.2 Semantic relationships:

Marta's semantic knowledge extends beyond knowledge of the

correctly.

93) That's where my sister lives.

94) [re her male principal] Alls you have to do is go into his office.

95) [J. is asking M. to talk about our previous visit when M. came to visit J.'s home]

J: And then what did you do? Do you remember?

M: Went to your house.

In spontaneous conversation Marta also frequently uses

inanimate it appropriately, reflecting an awareness of the feature of animacy (except as in 92).

96) S: Is there something special about wearing blue today?
M: You just wear it anytime.

97) [re camera] The flash on it didn't work.

98) [re a picture of an apple with a bite out of it].
It got bitten halfway.

99) J: The Muppet Show's good.

M: Yes, my granddad used to watch it.

Marta's responses to semantically anomalous utterance on the sentence repetition task also seem to reveal her awareness of features such as animacy.

100) J: The book is very happy.
M: The book is very happy. People are kind of happy.

J: Can a book be happy?
M: A person can.

101) J: The pencil can't see very well.
M: The pencil can't see very...[laughs]...eyes could see.

One could argue that her reaction to the anomalies

in such sentences is merely reflective of her awareness of the

meaning of particular lexical and inflectional morphological markers. In the section on syntax (4.2) Marta's ability to use passive structures appropriately was illustrated. This ability exemplifies the fact that she is aware of the semantic relationships embodied in the passive structure. She has learned that such notions as agent, object and patient do not have invariant syntactic roles. For example, she is aware that subjects are not always agents and in fact, may sometimes be objects or patients; she seems to know that the passive structure signals a different relationship of the NPs to the verb.

- 107) J: Can an apple be eaten by a stove?
M: No, apples are eaten by people!

In the following example, Marta's refusal to repeat the anomalous sentence repetition item also reflects her awareness of the meaning of the passive structure.

- 108) J: Marta was eaten by an apple.
M: Marta was eating an apple.

4.4.3 Lexical semantics:

Evidence of Marta's facility with language is also reflected by her knowledge of vocabulary items that one would not expect of someone with an IQ in the low 40s.

- 109) J: Bachelors are married.
M: No, they live alone.
110) J: What does it mean to be a genius?
M: Smart.
111) J: What does it mean to be retarded?

M: Not smart.

Generally retardation has been associated with a poor or impoverished vocabulary (Mein and O'Connor, 1960; Wolfensberger, Mein and O'Connor, 1963; Carroll, 1964).

In spontaneous interaction Marta uses words that reflect a relatively specialized vocabulary.

- 112) [shown a picture of a bear]
Polar bear, like in the word, "Kodak." [i.e., Kodiak?]
113) [shown a picture of a bus]
Touring bus.
114) [J. has asked M. to name as many fruits as she can]
pears, ... apples, ... pomegranates.
115) [We're trying to elicit the phrase, "Go to bed."]

S: Go to
M: [Cestures sleeping, flat palms together, head resting on back of one palm]
[We ask for "words"]
Zonk out.
Sack out.

The above shows that upon seeing a picture of a bear, Marta didn't simply say, "bear," but "Polar Bear," and "Kodak" (i.e., Kodiak?). Upon seeing a bus she didn't simply say, "bus" but "touring bus." When asked to name as many fruits as she could, Marta was only able to name three (with much prompting), but one of the three was "pomegranate"! When asked to verbalize the notion "go to sleep," it is interesting that Marta was able to provide several synonyms.

It also appears that she does not always understand the meanings of all the lexical items she uses. In the "Polar Bear"

stuff of jokes and puns, but since the humor created by her remark was seemingly unintentional, it seems that this example exemplifies a limitation in Marta's understanding of this lexical item.

Marta's selection of inappropriate lexical items sometimes also reflects that while she seems aware of structural constraints and possibilities, she is not fully aware of the semantic content of the items she selects.

118) [re her watch] It was broken, desperately broken.

119) [we're at M.'s home] I haven't shown you my garage yet, but my dad would be really hard.

There are many other examples of Marta's inappropriate use of words.

120) [Marta rote counts to eleven (with help) and lauds herself]

M: Hey, Marta! You're really smart. You've really worked on that address.

121) [J. uses M.'s father's first name "Jack" on an Elicitation test item to maintain M's attention.]

M: "Jack," that's my father's last name, "Jack."

122) J: Tell me a joke, Marta.

M: Go jump in a lake.

Marta's limited understanding of the notion of "joke," is further illustrated by her own telling of a joke. The following "joke" is not unlike that of a preschooler.

123) M: An' he told such a taco joke! An' he told me this, O.K. It's about this taco, an' the taco eats the meat, and the [laughs as she talks] ta' (unintell.) over (unintell.) told a joke.

Particularly interesting is Marta's propensity to use temporal

example above, Marta's comments, "Polar bear, like in the word, Kodak (Kodiak?)," does not make sense, even if we assume that she is referring to Kodiak bears. Marta associates both words with bears, but her unsuccessful attempt to relate the two reveals less than full knowledge of the full meaning of these words.

For some words with multiple meanings or "senses," Marta appears to be aware of only one meaning. For example, as 116) shows, she seems to have at least some notion of the meaning of "die".

116) J: What does that mean when somebody dies?
M: Never seem them again.

Note however her reaction to the comment re a battery in 117).

117) [P., J.'s husband, remarks that the camera battery was dead]

M: The battery was dead?

P: The battery was dead.

M: Like John Lennon
[John Lennon was killed several months prior to this interchange]

It can be argued that there are several verbs "to die," e.g., a person can die, a car can die, etc. While various senses of "to die," are semantically related, selectional restrictions are different for the different verbs. For example, one could say that one verb "to die" can take only animate subjects, while the other takes -animate subjects. Another argument might be that there is only one verb "to die," and that application of this verb to inanimate entities is metaphorical. In either case, Marta's comment in the above example is somewhat inappropriate and even bizarre. Her juxtaposition of the two senses of verbs "to die" constitutes a rule violation that is the

and numerical terms in her spontaneous speech. In utterances containing such terms it is especially evident that while she has learned the (subcategorization) rules governing the insertion of the "right kinds" of elements into the "right kinds of places" in the sentence, she often doesn't know the meanings of the terms she uses and phrases she constructs.

The mismatch between Marta's linguistic and conceptual knowledge is well illustrated in her use of sentences containing numerical references.

124) J: How many nights did you stay there? [at a hotel with the family]

M: Oh, about 4 out of 1.

125) I was 16 last year and now I'm nineteen this year. [M. had just recently turned 16 when she made this comment]

It was noted in section 4.2 on syntax that Marta is able to elaborate upon the NP by adding as many as 4 adjectives to the noun. However, while she is able to use a number of adjectives in a given noun phrase, Marta frequently uses somewhat perseverative numerical terms to modify, particularly the cardinal terms two or three and the ordinal terms second and third.

126) It takes me two hours to get to the [name of residential home] where I live.

127) These two dogs kept going after us.

128) It has like three rooms.

129) Well, I think my mother's gotten three notes . . .

130) I did my third year at [name of school].

131) . . . 'cause this is like, my third home.

132) I said I got two friends in there.

133) Three tickets were gave out by a police last year.

In some cases the numerical references are clearly nonfactual. For example, the sentence, "It has like three rooms," referred to Marta's parents' home, a large two-story house with many more than three rooms. In many cases Marta seems simply to have "plugged in" a numerical reference into an appropriate sentence slot without regard to meaning.

Similarly, in her use of temporal adverbials, it sometimes appears that Marta knows where such phrases should be inserted into a sentence, but does not really understand or attend to their specific meanings.

134) (future adverbial) (past tense)
It's very soon that they asked us to fly out.⁴

135) (future adverbial)
It's a week from Saturday and J., A., an' my mom 'n dad--
I think
(past tense)
I brought my camera with me that week.

In the examples above Marta has utilized temporal adverbials that do not agree with the tense of the verb. Given that Marta seems to know the meanings of the tense/aspect markers, it seems that the temporal adverbials rather than the verb forms are probably being erroneously used.

Ames (1946) has noted that normal children also "mismatch" temporal adverbials with verbs, during the acquisition process when

4.4.4 Comprehension-Semantics

In real-life contexts:

At times Marta gives appropriate responses that reflect both conceptual and semantic awareness.

140) [at zoo]

J: What do you want to go see?

M: Crocodiles.

141) [The examiner is asking M. about her visit with Jn., Ms' older sister. Jn. lives near the coast; thus Ms' response is quite plausible and quite likely correct.]
J: What did you guys do?
M: Well, we walked on the beach a bit.

142) [We've been talking about M.'s sister going away to college]
J: Where did she go? Where did Jn. go?
M: She moved to another school.

143) [We're asking M. questions from the Boston Aphasia Battery]
J: When do you think we're going to stop coming?
M: Never.

Many comments and responses, however, reveal the distinction between her semantic and conceptual knowledge. Often Marta provides answers that fall within the correct semantic category or domain (e.g. a location, a date, a number, etc.), indicating that she is aware of some semantic features associated with the question. For example, her responses to when questions reveal that she understands that when means "at what point in time," and her responses to where questions indicate that she understands that where means, "at what place."

However, to give correct responses, conceptual knowledge is

they become aware of adverbials, but do not yet have a command of their meanings, e.g., "I had a bath tomorrow," and "We will do it yesterday."

Another indication of the fact that Marta uses adverbials which she does not understand is in statements which are simply nonfactual.

136) I got discharged [i.e., from the hospital] a month ago Saturday. [At this time Marta had been discharged for many months.]

That Marta uses phrases that she does not understand is further reflected by her use of idiosyncratic temporal forms which appear to be imperfect versions of "standard" temporal adverbial forms.

137) One's got married, a week [i.e., a week ago?]

138) She just died, she died a month [i.e., a month ago?]

139) Oh, frack, we finally got that new Mexican 'cause 'is flights came in Wednesday month.

The imperfectly remembered adverbial forms may be the result of her failure to fully understand the meaning of the forms.

This is not to say that Marta always uses temporal adverbials erroneously. To the contrary, she often uses adverbials appropriately and in agreement with tense/aspect forms. Note example 125) in which Marta used past tense "was" with "last year" and first person present tense with "this year." Terms such as "tomorrow", "yesterday", and "now" are all used correctly. Thus, it appears that Marta has acquired an understanding of some but not all of the adverbials that she uses in her speech.

152) J: Who's the President of the United States?
M: President Lordy.

Note that while her answers may be factually incorrect or semantically anomalous, they are often structurally well-formed, as in 8) and 150).

On formal tests:

Marta attained mastery level performance on a number of tests in the semantics area, indicating that she has comprehension of a number of specific lexical items in English, i.e., pronouns me and you; possessive adjectives my, your, his, and her; who and what; the negative not; prepositions in front of, in back of, next to, under; and assorted simple vocabulary words.

Aspects of her performance were reminiscent of normal developmental patterns. For example, she did better on earlier acquired (according to Curtiss and Yamada's norms) object pronouns than on later acquired ones. Other features of her performance were unusual. For example, while she did well on in front of, and in back of, as well as next to and under, she did poorly on in and on, which are acquired earlier than the other prepositions in the normal child. While Marta did poorly on many tests for which the age of mastery is as low as two years of age, she also did well on a few tests for which the age of mastery is 7 or 8 (who vs what; for/with).

also required. In many cases, Marta will give the appropriate type of response to a question, but her response factually may be incorrect. Often her inaccurate response reflects her conceptual limitations. For example, her great difficulties with time and number concepts (to be described in Chapter V) are illustrated in her erroneous answers.

- 144) J: [J. has just given M. two pennies].
J: How many pennies do you have now?
M: Five.
- 145) J: Is your dad married?
M: Yes.
J: To whom?
M: [mother's name]. Two years ago.
J: When?
M: Two years ago.
- 146) J: What is your phone number?
M: 794-4488 [Not her real phone number, or even close].
- 147) S: When's your birthday?
M: I think, September 2nd. They have records on it.
[M.'s birthday is actually September 12].
- 148) J: So, September 2nd, and how old were you on your last birthday?
M: I think I was nineteen, when I changed dates.
[M. was actually sixteen.]
- 149) E: What year is this?
M: It's 1976 because Nixon threw up.
[It was actually 1980 at the time.]
- 150) E: What month is this?
M: This is 1977.
[asked on the same day as the above example]

Marta's responses in informal conversation also reflect limitations in her general knowledge.

151) J: What country do you live in?
M: [name of parents' town]

Table 7 (continued).

Semantics: Comprehension Test Results	M.'s perform- Age of	
	% correct* ¹ ance level** ² mastery***	mastery***
Subject Pronouns (he, she, they)	60	5
Object Pronouns		2-3
me/you	80	4
him	33	2
her	67	2
us	0	7-8
it	0	6
them	0	5-6
Who vs. What	80	7.5
It vs. other 3rd P. Prns. (-animate)	0	2
It vs. other 3rd P. Prns. (*animate)	40	4.5
Simple Negation	100	3-4
Case marking Prepositions		8
for/with	100	5
to/from	80	4
of/by	20	6-7
Locative Prepositions		6.5
in front of/in back of	80	5
next to/under	80	5-6
in/on	22	2
Lexicon: Description II	40	2
Lexicon: Description II	80	2
Disjunction (or)	could not do	4
Before and After	could not do	5
Tense/Aspect		2
finish	40	2
gonna	0	7
will	20	7

Table 7 (continued).

Semantics: Comprehension Test Results	M.'s perform- Age of	
	% correct* ¹ ance level** ² mastery***	mastery***
Possessive Adjectives		7
her	100	3-4
his	100	3-4
my	100	4
your	100	4
our	0	6
their	0	5
Quantifiers		2
one	40	4
many	20	5
none	40	4
every	100	2.5
some	20	4
all	80	3
a few	20	2
lots of	80	no norms
		no norms
		no norms

*Marta was given a score for percent correct on each test given. Based on normative data, each score was then translated into an age equivalent score. On the most recent version of the test battery most subtests tap each target structure or feature 5 times. A score of 4 or 5 correct (80-100%) is considered evidence of "mastery."²

**Age level scores for specific subtests were assigned to Marta on the basis of the normative data. For example, if Marta attained 40% correct on a given test, the age at which the majority of children received 40% correct was considered her age level equivalence.³

***The "age of mastery" for a given structure is that age at which 80% or more of the normative population attained scores of 80% or better.

Peabody Picture Vocabulary Test:

Marta also did poorly on the PPVT, attaining an MA of only 3:11. Whereas vocabulary was one of Marta's greatest strengths when she was a young child, her failure to increase her vocabulary as she grows older may account for her decreasing level of performance in this area. Her low score on this test is also interesting in view of her ability to use specialized vocabulary items.

Summary of Comprehension-Semantics:

There is a wide scatter in Marta's performance, and it is difficult to know whether failure on a given receptive test truly reflects comprehension difficulties. As with her performance in the syntax and morphology areas, Marta demonstrated greater knowledge expressively than receptively. Marta's comprehension in naturalistic contexts and her spontaneous elicited and imitative productions provide more revealing information regarding her semantic knowledge.

4.5 Pragmatics:

The study of pragmatics in linguistics has been described as the study of the rules governing the use of language in context (Bates, 1976; Rees, 1978). In the 1970s, just around the time focus was shifting from syntactically to semantically-based studies in language acquisition, there was also a trend toward focus on social/interactive or pragmatic factors governing and influencing language. The shift away from a theory appealing to abstract linguistic categories reflected the increasing sentiment that to fully

understand language, not only must cognitive factors be considered; so must communicative functions and the context in which language occurs (Halliday, 1975; Campbell and Wales, 1970). Searle (1969) felt that speech acts rather than sentences are the basic units of language. In his view, utterances cannot be understood in isolation, but rather depend upon nonlinguistic or prior linguistic context.

Shatz (1982) points out that there are several formulations of the dependency relationship between grammatical structure and social/interactive variables. One view emphasizes the overlaying of language structure upon a pragmatic base, such that the child's task in language acquisition is seen as a mapping on of form onto previously established communicative functions. (Bruner, 1975; Carnics, 1978; Macnamara, 1972, 1977; Zukow et al., 1979). Yet another view focuses upon the role of the structure of conversation in facilitating language acquisition. Sequences of dialogue are seen as providing a framework for the learning of various structural operations. In the process of being exposed to question/answer cycles, reformulations, expansions, etc., which occur during discourse, children purportedly learn the various substitutions, deletions, and transformations which operate on structures (Snow, 1972; Keenan and Schieffelin, 1976; Newport, 1977; Snow, 1977).

Some of the grammatical rules previously felt to be purely formal in nature are now believed by certain linguists to be linked to discourse factors. Kopper and Thompson (1980) and Givon (1979) have discussed the notion that syntactic structures and the rules

governing them, e.g., main vs. subordinate clauses, passives, topicalized and elliptical structures are functionally motivated and cannot be accounted for without reference to function. Grammatical elements like pronouns have also been identified as governed by context, as are stylistic variations of utterances (e.g., See you later honey is likely not to occur between two straight businessmen). Other grammatical elements like deixis (person, place and time deixis) have been identified as being motivated by communicative or functional considerations. For example, knowledge of when to use such items as you vs. me, here vs. there, and recently vs. soon are all claimed to be governed by the pragmatic context; the perspective of the speaker and the listener govern and influence the linguistic form. Other communicative functions which are said to motivate the form of complex structures is the need to distinguish old and new information e.g., in topicalized sentences and foregrounded vs. backgrounded information (Hopper, 1979).

The range of knowledge that the child must acquire in order to use language appropriately in context is quite broad and complex. This learning begins at the prelinguistic level. The prelinguistic expression of needs, wants and intentions (Jaffe, Stern, and Perry, 1973; Bruner, 1975), early ritualized games (Cleason and Weintraub, 1975; Carvey, 1974) and action games are just some examples of precursors to expressions of the same functions linguistically. Condon and Sander (1974) speak of linguistic-kinesic interaction as a source of language acquisition. In addition, early interactive

mother/child routines which begin during the prelinguistic stage are felt to develop and become increasingly elaborated, resulting in the child's control over the structural aspects of language (Stern, 1971).

Children seem to acquire pragmatic knowledge relatively early and quickly. It has been found that young children can and do adjust their language output according to their audience, switching to simpler forms of discourse when speaking to younger children (Cleason, 1973; Shatz and Gelman, 1975), and to different registers when speaking to people in different statuses or roles (Ervin-Trapp, 1977) or to inanimate objects, e.g., dolls (Sachs and Devin, 1973). Preschool children are able to handle a wide range of grammatical features which are controlled at least partially by pragmatic factors, e.g., modal auxiliaries, pronouns, and deictic terms (Shields, 1978), and definite and indefinite articles (Maratsos, 1976, 1979). The child's ability to distinguish old and new information is evident, claims Bates (1976) even at the one word stage, when the child is able to select the word which provides the most salient part of an idea (i.e., new information) in communicating her or his thoughts. Children also show knowledge of the rules of conversation, introducing, maintaining and changing topics appropriately (Keenan, 1974; Dore, 1977). Bloom, Rocissano, and Hood (1976) observed turn-taking behavior at the two-morpheme utterance stage noting that children at this stage did not maintain or elaborate on topics initiated by adults, whereas at the four-morpheme

or 2 year stage children were able to do both. Toller and Bankson (1976) noted that the majority of responses given by 3 year olds were appropriate.

Bruner (1975) feels that the emergence of language can be best described pragmatically, but acknowledges that the mechanisms involved in the elaboration of grammar out of a pragmatic base structure must still be defined. Many pragmatically-based arguments confine themselves to accounting for only certain aspects of language, especially the earlier acquired forms. In addition, studies indicate that such social/interactive factors as Motherese are insufficient to account for language acquisition and do not disallow the nativist position (Newport, Gleitman, and Gleitman, 1977). Pinker (1979) also gives some brief but well articulated formal arguments against the adequacy of a pragmatically based account of language. Supplementing the formal arguments against a pragmatically based approach to language learning, Marta's data provide empirical evidence against a pragmatic approach. To be sure, she shows knowledge of certain pragmatically-governed rules. For example, she is able to use pronouns anaphorically, to some extent.

153) J: [re a recent M.D. appointment M. has just mentioned]
Did they, he look at your eyes?

M: It was a her.

154) Her parents are all Armenian, they don't speak English.

155) There's the principal's office [a male] and there's the clock that he uses.

156) Well, I've gotten a different teacher [a female] and I love her.

157) My hair was, 'bout, well, last time I had it, cut, it was here [pointing to her neck].

However, there are many instances in which reference is unclear.

158) J: You seem a little sad today, M.

M: It's a little sad they have left. An' I told the head leader they're not sure if (they're) gonna set it for, for eight, eighth, our time which will be as, (pauses abruptly) our time an', the girl arrives where it's one, which is in school right now.

She is deficient in numerous aspects of her pragmatic use of language. While Marta can and does talk a lot, she has failed to acquire knowledge of conversational rules such as those defined by Grice (1975). Grice posits a "conversational principle," which is, "Make your conversational contribution such as is required at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged." Four subrules or maxims of this principle are (Grice, 1975) briefly stated:

- a. Quantity: Be informative as is required, but not too much so
- b. Quality: 1. Do not say what you believe to be false
2. Do not say that for which you lack adequate evidence
- c. Relevance: Be relevant
- d. Manner (be perspicuous): 1. Avoid obscurity and ambiguity
2. Be brief and orderly

Marta violates all four subrules. The quantity of her speech is not well controlled. In addition, the truth value of her utterances is often questionable, as is the relevance of much of her speech. Furthermore, obscurity often pervades her speech.

Below is an example of how Marta's responses can be

inappropriate and totally unrelated to the topic at hand.

159) J: You have, you have a savings account?

M: Yesss!

J: How do you earn your money?

M: Well, we were taking a walk, my mom, and there was this giant, like, my mother threw a stick.

J: Wait, Marta, is that, are you telling me how you

earned your money?

M: No, we were taking the money to, my trip. To, uh, Eureka, or something, to fly or something.

It is often difficult to tell whether such "inappropriate" responses are due to pragmatic or comprehension difficulties. For example, with regard to 159), it is possible that Marta did not understand the question, "How do you earn your money?". On the other hand, such responses may also be due to lapses in attention. Closer examination of some seemingly inappropriate comments has already revealed that there may be some logical connection between Marta's response or comment and the preceding remarks. The problem is that Marta does not always clearly establish the connection for the listener. For example, on several occasions when we were discussing new cars (since her family had just purchased two), Marta began talking about going

to the dump.
160) J: How are your mom and dad?

M: They're just fine.

J: Really?

M: They got a new car!

J: What kind?

M: Blue.

J: How nice! Is it a big one?

M: Yeah, it's a station wagon.

J: A station wagon!

M: Yeah, [shivers with excitement and claps]

J: Wow, then they can take you places in it!

M: To the dump, maybe.

J: Where?

M: To the dump.

J: [mystified] To a dump?

M: Yeah, you can dump trash.

J: Why would you wanna go to a dump?

M: We have.

Marta's parents later explained to me that the topics of new cars and dumps were in fact related. When they had had their old van the family would take occasional trips up to the local dump to dispose of something, such as an old appliance. These trips were apparently a great adventure for Marta. However, now that the van was gone and the family had purchased two new cars, Marta was worried that such adventures to the dump would no longer be possible.

Discussing the new car had consequently prompted her remarks about the dump. Thus two seemingly unrelated topics had a logical connection. In these cases it seems that Marta has difficulty communicating certain pertinent information to the listener.

Still other excerpts of dialogues reflect just how difficult it is to follow Marta during conversations and indicate that there is sometimes probably no logical connection between some of Marta's topics and her interlocutor's.

161) J: is explaining to M. what we're going to do in our session today. M. just begins talking]

M: I might get my bangs (unint.) trimmed, 'cause this friend, of my mom's is away, my mom's haircutting, go to the airport, 'n my haircutting came in! An' so we haven't made one yet. Just to get (gesturing cutting at back of head) back (unint.) here, 'n one [k]! y'know, [k] (unint.) really get the, thing, the what do you call it.

S: The hair, the scissors? J: The scissors? M: I was goin' there, cross the street from where I live it's right across from, (unint.) this is S: From your new, from where you live now?

M: Yeah, an' it's really nice, me 'n this friend went there, an' I went there an' I'm (sort of sings) grad-du-a-ting from, it! I'm (sings) [slaps self as if in rhythm]

S: You're now what?

J: What are you?

M: (I think it's, they) go up to fifty an hour, a dollar an hour an' am,

S: Hh. A new class you mean, or a new place?

M: It's no, the place where I get my hair cut, pays an hour if it's a woman, I think, if it's a man it pays, he pays, five hours, I think, of work he pays, five hours, I think, of work he pays. He's out of town, so the woman works by herself, she knows where the phone is. An' this new girl my mother [ə] got was so upset, an' she didn't know any kind at work. She was brand new, an' she didn't know, she didn't even, . . .

It is THIS type of conversation which is quite characteristic of her speech that contributed to Marta's being labeled a schizophrenic in addition to mentally retarded. Marta's ability to produce complex utterances and her ability to use these utterances for efficient, effective communication do not go hand in hand. Some of Marta's inappropriate responses to the comments of others seem to reflect difficulties with presupposition and implicature.

162) [re Jn., M's sister]
 J: What kind of doctor is she going to be?
 M: A female.

163) [talking about sister having gone to camp]
 J: She went to Camp C. on her vacation?

M: Yeah.

J: Oh.

S: By herself?

M: By bus.

For example, Marta's response to (162) is true, but inappropriate. While hers is certainly a possible response, she has clearly missed the intent of the question, interpreting it in a more literal fashion. Shultz and Robillard (1980), in discussing the development of humor through intentional linguistic rule violation, call this "over-literality."

Marta's response to (163) is also inappropriate. She does not answer the actual question, seeming to attend more to the surface structural aspects of the previous utterance and less to its content by responding to one by phrase with another by phrase.

Such responses are often the stuff of jokes in which such word play is used intentionally to create humor. In Marta's case, while her responses reflect her awareness of the semantic and structural ambiguities of certain utterances, she seemed unaware that such responses were in any way inappropriate or humorous.

While Marta demonstrates an awareness of many discourse conventions and features such as turn-taking, responses to questions and comments, elaboration of a topic, and requests for information, she often fails to make use of these conventions. Conversing with Marta is often quite odd because she will sometimes remain almost completely silent except for monosyllabic grunts in response to

questions and comments, then will suddenly start off on one of her spiefs, either in response to comments or due to some internal stimulus.

Givon (1979) maintains that certain pragmatic constructions have, through the process of syntacticization and increasing automatization, become opaque, syntactic constructions. He argues that language change is motivated by pragmatic factors and cannot be analyzed without reference to such factors. He and others (e.g., Slobin, 1977) have also argued that some of the processes observed phylogenetically are also operative ontogenetically. For example, child speech, like unplanned discourse, is less marked by complex embedded structures, more by coordination, repetition, etc.

It is important to note, in discussing Marta's pragmatic competence that she grew up in a normal family environment and was thus able to learn language within a normal social context. That is, the environment provided her with the necessary social and linguistic input to acquire language normally. However, as mentioned in Chapter II, from the very beginning she did not respond in a normal manner socially. At 20 months her mother noted that she "often goes off, seems quite unfocused and unfocusable...and it's very hard to chat away to her when she responds so little." By the time Marta could talk well enough to engage in conversation she was noted to talk incessantly about topics unrelated to the linguistic and social context. Subsequent reports mention this same characteristic. Thus while there are no audiotapes of Marta from these early years, it is

clear that she has never been normal in her social interaction. Her ability to interact efficiently and appropriately seems as limited now as in her early childhood. While she can use some conversational conventions, she does not do so consistently and appropriately and shows quite a high error rate relative to normal children (cf. Section 4.6. Marta showed a 39% error rate compared to under 2% error rate for 3 year olds on CYCLE discourse analysis). She fails to respond to questions, introduces new topics inappropriately, and fails to grasp the implications of other's utterances.

Marta's difficulties with the pragmatic aspects of language are interesting in view of theories that propose that language emerges from a pragmatic base. She thus provides evidence against a functionally-based linguistic theory where communicative functions are considered the basis for structural and semantic aspects of language (Bates and MacWhinney, 1978; Givon, 1979). As evident from the above discussion, Marta's use of language as a communicative tool is extremely deficient. While she can talk a great deal, her conversational ability and her ability to use language effectively to convey a clear message are quite diminished. Mary and educational records indicate that these problems have been evident throughout Marta's development. Thus, it is highly unlikely that her syntactic or grammatical capacities arose out of her communicative capacities. A similar case was reported on by Blank, Gessner, and Esposito (1978) who studied a young boy who developed language but could not use it communicatively.

Conditional tasks: Conditionals were interesting to explore since their understanding and use seems to require the integration of syntactic, morphological, semantic, and conceptual knowledge. Given that Marta's syntactic and morphological abilities seem to outstrip her semantic and conceptual abilities I wondered to what extent this would be reflected in her understanding and use of conditionals. While the first conditional or conditional-like structures begin emerging as early as 2 1/2 years of age, the complexities of this structure are often not mastered until at least 8 or older (Reilly, 1982). Reilly (1982) found that the emergence and development of conditionals involves the complex interaction of conceptual and linguistic abilities which is revealed in the child's linguistic behaviors ranging from two years on up to eight years. While at two and two and a half, the child has not yet mastered the complex morphological features associated with conditional structures in English, she/he is already capable of conveying notions associated with the conditional, e.g., antecedence and consequence. As the child grows older, she/he elaborates and refines both her/his conceptual and linguistic knowledge to understand and produce a variety of conditional constructions. Reilly notes that the relationship is a complex one; at times conceptual development is ahead of linguistic development and vice versa.

While she did not show comprehension of counterfactual questions (see Table 8), Marta's responses to hypothetical and generic questions were generally appropriate. Counterfactuals deal with situations

that have not happened but could (See examples of counterfactuals, hypotheticals, and generics in Table 8). Perhaps this was the distinguishing feature for Marta; the ability to mentally project a situation that is not logically possible might be conceptually more difficult than thinking about a situation that is logically possible. With regard to hypothetical conditionals, Marta's type of response was characteristic with children who were five and older in Reilly's study (1982).

164) J: What if you get a bad cut?

M: If I had a cut I would find a bandaid.

Younger children generally responded with present antecedent and future consequent clauses, e.g., If I had a bad cut I will get a bandaid. Only the older children seemed able to deal with the notion of possibility as opposed to simple predictability and to mark it morphologically. The fact that some of Marta's responses fall into the categories shown by Reilly's older subjects may further attest to her sophistication in the linguistic domain.

In contrast, her ability to produce conditionals was quite deficient. On the Lion's Face task where the evaluator and subject take turns constructing a lion's face and saying, "If you put the X on I'll give you a jelly bean" (X = nose, eyes, etc.), Marta could not produce antecedent and consequent clause structures. She instead gave simple imperative commands, "Put the mouth on." Even then, her comments were simply repetitions of part of my utterance from the previous "turn" (i.e., "If you put the mouth on, I'll give you ..."). In contrast to this low level performance, Reilly found that one two

Table 8 (cont.)

J: If I were a raccoon, I would live in a tree.
 M: I would live in a tree.

[pausing after antecedent clause to get her to repeat it]
 J: If I were fat,
 M: If I were fat, pregnant.
 [J. does many repetitions of "If I were fat"; M. only repeats "I were fat"]

J: I'd be on a diet.
 M: I'd be on a diet.

Table 8

Performance on conditional tasks

Comprehension

Counterfactual "What if" - questionable comprehension

J: What if this lion had been a pig?
 M: Eat like a pig.

J: What if this lion's face had been a monster face?
 M: A bear is scary.

Hypothetical "What if" - showed comprehension

J: What if you ran across the street without looking?
 M: You would get hit by a car.

J: What if you get a bad cut.
 M: If I had a cut I would find a bandaid.

Generic "What if" - showed comprehension

J: What if you eat lots and lots of chocolate cake?
 M: You get fat.

J: What if you go outside when it's snowing without your clothes on?
 M: You get sick.

Production
 Lion's Face Task
 (to elicit antecedent/consequent structures)
 Could not produce conditional structures (see Appendix I for description of task)

Sentence Repetition Generally repeated back only the final clause of the stimulus sentence

J: If the sun comes out, the snow will melt.
 M: The snow will melt.

and a half year old could produce the full target form:

Kate (2;10): If you put on an eye, I'll give you a jelly bean.

On imitation tasks Marta generally repeated back only the final clause of the stimulus sentence, a response not commonly noted in normal children (Selligo, 1982).

165) J: If the sun comes out, the snow will melt.

M: The snow will melt.

166) J: If I were a raccoon, I would live in a tree.

M: I would live in a tree.

On the rare occasions when I could get her to repeat the antecedent clause, she generally omitted the word "If," even after repeated attempts to get her to repeat it.

167) J: If I were fat,

M: I were fat, pregnant.

(J. does many repetitions of If I were fat, M. only repeats, "I were fat . . .")

J: I'd be on a diet.

M: I'd be on a diet.

168) J: If I had been fishing,

M: I had been fishing,

J: I would have caught the biggest fish.

M: I woulda caught the biggest fish.

While Marta seemed to have trouble repeating the word "if" as well as the entire stimulus phrase, when the sentence was broken into two parts, she had no trouble repeating back the phrases, including past perfect and pluperfect forms. Limitations in her auditory memory span (discussion in Chapter V) may be relevant here. Perhaps Marta

simply could not keep in mind the lengthy stimulus sentences.

There are also very few conditional structures in Marta's spontaneous speech. However, those conditionals that do appear do not clearly indicate that she knows the meaning of such structures.

169) If her Timex breaks, that's it.

170) The place where I get my hair cut! pays an hour if it's a woman, I think, if it's a man it pays, he pays, five hours, I think, of work, he pays . . .

As mentioned above, it has been said that production and use of conditionals requires the integration of syntactic, morphological, semantic, and conceptual knowledge. Marta demonstrates in her performance on comprehension tests that she has at least a limited conceptual understanding of certain conditions. However, example (169) shows that she can generate conditional-like structures which are not altogether meaningful. Thus, it seems that the ability to produce a structure which resembles conditionals syntactically does not necessarily coincide with the ability to produce a structure which conveys a conditional sense. While conditionals may normally require an integration of various kinds of linguistic knowledge with conceptual knowledge, such an interface is not necessary: the structure of the conditional is separable from any conceptual and semantic underpinnings.

4.6 Productivity:

It might be proposed that Marta's linguistic capacity is more apparent than real, that her utterances consist primarily of

formulaic, stereotypic strings. However, certain factors show this not to be the case.

A number of Marta's sentences are unlikely to be utterances she has heard others use, as indicated by their unusual form and/or content.

- 171) I ate slow 'n' went to the beach.
- 172) [re John Lennon] He got married to Yoko. Married to a wife.
- 173) I was like fifteen or nineteen when I started moving out o' home, so now I'm like fifteen now, and I can go . . .
- 174) You see, so that's where they been the mother's accent spits right out the mouth.

In addition, Marta makes errors which indicate that she has learned various linguistic rules and that she, like a child learning language, sometimes erroneously overgeneralizes these rules. Such errors reflect that she is not simply parroting back sentences and forms she has heard.

- 175) I don't know how I caught it.
- 176) The parents of her, are, from Peru.
- 177) These are two classes I've taken.
- 178) (Item on Elicitation test)
[but here the candles have] been litten.
- 179) Did you heard . . . about my camera?
- 180) . . . it was given a month by this friend.

Marta's apparent ability to create novel, function-changing forms (e.g., through nominalization) also reflects the productive nature of her expressive language.

- 181) Father: What about the problem of you and cussing, Marta?
M: Well, big upsetness!
- 182) We went car-looking.
- 183) I don't have a roomer. My roommate left.
- 184) A new recoveress cam to [name of city college]!
- 185) An the lady, the Bullocker, very young that cut's hair. [There is a chain of department stores in California called Bullocks.]

Admittedly, Marta can be somewhat perseverative linguistically. Some often repeated phrases have been "I was so surprised," "I'll never forget that," "Look at my fat," and "Who killed John Lennon?" Such utterances are not echolalic per se, since many appear to be repetitions of Marta's, rather than someone else's utterances. Many of the formulaic expressions Marta uses are permeable (i.e., they are not "frozen"; elements within the phrases are analyzable and subject to change). For example, for weeks and weeks after Thanksgiving, Marta repeated the sentence, "Thanksgiving's coming". On my first visit following the supposedly long-awaited holiday, Marta rushed up shrieking, "Christmas Eve is coming!" Indeed, Marta tends to latch on to particular themes, e.g., eating, getting her hair cut, and her Timex watch are all topics of special interest to her. However, she is not like the high-level autistic who replays the identical "tape" On several occasions, Marta mentioned that her father had bought a new car and made references to trips to the city dump. She did not, however, use identical phrases and sentences on each occasion. Thus Marta's language is productive in spite of its

- 189) - What's that guy's name?
 - The mother of um, what's that girl's name?
 - Really get the, thing, the, what do you call it?
 - I think it was in, what was that town, [name] or something.

Below is an example of a spiel, with stereotyped phrases underlined. Most of these phrases occur frequently in Marta's speech.

For example, that she habitually uses the adjectives two and three to modify (cf. three notes, two friends).

190) It was kind of stupid, for dad, an mom got um three notes, one was a pants store, (of) this really good friend an' it was kind of hard. An' the police pulled my mother out of (there) an' told the truth. I said, "I got two friends in there!" The police pulled my mother (and so I said) he would never remember them as long as we live! An' that was it! My mother was so mad!

Possibly such spiels enable Marta to speak with a superficial fluency. Consideration of much of her speech reveals its limited scope in terms of the range of ideas and topics she can or will discuss. It has been argued that normal speakers incorporate routines and automatic phrases in their conversational speech (Pawley & Syder, 1980; Kempler, 1977; VanLancker, 1975) and that such routinization enables us to speak with fluency and rapidity so that we do not have to constantly construct "from scratch" our utterances.

We have a sizeable repertoire of prescribed phrases that we can retrieve during speech to reduce the energy and effort required for formulating sentences. Marta, too, has a repertoire of speech formulae that she calls upon, but the set seems more limited than that of the normal individual's and much less attention to meaning

repetitive themes.

While the productive nature of her language cannot be denied, Marta's frequent use of somewhat stereotyped phrases makes it appear that she simply plugs in a certain phrase into various structures, "mad libs" fashion. Out of context, many of the phrases and sentences may seem quite normal. However, the sentences were always produced during lengthy stretches of Marta's speech I have termed, "spiels." It is during such spiels that Marta produces the greatest output. Much of the speech contained in the spiels seems to contain stereotyped or perseverative chunks and phrases, unclear anaphoric reference, frequent topic switches, and imprecise articulation.

While individual sentences appear to be well-formed, they are often uninterpretable even in context. It was during such "spiels" that most of the following phrases occurred.

The examples under each number below are from various transcripts and do not reflect consecutive utterances.

- 186) - I heard the principal came back.
 - I heard United broke down.
 - I heard my psychologist is back.
 - I heard it's very sad news about . . .
 - I've heard it's very scary news about . . .
 - They finally got another man, I heard.

- 187) - It was really surprising
 - I was really surprised
 - A week ago I was so surprised

- 188) - Mrs. Smith, my principal, died.
 - Well, my grandmother died, in Minshin. [i.e., Michigan]
 - He died. Immediately died.

constituents may be omitted.

- 195) It makes me feel sad because they had to leave, 'n
(stops talking abruptly)
- 196) She was so mad at
- 197) I think (picked up) the VW that, day.
- 198) J: Who lost 50 pounds?
M: I did, at the wedding, I didn't eat my appetite
(unintellig.) my appetite was like (at the time).

Other utterances are uninterpretable.

- 199) Clean up the husband is.
- 200) She was thinking that it's no regular school, it's just plain old no buses . . .

The CYCLE spontaneous analysis (CYCLE-S) gave some quantitative measure of just where Marta's errors cluster. The CYCLE grammatical analysis indicated that Marta's syntactic knowledge of language is superior to her semantic and pragmatic knowledge. The majority of her errors were in the pragmatic aspects of language.

The CYCLE grammatical analysis revealed that Marta uses a wide range of structures and features. Of 62 grammatical categories analyzed, Marta used 56, or 90%. Her error rate for these categories was 2.7%. This compares favorably to the 51 categories used by two normal children, Colleen (7 1/2) and Michael (8 1/2), whose language was compared to Marta's. Of 24 syntactic operations analyzed (e.g., negative marker placement, equi-NP deletion, subordinating conjunctions, etc.), Marta made 2 errors, comparing favorably with Colleen's 10 and Michael's 1.

Marta used 22 of the 24 semantic categories analyzed. Her

119

and appropriateness is evident in Marta's speech, than in the normal's. Of course, the claim that normal individuals utilize stereotyped forms in discourse does not preclude the need to account for the ability to use language productively and creatively, but merely gives some insight into the processes involved in fluent speech. Similarly, Marta's use of stereotyped phrases does not negate her linguistic ability.

Errors:

While Marta produces many sentences that reflect a knowledge of syntactic and morphological rules and semantic features, her productions are not without errors. In fact, during lengthy stretches of speech Marta's language is filled with errors (see Appendix III).

Many errors Marta makes are not unlike those observed in normal children.

- 191) Now this is my (in) fact third home I've ever have lived in.
- 192) There were a Timexes.
- 193) Three tickets were gave out by a police last year.
- 194) [re. her watch] It was gaven a month (i.e., month ago) by this friend.

In examples (193) and (194), for instance, she has correctly applied tense to the auxiliary, but has erroneously also marked tense on the main verb. Also common, however, are errors not characteristic of normal language learners. For example, major

118

202) (M. hears people speaking a foreign language (not Spanish)). They're speaking Spanish, can you hear it?

error rate in the semantic domain was somewhat higher than in the syntactic area. Two samples of approximately 50 utterances analyzed separately yielded slightly different error rates; 6% and 9%. This is a fairly high error rate compared to the normal children studied thus far.

Pragmatic analysis of data from normal children using the CYCLE-S methodology revealed that normal children generally use the full range of discourse categories (see Appendix I) from an early age and have a very low error rate of only 1.38%. Two samples of Marta's language were analyzed for pragmatic knowledge using the CYCLE-S procedures and her overall error rates were extremely high, 19% and 39%. She made many errors in categories concerning topic maintenance, reflecting her tendency to change and introduce topics inappropriately. In addition, she often failed to respond to questions.

4.7 Phonology:

Marta's phonological knowledge was not extensively examined in this study. However, certain observations are briefly described below.

4.7.1 Production: Marta shows a sensitivity to the sounds of language and on a number of occasions made reference to the fact that a particular person had an accent, or was speaking another language.

201) My principal's from Germany. That's why he has an accent.

On occasion she has attempted to "speak" another language.

203) J: M., can you count for us? One....

M: Uh, deux, trois, cinco, six, (unintell.) I could understand but no Spanish. (unintell.) Spanish, I have French.

J: Can you count in English for us?

M: One, two, three, four,

J: Can you count anymore after that?

M: Uhdo, quato, cinco, ses.

Note the mixing of French and Spanish and the quasi-Spanish words.

As stated in the case history, Marta's family spent a year in France when Marta was 8. At that time she apparently picked up numerous French phrases and words and learned some French phonology. Vestiges of this knowledge still remain.

204) S: How do you say your name in French?

M: [mɔʁt'a], a boy that name which I've taken, um, in France, which is called, "madame", /madám/ an' "woman in France is "muh'dum" [mœdúm]. Like the accents . . .

S: What are men called?

M: They're called "monsteur," [mœsjœr] "monsieur" [mœsjœr].

S: Very good!

M: Very good French I've ever spoken, lived in there. I should know some.

S: Well you used to know a lot of words.

M: We used to, I used to. Yeah, so Rheims [ʁɛ̃] is kinda nice, France . . .

In pronouncing "Rheims" she was able to give a fairly accurate pronunciation, including use of the French uvular [ʁ]. It may also be noted that in addition to being aware of a difference between French and English pronunciation, Marta is aware of differing stress patterns.

In English, Marta's production of isolated words seems fairly normal although in connected speech she tends to mumble and slur the words and her intonation and pause patterns appear to be at times rather bizarre.

4.7.2 Receptive Phonology:

Marta's performance on the receptive phonology test revealed that her ability to discriminate phonological contrasts is normal. Of the 156 "illustrated" minimal pairs presented to her, Marta correctly distinguished 143, or 91.7%. The items she missed may be due to her lack of knowledge of some of the vocabulary items on the test (e.g., muscle vs. muzzle) or to difficulties in interpreting some of the test pictures.

4.7.3 Auditory closure (ITPA):

On this test the examiner reads a list of words with syllables

or sounds omitted and the subject must guess the word, e.g.,

airpla / tele / one re / ig / . / ator

This test taps part/whole perception through use of verbal elements. That is, upon being presented with a part, the subject must project the whole on the basis of this partial information. This ability seems linked to phonological knowledge in that in order to project a whole word from a part, the individual must have an underlying representation of the word and an awareness of the set of possible elements that can fit into particular "slots" within a word.

Part/whole integration was also tested in the nonlinguistic domain through administration of the Perceptual Integration Test (Elkind, Kogler, and Co, 1964) and the ITPA Visual Closure subtest. Marta's part/whole integration capacities could then be compared across cognitive domains, i.e., language and nonlanguage perception.

Marta's raw score on the auditory closure subtest of the ITPA was 18, giving her an age score of 6:1, the highest age level score she attained of all the ITPA subtests she was given. This score contrasts with Marta's preschool level performance on the nonlanguage part/whole perception tests (listed in Chapter V). Thus, it seems that Marta's part/whole perception for linguistic input is different from that for nonlinguistic input.

4.8 Summary of Language Performance:

4.8.1 Production: It should be evident from the preceding sections that Marta's language is rather well developed, particularly in the

areas of syntax and morphology. Expressively she is capable of producing forms and structures characteristic of a child of at least 5 or older. Some indicators of the sophisticated linguistic level of her internalized grammar are her use of passivization, of various kinds of subordination, and of morphological markings for such features as agreement, pluralization, and tense and aspect.

Other aspects of her language are not as advanced. Her semantic knowledge for example, seems to lag behind her syntactic and morphological knowledge. Marta's utterances are sometimes semantically anomalous. There are several possible reasons for this. Such structures may reflect a lack of semantic (but not conceptual) knowledge, or alternatively, a lack of conceptual knowledge which is then reflected semantically. An example of deficits in semantic knowledge without deficits in conceptual knowledge might be a child who knows gender distinctions conceptually but does not yet show knowledge of linguistic forms (e.g., pronouns) associated with gender. Marta's anomalous utterances may reflect one or the other or both problems.

Most of Marta's semantic difficulties seem to reflect problems in lexical semantics. In example (205), for example, Marta erroneously uses the term address.

(205) (Marta rote counts to eleven (with help) and lauds herself)

M: Hey, Marta! You're really smart. You've really worked on that address!

It is quite possible that she has a nonlinguistic conception of address or rote-counting, but is confused as to which linguistic term goes with the appropriate nonlinguistic concept. However, this is difficult to verify.

In most cases it seems that Marta's semantic errors reflect her conceptual deficiencies. For example, she has conceptual difficulties with numbers and some temporal notions, as will be discussed in Chapter V. These conceptual difficulties understandably make it difficult for Marta to correctly associate the appropriate linguistic terms with the appropriate conceptual notions. Such conceptual difficulties apparently do not, however, preclude the learning of at least some of the structural properties of the linguistic terms (i.e., syntactic properties). Marta has thus been able to figure out where to use certain forms and phrases for which she does not know the full meaning and for which she lacks conceptual understanding. While semantic knowledge and conceptual knowledge seem closely linked, syntactic knowledge appears to be more independent.

However, this is not to say that semantic level and cognitive level are synonymous; there is also a separation between Marta's conceptual and semantic knowledge systems. This is illustrated by Marta's production of sentences that are well-formed syntactically and semantically, but which reflect conceptual confusions. Thus, when asked who the president is Marta can name a president, or when asked when an event happened, she can name a point in time, but due

to her conceptual limitations or lack of nonlinguistic knowledge, she is unable to provide the correct response.

Marta's language is definitely productive, as reflected by her capacity to create novel utterances, and by her production errors, which often look very much like those made by children during the language acquisition period (e.g., rule overextension).

Marta is able to use her language communicatively as well as referentially to the extent that she utilizes it to obtain and give out information. Pragmatically, however, her language use is deficient. While she has on varying occasions exhibited an awareness of certain communicative devices that contribute to a pragmatically-appropriate interchange, Marta often fails to use these devices. It is difficult for her to tell a coherent story of a past event, reflecting a lack of awareness of what and how much information to supply the listener. In some respects Marta is doing what normal children do at certain stages of language acquisition. However, she has much more difficulty using language communicatively than the normal child who is functioning at a parallel linguistic level. There is a discrepancy, then, between her knowledge of the structural aspects of language and her understanding and use of language.

4.8.2 Comprehension:

The results of formal comprehension tests indicate that Marta has a very scattered and abnormal comprehension profile. Her

performance on these tests shows a wide scatter in age level, ranging from below 2 years to above 8 years. On many tests she performed at or below the 2 year level.

One possibility is that the tests were not in fact testing what they purported to test, i.e., comprehension of specific structures and features. Perhaps the conceptual demands of the tasks were simply too great for her. Often Marta tended not to look carefully at each answer choice, sometimes perseverating and pointing to the same location in the array on each item. In addition, as mentioned above, at times she seemed to attend to only part of the test sentence.

Some of these problems were dealt with by explicitly pointing out each answer choice on each item before allowing Marta to respond (Shorr and Dale, 1981 have also used this approach) or asking Marta to repeat the test sentence prior to responding. Part of the problem, point out Shorr and Dale, is the nature of the pointing task. In reading a test sentence to a subject and asking her/him to consider choices in any array which correspond to that sentence, the researcher is creating a situation quite unlike what goes on in true language comprehension. Usually, upon hearing an utterance we ascribe some meaning to it, be it correct or incorrect. What such tests may in fact be measuring is "reflectivity," claim Shorr and Dale, the capacity to consider and reflect upon a situation and various alternatives. Reflectivity, undoubtedly necessary in problem solving, is depressed in the mentally retarded. Thus, perhaps this

nonlinguistic factor contributed to Marta's poor performance on comprehension tests.

Marta's performance on formal comprehension tests may tell us as much or more about her nonlinguistic limitations as about her linguistic ones. On many tests she performed more poorly than the two year olds in the CYCLE's normal sample. This indicates that she had more difficulty dealing with the tasks than the much younger normal children. Indeed, whereas the young preschooler may have a brief attention span and may be easily distracted, even the two year olds generally seem curious and motivated by the CYCLE test materials. While Marta's productive language capabilities surpassed the normal two and three year olds', her test taking capacities were worse. In the test setting Marta lacked the alertness and spark of enthusiasm so characteristic of the young child. Her attention span was sometimes longer than a preschooler's but she worked at a much lower energy level, needing to be frequently prodded to look at the test materials, to pay attention, etc.

Despite the problems noted, it should not be assumed that formal test results do not give at least some insight into Marta's language abilities. In some cases the poor test results probably reveal an actual lack of comprehension of particular forms. For example, in spite of the fact that Marta frequently uses locative prepositions expressively, she did poorly on formal receptive tests for the same prepositions. Close examination of her expressive use of some of these forms reflects that she does not always use them

appropriately. Thus, in certain cases, her low test scores may indicate a true comprehension deficit. Tests alone, of course, should not be the sole determinant of one's abilities or knowledge. Converging evidence of different kinds is needed. In Marta's case especially, results of formal testing are only useful when viewed alongside her spontaneous language performance.

4.8.3 Comprehension vs. Production:

With regard to the question of the relationship between Marta's comprehension and production, it appears that there is indeed a discrepancy, with production exceeding comprehension, although the gap is not as wide as a comparison of performance on receptive language tests and spontaneous production would imply. Nonetheless, it does seem that Marta uses lexical items and phrases that she does not fully understand, although she seems to have a sense of where to use the items syntactically. To be sure, young children acquiring language do this as well (e.g., Ames, 1946; personal observation), but the production-exceeds-comprehension status of given lexical items is a transient phenomenon. For Marta, it is likely that the production-exceeds-comprehension status of many lexical items has persisted for years.

Notes

1. Transcription notations:

- M = Marta
- A = M's sister
- Jm = M's sister
- J = Jeni
- S = Susan Curtiss
- F = Father

(unintellig.) = "unintellig." or "unint." in parentheses indicates a phrase or word that is unintelligible on the audiotape.

(X) = an item in parentheses within an example, indicates that we think this is what was said at this point.

X = an underlined item highlights it to illustrate a point being made in the text.

X = a double underlined item reflects emphasis made by the speaker.

, = a comma indicates a pause.
(a comma followed by a long space indicates a long pause.)

. = a period indicates sentence final intonation.

[] = phrases in square brackets give contextual notes.
letters in square brackets = a phonetic transcription.

2. Some of the subtests Marta was given had not yet been revised to the 5-item format at the time of administration. Thus, her percentage scores shown in Table 5 sometimes are not uniform 20% increments (i.e., 20-40-60 etc. %). In these cases the criterion of 30% or better performance is still used as an indicator of mastery.

3. Marta could earn an age level equivalence above the age level of mastery on a given test if, for example, she had a 100% score and 80%

of 7 year olds earned only 80%, and only 80% of the 8 year olds (the oldest normals tested thus far) averaged 100%. In this case, while the age of mastery is at the 7 year level, Marta would earn an 8 year equivalence.

4

Pam Munro maintains that this sentence is grammatical, analogous to, "They asked us to fly out very soon." I still think there's something strange about the apparent cleft construction, "It's very soon that they asked us to fly out", just as I would find "It's frequently that they asked us to come," or "It's all the time that they called us" a bit odd. Odd or not, I agree with Pam that example 134) may in fact be grammatical. I had assumed that Marta had simply juxtaposed the sentences "It's very soon" and "They asked us to fly out" to construct the more complex sentence. But, given Marta's ability to use quite complex structures, it is possible that the cleft reading is correct. In any case, it is impossible to tell what Marta meant from context since she was off on a "spiel" (see 4.1) at the time she made this utterance (see Appendix III).

CHAPTER V

5.0 Nonlanguage cognition

This chapter focuses upon Marta's nonlinguistic cognitive abilities, exploring just how developmentally advanced she is in nonlinguistic areas, especially those areas that are hypothesized to be prerequisite to or "homologous" with language. As stated in Chapter III, Marta's nonlanguage cognitive abilities were examined by administering formal tests and observing her in naturalistic settings.

Section 5.1 examines how well Marta did tests that reveal her developmental level in terms of Piagetian stages. This includes her performance on sensorimotor and concrete-operational tasks developed by Piaget and his colleagues as well as on other tasks which have been described in Piagetian terms (e.g., stereognosis, Laurendeau and Pinard, 1970). Section 5.2 examines how well Marta did in specific areas that have been linked to language, such as hierarchical construction, rule abduction, and memory. Section 5.3 gives Marta's performance on selected neuropsychological tests. Subsequent sections discuss how her general nonlinguistic abilities overall compare to her linguistic abilities.

Marta was difficult to test in the nonlinguistic domain since she sometimes seemed to have difficulty with task-related demands (as was the case in the linguistic domain). Some of the tests were given

several times to increase the chance of obtaining valid and reliable results. The nature of the tasks was extremely varied. Generally tests were presented in the form of games to increase their appeal. Marta was usually quite willing to participate.

5.1 Tests based in Piagetian Theory

The Piagetian structuralist or constructivist theory has provided a comprehensive framework for the study of the development of cognitive processes, and has influenced theory and research in the fields of psychology, psycho-linguistics, and education. In both the original formulation of the theory and its various modifications, language is seen as one expression of more general cognitive capacities. Many recent alternative models of cognitive development have been claimed to be potentially compatible with a Piagetian model, and it has also been suggested that new developments can simply be incorporated into the general Piagetian framework, especially in view of Piaget's recent revisions of his own theory (Halford, 1978; Beilin, 1980). For example, the theory has remained fairly indomitable in the face of new approaches to cognitive development which have arisen out of mathematics (e.g., category theory, cited in Beilin, 1977) and computer technology (e.g., information processing and artificial intelligence models). Because of the widespread support for this theory and its claims regarding the language/cognition relationship Marta's performance on various Piagetian tasks was surveyed.

stages in his theory of cognitive development. Piagetian scholars assume that each phase is linked to language in some significant way.

A. The Sensorimotor Stage

According to Piaget, the sensorimotor stage lasts from birth to about two years. It is in the latter stages of this sub-stage that initial developments relevant to the subsequent emergence of language, are said to appear. Whether these developments are viewed as necessary and sufficient conditions or simply necessary, depends upon the views of the particular researcher.

In the earliest phases of the sensorimotor stage the child's behavior is considered essentially pre-cognitive since it "depends on responding to the stimulus as presented rather than as represented or interpreted by cognitive activity. Thus, early sensorimotor behavior lacks the representational component of true cognition" (Halford, 1978). The so-called "pre-cognitive" behaviors consist of basically reflex-like activity, e.g., sucking, crying, and swallowing. However, these simple reflexes undergo modification and elaboration as soon as the child begins to interact with the environment.

Sensorimotor interaction with the environment results in the acquisition of certain basic concepts, e.g., means-ends knowledge, the object concept, and semiotic functions, and it is these concepts that are considered by Piaget and his followers (e.g., Sinclair (de Zwart), 1971, 1973, and 1975ab) to be critical to subsequent cognitive developments such as language.

In stage 5 (12-18 months) of the sensorimotor period the child

5.1.1 The relationship between language and cognitive stages

In considering the relationship between language and cognition some have assumed that the link between the two areas can be characterized in terms of a link between language attainments and Piagetian cognitive stages (Sinclair, 1973, 1976b; Ingram, 1973; Tremaine, 1975). It should be mentioned, however, that there is some debate as to whether the notion of "stage" is a useful heuristic (Brainerd, 1978). The classic concept of stage embodies the idea that there are clearly demarcated phases in child development with each stage characterized by a "different kind of psychological structure" (Ginsburg and Oppet, 1969). Some criticisms leveled at a stage theory of development are that it sets up artificial constructs, that cognitive development actually proceeds in a smoother, more slowly evolving fashion. As Flavell (1978) puts it,

"human cognitive growth may simply be too contingent, multiform, and heterogeneous--too variegated in developmental mechanism, routes, and rates--to be accurately characterized by any stage of the Piagetian kind."

Fischer (1978), while criticizing the specifics of Piaget's stage hypothesis, argues that the stage notion is nonetheless a useful one which should be retained. Indeed, it seems clear that qualitative changes in cognitive structure do occur in development. What needs to be addressed is whether these changes correspond in some significant way with language development. Piaget's stages provide a useful framework for making this comparison.

Piaget specifies four, age-related, invariant developmental

is said to become innovative, exploratory, and adventuresome in her interaction with the environment, discovering new means to familiar ends. These emergent abilities have been described as the earliest, most primitive forms of problem-solving. In addition, means-ends behavior is seen as possibly precursory to tool use, which in turn has been linked to language development (Bates, 1979). Bates proposes that tool use and symbolic activity in children "involve some common structural capacities for part/whole analysis and substitution of parts within those wholes" (p. 322) . . . "a capacity that must be shared with symbols in language and in play" (p. 331).

It is claimed that further reflections of the child's emergent representational capacity are evident in her evolving object concept. She now can conceptualize that the object has an existence and life outside her own, understanding that the object can make a sequence of movements outside her perceptual awareness. Thus, if an object is surreptitiously moved to alternate hiding places, the child will systematically search for it in all possible places even if she has not herself seen the displacements. The attainment of object permanence has been linked causally and chronologically to single word acquisition. For example, Bloom (1973) claims that her child Allison did not begin to use words for objects in a stable, consistent manner until around 18 months, when object permanence usually emerges. Corrigan (1978) also noted that Stage 6 object permanence is linked to the child's ability to comment upon an object that is no longer in

view or one which has reappeared (e.g., "all gone").

Stage 6 (18 to 24 months) has been described as the transition to the next period of development in which the infant is able to use mental symbols and words to refer to absent objects. A crucial development of this stage is the emergence of the ability to mentally represent an absent object or action. The child is also said to develop the capacity to mentally differentiate between the symbol and its referent, i.e., the item (or complex of items) the symbol stands for. This newly developed ability for representation is called the "semiotic function." The child is now capable of "deferred imitation," where behaviors the child observes can be re-enacted in detail at some later time. Symbolic play also emerges during this period as yet another example of the semiotic function. The child may hold a piece of bread crust in the air, make motor sounds, and say, "airplane," or, holding a piece of clay, say, "cookie." It is claimed that such abilities have obvious relevance to language since language involves the ability to represent and symbolize. In fact, mental representation is claimed by some to be the primary prerequisite for language (e.g., Sinclair, 1975; Morehead and Morehead, 1974). Others have observed that the onset of language acquisition correlates with the more "dynamic" aspects of sensorimotor intelligence such as means-ends behavior (Snyder, 1975).

In view of the critical role which sensorimotor achievements are assumed to play in language development, Marta was given various sensorimotor tasks. Marta succeeded on all tasks for object-

permanence and means-ends behavior (Uzgirls and Hunt, 1975). Thus, she appears to have attained Stage 6 of the sensorimotor stage, knowledge considered by some (Piaget, 1980; Sinclair, 1976) to be prerequisite to language acquisition.

Thus Marta's case itself does not challenge the claim that sensorimotor achievements are at least necessary for the emergence of language. It is likely that some awareness of the world and of objects and their properties is necessary for language acquisition. However, there is already evidence from other sources that sensorimotor knowledge is neither sufficient or even necessary for language acquisition. Goldin-Meadow, Seligman, and Gelman (1976) for example, note that while the production of object words may not occur until 1 1/2 years of age when object permanence is supposedly just coming in, the comprehension of object words comes in much earlier. Huttenlocher (1974) too, reports that comprehension for object words can develop as early as 13-14 months.

Previous research has already demonstrated a discrepancy between the emergence of mental and syntax representation, reflecting the lack of a causal or temporal link between the two abilities. Some children seem to acquire a degree of representation long before the emergence of syntax (Huttenlocher, 1974; Corrigan, 1978), while others begin combining words prior to demonstrating a representational capacity (Corrigan, 1976; Ingram, 1975; 1978). Studies of children learning American Sign Language as a native language also challenge the assumption that language development must wait for the attainment of

sensorimotor knowledge. Single signs have been reported to emerge as early as 5 months, and there have been some observations of children using multi-sign utterances at 10-12 months (Schlesinger and Meadow, 1972; McIntire, 1977) long before the time the putative cognitive prerequisites appear.

The case of "Antony," (Curtiss and Yamada, 1981) also indicates that sensorimotor achievements may not be prerequisite to language acquisition. While it was highly questionable as to whether Antony possessed the requisite sensorimotor abilities (at the age of 6-7), he demonstrated a well-developed linguistic ability.

In the Piagetian view the sensorimotor period provides an all important basis for the learning which takes place in subsequent stages of development, i.e., the pre-operational stage, the concrete operational stage, and the logical or formal operational stage. Each stage of development is assumed to build upon the achievements of the previous one. Marta's case is especially relevant to claims regarding links between the concrete operational stage and language.

B. The Pre-operational Stage

The pre-operational period roughly spans the 2 to 6 year level. Pre-operational behavior is often defined as the absence of cognitive principles characteristic of the following stage; the concrete operational stage (ages 6 or 7 to 11), e.g., reversibility and decentration (see 5). There are, however, some definite developments characteristic of this developmental period. The child is said to continue to develop abilities which emerged at the end of the

In addition to this "spatial decentration," operational children also demonstrate a "temporal decentration" (Flavell, 1977). Whereas the preoperational child had trouble focusing on anything but present states, the operational level child is able to keep track of all past, future, and present states and the operations which produce them. She is able to mentally refer back to previous states and to project potential future states. Furthermore, the operational child's mental operations are "reversible." In other words, the child is able to mentally undo an operation (inversion) and is aware that certain factors in an operation can compensate for others (compensation).

Several abilities felt to be crucial indicators of concrete operational intelligence are conservation and seriation. In conservation tasks, quantities are manipulated and the child must make judgments as to whether the manipulations or operations are relevant to the quantity dimension in question. Reversibility and decentration are required to make the correct judgments.

Seriation is the ability to systematically arrange a collection of items along a specific dimension along which they differ, e.g., size. The ability to perform seriation tasks thus requires an ability to see relationships among items of a collection. The end result of seriation is said to constitute a "good form" (Inhelder and Piaget, 1964) and as such, involves more of a perceptual capacity than say, classification.

Seriation requires reversibility since one must be able to see the relationship of a given item in several "directions," i.e., the

sensorimotor period, i.e., imitation, play, drawing, and mental imagery, in addition to language. Language acquisition, of course, is a significant achievement of this cognitive stage.

At the pre-operational stage much of the child's reasoning is described as pre-causal, pre-logical, and basically intuitive. Then, with the onset of concrete operational intelligence, between the ages of about 6 to 8, a marked transformation is said to occur in the child's thinking. The child reasons in a qualitatively different, decidedly more mature fashion, at least from an adult's standpoint.

C. The Concrete Operational Stage

This developmental stage is said to span approximately the 6 to 11 year period. Whereas the preoperational child made judgments on the basis of superficial perceptual phenomena, the concrete operational child uses mental operations to solve problems. Thus, if shown two equal sticks which are then placed in a perceptually deceptive T configuration so that one looks longer, the concrete operational child can resist the perceptual trick and reason that the sticks are still of equal length. Also, whereas the preoperational child had difficulty focusing on more than one feature of a problem at a time (i.e., showed centration), the concrete operational child is able to attend to numerous features simultaneously in problem solving. Thus, when water from a tall narrow glass is poured into a short wide glass, the operational child, able to attend to both the height and width of the glasses, can reason that the amount of water is unchanged.

item is at once larger (longer, heavier, etc.) than some items in the series and smaller than other items.

It is claimed that certain linguistic structures reflect the concrete operational features of reversibility and decentration. These nonlinguistic features are either assumed to be prerequisite to particular linguistic attainments (Ingram, 1975) or to reflect common underlying mechanisms (Beilin, 1975).

Decentration, for example, is evident in the child's ability to use coordination, in that the child is able to attend to several features simultaneously (It's tall and it's thin). Sinclair (1969) noted that in contrast, nonconservers tend to use undifferentiated terminology to describe materials which differ in two dimensions. For example, if shown two pencils, one short and thick and the other long and thin, the nonconservers would describe both as "big," purportedly attending only to width and length, respectively.

Reversible operations are purportedly reflected in the ability to use comparative and superlative constructions. Whereas nonconserving, preoperational level children use absolute terms to describe a series of seriated items (either the items are "long" or "short", for example), conserving, operational level children are able to use comparative terminology. The feature of reversibility is evident in that the child, having just identified the sticks from shortest to longest as, "short, longer, longer, longer..." is then able to start at the longest stick and say, "long, shorter, shorter, shorter ...", thus labeling sticks she has just previously called

"longer" as "shorter."

The feature of reversibility is also claimed to be evident in the child's use of temporal terms and concepts (Beilin, 1975). Ferreiro and Sinclair (1971), for example, found that pre-operational children are unable to reverse linguistically the sequence of two temporally ordered events. They observed that when children were shown a sequence of actions involving two dolls and then were asked to describe the actions mentioning the second event first, that pre-operational children had great difficulty. The youngest children studied (about 4 1/2) either seemed to ignore the instructions (giving a description that retained the temporal order) or simply mentioned the two actions without any temporal indicators (e.g., "He went upstairs and she washed him.") Children of about 5 1/2 attempted to use temporal indicators but also had difficulty with the task. Upon questioning, Ferreiro and Sinclair established that the children knew which event came first, but simply could not encode or perform temporal reversals linguistically.

The capacity to do reversible operations has also been proposed to account for the older child's capacity to produce certain more advanced linguistic structures (e.g., Ingram, 1975).

The attainment of concrete operational thinking has been considered prerequisite to the acquisition of many complex structures such as passives (Baldie, 1975; Beilin, 1975; Sinclair and Ferreiro, 1971), productive nominalizations (Ingram, 1975), cleft constructions and other embedded constructions (Ingram, 1975). Acknowledging that

tasks for solid continuous and discontinuous quantity (Uzgoris, 1964). Wallach et al. (1967) found that 55% of children conserved for liquid quantity by age 7:8.

Her responses on length tasks were more difficult to interpret, since out of four administrations she gave conserving responses on two occasions (in the second and third administrations). To explore whether her conserving answers were fortuitous, care was taken in the fourth administration to phrase the same/more test question such that the final clause of the question did not contain the conserving or right response. This would rule out the possibility that echo responses would resemble conserving answers. On this occasion, Marta (who was particularly alert and attentive) gave non-conserving responses to all questions. By age 9, 67% of normal children who were given similar length tasks, demonstrated conservation abilities (Lovell et al., 1962).

2. Seriation as an indicator of cognitive level

When given seriation tasks using rods of varying lengths (see task description in Appendix II), Marta was unable to draw a prediction of how the rods would look in seriated order and was unable to seriate the rods. Her most successful predictive drawing consisted of a series of parallel lines of roughly the same length and color. Marta's performance was thus at Stage I, a pre-school level.

Thus, Marta failed on two types of tasks which are strong indicators of concrete-operational intelligence, indicating that she

such linguistic structures often appear earlier than the concrete operational period, Ingram (1975), hypothesized that while pre-operational children may use such structures, they do not yet use transformational rules to "generate them". Complex sentences which the child produces at this stage are, according to Ingram, quite infrequent and are generated by a Phrase Structure grammar rather than transformationally (e.g., I want to + VP). In the concrete operational stage the child's grammar is hypothesized to undergo a major restructuring involving a shift from a phrase structure grammar to a transformational one. Restructuring or reorganization has been considered in various aspects of the grammar; syntax (Brown, Cazden, and Bellugi, 1968, Ingram, 1975; Clark, 1974, 1975; Bowerman, 1982), morphology (Ervin, 1964; Bloom, Lighter, and Hafitz, 1980), phonology (Ferguson,), and the lexicon (Bowerman, 1974, 1977a; 1982). However, the timing of this putative restructuring has not always been found to coincide with the period of concrete operational thought. Bowerman, for example, in studying complex sentences, found evidence of restructuring already by age 3 1/2, long before concrete operational intelligence is supposed to emerge. Farisi and Antinucci (1971) and Brown (1973) have also claimed that knowledge of transformational operations involved in embedding comes in much earlier.

1. Conservation as an indicator of cognitive level

Marta did not conserve for solids or liquid quantity, weight, or number. After age 8:11 85 to 90% of children succeeded on similar

is at a pre-operational level.

3. Spatial abilities

The development of spatial reasoning and concepts has been shown to reflect the same cognitive principles evident in other areas of cognition, e.g., reversibility and decentration. A copying task and a stereognosis task gave some idea of Marta's spatial concepts and whether they correlated with her performance in other cognitive areas.

a. Copying: On the Piaget and Inhelder (1967) copying tasks Marta performed at the IB-IIA stage, roughly the 3 1/2 to 4 year level. At this stage in copying, curved lines begin to be distinguished from straight sided lines but the square and triangle are still indistinguishable.

b. Stereognosis: On the Stereognosis test (Laurendeau and Pinard, 1970) Marta did fairly well on part I which involves palpation of familiar objects. She scored 6 out of 11 when asked to name the object palpated and 11 out of 11 when asked to point pictures of the items palpated. On part II involving palpation of topographical shapes, she scored 6 out of 12 when asked to point to a picture of each shape palpated and 4 out of 12 when asked to point to a duplicate shape in an array. On part III involving palpation of Euclidean shapes, she scored 4 out of 12 when asked to point to a picture of each shape palpated and 5 out of 12 when asked to point to a duplicate shape. This performance is at the IB-IIA stage, or 3 1/2

year to 4 year level. Thus, Marta's performance on these two tests additionally reflects that she is functioning at a pre-operational level.

4. Classification as an indicator of cognitive level

Yet another indicator of concrete operational level intelligence is classification. While the development of classification (as well as seriation) has been traced by Piaget and his colleagues (as well as others) from the pre-operational and even sensorimotor periods on up, it is generally at the concrete-operational level that these abilities are claimed to become fully developed. Inhelder and Piaget argue that classification and seriation abilities originate in perceptual and sensorimotor structures, the most elementary cognitive structures, and while the development of these operations is independent of language, language may be dependent upon them.

According to Inhelder and Piaget (1964), early classificatory skills (Stage 1) seen in the pre-school child (2 1/2 - 5) are nonhierarchical. Inhelder and Piaget refer to "graphic collections" by the young child, i.e., the organization of materials in a syntagmatic fashion. Thus, if given a toy tree, man, flower, and woman, the child may group the man with the tree and the woman with the flower saying, "The man is standing under the tree," and "The woman has a flower," instead of classifying the items along shared attributes (e.g., vegetation, humans). Also, when given assorted geometric shapes to classify, the very young child may make groups of identical formations, e.g., groups of triangles atop squares to make

"houses."

In contrast, the older child of 4 or 5 to about 7 seems to be able to classify on the basis of a given feature (e.g., color, shape, size), i.e., paradigmatically, but has difficulty dealing with several features at a time. For example, while she/he can make piles of squares and piles of red things, she may have difficulty making piles of red squares.

Generally, when given circles and squares of different colors (red or blue) and sizes (large or small) Marta was not able to do a spontaneous sort. She was able to sort by color when specifically asked to do so. However, she was not able to shift tasks and sort by size or shape even upon repeated prompting. Kendler and Kendler (1962) found that pre-schoolers were able to do such reversal shift tasks. Inhelder and Piaget (1958) found that 56% of the 7 year olds were able to sort in at least two different ways (e.g., first by color, then by shape).

Recently Marta showed the ability to sort items along several dimensions, however. When presented with a set of colored shapes and asked to "put them into groups, Show me which ones belong together," Marta made four piles; red circles, blue circles, red squares and blue squares (each pile containing both large and small shapes). Thus, while she ignored the feature of size, Marta showed the ability to deal with color and shape simultaneously.

In being able to sort colored shapes along two dimensions simultaneously, she was performing at a late-preoperational even early

concrete operational stage. However, it should be noted that Sugarman (1979; 1981; 1982) is studying classification abilities in pre-schoolers found that using her methodology, children aged 24 to 36 months were able to attend to two features in sorting tasks also.

The child with advanced classificatory abilities characteristic of the concrete operational stage is better able to deal with several classes simultaneously and to conceptualize subclasses as well as subordinate classes, i.e., to grasp hierarchical relationships. The child at this stage is thus able to deal with "class inclusion" whereby all members of one class are contained in another, but not vice versa (e.g., all roses are flowers, but all flowers are not roses). Marta failed all class inclusion tasks, indicating that she may have difficulty manipulating the hierarchical relationships among the classes and subclasses involved (e.g., apples, oranges, fruit).

Thus, Marta's performance on certain classification tasks was intriguing, since in some respects her performance was very immature (e.g., she could not shift tasks) while in others it seemed relatively more advanced than any other nonlanguage area examined.

5. Other areas

Marta's low level of performance in several other cognitive areas further confirmed that she functions at a preschool level or lower in many nonlanguage domains.

a. Representational abilities: In so far as language has been viewed as just one expression of a general representational capacity

evident in other areas (Piaget, 1951; Nicolich, 1975, 1977) Marta's abilities in several semiotic areas were examined for comparison purposes.

Play: Marta's interaction with objects is extremely deficient when compared to that of normal children. Thus, her play behavior was difficult to assess. When shown a new or unfamiliar object she demonstrated minimal interest in it, and needed prompting and encouragement to explore it. Marta's lack of exploratory behavior with regard to objects in her environment may be linked to the factor of "cognitive motivation" (Haywood and Wachs, 1966; Haywood and Weaver, 1967; Haywood, 1971; Dobb, 1967). Two sources of cognitive motivation have been described, intrinsic sources which cause people to explore and learn from an inherent desire to do so, and extrinsic sources, which cause people to learn for external reasons like material gain, comfort, and safety (Haywood, 1971; Odom-Brooks and Arnold, 1976). Retarded individuals have been noted to lack intrinsic motivation, failing to show the curiosity and exploratory behavior characteristic of their normal peers. In this respect, Marta's behavior is very similar to that of other retarded individuals.

Marta seldom if ever engages in pretend or make believe play and does not particularly enjoy games or arts and crafts. She has no hobbies although she loves to listen and dance to Beatie music. Only on one occasion did I observe symbolic play behavior in Marta. I had been trying to engage her in some dramatic play, using my red collapsible umbrella as a "microphone" with which to "interview" her.

I was having little success getting her to "pretend." Suddenly Marta grabbed my umbrella, announced playfully that it was a tomato and that she was going to eat it. She pretended to bite the umbrella and then stated that she was "not going to eat it after all." "Why not?" I asked. "Because it's not a tomato, it's an umbrella." Marta's play abilities cannot be readily compared to those of normal children. However, in some respects they were no more advanced than those behaviors seen in 2 1/2 year olds.

Drawing: This ability gives insight into both representational and spatial abilities. Throughout the course of the study Marta was occasionally asked to draw a picture. Sometimes she was asked to draw something in particular, but generally she was encouraged to draw "whatever she liked."

Marta's spontaneous drawings were quite perseverative and primitive when asked to draw "whatever she liked". Marta almost always drew the same thing, a human consisting of head and legs, with eyes, nose, mouth, and sometimes hair. She also wrote her full name on most pictures. Marta frequently drew the stereotyped picture even when specifically asked to draw some other item. On one occasion with a great deal of prompting she drew her family. On another occasion she drew a quadrilateral shape and called it a "motel," then a "McDonald's," (selecting words beginning with the /m/ sound). Normal children often label their spontaneous drawings representationally at age two.

Another feature of Marta's drawings is that she makes "sun"-like

shapes, a favorite "gestalt" of young children (Kellogg, 1970). Such "suns" are not necessarily representations of the solar sun, but are simply a stage of drawing common in preschoolers. Often humans drawn by children at this stage will have rays emanating from them. Indeed, Marta's humans sometimes feature such rays. Sun gestalts do not usually appear, states Kellogg, until after humans, but they are already common at ages 3 and 4.

Marta's drawing is at the pre-school level at best, but does not seem comparable to the drawing of normal children due to its stereotyped and unimaginative quality. Some examples are given in

Figure 1.

Thus, when Marta's performance in three areas (language, drawing and symbolic play) which have been hypothesized to reflect representation are compared, she is seen to perform at an appreciably higher level linguistically.

b. Number concepts: In so far as the acquisition of number concepts shows a definite, age related (stage-linked) developmental progression, this was another important cognitive area to examine. Also, since certain number concepts and operations are considered to be specialized to the left hemisphere like language (e.g., Gardner, 1976) it was of interest to explore how Marta's number concepts compared to her linguistic level.

Marta's number concepts are extremely limited. Administration of Gelman's "Magic Show" revealed that Marta can discriminate small sets, i.e., 2 vs 3. When asked to point to selected printed numbers

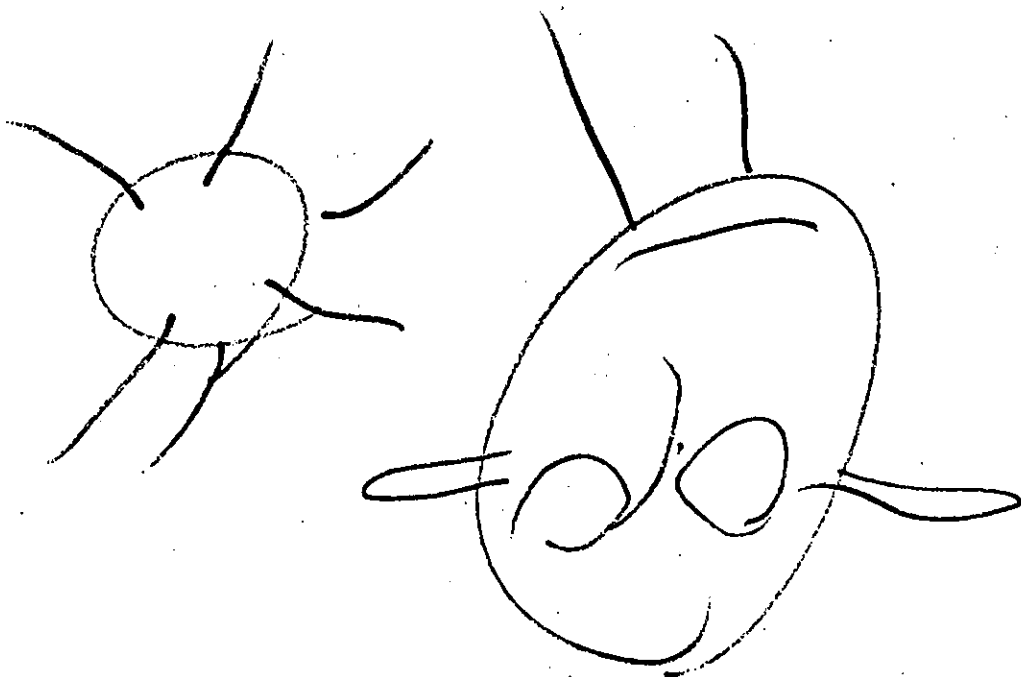


FIGURE 1: One of Marta's Spontaneous Drawings

from 0 to 9, Marta correctly pointed to all numbers except 4 and 9. Marta's number concepts seem to be at best at the 3 year level, however. While she can recite numbers into the teens, her true counting and numerical concepts are poor. I have observed her "count" up to seven items, pointing to each item in the array. However, she often makes errors, even when the array contains only 3 or 4 items. Marta generally knows that she must point to each item, but may assign two numbers to a given item and may count the same item several times. Thus, she fails to demonstrate knowledge of the 1-1 principle in counting (Gelman and Gallistel, 1978). In those cases where she has correctly counted the items in an array, she cannot then immediately tell you how many items there are, failing to show knowledge of the cardinal principle and demonstrating that her counting skill is merely a rote-learned one. She cannot tell time and has no concept of money values. Unlike many children of 2 and 3, Marta does not know her own age, although her guesses are usually within a reasonable range of her actual age. Marta's extreme difficulties with numbers and counting have persisted from her childhood when her parents and teachers noted that she could not grasp the relevant notions.

Marta's responses to infinity questions further highlight her limited ability with numerical concepts. On one occasion, when asked to name the biggest number she could she said, "3". When asked to add one to that she said, "8". On another occasion the biggest number she could name was "10". When asked to add one to that she said, "2", and asked to add another one she said, "3".

Just as she had difficulties doing tasks involving number concepts in the task-oriented setting, Marta demonstrated similar difficulties dealing with numbers out in the "real world." On several occasions, when asked to give a staff member 5 pennies, for example, Marta would invariably err in counting, giving too few or too many.

5.1.2 Summary of Performance on Piagetian and Other Stage-Linked Tasks

It is significant, in view of Marta's performance on the above cognitive tasks, that she is able to produce such a range of complex constructions linguistically. One would predict that Marta, lacking the Piagetian concrete-operational attainments of reversibility and decentration, would not be able to use the linguistic structures that purportedly rest upon such cognitive attainments. Sinclair (1975b) predicted that production and comprehension of structures, like where the clause order is noncongruent with temporal order, would be impossible without concrete-operational level thought.

'The girl goes upstairs when the boy has parked the car ...' 'It remains to be shown that retarded children in their early teens with a mental age of, below six, are incapable of understanding and constructing such sentences, although this would seem plausible' (p. 225). In refutation of this prediction, Marta uses a variety of

structures that have been linked to reversibility and decentration, e.g., passives (204), comparatives (205), embedded structures (206), and complex constructions where the order of mention of the clauses is non-congruent with the temporal order of the actions (207).

is necessary, but not in and of itself sufficient to account for language acquisition. Cromer (1974b, 1976a, 1981) has discussed this version of the Cognitive Hypothesis extensively, proposing that while cognitive achievements may be integral to language learning, it may be necessary to posit certain specifically linguistic capabilities. This hypothesis predicts that language will keep pace with cognitive development or will lag behind it, but does not allow for the profile of selectively enhanced language. Marta's data refute this view as well since while she lacks the putatively necessary cognitive abilities, e.g., reversibility and decentration, her grammar includes many of the linguistic structures assumed to embody these notions. Passives, comparatives, and embedded structures, for example, are part of her productive grammar.

204. (re. barracudas)

I was never swallowed by one.

205 (talking about a dress she wore to a wedding) I got skinnier and skinnier an' it fit.

206 I'm very good friends of a girl that cuts [name]'s hair, that I'm working with.

207 ... I told the police when I got lost.

The fact that such structures are not uncommon to Marta's speech and she makes errors in producing such utterances (see Chapter IV) indicates that her speech is truly productive.

When viewed alongside her linguistic abilities, Marta's performance on the above nonlinguistic cognitive tasks refutes both the Cognitive Hypothesis (Cromer, 1974b, 1976, 1980) and the Correlational Hypothesis (Bates et al., 1977, Cromer, 1976; Miller, 1981). The strong form of the Cognitive Hypothesis states that cognition is sufficient to account for language development (except in cases of severe language deprivation or of sensory or motor deficits) (Miller, 1981) and predicts a close correlation between language and cognitive development. Selectively enhanced language relative to cognitive level is not predicted by this view, nor is selectively delayed language. Marta's data argue against this hypothesis, given that her language level exceeds her cognitive level. Marta's case then, adds to already increasing evidence from other sources that cognitive development alone is not sufficient to account for language learning.

The weak form of the Cognitive Hypothesis states that cognition

Table 9

Performance on Stage-related Tasks

Area	Performance	Level
Sensorimotor abilities (Uzgiris and Hunt, 1975)	Shows object permanence and means-ends knowledge	Has attained stage 6
Conservation (Fogelman, 1970)	Did not conserve for length, solid or liquid quantity, weight, or number	Pre-operational performance
Spatial abilities (Stereognosis (Lau-rendeau and Pinard, 1970))	Stage IB-IIA	3 1/2-4 yr. age level pre-operational
Copying (Piaget and Inhelder (1967))	Stage IB-IIA	3 1/2-4 yr. age level pre-operational
Representational abilities (Play (Knox, 1974; Takata, 1974; Florey, 1971))	Little symbolic play noted; poor exploration of objects	Preschool level
Drawing (Kellogg, 1970; Selfe, 1977; Vereecken, 1961)	Repetitive and perseverative; cephalopod humans	Preschool level
Number concepts (Gel-man, 1972; Gelman and Gallistel, 1978)	Lacks true counting concepts; can rote count	Preschool level 3 yr. level at best
Classification (shape, color, size) (Inhelder and Piaget, 1964; Lovell, Mitchell and Everett, 1962)	Can sort by color and shape; cannot do reversal and Piaget, 1964; sal shifting	Late pre-operational
Classification ("conceptual/semantic") (Curtiss, Unpub.)	Could not sort by gender, animacy, etc.	3 yr. level at best
Seriation (Inhelder and Piaget, 1964)	Cannot anticipate seriation; cannot seriate	Pre-operational

Table 10

Performance on tasks tapping putative general abilities

Classification	Performance	Level
Inhelder and Piaget, 1964; Lovell, Mitchell and Everett, 1962	can sort by color and shape; cannot do reversal shifting	
Curtiss conceptual/semantic tasks (unpubl)	could not sort by gender, animacy	
Rule Abduction (Rule/non-rule governed learning (Muma and Muma, 1979))	did not exhibit rule-governed learning	
Simple rule acquisition (after Furth, 1963)	on one occasion learned simple "same" rule after 50 trials	
Hierarchical construction Blocks (Vereecken, 1961; Greenfield, 1978)	could only do simple bridge	
Sticks (Greenfield and Schneider, 1977)	could only do stack and row	

5.2 The Correlational Hypothesis

As mentioned in Chapter I, some researchers have hypothesized that nonlanguage abilities may not be prerequisite to language per se; rather, both nonlinguistic and linguistic developments may be behavioral expressions of some third, underlying governing mechanism or mechanisms (Bates, 1979), a view sometimes labeled the Correlational Hypothesis. An indication of this would be the discovery of general cognitive principles across domains. Whereas the Cognitive Hypothesis predicts an invariant order of emergence of abilities, with nonlanguage cognitive attainments preceding or coinciding with language attainments, the Correlational Hypothesis predicts a possible variation in order of emergence of abilities, while still maintaining the primacy of general cognitive functions over linguistic ones. By positing a third, underlying cognitive mechanism, "correlationists" can account for the variance in order of emergent abilities by invoking the concept of "blockage," where it is said that a given behavior may be absent due to superficial peripheral reasons rather than to an absence of the underlying cognitive mechanism itself. Such a theory purportedly predicts the possibility of the High Language/Low Cognition profile, since the cognitive deficiencies could be explained away by peripherally-based difficulties like apraxia or emotional disorder. If no such source of "blockage" exists, some slight variance in order of emergence is still permissible, since domain-particular factors are assumed to affect the emergence and expression of a given general ability. However,

advocates of this view acknowledge that abilities across domains should appear within a reasonable time of one another (Bates et al., 1977).

Researchers have attempted to find evidence of common organizing principles by looking for common denominators in behaviors across domains. Some candidates for the set of general abilities which have been considered are categorization and classification (Rosch et al., 1975), rule induction or abduction (or hypothesis generation) (Osherson and Wasow, 1976; Neimark, 1970; Maratsos and Chalkley, 1980; Cromer, 1976, and hierarchical organization (Greenfield, 1978). The areas are not mutually exclusive; for example, categorization and rule abduction may require similar abilities such as the ability to extract out regularities.

To test the hypothesis that there are general cognitive principles operating across domains, Marta was tested for her abilities in classification, rule abduction, and hierarchical organization in the nonlanguage areas and her performance was compared to evidence of these abilities in language.

A. Classification as an indication of commonly governed abilities

In addition to providing information as to her cognitive stage, Marta's classification abilities were of additional value in view of the claim that both syntax and semantics involve structures of classification (Inhelder and Piaget, 1964). Classes and categories are assumed to play a significant role in language in the formation of semantic and syntactic categories. In both the nonlinguistic and

Linguistic domains we classify and categorize our world. The abilities to classify things in action (e.g., to use a category of objects for the same action) is said to be reflected in language as the ability to formulate linguistic categories, e.g., NP and VP. (With regard to seriation, it has also been claimed that the child's ability to put things in a spatial order is equivalent to the ability to concatenate linguistic elements).

Marta was given one additional set of classification tests (Curtiss and Yamada, unpubl.), some of which require the subject to sort along dimensions which are also coded in English, e.g., gender, to compare her ability to classify along a given dimension in the nonlinguistic domain with her ability to do so in the linguistic domain. For example, given that Marta marks gender in her use of pronominal forms, it was of interest to see whether she would also show an awareness of gender on a nonlinguistic task.

When given pictures of males and females and asked to "make two piles of things that are the same," Marta did not sort on the basis of gender. Similarly, she did not sort on the basis of human vs. non-human features when given pictures of people and animals.

Since Marta appropriately identifies men and women and generally uses pronouns appropriately (semantically), her difficulty in performing the nonlinguistic sorting tasks may not have reflected a lack of conceptual knowledge of the categories involved, but rather a failure to abduce, on the basis of random available data, the task or rule at hand. That is, Marta was unable to figure out what the task

was. This is a very low level of performance since work with normal children has revealed that even 3 year olds are able to spontaneously sort pictures on the basis of gender (Curtiss and Yamada, unpubl.). Thus, while this task did not clarify whether the classifications Marta makes in language are isomorphic with those she makes in the nonlinguistic domain, it illustrated other cognitive deficits. Other observations indicate that there is a discrepancy between Marta's ability to form categories in the linguistic vs. nonlinguistic domains. For example, when Marta's limited numerical abilities (see above) are compared with her tendency to use many numerical references in language, it seems that she has learned a set of distinctions (i.e., numerical) in the linguistic domain for which she has minimal conceptual knowledge. There does not seem to be a one-to-one relationship between the classifications one makes in nonlanguage as opposed to language areas. Other studies also show that there can be a dissociation between the set of distinctions one makes conceptually versus grammatically. Bohme and Levelt (1979), for example, observed in children learning German, that some learned to mark grammatical gender prior to attaining a conceptual notion of gender. Grammatical gender, of course, differs from the marking of gender on say, pronouns, since the latter reflects the conceptual notion of gender while the former does not. It is notable that the children in Bohme and Levelt's study learned to make distinctions in the language domain that do not exist in the nonlanguage domain. Gender marking on nouns is usually arbitrary (although some have claimed that it functions to

maximally contrast certain pairs of lexical items, e.g., in a given language, sun and moon, are usually of opposite gender (Newman, 1982). Such findings argue against the notion that language learning is simply a matter of mapping on linguistic forms into previously laid conceptual foundations

The difficulties which Marta had on classification tasks requiring her to sort similar items (Inhelder and Piaget, 1964; and Curriess, unpub.) is intriguing in view of the fact that in language she is obviously able to categorize elements on the basis of similar features. The fact that she knows how to "plug in" various adverbial forms into their appropriate places within a sentence structure, for example, indicates that she has perceived that various adverbs form a class and can be interchanged. Similarly, it seems that Marta has been able to sort linguistic elements appropriately into noun and verb classes. She rarely if ever has been noted to make form/class errors. Of course, the fact that she does poorly on tasks requiring abstraction of "same" rule does not necessarily indicate that she has no classificatory abilities in the nonlanguage domain.

While Marta's performance on classification tasks was not very good, impressionistic evidence that she does in fact categorize and organize her world came from naturalistic observations. The fact that Marta does not become totally disoriented when she enters new surroundings, for example, indicates that the objects and situations are familiar to her, that she is able to recognize examples of familiar items and is able to perceive the shared attributes

of the objects, e.g., upon seeing an empty chair (which she has never seen before) she recognizes that it is a member of the class of chairs and sits in it. In addition, upon passing a school one day I asked her what kind of facility it might be and without hesitation she responded, "school." In spite of the fact that she had never before seen this school or been directly told that this was a school, she was able to categorize it, presumably on the basis of shared attributes with schools she had previously seen (i.e., with playgrounds, buildings, etc.). Also when I asked Marta to bring me my journal ("red book") from the next room, unable to find the book, she brought me a newspaper (that was near the place the book was supposed to be). Her choice to bring the newspaper rather than say, a salt shaker, may also reflect her ability to perceive functional or conceptual similarity.

While these examples illustrate a very primitive level of classificatory awareness, they indicate at least some competence in this area.

Rule abduction:

Other abilities hypothesized to inhere in linguistic and nonlinguistic domains are general purpose inductive strategies (Reber, 1973; Dore, 1975; deVilliers, 1980; Maratsos and Chalkey, 1980, Sinclair, 1975). Thus, it was of interest to compare Marta's nonlinguistic rule abduction ability with her ability to learn linguistic rules.

On the Rule/Nonrule Governed Learning subtest of the Muma Assessment Program (Muma and Muma, 1979) Marta failed to demonstrate

rule governed learning even after 50 trials. On the Simple Rule Acquisition test Marta failed to reach criterion (10 consecutive correct answers) on test 1, and since she seemed to have no idea of the rule to be abduced, testing was terminated. On another day when given test 2,3, and 4 consecutively, she reached the criterion for success on the last 10 items of test 4, after 50 trials. This was her best performance. When given the four subtests on another, more recent occasion, she failed to abduce the rule even after 80 trials (see task descriptions in Appendix II).

Her performance on the Simple Rule Acquisition test was poorer than that of any of 10 normal preschoolers whose performance was compared to Marta's. Five of the 10 children aged 3 to 5 abduced the rule within or after the first 10 items of the first test (2 of the children, one 3:0 and one 4:3, learned the rule after 3 items). Four additional children abduced the rule on the 2nd test within the first 10 items (one child, 5:5 abduced the rule after 1 item and another child 5:2, after 3). Thus 9 of 10 children rather quickly abduced the rules, with the number of trials required to learn the rule ranging from 3 to 30 trials. Nonetheless, while she required more trials than the normal preschooler, Marta was ultimately able to abduce a rule.

As seen above, Marta showed some limited rule abductive abilities. In the classification tasks where the subject is simply instructed to "put the items into two piles of things that belong together," some rule abstraction seems required for the subject to select a feature or features along which to classify and organize the

items. The Rule/Nonrule Governed Learning test also tests the nonlinguistic ability to abduce simple rules on the basis of limited available data.

One could argue that Marta's capacity to classify items and abduce rules in the nonlinguistic domain is relevant to her capacity to do so in language. Marta was able to sort on the basis of color and shape (although she could not then shift tasks and sort along another dimension) and was able, after an extensive number of trials (many more than the normal four year old required), to abduce a simple "same" rule. However, does the fact that Marta finally abduced a simple "same" rule (on one occasion) indicate that she has adequate rule abductive capacity to account for language? Similarly, does the fact that she is able to sort on the basis of two features simultaneously mean that she has enough classificatory capacity to acquire language? It should be pointed out that the nonlinguistic rules Marta learned were extremely simple, and hardly seem comparable to the linguistic rules and constraints she has been able to master. Of course, care must be taken to not confuse a poor performance on particular tasks with an actual lack of the relevant capacity. For example, the type of rule abduction tested in the nonlanguage domain may have simply failed to capture the relevant or critical parameters of the hypothesized general rule abductive capacity. Also, it is perhaps unfair to compare her rule abduction ability on a time-constrained task with her apparent ability to apprehend linguistic rules since she had the opportunity to learn rules in the

latter domain over a more protracted period. Nonetheless, the nature of the linguistic rules she had acquired seems qualitatively different from the nonlinguistic rules for which she was tested.

One might ask why Marta wasn't given nonlanguage rule abduction tasks that are more analogous to linguistic rules? First, it seems fairly evident that Marta would have had great difficulty dealing with nonlinguistic tasks which were any more difficult than the simple tasks she was given. Recall that while she was able to abduce a rule, it was only after an extensive number of trials and failure on three previous tests. Second, I would argue that there do not seem to be many (if any) nonlinguistic cognitive abilities that involve rule learning and that are truly comparable to linguistic rule learning. Of course, the difficulty in discovering nonlinguistic behaviors that seem in any way comparable to language may in itself be revealing.

Not everyone would agree with this viewpoint. Maratsos and Chalkley (1980), for example, are among those who propose that the learning of syntactic categories is not unlike what we do in other domains, e.g., concept formation (Nelson, 1974; Rosch et al., 1976 and perhaps learning social roles. They point out that a social role such as mother is not defined by its inherent characteristics, but more by how it functions in relation to other parts of the system. Acquisition of this knowledge, they say, is similar to what goes on in the learning of syntactic categories. The child's learning of the "systematicity and abstractness" of the linguistic system, along with its "arbitrary exceptions,

idiosyncracies, semigeneralizations ...", etc. parallels what she must learn about other "characteristically human activity" (Maratsos and Chalkley, 1980).

Grammar, with its mixture of logical rule and arbitrary usage, proposes to a young mind a foretaste of what will be offered to him later on by law and ethics, those sciences of human conduct, and by all the systems wherein man has codified his instinctive experience.

(Yourcenar, 1961)
Cited in Maratsos and Chalkley, 1980

However, Maratsos and Chalkley, in implying that the principles involved in the learning of syntax also underlie these other knowledge systems, do not account for why expression of the principles in the various domains occur at such disparate times in the child's development. While children are talking fluently by age 4, for example, the complexities of the systems of government bureaucracy are still much beyond them. Similarly, while Marta has definitely acquired much syntactic and morphological knowledge, she seems to have little understanding of the exigencies of governmental structure.

J: Who's the President of the United States?
M: Lincoln.

Neimark (1970) in discussing rule learning implies a similarity between learning rules for "constructing a grammatical utterance" and for "being a good child." It is difficult to believe that these are the best examples of nonlinguistic parallels to linguistic rule abduction. What other ability requires the integration of so many systems, and is learned so readily, quickly and early? What enables the child, if rule abduction is indeed involved in language, to arrive

at the correct hypotheses so efficiently? We are hard pressed to find a system comparable to language because no other system seems to be so simultaneously tied up with conceptual, perceptual, and social factors. Pinker (1979) argues that positing some kind of theorem for rule generation is theoretically not viable, since if the child were simply gifted with some general rule inductive capacity, the time required to test data and arrive at and form the correct hypotheses re language would be indeterminable. The range of possible grammars seems to be constrained then; most likely innately so. From an empirical and theoretical standpoint then, the principles governing language and nonlanguage abilities are better described as distinct from one another, although there is probably some overlap. The fact that general rule learning does not seem adequate to account for complex syntactic acquisition implies that there may be rules specific to language, unseen in other cognitive areas.

C. Hierarchical construction

Hierarchical organization was an important cognitive area to examine in so far as it is a characteristic of both linguistic and nonlinguistic domains. The presence of hierarchy in various aspects of cognition has been hypothesized to reflect homology, or shared cognitive principles (Piaget, 1980; Bates, 1979; Greenfield and Schneider, 1977). The feature of hierarchy has already been mentioned with regard to classificatory skills. Greenfield and her colleagues have also examined hierarchical organization in the action

(constructive-praxic) domain. Greenfield and Schneider note that "studies of children's three-dimensional constructions reveal increasing hierarchical complexity with age (Goodson and Greenfield, 1975) as do studies of language development." In both domains the child deals with individual elements before combining and building hierarchically organized, more complex structures. The ability to formulate complex linguistic structures and complex hierarchically organized concrete structures (e.g., with blocks) is argued to reflect a general hierarchical capacity.

Greenfield and Schneider claim that the existence of "formal" parallels in action and language are an indication that there exists a unitary set of cognitive principles underlying both language and nonlanguage domains.

Goodson and Greenfield (1975) and Greenfield and Schneider (1977) explored the role of three structural principles in complex combinatorial activity: hierarchical complexity, interruption, and role change, claiming that the process of construction as well as the completed structure itself, reveals commonalities across action and language. They draw the following analogies: Just as children form simple sentences before combining them into hierarchically more complex structures, so do they first manipulate individual items like cups and blocks before combining them in hierarchically complex configurations. They also note that the use of complex structures can be linked to an increasing capacity to deal with the feature of interruptedness.

In visuo-construction, the child can build one part of the structure, go to another part, then return to complete the first part. Whereas the very young child avoids interrupted strategies in construction play, as she grows older, her tendency and capacity to use and deal with interruptedness increases (Goodson and Greenfield, 1975).

In language there is also progression whereby a child seems to develop an increasing capacity to deal with interruptedness and complex structures (Bever, 1970; Slobin, 1971). In order to understand and produce a sentence containing a center embedded relative clause, for example, the child must hold one part of the sentence in abeyance, then return to it, in order to successfully complete the sentence, e.g., The girl/ who hates parties/ left.

Thus, just as syntactically more complex structures can involve interruption of grammatical constituents (e.g., with center embedded relative clauses), so can strategies for constructing hierarchically complex visuo-constructive structures involve interruption strategies. Finally, just as the feature of role change operates in language, such as in certain relative clauses (where the co-referential NP plays a different grammatical and semantic role in the main clause than in the embedded clause), so can role change be evident in manipulative play. In a given operation, for example, a cup can function as a active moving element, then be put down and used as a receptacle, i.e., a passive object/locus element.

Marta was very poor at constructing the hierarchical models of sticks and blocks. When copying models of stick configurations she could not even copy a simple bridge (11), and when copying block models she could not construct anything more complex than a simple bridge. Vereecken (1961) noted that children of 2.9 and 2.10 were able to construct a simple bridge. Marta seemed to be aware that she should use more blocks for the more complex models but could not recreate the hierarchical relationships involved.

Thus, whereas Marta is producing hierarchically complex linguistic structures, she was not able to construct anything but the simplest structures in the visuo-constructive domain. In Marta's performance the features of complexity, interruption, and role change are evident in language but not in the action domain. Piagetians might be tempted to call upon the notion of "decalage," the notion of uneven performance which has been built into the theory. However, some constraints should be placed on this notion. The concept that language and nonlanguage abilities are linked by some third, common underlying principle or principles predicts that variation may occur in the order of emergence of the behaviors; however, the behaviors should appear within a reasonable time of one another (Bates et al., 1977). Given that Marta is now in late adolescence and has not yet acquired the putative analogous or homologous behaviors it is doubtful that she ever will.

The discrepancy between Marta's capacity to produce hierarchically complex structures in language vs. nonlanguage

suggests that while superficial similarities across domains may exist, the constraints and governing principles operating in the two domains are not the same. The similarities across domains do not necessarily imply that they are mutually dependent or derive from some more general, common capacity. Even those who have argued in favor of the existence of formal parallels (e.g., Greenfield and Schneider, 1977) caution against carrying the analogy across domains too far. Indeed, the analogy is a more general one. All that can be said with regard to language and action, for example, is that hierarchical organization increases with development. While study of hierarchical complexity in action may result in an increase in knowledge regarding that domain, it is difficult to see how it can increase our understanding of human language and language acquisition.

While much research is yet to be done with regard to exploring formal parallels across domains, inherent differences in the constraints upon the physical as opposed to linguistic domain are immediately evident. Limitations in the visuo-constructive domain are very much linked to physical laws. For example, a hierarchically complex block structure must be fairly symmetrical in height in order to stand. Such purely physical considerations do not, however, constrain embedded structures in language. It is doubtful that simply identifying hierarchical structure in various systems and domains is going to be very revealing. It must also be shown that the constraints and limitations operating across domains are similar in nature.

One might argue that Marta demonstrates difficulty in the non-linguistic area due to blockage such as emotional or physical problems. For example, her difficulty in building block models may reflect a fear of engaging in visuo-constructive tasks, limited visuo-perceptual abilities, or a motor apraxia. One or all of these problems could result in the absence of an ability in one domain even though the more general underlying governing mechanism exists. In Marta's case, however, none of the above problems account for her deficits. While Marta was not able to build the more complex hierarchical models, she was able to reproduce simpler structures (a stack, row, and simple bridge) as well as a tall tower composed of numerous blocks. If Marta had a fear of manipulating the blocks, a serious visuo-perceptual problem, or an apraxia, we would not expect the problem to apply only to the construction of models beyond a certain level of complexity. A deficiency due to channel-specific blockage would affect all performance in a given area; the fact that she built a tall tower indicates a willingness to manipulate the materials and an adequate degree of visual acuity and coordination to properly place and balance the blocks. Given that positing blockage problems cannot be used to account for her poor performance in the constructoinal domain, it is likely that Marta indeed lacks the nonlinguistic cognitive capacities underlying the tasks given.

D. Logical sequencing:

It has also been suggested that logical structure is a common denominator in linguistic and nonlinguistic areas.

The normal individual, understanding and constructing a sentence describing ordered events, appears to require knowledge of the logical structure underlying the sentence. That is, conceptual awareness of the temporal relationship of a series of events is reflected linguistically in the use of such elements as temporal adverbials and tense/aspect forms. However, this does not show the extent to which linguistic aspects which overtly mark temporal and sequential concepts, are tied to the concepts themselves. A similar question was posed with regard to classification. In both cases it is important to determine to what degree the distinctions we make linguistically are simply a mirror of those we make conceptually. This question was explored through asking Marta to put pictures into logical order (see task description, Chapter III). A child's ability to organize pictures into a logical sequence may also reflect "event knowledge", a term used in conjunction with schema theory (Rice, to appear) where "a schema consists of a set of (usually unconscious) expectations about what things look like and the order in which they occur" (Mandler, 1979). As Rice puts it, a schema is "a mental structure whose elements are related to one another on the basis of spatial or temporal contiguities instead of class membership and similarity relationships" (a characteristic of categorical organization). Even young children have an awareness of familiar sequences of events: 3 year olds, for example, are able to describe reasonably accurate sequences of events (Nelson quoted in Rice, to appear) and at play are able to act out by long elaborate sequences of similar activities (Garvey, 1977).

Table 11

Hypothesized relationship of selected nonlanguage abilities to language and indication of whether Marta's case supports or refutes the putative relationship		Marta's case
Nonlanguage area	Hypothesized link to lg.	supports hypothesis?
Sensorimotor abilities Stage 5 and 6	prerequisite to emergence of language	does not address
Concrete operational abilities a.g., conservation seriation stereognosis copying	necessary for later linguistic development, e.g., passives, comparatives, ability to describe events out of temporal order, necessary for transformations	no
Representational abilities play drawing	along with language they are expressions of the semiotic function, thus all perf. in areas should be roughly equivalent	no
Classification	reflects general ability to extract classificatory principles in lg. and nonlg. domains; perf. in lg. and nonlg. should be equivalent	no
Rule abduction	reflects general ability to use all-purpose inductive strategies (rule abduction and hypothesis generation) thus, similar level in lg. nonlg. domains should be evident	no
Hierarchical construction	reflects general ability to deal with hierarchical relationships; thus, ability should be evident at same level in lg. and nonlg. areas	no
Memory	auditory short term memory is necessary for the comprehension and subsequent production of language--length of span is thus correlated with language level	no

When an individual like Marta cannot relate such stories or act out certain activities, we must, of course, consider whether conceptual as opposed to social problems are the source of the limitations.

Marta was unable to order pictures into logical sequences, an ability reflected in the normal 5 year old (Friedman, 1978; Curtis and Yamada, unpub. data) (see task description, Appendix II). If we interpret this performance to indicate that Marta has difficulty conceptualizing sequences of events in time, then there is a discrepancy between her ability to use temporal markers linguistically versus her ability to mark time nonlinguistically. Indeed, as her memory performance indicates (see next section), Marta sometimes has difficulty recalling sequencing of events in their correct order and relationships. In contrast, as described in Chapter IV, she makes extensive use of temporal adverbials in her speech, inserting them into appropriate places in the sentence in spite of her limited conceptual understanding of some of the forms.

E. Memory:

Memory clearly plays an integral role in learning and cognitive processing and was therefore a crucial area to examine in relation to language acquisition. Its crucial role in learning is generally emphasized in information-processing models. It is not, of course, a unitary phenomenon, several different types of memory have been posited, e.g., short term, long term, immediate, auditory, visual,

sequential, spatial, etc.

Memory has been linked to intelligence; it shows a clear developmental progression (Hagen et al., 1975; Terman, 1916) and has been used as a measure of intelligence for over 50 years. It is not yet clear just how memory is related to language, although some have found a correlation between auditory sequential memory and language (Graham, 1968; Masland and Case, 1968; Menyuk, 1964). There is also neurological evidence linking auditory short term memory and language; the left cerebral hemisphere (the language hemisphere in normal right-handers), has been found to be better at auditory sequential short term memory (Warrington and Weiskrantz, 1973; Zaidel and Sperry, 1974; Milner and Teuber, 1968). Bloom and Lahey (1978) point out, however, that the correlation between auditory memory span and language does not necessarily indicate a causal or dependency relationship between the two areas, noting that three year olds who can only repeat lists of two or three unrelated words, are able to understand and produce rather long sentences, due perhaps to the facilitative effects of semantic structure. In contrast, autistic children often have superior short-term memory skills alongside poor language abilities.

Some studies of selectively impaired individuals with disassociations between language and cognition have shown auditory sequential memory to be the only nonlanguage ability to correlate with

enhanced language level (Curtiss and Yamada, 1981), thus leading investigators to postulate that memory span ability may sometimes facilitate language acquisition (Curtiss and Yamada, 1981). Such a strategy for language learning is not necessarily used by normals, but is merely cited to be a possible alternative or idiosyncratic used by certain impaired individuals. However, this highly speculative strategy cannot be used to account for Marta's enhanced language ability, since she did very poorly on word span and digit span tests. On the Weiman and Morency Memory Span test, a word span test, she was not able to repeat back sequences of more than three items, obtaining a score of 6, i.e., "below the level of adequacy," and on the Auditory Sequential Memory subtest of the ITPA, a digit span test, she could not repeat back sequences of more than three numbers, earning a score of 8 (psycholinguistic age score 3.0). She performed similarly on a nonstandardized word span test designed by the author consisting of some of Marta's favorite words (e.g., Beales, cake, fat). Thus Marta's performance indicates that a good memory span is neither necessary nor sufficient for language development.

In fact, it is probable that language facilitates Marta's memory rather than vice versa. While her performance on word and digit span tests was quite poor, it was relatively better than her performance on the Memory for Auditory Nonverbal Stimuli (MANS) developed by Curtiss, Kempler, and Yamada (unpubl.). While she was able to associate each of three sounds with the appropriate pictures, she could not do even two-item sequences. This performance is equivalent to only the very

youngest children in the normative sample thus far examined (i.e., 2 to 3 year olds). In addition, on the Verbal Mediation test, which tested to see whether Marta would make use of rhyming to aid memory, it was found that she recalled 27% of type 1 cards (rhyming) as compared to 13% of type 2 (unrelated) and 0% of type 3 (conceptually related) (for description of task, see Appendix II). This result indicates that Marta made use of the phonemic similarity of the cue word in type 1 sets.

Marta's memory span seems to correlate more with her IQ than her linguistic level. Miller (1956) found that normal subjects could process 7 ± 2 chunks of information, compared to 4 ± 1 for retardates.

Marta thus showed the same discrepancy between her memory for sequences of unrelated words and her memory for sentences as that noted by Bloom and Lahey (1978) in normal three year olds. Marta's ability to repeat back sentences containing up to 9 morphemes as well as her ability to understand simple sentences seem to indicate that she makes use of semantic and syntactic structure to aid memory.

While, as neurological evidence indicates, auditory short term memory and language may both be lateralized to the left hemisphere (in the normal right handed)(Warrington & Weiskrantz, 1973; Zaidel & Sperry, 1974; Milner and Teuber, 1968), Marta's case indicates that they are dissociable.

Marta performed at relatively the same level on auditory and visual sequential memory tests, indicating that her enhanced language level is not attributable to strength in the auditory modality.

Marta did very poorly on the Knox Cubes test, giving only perseverative responses to each stimulus item, tapping blocks 1-2-3-4 each time a sequence of two or more taps was modeled (for task description, see Appendix II). She also did very poorly on the Corsi Blocks test (described in Milner, 1971), imitating only single and two-tap sequences.

On the Visual Sequential Memory test of the ITPA (Kirk, McCarthy and Kirk, 1968) she was able to reproduce sequences of up to 3 tiles, attaining an age score of 4.1 (for 10 year olds). Her score reflects the fact that she could do some but not all 3-tile items. Thus, her performance was similar to her sequential memory performance in the auditory modality.

F. Memory in Naturalistic Contexts:

Marta has a great deal of difficulty remembering factual information, even at the most simple levels. For example, she does not know coin values. One day, when we were buying an apple from a vending machine, I put 4 coins of differing values in my palm, held it out and said, "Take the quarter." Marta took the penny. She also has difficulty with rote-counting, days of the week, months of the year, etc., all items which teachers have attempted to teach her many times. In contrast to her difficulties with such tasks, Marta often shows the ability to remember events. For example, upon being told that a friend was getting married, Marta remembered this fact and months later was even able to recall the name of the prospective

spouse. A week after she stayed overnight at my home I questioned her to find out how much of the visit she remembered. She seemed to recall the entire experience, what we'd done and what we'd eaten at each meal. However, at times, when talking of some past event she conflates several experiences, confusing people, places, actions, etc. Sometimes events of the distant past are intermingled with a recent event and referred to as if it all just occurred. In addition, Marta seems to have difficulty in remembering where she was supposed to be at given times, even though her daily school and living schedule is very regular. On several occasions following our sessions it was necessary for Marta to show me where she was supposed to be, e.g., occupational therapy, cooking class. However, Marta usually showed no awareness of where she needed to go, simply standing and staring blankly, in spite of my pleas for her to show me or tell me.

The distinction between semantic and episodic memory made by Tulving (1972) captures to some extent the difference between the types of things Marta does and does not remember. Semantic memory holds facts, e.g., chemical formulae, rules for addition and multiplication, knowledge that autumn follows summer, while episodic memory holds temporally coded information and events, "...information about how things appeared and when they occurred" (Klatsky, 1975). Semantic memory is not as malleable and transient as episodic memory, since due to the constant influx of new information, material in episodic memory easily becomes irretrievable. It appears then, that Marta has poor semantic memory and relatively better episodic memory.

Marta's confusions about series of past events or about her daily schedule (which also involves a sequence of events) probably reflect her difficulty with semantic memory. Memory for individual events is a gestaltic, more episodic ability, and contrasts with memory for a sequence of events, which requires attention to ordering and sequencing, more akin to the "rule-like" quality of semantic memory.

There is only one inconsistency in characterizing Marta's memory ability in terms of episodic and semantic memory components; while she is supposedly poor in semantic memory, she has learned the rules of language, considered by Tulving to be part of the domain of semantic memory.

It seems that there is something distinctive about language that enables Marta to apprehend its rules, but not the many facts, formulae, and rule systems that normally contribute to general knowledge. The fact that Marta has been able to learn grammatical rules, but not, say, mathematical rules, and musical conventions, indicates that grammatical rules are qualitatively different from other types of rules. It is not possible to tell from these data alone how the rules of language differ; only that they do differ.

Thus, with regard to her performance on various nonlinguistic tasks assumed to tap "general" abilities, Marta did poorly relative to her linguistic performance.

5.3 Neuropsychological testing:

As previous sections have verified, Marta demonstrates a very unusual performance profile. A comparison of her abilities across linguistic and nonlinguistic domains indicates that she demonstrates an island of language ability, a provocative finding indeed, in view of current theories of cognitive prerequisites for language. One possible means of accounting for such a remarkable profile would be to identify neuropsychological correlates. Perhaps her cognitive deficits are due to problems associated with one or the other hemisphere.

It is now believed that each hemisphere is specialized to process information in particular and distinct modes, that the hemispheres are distinguished by their strategies of processing rather than by the functions they mediate. Whereas the left hemisphere is felt to process in a sequential analytic, linguistic mode, the right is believed to do so in a parallel, holistic, spatial, and nonlinguistic mode (Witelson, 1977).

In giving Marta tasks believed to be associated with particular hemispheres I was interested in seeing whether she would show strength on left-hemisphere tasks and weakness on right-hemisphere tasks, or whether some other pattern would emerge.

Testing Limitations:

In attempting to assess Marta's abilities in hemispheric terms I encountered many of the same difficulties with testing that I had had

Table 12

Performance on Neuropsychological Tasks

	<u>Performance</u>
<u>Memory</u>	
Auditory Memory Span Test (Wepman and Morency, 1973)	Score: 6 "Below the level of adequacy" Rating -2
Auditory Sequential Memory (ITPA) (Kirk, McCarthy, and Kirk, 1968)	Score: 8 Psycholinguistic age score: -3.0
Visual Knox Cubes Test	Score: 0
Corsi Blocks (cited in Milner, 1971)	No norms; could do only 1 tap items consistently; some 2-tap items.
Visual Sequential Memory (ITPA) (Kirk, McCarthy, and Kirk, 1968)	Score: 8 Psycholinguistic age score: -4.1
Memory for Designs (Graham and Kendall, 1960)	Score: 28 (off bottom of scale)
<u>Disembedding</u>	
Preschool Embedded Figures Test (Coates, 1972)	Score: 2 below mean of (8.8) for 2 3/4 year olds
Southern California Figure/Ground Test (Ayres, 1966)	Score: 7 below mean for 4.0-4.5 year olds by .8
Gestalt Perception Mooney Faces Test (Mooney, 1957)	Score: 17 (of 40)
Perceptual Integration Test (Elkind, Koegler, and Co, 1964)	Did not demonstrate part/whole integration
Facial Recognition (Benton et al., 1975) short form	Score: 15 defective performance
Familiar Sounds Recognition	Score 20 (of 25) No norms
Familiar Voices Recognition	Score: 4 (of 5) No norms

to deal with in language and cognitive assessment. Due to Marta's attentional and perhaps cognitive limitations, some tests that I had planned to give could not be given, e.g., a tachistoscopic test and the Raven Progressive Matrices (Raven, 1951) test. The former test requires the subject to focus on a center point to do the task. Since it was felt that Marta could not reliably focus her attention in this way, the T-scope task was not given. The Raven Progressive Matrices test, a nonverbal intelligence test, was attempted, but Marta could not seem to understand what the task was, so testing was discontinued. The dichotic listening test was given, in spite of the fact that Marta had a great deal of difficulty remembering which picture went with which syllable and in spite of her failure on the pretest.

For the most part, Marta did extremely poorly on all tasks given involving either hemisphere except on a few tasks hypothesized to be governed by the right hemisphere. Her performance is detailed below.

A. Dichotic Listening:

The dichotic listening technique is used as an experimental technique to reflect cerebral lateralization. Generally the task involves presentation of two simultaneous, competing stimuli, one to each ear. Each ear is connected to the brain by two auditory pathways, the ipsilateral, or same side connection, and the contralateral, or opposite side connection. In dichotic listening the ear contralateral to the hemisphere lateralized for a particular function performs better than the ipsilateral ear. Normal

right-handed adults show a slight right ear advantage when verbal stimuli are presented, i.e., left hemisphere processing, and a slight left ear advantage when nonverbal stimuli are presented, i.e., right hemisphere processing (Curtiss, 1977, Kimura, 1967).

Marta had a great deal of difficulty on the dichotic listening task (for a description of the task, see Appendix II). This task was chosen because it required no reading; only pointing responses in a free visual field. On the first 30 training pairs in which identical stimuli are presented to each ear, Marta scored only 13/30. She got all tee and dee items correct (5 each) and 3 gee items. In spite of this poor performance, two blocks of 60 dichotic pairs were presented to "see what would happen."

Marta did quite poorly on both blocks of 60; however, her performance on each block with regard to rate of error and to ear advantage was remarkably similar. In the first block of 60 Marta missed 33, and of the 27 correct responses she identified 16 right ear items compared to 10 left ear items. Thus, her scores for the two blocks were almost identical. In both cases she showed a slight right ear advantage, suggesting left hemisphere dominance for language processing.

5.3.1 Abilities controlled by the left hemisphere:

Some tests for abilities controlled by the left hemisphere have already been described in the previous section under memory, i.e., auditory and visual short-term memory tests. The left hemisphere is

hypothesized to be a sequential, analytical processor, as opposed to the right hemisphere which is thought to be a more simultaneous, gestaltic processor. Some propose that the left hemisphere is not a "language hemisphere," per se, but rather a "sequencing hemisphere."

Because oral language is a sequential phenomenon, it is lateralized to the left hemisphere (Krashen, 1972). This hypothesis posits a fairly strong correlation between sequencing ability and language and it is therefore of interest that Marta does so poorly on sequencing tests.

Recall that both her auditory and visual short-term memory span performance was extremely poor. Marta was unable to hold sequences of more than 3 items in memory; sometimes she was unable to repeat even 3-item spans.

Marta also has a great deal of difficulty carrying out any sequence of actions. When involved in a task requiring several "steps," she must be prompted each step of the way.

In addition, she has a great deal of difficulty with numbers and counting. Even after years of education she cannot count even 5 items consistently.

A. Disembedding:

In disembedding tasks the individual must locate a simple figure which is contained and hidden in a larger, more complex figure. There is some conflict in the literature as to whether this is a left or right hemisphere ability, or perhaps a bilateral one. It appears to be a left hemisphere ability in that it correlates strongly with aphasia (Teuber and Weinstein, 1956; Russo and Vignolo, 1967). However, recent

evidence indicates that when the embedded item is familiar or simple, the right hemisphere can perform the task (Curtiss, 1979; D. Zaidel, p.c.), possibly due to the strategy of template matching used by the right hemisphere (E. Zaidel as cited in Curtiss, 1979). Such tasks were also appropriate for administration since disembedding or figure/ground perception has been claimed to be involved in receptive language (Irwin, 1948; Oakland and Williams, 1971; Townsend and Bever, 1977).

On the Preschool Embedded Figures test (Coates, 1972), Marta did very poorly, obtaining a score of 2, quite a bit below the mean of 8.81 for 2 3/4 year olds (Waldrop, as cited in Coates, 1972) (for a task description, see Appendix II). On the Southern California Figure/Ground Perception test (Ayres, 1966) Marta obtained a score of 7, below the mean of 9.5 for 4.0 to 4.5 year olds, the youngest children in Ayres' normal sample.

Marta's relatively poor performance on the above part/whole and gestalt perception tests contrasts with her facile performance on the Auditory Closure test of the ITPA, which requires a similar ability using words. Whereas Marta was not able to project the whole from looking at a part in the nonlinguistic domain, she seemingly found the task easy in the linguistic domain. Once again then, Marta's strength appears to be in language. Perhaps, though the abilities in the nonlinguistic and linguistic domains are superficially similar, there are some deep, qualitative differences, as was seen in the comparison

of hierarchical construction ability and syntax.

5.3.2 Abilities controlled by the right hemisphere:

A. Gestalt perception (and part/whole perception):

Clinical data indicate that gestalt perception and part/whole perception (which actually seems to be a type of gestalt perception) are right hemisphere abilities in the adult (Newcombe, 1969; Lansdell, 1968; Nebes, 1971). These abilities involve conceptualizing a whole upon exposure to only a part or parts. That is, upon seeing only a part of something the subject must project the whole. In part/whole tasks the stimuli used are single, identifiable parts (e.g., a piece of pie) and the whole (i.e., the entire pie) must be conceptualized from this single part. In gestalt tests the whole must be conceptualized from an apparently disparate set of parts (e.g., a partially obliterated silhouette is shown and the subject must identify the silhouetted item).

On the Perceptual Integration test Marta's responses reflected that she attended either to the parts or to the wholes rather than to both simultaneously. Elkind et al. (1964) found that 5-6 year olds tend to see only wholes or parts (centration), 7-8 year olds see both parts and wholes but do not integrate them, and older children (8-9 years old) are able to see wholes and parts in relation to one another (e.g., "It's a man made out of fruit"), evidencing part/whole integration. 75% of 9 year olds tested by Elkind et al., (1964) showed this ability.

Marta did very poorly on the Visual Closure subtest of the ITPA, obtaining a raw score of 3 for an age score of 2.2.

On the Mooney Faces Test (Mooney, 1957) Marta obtained a score of 17/40 (42.5%) with much prompting. On each item Marta had to be reminded of the six possible categories and much encouragement was required to get her to respond. Due to the slow, laborious fashion in which Marta did the test, two separate sessions were required to administer it. Many of her responses seemed to be guesses.

B. Facial recognition:

The Benton Test of Facial Recognition is a standardized procedure for assessing the ability to identify the discriminate photographs of unfamiliar faces (Benton, Van Allen, de S. Hamsher, and Levin, 1975). Benton et al. (1975) found a link between disease of the right hemisphere and defective performance on this test, a result which concurred with that of De Renzi and Spinnler (1966), and Warrington and James (1967). There is a 54 item (long) version of the test as well as a 27 item (short) version from which a long version score can be projected. Marta was given the short version and scored .15 (projected long version score = 32), a "defective" performance.

C. Familiar Sounds Recognition task:

While research examining right-hemisphere dominance has generally utilized visual stimuli, some current studies (VanLancker, p.c.) are now investigating whether certain auditory stimuli are also

primarily processed by the right hemisphere, e.g., environmental sounds (Curry, 1967, 1968; Carmon and Nachson, 1973) and certain types of music (Kimura, 1967; Gordon, 1970; Cook, 1973). While she only did half of a 50 item test, Marta was able to correctly identify 20 of the 25 items. Normative data are just now being collected; however, Marta's performance was almost identical to that of my son's who was about 23 months old at the time of testing.

D. Familiar Voices Recognition task:

Speech is generally associated with left hemisphere processing. However, particular aspects of speech may in fact, be processed primarily by the right hemisphere, e.g., overall intonation contour (Blumstein and Cooper, 1974) and emotional tone (Heilman, Scholes, and Watson, 1973; Searleman, 1977). According to VanLancker (p.c.), familiar-voice recognition may rely on right hemisphere gestaltic perception, analogous to the recognition of familiar faces. One indication of this is the facility with which most people can recognize the voices of family, friends, acquaintances, colleagues, and media personalities. While this research is still quite new and the issues still largely unexplored, Marta was given a familiar voice recognition task to see how readily she would be able to identify the voices. Marta was given the task twice, and on her better performance identified 4 of 5 voices. Interestingly, the voice that she failed to recognize was my own, the voice least familiar to Marta of the 5. The other people on the audiotape were immediate family and a family

friend, all people she has known since birth and early childhood.

5.3.3 Abilities controlled by both hemispheres:

In so far as the following tests require a sequence and variety of behaviors, i.e., attention to and visualization of a visual pattern, and reproduction of this pattern through a complex sequence of motor movements, they are felt to require involvement of both hemispheres. Marta performed at abysmal levels on both tests. On the Graham and Kendall Memory for Designs test her score was 28 (with 0 being the highest possible score), a score so poor that it was off the bottom of the scale.

The Benton Visual Retention Test (Benton, 1965) is designed to test visual perception, visual memory, and visuo-constructive abilities. Marta was given administration C (a copying version) and did very poorly, attaining a score of 0. Frequently she drew undifferentiated circular shapes in response to the various models and ignored the peripheral shapes completely. Sometimes in response to test stimuli she drew faces and had to be constantly reminded to try to draw the stimulus figures presented.

5.4 Summary of Performance on Cognitive Tests

In the preceding sections a wide range of Marta's nonlinguistic cognitive abilities were surveyed. In virtually all areas studied, Marta's abilities in the linguistic domain appear to outstrip her

non-language abilities.

An examination of the language/cognition relationship in terms of Piagetian stages revealed that Marta lacks those abilities characteristic of the concrete operational period (e.g., reversibility and decentration) that have been claimed to underlie certain language attainments. Marta uses these very linguistic structures (e.g., passives, comparatives, and complex structures in which the clauses are temporally incongruent that one would predict she could not use, were the Piagetian abilities truly prerequisites.

Her profile also disputes the Correlational Hypothesis claim that certain nonlanguage and language abilities are reflective of common governing mechanisms. Given Marta's sophisticated linguistic level it is clear that she is able to classify and categorize elements, abduce rules, and formulate hypotheses, in the linguistic domain. However, she showed little nonlinguistic proficiency in these areas. Marta's linguistic abilities were much in advance of her classification, rule abduction, hierarchical constructive, logical sequencing, and memory abilities. Given that she is nearing the end of adolescence, it is doubtful that the putatively commonly governed cognitive abilities will ever emerge. In each case an extensive gap between the linguistic manifestation of a given ability and its nonlinguistic counterpart, argues against the notion that the two abilities are in fact, "of a piece" with one another.

Also, given Marta's poor short term memory span, her case argues against the notion that the constraints on syntax are primarily

processing and memory limitations. While memory span has often been linked to syntactic capacity, Marta's performance indicates that memory span is not necessary for complex syntax.

5.5 Summary of Performance on Neuropsychological Tests

While Marta excels at language, an ability localized to the left-hemisphere in most people (e.g., Krashen, 1972; Diamond, 1980; Geschwind, 1974; Springer and Deutsch, 1981), she shows no similar ability in any other area believed to be controlled by the left hemisphere. On short-term memory, sequencing, and computational tasks, for example, abilities thought governed by the left hemisphere, Marta did extremely poorly. It is provocative that Marta does not do well in other areas associated with the left hemisphere. This finding suggests that Marta's island of abilities is a small, specialized one indeed, truly an island of linguistic abilities. Perhaps other left hemisphere abilities are not similarly spared because they are located in different parts of the left-hemisphere from language. Mathematical abilities for example, have been noted to be located posteriorly in the left hemisphere (i.e., in the parietal lobe, or angular gyrus).

While the trend in recent years has been to describe the left hemisphere as an analytic, sequencing rather than language hemisphere per se, Marta's data indicate that it is possible to dissociate certain kinds of sequencing abilities from language abilities. Sequencing then, at least the kind tested here, does not seem to be as closely linked to language as has been previously assumed.

In contrast, she was at least able to do a few of the tasks thought to be governed by the right hemisphere, e.g., familiar voice recognition and an environmental sound recognition test (VanLancker, 1982, unpubl.). While the environmental sound recognition test is still very much in the experimental stages, it is hypothesized to tap right hemisphere abilities. Also, in naturalistic observations I noted that Marta can do simple jigsaw puzzles, a visuo-spatial ability perhaps governed by the right hemisphere. One of Marta's teachers once told me that Marta can solve two 12-piece puzzles simultaneously, with the pieces of both puzzles mixed together! However, her performance on many other visual-spatial right hemisphere tests was quite poor.

Generally, language stands alone as Marta's cognitive strength; no other ability strongly correlated with it.

I thank Cathy Dent for some interesting comments and discussion on this matter.

CHAPTER VI

6.0 General Summary

While the amount of data presented in the previous chapters is admittedly somewhat overwhelming, extensive data collection was necessary in order to obtain an accurate assessment of Marta's abilities and to establish, beyond a reasonable doubt, that Marta is indeed hyperlinguistic.

By using a variety of assessment approaches over a protracted period, I was able to determine that her difficulties cannot be ascribed to apraxia or emotional problems, but rather are actually due to actual cognitive limitations. In spite of the diverse ways in which Marta's cognitive knowledge was tapped, all systems except expressive language seemed grossly underdeveloped or deficient. The relative sophistication of her expressive language, as noted in Chapter IV, stands in striking contrast to these other abilities.

A cognitive system that can talk but that is otherwise extremely deficient, conjures up the image of a mindless loop system that simply takes in input and spews it back out unanalysed. One would predict that such a system would be echolalic and nonproductive. This might be the case if the system were completely incapable of any conceptual activity whatsoever. In fact, certain autistic children seem to function in this fashion. Marta, however, does have some conceptual

understanding. While much of what she says is sometimes difficult to interpret (see Chapter IV and Appendix III for examples), the structures are productive. Marta's errors and her ability to create novel forms attest to the productive nature of her language. She has not achieved linguistic competence in the complete absence of cognition, but has done so with a much diminished cognitive capacity. As such, Marta's hyperlinguistic performance bears important implications for our views of the language/cognition relationship and for a theory of language acquisition.

These data argue strongly against certain assumptions about the relationship of language to cognitive stages. Marta's High Language/Low Cognition profile counters claims that more advanced linguistic attainments rest upon nonlanguage attainments of the concrete-operational period, for example. She uses many linguistic structures that purportedly depend upon concrete-operational abilities (e.g., reversibility and decentration). However, she fails on the hypothesized prerequisite concrete-operational level tasks. Marta's performance thus refutes even the weak form of the Cognitive Hypothesis in that it shows that many nonlinguistic abilities are neither sufficient nor necessary for the emergence and development of language.

Perhaps even more noteworthy is the fact that Marta's performance profile challenges the related Correlational Hypothesis. This is the compromise position in which cognitive behaviors are not themselves assumed to be prerequisite to language abilities. Instead

they, along with language, are viewed as manifestations of a common underlying cognitive mechanism. This view has received increasing attention in recent years, in the face of mounting evidence that language abilities sometimes emerge prior to their supposed prerequisites (Cromer, 1974b, 1976a; Bowerman, 1978; Miller, 1981). In establishing underlying general cognitive principles as primary to both language and cognitive behaviors, this hypothesis does not predict an inviolate order of emergence of abilities across domains, but rather allows a variation in their order of appearance.

Individual differences as well as domain-specific factors contribute to the variation in order of emergence of abilities across domains in different individuals. Thus, that Marta exhibits language abilities in advance of their supposed commonly governed nonlanguage homologs" is not in itself damaging to the Correlational Hypothesis. However, given that it has been many years since Marta completed the language acquisition process, the temporal discrepancy between the emergence of her linguistic and non-linguistic abilities is sizeable. It has been acknowledged that if two abilities are commonly governed, they should emerge within a relatively narrow time frame (Bates et al., 1977). A large temporal gap between the emergence of abilities across domains presumably indicates that they are not "of a piece" with one another.

In addition, claims that specific cognitive abilities are operative across domains were not supported by Marta's data. For example, with regard to the feature of hierarchical organization,

whereas Marta constructs complex hierarchical structures linguistically, she is very deficient at building hierarchical structures in the nonlinguistic domain. Of course, even if she were proficient at such tasks and we were able to establish that hierarchical ability exists in all domains, this would not be particularly revealing with regard to our understanding of language and language acquisition. The presence of hierarchy across domains does not in itself imply the existence of shared governing mechanisms since hierarchical structure can be found in most complex systems of the universe (Curtiss, Yamada, and Fromkin, 1979; Fromkin and Kilma, 1981). The analogy is much too general to really be of much use, as was mentioned in Chapter V.

The hypothesis that common rule abductive capacities are operative across domains was also not supported by Marta's data. However, while she did not do particularly well on nonlinguistic rule abductive tasks, she showed at least some limited ability in this area. One must ask of course, what "comparable" abilities in the linguistic and nonlinguistic domains would consist of. The fact that Marta required many trials to finally abduce a simple "game" rule does not seem in any way equivalent to her ability to extract similarities and relationships among linguistic forms and structures and to learn and/or perceive abstract linguistic categories. The discrepancy may be due to the fact that the nonlinguistic tasks given to Marta simply failed to tap the relevant, general rule abductive capacity. But it is difficult, if not impossible, to find even intuitively comparable

systems of rules in other cognitive domains. Suggestions of possible homologs, e.g., the learning of social roles (Maratsos and Chalkley, 1980) or how to be a good child (Neimark, 1970) fail to be convincing, and more complex systems like knowledge of how to play chess or of musical theory are not good candidates since they are mastered by only a select few.

Examination of Marta's behaviors and abilities in naturalistic contexts fails to reveal any rule abductive ability which in any way seems comparable to what she does linguistically. The difficulties in finding nonlinguistic behaviors that seem equivalent to rule learning in language are in themselves indicative that no equivalencies exist.

Such was also the case with other abilities, such as classification. Whereas Marta, in using language, shows a capacity to perform a kind of classification at a fairly sophisticated level, she could not do more than the most simple classification tasks in the nonlanguage realm.

If similarities across domains are to be any significance they must be less general, and more highly specialized in nature. The kinds of constraints seen in one domain should also be evident in others. Thus far, however, analogies at this level have not been discovered.

Perhaps then, there is no analogue to the principles of grammar in other systems. I agree with Chomsky (1980), who wonders why we should expect a generalized cognitive capacity that is expressed uniformly across domains. "There seems little reason to suppose that

the principles of grammar or universal grammar have any close analogue in other systems, though naturally one must keep an open mind about the matter" (pp. 245-246).

Marta differs from previous subjects in that in her case no other cognitive ability is spared along with language. Previous studies have found at least one ability that correlated strongly with language, most notably, auditory short term memory. Auditory short term memory has been theorized to be linked in some significant way to syntactic ability (Menyuk, 1964; but cf. Cromer, 1976a; Bloom and Lahey, 1978). Some approaches to language learning theory have proposed that language is integrated with other aspects of cognition in differing ways. Whereas semantics is seen as tied to conceptual development, syntax is assumed to be tied more to processing factors like short-term memory and sequencing abilities.

However, unlike other High Language/Low Cognition subjects, Marta's auditory memory span capacity did not at all correlate with her syntactic level. Her memory span is extremely limited as compared to her syntactic capacities, which are relatively more advanced. Whereas Marta has difficulty remembering 3-item sequences, she produces sentences up to 20 words in length (e.g., "She, does paintings, this really good friend of the kids who I went to school with last year and really loved.") While Marta cannot repeat back sentences as long as the ones she produces, her short term memory for sentences seems appreciably better than her memory for unrelated items; she can repeat sentences of up to 9 morphemes in length. Thus,

it seems that structure facilitates her memory performance rather than vice versa.

In view of Marta's poor memory span, it is clear that syntactic capacity involves something other than just memory span capacity. A logical assumption might be that semantics contributes to Marta's capacity to remember sentences but not unrelated words. Perhaps Marta remembers sentences more easily because they have a cohesive structure and meaning. This is an interesting hypothesis in view of the fact that Marta shows some deficiencies in semantics. As was shown in Chapter IV, she uses certain lexical items and structures (e.g., numerical terms, adverbials) which she does not fully understand. Of course, as is evident from Chapter IV, Marta's speech is not devoid of meaning. The lag in semantics that does exist seems due to general cognitive deficits and indicates that the semantic component is linked to general cognition to a greater degree than the syntactic component. Because semantics involves the expression of concepts in linguistic terms, it is logical that if the concepts are absent or impaired, the ability to express the concept linguistically will be in turn affected.

Of course, it is important to emphasize that conceptual knowledge is not simply a mirror of semantic knowledge and vice versa. The two domains are also separable to some extent. This is illustrated by the fact that one can have a semantic deficit without necessarily being conceptually impaired. A semantic deficit without a concomitant conceptual deficit would consist of an impairment in the

ability to associate the concepts one knows with linguistic terms. Thus, an individual that seems to have grasped the notion of colors, but just cannot seem to learn which term goes with which color, might be termed as having a semantic disorder. It should be pointed out that this situation arises in normal language acquisition as well, such as when the child seems to be (conceptually) aware of colors and knows various color terms, but just does not yet know which colors go with which terms. Marta does not seem to possess such a disorder since she is quite proficient at matching concepts she does possess with their appropriate linguistic forms. For example, semantically her use of pronouns is quite accurate and appropriate as is her use of tense/aspect forms to mark past, present, and future. In these cases she has associated the correct linguistic forms with the relevant concepts. Marta does not possess a primary semantic deficiency then, but rather a secondary one, since her semantic deficiencies seem to be the result of cognitive deficiencies. Gaps in her semantic knowledge occur in just those areas where she is conceptually deficient. That semantic and conceptual knowledge are not inextricably linked is also illustrated by Marta's use of forms that are well-formed syntactically and semantically, but which are factually incorrect.

The various conceptual deficits evident in Marta's language render it abnormal in several respects. For example, Marta's limited numerical abilities were discussed in Chapter V. Although she cannot consistently count even 5 items, or give her correct age, she frequently uses numerical references (albeit erroneously) in her

spontaneous speech (see Chapter IV). Her inappropriate and anomalous utterances involving numerical reference are undoubtedly due to her nonlinguistic deficits. It is important to note, however, that these conceptual deficits have not precluded her learning the forms themselves and her use of them in sentences. This discrepancy between the learning of form and content is also evident in normal language acquisition. For example, children sometimes use temporal terms prior to gaining full knowledge of their meanings.

206) [Wants to get out of the shopping car seat]

Aaron (age 2:2): I wanna get out this Tuesday!

This was also the case with Marta, who uses various adverbials, but who sometimes seems to lack knowledge of their specific meanings as mentioned in Chapter IV.

In certain cases then, a conceptual deficit will affect the manner in which a structure is used, but does not disallow the learning of the form itself, indicating that conceptual knowledge is not by itself sufficient or even necessary to account for syntactic knowledge.

Judging from Marta's data, this is definitely the case with particular lexical items and phrases, and also apparently true of more complex structures like relative clauses and conditions. While Marta tends to produce such complex structures during her spiels (stretches of rapid, voluminous speech as mentioned in Chapter IV), they do not seem wholly memorized, or echolalic; it appears that she is able to generate the structures syntactically without necessarily having a

full semantic interpretation for them.

With regard to productivity, perhaps the appropriate question is not so much whether Marta's language is productive--it clearly is,-- but rather how productive. While Marta's spiels include productive utterances (as indicated by her complex, novel or unusual utterances as well as her errors), they also seem to include stereotyped or perseverative chunks and phrases, unclear anaphoric reference, frequent topic switches, and imprecise articulation. One teacher of Marta's once commented that Marta's speech sounds like parts of conversations she's heard. Indeed, it sometimes seems as if Marta inserts lexical items and phrases into sentences almost "mad libs" fashion.

As noted in Chapter IV, normal speakers apparently incorporate routines, automatic phrases and formulae into conversational speech, possibly to minimize the effort required for constructing sentences. To lessen the burden on ourselves and to make our speech facile and fluent, we make use of an extensive repertoire of prefabricated phrases and expressions. No doubt some normal individuals make more use of such speech formulae more than others. All of us are familiar with individuals who are given to liberal (and often annoying) use of cliches. While Marta may use speech formulae to give her fluency in speech production, her speech differs from the normal individual's in significant ways. The differences are likely caused by her conceptual and social/interactive limitations. For example, Marta seems to have a much smaller stock of speech formulae to call forth than the normal

completely transparent form/function relationship does not always exist in language, that due to language change some forms are vestigially abstract, with no apparent functional motivation. This fact is a strong argument against a fully pragmatically-based theory of language acquisition. While certain formal characteristics may be traceable in some way to functional origins, such functional motivations do not account for how or why a given child is able to learn the rules of language. The child's capacity to acquire forms which are abstract--forms whose diachronic histories are unavailable to the language learner--must still be accounted for. Purely functionally-based grammars may be relevant to accounting for certain language changes, but not for how language is acquired.

The behavioral and cognitive evidence then, is that Marta possesses an island of linguistic ability. Can this island be characterized along hemispheric parameters? That is, are left-hemisphere functions relatively more intact than right hemisphere functions? Initial results do not show that left hemisphere abilities as a group are spaced alongside deficient right hemisphere functions. Language is the only left hemisphere ability that seems particularly enhanced. Also, Marta was able to do environmental sounds recognition and familiar voice recognition on several nonstandardized tests, abilities which some have theorized to be controlled by the right hemisphere. It does not appear that Marta's deficiencies can be defined along strict hemispheric parameters, then.

209

person; the same ones crop up more frequently and thus more conspicuously. In addition, she uses the speech formula in syntactically appropriate, but often semantically or pragmatically inappropriate ways. Even in her use of speech formulae then, a dissociation between Marta's linguistic and nonlinguistic knowledge and between her syntactic and semantic knowledge is evident.

Marta's data also challenge claims that pragmatic factors play a primary role in the acquisition process. As indicated in Chapter IV, her pragmatic functions are extremely impoverished. While she is able to express basic pragmatic functions (e.g., needs and wants), more complex functions seem beyond her. Note for example, her inability to relate an incident in a manner which is clear and comprehensible to the listener. She fails to follow the Gricean subrules of conversation (Grice, 1975), neglecting for example, to take into account the listener's perspective and to be sensitive to new vs. old information. However, she does use syntactic structures which are said to embody (and to be functionally motivated by) such notions, such as subordinate as well as main clauses, passivized structures, and relative clauses. Thus, her use of such structures cannot be said to hinge on pragmatic functions.

It does not seem unlikely that early on in language acquisition the child makes use of pragmatic considerations when and wherever possible. However, the notion that such considerations are fully explanatory of the language acquisition process seems unwarranted. Givon (1979) and others (Bates and MacWhinney, 1978) admit that a

208

functions are relatively more impaired than left hemisphere functions should be further researched. Of course, one major pitfall with neurological and neuropsychological assessment measures is that they are task-oriented, and not naturalistic, and as evident in Chapters IV and V, Marta characteristically does poorly on such tasks. Unfortunately, it is not clear that this problem can be avoided with regard to these tests since after all, many variables must be controlled if there is to be unambiguous interpretation of the results.

Now that the High Language/Low Cognition profile has been documented in this and previous studies, further work in this area should even more carefully explore the type of language that emerges. The topic of productivity is of crucial interest. As mentioned above, the question to be researched may not necessarily be whether the speech is productive, but whether the nature of productivity differs from that seen in normals, and if so, how. The idea that High Language/Low Cognition individuals make more use of fewer speech formulae should be examined, for example.

With regard to evaluating nonlinguistic cognitive knowledge, it seems that development of non-task-oriented procedures for assessing nonlinguistic abilities beyond the sensorimotor stage are needed. Just as it is possible to assess language naturalistically through spontaneous speech analysis, so should it be possible to assess nonlanguage functions naturalistically. As was stated in Chapter V, while Marta did poorly on classification tasks, for example, her

However, in certain respects Marta's behavior is reminiscent of individuals with right hemisphere damage. For example, in Chapters IV and V a discrepancy between structure and function in Marta's language was illustrated, with the former being greatly enhanced relative to the latter. The structure/function gap is also reflected in Marta's ideational vs. affective awareness. In Chapter II it was noted that Marta's capacity to know when she should feel sad was relatively better than her capacity to feel the emotion itself. Similarly, in individuals with right hemisphere damage, one sometimes sees the capacity to show intellectual but not emotional awareness (E. Zaidel, P.C.).

The neuropsychological data are admittedly somewhat incomplete and sketchy. Due to Marta's difficulty in the task-taking setting and (presumably) her low cognitive level, it was not possible to obtain certain kinds of desired data (e.g., tachistoscopic testing, auditory evoked potentials, etc.).

6.1 Prospects

At this point, left unresolved is the matter of definitively identifying which part of the brain is disturbed and just how it's disturbed. It would be of interest to attempt to get "hard" neurological evidence of what is going on in Marta's brain. The PET scan test for example, would hopefully provide an interesting dynamic picture of Marta's brain activity while she is engaged in linguistic vs. nonlinguistic tasks. The possibility that right hemisphere

interaction with her environment indicates at least some classification capacity. Perhaps development of a protocol for observing and assessing classification abilities in the natural environment would better capture what the individual knows about categories and classification.

By fine-tuning our assessment of language and improving our assessment of nonlanguage, the nature of this unusual cognitive profile will be more clearly defined.

6.2 Conclusion

Marta's profile indicates that language can develop despite extremely limited nonlinguistic cognitive abilities, many of which have been hypothesized to be prerequisite to language or to reflect underlying principles necessary for both nonlinguistic and linguistic development. Such findings demand a reshaping of our conception of the relationship between language and cognition and of language itself.

The High Language/Low Cognition profile is only predicted by those models of language that regard language, or at least aspects of language, to be autonomous from other cognitive systems. Such a profile is not predicted by purely cognitively, semantically, or pragmatically based models. Like the six blind men in the Indian fable, to some extent all the various approaches to language acquisition provide accurate descriptions of processes involved in language learning. Where they err is in assuming that on the basis of

defining and exploring only a part of the animal, they have explained the "whole elephant." Language is a complex system. It is impossible to simplistically state whether it is or is not dependent upon other mental functions in "all or none" terms. In a sense, language is both independent of and dependent upon nonlinguistic functions. This fact must be incorporated into any viable linguistic theory.

The data presented in this study support the recent trend toward an integrated model of language acquisition, i.e., one which involves numerous cognitive systems, the social/interactive environment, and perception, but which also posits innately based language-unique factors. The models of language and language acquisition proposed by Chomsky (e.g., 1980) and more recently Roeper (1978; 1982) represent such models since they embody the dual (dependent/independent) nature of language.

Language, as one kind of cognitive system, may intersect with other cognitive systems, but it is not wholly dependent upon those other systems, nor is it simply one expression of a set of general cognitive capacities. Whereas data from adult aphasics indicate that once established, language can continue to function in spite of selective deficits, Marta's case shows that language can emerge in development without the full support of other cognitive systems. As Chomsky (1980) puts it,

"... it might be proposed that various 'mental organs' develop in specific ways, each in accordance with the genetic program, much as bodily organs develop; and that multipurpose learning strategies are no more likely to exist than general principles of 'growth of organs' that

their meanings is considered part of the conceptual component. Marta's abilities are well characterized by describing them in terms of a dissociation between the computational and conceptual components of language. That is, the computational component seems relatively intact alongside a deficient conceptual component. This conceptualization captures why certain aspects of her semantics seem fine and others more impaired (e.g., Marta has mastered certain semantic rules, but is deficient pragmatically).

Syntax is the aspect of Marta's language that has emerged most unscathed by her nonlinguistic deficits. That syntax is relatively less impaired implies that it is relatively more independent, whereas other aspects of language seem to be more closely tied to nonlinguistic condition. In view of the fact that externally based factors like social/interaction, and internally based factors like general cognition cannot account for our capacity to learn the rules of grammar, it appears that innate, language-unique cognitive principles may be involved. While Marta has such extreme difficulty with the simplest of tasks and rules in the nonlinguistic realm, she has been able to master certain language-particular (i.e., English) versions of rules such as WH-movement and I would predict likewise for other conditions such as the Specified Subject Condition, the Tensed-S Condition, and the Subjacency Condition. Marta tends not to produce many of the relevant "test" sentences, but I have not seen consistent violations (of course, occasional violations can be attributed to performance factors.) Marta then, may have come to the

account for the shape, structure, and function of the kidney, the heart, the visual system, and so forth ... Rather, specific subcomponents of the genetic program, coming into operation as the organism matures, determine the specific properties of these systems" (p. 245).

Marta's data also support the notion that various aspects of language are separable and may be differentially linked to nonlanguage functions. Whereas she is able to produce very syntactically complex structures, the content of her speech is much less sophisticated. The semantically anomalous nature of many of her utterances reflects the fact that a depressed cognition affects the individual's capacity to formulate meaningful utterances, but does not preclude her or his learning of the structural features themselves. Syntax and semantics then, may be somewhat dissociated. However, semantics is not a singular entity. Some aspects of semantics seem linked more to structure while others seem linked more to conceptual ability. Chomsky's modular conceptualization aptly captures the distinctions.

As mentioned in Chapter I, Chomsky's theoretical model of language is a categorical or modular one where language is described as consisting of two components, the computational and the conceptual. The conceptual component interacts closely with other aspects of cognition, embodying pragmatics, thematic relations, object reference, etc., while the computational component includes the rules of language and is autonomous of the rest of cognition. The areas traditionally defined as semantics exist both in the computational and conceptual components. Whereas semantic rules are considered part of the computational component, the learning of particular lexical items and

language-learning task with an innate knowledge of certain universal language principles and an innate capacity to learn the language-specific versions of these universal principles.

Many have argued that syntactic phenomena call for innately-based language-unique cognitive principles (e.g., Fromkin and Klima, 1980; Osherson and Masow, 1976; Cromer, 1981; Roeper, 1978, 1982). For example, the knowledge of grammatical categories like noun and verb and the ability to learn and/or perceive such grammatical notions as subject, direct object, and indirect object, seem thus far to be uniquely linguistic. (However, Fromkin and Klima point out that certain features of phonological systems also appear to be unexplained by production/perception capacities in man).

While particular structures may serve some nonlinguistic, say communicative function, it is their specific syntactic structure that is uniquely linguistic. For example, Fromkin and Klima (1980) discuss the fact that relative clauses may possess the communicative functions of "narrowing down the possible realm of reference to an individual referent," and "refreshing in the mind of the addressee the background of shared experience and knowledge." However, the particular structure itself is not so easily explained by reference to function or production/perception capacities.

To posit the existence of a highly evolved cognitive system which includes particular uniquely linguistic features, is not an ad hoc notion. There is already evidence that humans have biological adaptations whose function is specifically linguistic. For example,

it is now evident that the human vocal tract has evolved such that it differs markedly from that of nonhuman primates (Lieberman, 1972). The modifications and differences seem to have evolved primarily for adaptation of the vocal tract to speech so a wider range of speech sounds could be produced. In addition, certain parts of the human brain seem to have evolved such that they are highly specialized for language (although as Osherson and Masow (1976) point out, such areas of the brain do not necessarily perform only linguistic functions).

The claim that human language might possess unique properties has been much maligned in the past. Such claims have been laughed at as naive, anti-evolutionist, counter intuitive, discontinuous, and presumptuous. Bates (1979), in discussing her views on the evolutionary development of language, points out that evolutionary phenomena often result from the synthesis of various developments; language may in fact be just such a "jerry-built" system, a held-together package of numerous converging evolutionary developments. She uses this as an argument against the idea that language could in any way be independent of other cognitive mechanisms. However, to argue that language, or at least aspects of language are independent of other abilities does not preclude an account of language evolution such as the one Bates describes. It seems to me to be entirely possible that the synthesis and interaction of evolving mechanisms interrelated to create a qualitatively different, highly specialized cognitive system, a system that possesses organizing principles that simply no longer have any true

analogs in other cognitive domains. It is a system that has evolved to a point at which it is essentially an independent cognitive system. That part of language embodying the rules of grammar is the most highly evolved, specialized aspect of this "new" system, and is relatively most independent of other cognitive systems.

Nonlinguistic social, conceptual, perceptual, and processing factors all undoubtedly contribute to the acquisition of normal language in nontrivial ways. One distinguishing factor of language as a cognitive system may very well be the fact that it involves the integration of so many cognitive systems. However, whereas many aspects of language may indeed involve interdigitation with nonlanguage mechanisms, others do not. The grammatical rule system of language (or what Chomsky has termed the computational component) is the one aspect of language that cannot be explained away by an appeal to nonlinguistic, general abilities. In the absence of strong evidence to the contrary, Marta's data indicate that this part of the language capacity involves cognitive principles unique to language. Data from this study thus attest to the dual (dependent/ independent) nature of language as a cognitive system.

APPENDIX I

1. Receptive Language Measures

A. CYCLE-R

The following description of the CYCLE-R is largely taken from Curtiss, Kempler, and Yamada, 1981.

CYCLE-R: The receptive battery was developed as a research tool to obtain detailed information about children's linguistic knowledge in the areas of syntax, morphology, phonology, and semantics.

The battery consists of four subbatteries (syntax, morphology, semantics, and phonology), each of which contains a wide range of tests which permits the tracking of development in each grammatical component.

Several design features were built into the various subtests, allowing them to be used with individuals with limited conceptual and attentional abilities.

Although it is impossible to completely separate language ability from test-taking ability in formal receptive language tasks, the CYCLE tasks are simple to minimize nonlinguistic task demands as much as possible. In the receptive language tests the examiner reads a test sentence aloud and the subject is to act out or follow the instruction

Receptive Language Subtests from CYCLE-R

Given to Marta

Active Voice Word Order	Possessive Adjectives: my, your, his, her, out, their
Attributive/Stative	Possessive Morpheme /-s/
Auxiliary-Be Plural	Quantifiers: some, many, none, one, every, all
Auxiliary-Be Singular	Receptive Phonology
Before and After I and II	Reflexive Pronouns
Case-Marking Prepositions: by, for, of, to, with	Simple Declaratives
Clefting	Simple Modification
Comparative Marker /-er/	Simple Negation
Complex Modification	Subject Pronouns
Complex Negation	Subject Relative Clauses
Disjunction	Subject Relative Clauses ending in N-V
Double Embedding I and II	Tense and Aspect Markers: finish, beting, -ed, gonna, will
Double Function Relative Pronouns	Verb Plural
Lexicon: Reference I, II, III	Verb Singular
Action I, II, III	Wh- Questioning of Object
Description II, III	Wh-Questioning of Subject
Locative Prepositions I, II, III: in, on, under, next to, over, in front of, in back	Who vs. What
Noun Singular/Plural	
Object Pronouns	
Object Relative Clauses	
Object Relativized in an Object Relative Clause	
Passive Voice Word Order	

(sometimes with objects), or to point to the picture corresponding to the test sentence (see Curtiss et al., 1981 for sample items).

B. Token Test: Ten or 20 small plastic chips ("tokens") are presented to the subject in a predetermined array. The tokens vary in color (red, white, blue, green, yellow), size (large and small), and shape (circles and squares).

The test given to Marta consists of six parts. Instructions increase systematically in length from part to part, with the instructions in part F increasing in structural complexity as well.

Part A: Show me a square.

Part B: Show me the blue circle.

Part C: Show me the large green square.

Part D: Take the white square and the green circle.

Part E: Take the small blue circle and the large yellow square.

Part F: If there is a black circle, pick up the red square.

C. The Peabody Picture Vocabulary Test, Revised: The PPVT is designed primarily to measure a subject's receptive vocabulary for Standard American English (Dunn and Dunn, 1981). In this test the subject is shown an array of four pictures for each item. The examiner says, "Show me _____," and the subject is to point to the appropriate picture. As the test proceeds, the vocabulary words increase in difficulty. Raw scores are converted to mental age scores, I.Q.'s and percentiles.

2. Expressive Language Measures

A. CYCLE-Elicitation Battery:

Items on this test involve a sentence-completion format. Two-

picture arrays are sometimes used to set up a contrast which serves to cue the child for the desired response. Pointing to the top picture, the examiner describes or refers to that picture. She then points to the bottom picture and starts a sentence which the child must complete, e.g. (pointing to top picture) Here is a dog, and (pointing to bottom picture) here are two _____. Single picture arrays are also used to cue the child for the desired sentence completion item, and to increase the child's interest and attention, e.g., (pointing to a picture depicting an unhappy looking boy sitting at a table with a woman standing alongside) Brian's mother said: "Please drink your milk, Brian." But Brian said, "No! I _____ (won't)." For a description of scoring measures see Curtiss, Kempler and Yamada, (1981).

B. CYCLE-Spontaneous Speech Analysis: Three separate analyses from the CYCLE-S were performed: Grammatical, semantic, and conversational analyses. Generally the first 100 utterances, regardless of form or content, are used for the conversational analysis. The grammatical and semantic analyses exclude "automatic" utterances and exact repetition of self or others. For a more complete description of this methodology, see Curtiss, Kempler, and Yamada, 1981.

Grammatical Analysis: The grammatical analysis consists of giving one of five weighted scores (1-5) to one of a prescribed set of syntactic and morphological structures in a given sentence.

Elicitation Tests

- Active Voice Word Order
- Passive Voice Word Order
- Promise / Ask / Tell
- Affirmative Conditional Modals: would, could, should
- Quantifiers: many, some, one, none
- Auxiliary-Be Singular/Plural
- Reflexive Pronouns
- Case-Marking Prepositions: by, of, with, for, to, from
- Regular Past participle
- Complex Modification
- Simple Declaratives
- Counterfactual Conditionals
- Simple Modification
- Direct Object/Indirect Object
- Simple Negation: doesn't, isn't
- Ellipsis with "does"
- Some → Any
- Embedded Negation
- Subject Pronouns: he, she, they
- Expressive Phonology
- Subject Relative Clauses
- Future Conditionals
- Subject Relative Clauses
- Irregular Past Principle
- Tense and Aspect: gonna/will, -ed, -ing
- Locative Prepositions: off/on, on, under, in front, in back/ in/out
- Verb Singular/Plural
- Negative Conditional Modals: wouldn't, couldn't, shouldn't
- Noun Singular/Plural
- Object Relative Clauses
- Passive
- Passive Past Participle
- Possessive Pronouns: his her(s)
- Possessive Morpheme /-s/
- Present Affirmative Modals: can, do
- Present Negative Modals: won't, can't, don't

1. obligatory but omitted
2. semantically/pragmatically inappropriate and syntactically ill-formed
3. semantically/pragmatically appropriate but syntactically ill-formed
4. semantically/pragmatically inappropriate but syntactically well-formed
5. correct semantically/pragmatically appropriate and syntactically well-formed

Thus, for a given feature, say, subject pronouns, a score of 1 to 5 is given to each occurrence for obligatory but omitted occurrence of the feature throughout the speech sample. Then, the scores are summed and a mean is obtained. The closer the subject's score is to 5 indicates how frequently she or he uses the feature correctly. In evaluating a given subject's grammatical performance attention is paid to the range of structures used from among the specified set of structures included in the analysis. In addition, attention is paid to the percentage of total utterances that embody those structures or operations judged to be more complex linguistically.

2. Semantic analysis: In the semantic analysis the subject is assessed for her or his use of a specified number of semantic functions and categories. As with the grammatical analysis, the subject's use of each function or category is tallied according to three weighted scores.

1. obligatory but omitted
2. semantically inappropriate
3. correct, semantically appropriate

This scoring method gives some indication as to how often the child correctly uses a given semantic feature. A mean for all semantic categories used gives some indication of the subject's range and

NOUN PHRASES

Determiners/Demonstratives
 Quantifiers
 Subject Pronouns
 Object Pronouns
 Reflexive Pronouns
 Indefinites
 Relative Pronouns
 Dummy "it"/"there"
 Possessive Morpheme /-s/
 Regular Plurals
 Irregular Plurals
 Locative Prepositions
 Case-Marking Prepositions
 NP Present in PP

AUXILIARY

Regular Past Tense
 Irregular Past Tense
 Tense Assignment
 Regular Past Participles
 Irregular Past Participles
 Have (aux)
 Present Progressive: be
 Present Progressive: -ing
 Uncontracted Modals
 Contracted Modals

VERB PHRASES

Verbs with Particles
 Predicate Adjectives/Nominatives
 Third Person Subject Pronouns
 Non-third Person Pronouns
 Be (verb)
 Other Equational Verbs
 Be Contraction

OPERATIONS

Subject-Aux Inversion
 Subject Questioning
 Object Questioning
 Other Wh- Movement
 Do Support in Questions
 Negative Placement
 Do Support in Negatives
 Negative Contraction
 Ellipsis/Deletion
 You-Deletion
 Particle Movement
 Proposed Indirect Object
 Subject Relativization
 Object Relativization
 Relative-Be Deletion
 Equi-NP Deletion
 Other Subordinate Clauses
 Some → Any
 Passive

OTHER

Subordinating Conjunctions
 Coordinating Conjunctions
 Infinitival Complements/Same Subject
 Infinitival Complements/Diff. Subject
 Infinitival Complementizers
 Other Complements
 Adverbials
 Active Voice Word Order
 Simple Declaratives
 Comparative /-er/
 Superlative /-est/
 Passive: be
 Passive: get.
 Passive: -en
 Passive with Agent

productivity in the expressive semantics area, range and productivity in this language area.

3. Conversational analysis: The conversational analysis is performed by assigning a mean weighted score to each occurrence (or obligatory but omitted instance) of a specified set of discourse functions. The weighted scores are:

1. child does not do where appropriate
2. child does inappropriately
3. correct child does appropriately

The conversational analysis also produces a ranged score, equal to the total number of different discourse functions utilized by the subject.

Marta's performance was compared with that of normal children between 4 and 9.

C. Developmental sentence scoring (Lee, 1974; Lee and Canter, 1971):

In this technique, 50 consecutive, nonecholalic, "complete" (utterances including subject and verb) sentences are evaluated in terms of eight grammatical features. Each scorable item is given a score from 1 to 8 with higher scores reflecting developmentally more advanced forms. An extra sentence point is given to each sentence that is error-free in all aspects of language. Each sentence is then given a score, the scores of all the sentences are summed, and a mean sentence score (DSS) is obtained. An expressive language level can be obtained by examining normative findings and matching the subject's DSS to the age level at which 50% of the children scored a similar score. Norms are based on findings from 2 to 7 year olds.

Semantic Analysis Categories

Agent
Experiencer
Patient
Goal
Instrumental
Dative
Comitative
Benefactive
Directional
Locative
Quantification
Attribution
Irrealis
Possibility
Obligation
eictic
Stative
Active
Equational
Genitive
Negative
Anaphora
Intentionality
Causality

Conversational Analysis Categories

Turn-taking
Establishes New Topic
Continues Topic across Speakers
Elaborates Own Old Topic
Requests for Information
Statements/Comments/Descriptions
Acknowledgments
Responses to Questions and Requests
Interrupts at Appropriate Points
Labelling
Hands
Calls
Imitations of Others
Repetitions of Self
Repairs
Captures Presupposition/Implicature of Previous Utterances

4. Easy to see/Hard to see task (C. Chomsky, 1969):

Procedure: Place a blindfolded doll on the table in front of the subject.

Test question: 1. Is this doll easy to see or hard to see ?

2. Would you make her easy/hard to see?
(Choice of easy/hard in #2 is dependent upon subject's response)

3. For subject who answers "hard to see" ---
Why was she hard to see before?
What did you do to make her easier to see?
Why did that make her easier to see?

A slightly modified version of the task was also given in which no blindfold was used. The doll, with eyes closed, was placed on the table in front of Marta and the above test questions were posed.

5. Conditional Tasks (taken from Reilly, 1982):

Procedure 1: What if? Using a variety of pictures as stimuli, the subject is asked different questions to elicit all types of conditionals consequents.

Procedure 2: Pretend. This task focuses on the production of hypotheticals with an initial model provided. The experimenter says, "We're going to play a pretending game. First, I'll pretend to be something and I'll tell you about it. Then it's your turn. If I were a duck, I would swim in the water." The second part of this task involves pretending to do something, and a model is given, "If I ate 4 elephants, I would get sick."

Procedure 3: Lion's Face Construction. This task is designed to demonstrate comprehension and production of predictive conditionals. On the table is an outline of a lion's face, and small pieces of colored paper shapes for putting a face on the lion. A bowl of small bits of food rewards is placed on the table, (e.g., jellybeans, marshmallows, raisins). The experimenter says, "We're going to play a game and give the lion a face. I'll go first and show you how it works. If you put the eyes on, I'll give you a marshmallow." The subject performs the task and is rewarded. The experimenter and subject take turns until the face is completed.

Procedure 4: Lion's Face Transformation. Once the face of the lion is complete (see Procedure 3), the subject is asked counterfactual questions about the lion, e.g., "What if the lion had been an elephant?" in order to elicit counterfactual conditionals.

Procedure 5: Bears and Pigs. The goal of this task is two-fold: 1) to investigate comprehension of counterfactuals and 2) elicit counterfactual consequences. The subject is read The Three Little Pigs and The Three Bears. Then the experimenter shows a picture of a situation with a known result, e.g., the straw house which is blown down by the wolf, and asks what would occur if some crucial variable was altered. For example: "What if the straw house had been made of bricks?"

Procedure 6: Imitation. This traditional imitation task serves as a complement to the other tasks. The subject is asked to repeat two tokens of each conditional type.

Description of Nonlinguistic Test Procedures

1. Sensorimotor abilities (Uzgiris and Hunt, 1975):

The Uzgiris-Hunt Ordinal Scales of Psychological Development (1975) provide a means of assessing conceptual development during the sensorimotor stage (0-2 years).

A. Object concepts: Marta was assessed as to whether she could 1) find an object which is completely covered with a single screen in two places alternately; 2) find an object which is completely covered with a single screen in three places, 3) find an object after successive invisible displacements; 4) find an object under three superimposed screens/ 5) find an object following one indivisible displacement with a single screen; and 6) find an object following one invisible displacement with three screens.

B. Means-ends: Marta was assessed as to whether she would 1) let go of an object to reach for another; 2) use a relationship of support to obtain an object; 3) use a string horizontally to obtain an object.

2. Spatial abilities

A. Stereognosis (Laurendeau and Pinard, 1970): On this test the subject must reach behind a screen with both hands to palpate a series of familiar objects and geometric shapes (embodying both topological and Euclidean relationships). The subject is to identify the item she has felt by oral labeling (for objects), or by pointing to either a pictorial representation of the item or a duplicate item in an array

in front of the screen.

3. Concrete operational abilities

A. Conservation abilities:

1. Length: Marta was shown two Play-doh "worms", one straight and one undulating, and asked to judge whether they were the same or whether one was longer (after Lovell, Healy, and Rowland, 1962). She was also shown two sticks of equal length in various configurations (i.e., one stick pushed ahead, both sticks placed in a "T", and both sticks placed to form an acute angle), and was asked whether the sticks were the same or whether one was longer (Lovell et al., 1962).

2. Solid quantity: Marta was shown two equal balls of Play-doh and was asked to verify that the two balls were indeed the same. When one was rolled into a hog dog, she was asked to judge whether the ball and hot dog had the same amount of clay or whether one had more (Elkind, 1961). The hot dog was then rolled into a cylinder and then broken into three pieces (Uzgiris, 1964) and with each transformation, Marta was asked to make "same or more" judgments.

3. Liquid quantity: Marta was given two identical tall narrow glasses and one low wide glass (Wallach et al., 1967). Liquid was poured into the two tall glasses so that both had equal amounts. When the liquid from one tall glass was poured into the low wide glass, Marta was again asked to make a "same or more" judgment ("Do we have the same to drink or does one of us have more?"). After the liquid

was poured into three small glasses (Beard, 1963), Marta was again asked to make a "same or more" judgments.

4. Weight: Marta was given two balls of clay, one in each hand. Once she had agreed that both balls weighed the same, transformations were performed on one of the balls (analogous to those made in the solid quantity tasks) and Marta was asked to make "same or more" judgments with regard to weight (Elkind, 1961).

5. Number: Marta was given a number conservation task using pieces of cracker rather than the usual poker chips. Six cheese-bits crackers were placed in a row in front of Marta. Alongside this row another row of similarly sized, matzo crackers were placed.

Transformations involving spatial displacement were made, and Marta was asked to make "same or more" judgments (after Wohlwill and Lowe, 1962).

B. Seriation: (Piaget and Inhelder, 1959; Inhelder and Piaget, 1964; Lovell, Mitchell and Everett, 1962)

The task consists of three subparts: anticipation of prediction of seriation, active seriation, and insertion. Marta was shown a line drawing of a series of Coke bottles seriated by size to illustrate the concept of being "in order". After the picture was removed from view Marta was then shown a set of eight rods of different colors and lengths (in a prescribed random linear configuration) and asked to make a drawing, using first colored pencils, then a black pencil, of what the sticks would look like if they were in order. She was then asked to actually seriate the rods. In the insertion task Marta was

she would spontaneously think to sort on the basis of gender (coded in English by the pronominal system). Testing with normal children (Curtiss and Yamada, unpub.) has revealed that three year olds are able to spontaneously sort pictures on the basis of gender. Marta was given four semantic classification tasks: male/female, human/nonhuman, animate/inanimate, edible/inedible. In each task Marta was given a stack of cards and asked to sort the cards into two boxes, "Which ones belong together?", "Which ones are (kind of) the same?" After sorting the cards Marta was asked to explain why she had sorted them in that fashion. If she failed to perform the sort correctly, the examiner did an additional trial, guiding the task by presenting each card one at a time asking, "Does this belong with the ___ or the ___? These tasks have been normed on children between 2 and 6 years old (Curtiss and Yamada, unpub.).

D. Number concepts:

1. Magic Show (Gelman, 1972, 1980): Using extremely small number sets (i.e., sets of 2 or 3 items) the Magic Show probes number concepts previously only testable in older children. Without using the words "more" or "same," but rather, "winner," and "loser," Gelman was able to explore among other things, whether young children see displacement and density as relevant to numerosity. In this task, the subject is shown two plates. One plate has two identical objects and one three. After it is established that the three-object plate is the "winner," a series of items follows in which the subject must identify which plate is the "winner." (Between each item the plates are hidden

to "insert" two additional rods in a seriated array. There are norms for all phrases of this task from Piaget and Inhelder and from Lovell et al., for children between 4 and 9 years of age.

C. Classification:

1. Inhelder and Piaget classification tasks (Inhelder and Piaget, 1964; Lovell et al., 1962): Marta was given a set of paper cut-outs which varied in shape (circles and squares), size (large and small), and color (red and blue). She was asked to sort the cut-outs into two piles to test whether she would spontaneously sort along one of the 3 parameters. She was also specifically asked to sort along one of the parameters and then to shift to a new parameter.
2. Class inclusion tasks: Marta was given a standard Piagetian class inclusion task (Inhelder and Piaget, 1964; Lovell et al., 1962) using materials that were felt to be perceptually and conceptually salient to her, i.e., apples and oranges. A row of five apples and a row of 5 oranges were placed before Marta and she was asked, "Is there more fruit or more apples?", and, "Is there more fruit or more oranges?" She was also given a more conventional version of the task in which colored (red and blue) squares were given to her. She was then asked questions "Are there more square ones or more blue ones?"
3. Curtiss "semantic" classification tasks (Curtiss, unpub.): Marta was also given classification tasks requiring her to sort pictures along a conceptual distinction which is codeable in English (e.g., gender or animacy). For example, Marta was asked to sort a stack of pictures, where each picture depicted a single person, to see whether

screens and the sets are manipulated by the examiner.) If the subject succeeds on these items she is given an additional series of items in which spatial displacements of the sets of "winnerless" sets are shown. In each item the subject is asked to judge on which plate is the winner, and during "winnerless" trials, is given additional materials and asked to "make one the winner."

2. Counting: In the counting task modeled after Gelman and Gallistel (1978), Marta was shown sets of items where the sets ranged in size from one item to nineteen, and was asked to count the sets. Her counting behavior was analyzed to determine whether she had acquired the basic counting principles outlined by Gelman and Gallistel.

1) the one-to-one principle: "... one and only one numeron must be assigned to each item in the set" (Gelman and Gallistel, 1978: 91).

2) the stable order principle: "Numerons used in counting must be used in the same order in any one count as in any other count" (Gelman and Gallistel, 1978:94).

3) the cardinal principle: "The final numeron assigned to the last object in the set represents a property of the set--its cardinal number" (Gelman and Gallistel, 1978:98).

3. Infinity: This task consists of a series of questions regarding the concept of infinity, described in Gelman (1980), e.g., "What is the biggest number you can think of?", and "What happens if you add one to it?"

4. Number recognition task: Marta was shown an array of printed numbers and was asked to identify the numbers indicated by the examiner.

E. Hierarchical construction: The tasks given were modeled after Greenfield and Schneider (1977) and Greenfield (1978). Additional models designed by Curtiss and Yamada were also given.

Both block and stick model tasks were given to Marta. She was shown a series of models of increasing complexity and was asked to build identical structures. The models to be replicated ranged from simple stacks and rows to complex hierarchical structures. Marta was not allowed to view the actual construction of each model, but was permitted to look at the completed model as she built her own structure. Her performance was compared to that of normal pre-school children based on norms by Greenfield and Schneider, 1977, Greenfield, 1978, Vereecken, 1961, and Curtiss and Yamada (unpublished).

In addition, a nesting-cup task, modeled after Greenfield et al., (1972) involves the nesting of a set of seriated cups of different colors. The task given to Marta consisted of several subtasks. First, Marta was asked to "put together" a 5-cup set, then a 9-cup set. Then she was asked to insert cups into an already nested 5-cup series. Normative data are available for 11 to 36 month old children from Greenfield et al., and Curtiss and Yamada have additional normative data from 2 to 5 year olds.

is to repeat a sequence of digits. Marta's performance was compared to Kirk et al.'s normative population ranging from 2 and 11 years old.

To obtain a measure of Marta's auditory short term memory that was less overtly verbal than word or digit span tests seem to be, the Memory for Auditory Nonverbal Stimuli (MANS) test was given (Curtiss, Kempler, and Yamada, unpublished). In this test the subject is trained to associate a given familiar sound (played on an audiotape) with a particular photograph. So, for example, upon hearing a bark, the subject is to point to the photo of a dog. At no time are the sounds or the pictures given verbal labels by the examiner. The instruction given is simply, "When you hear this (sound is played on tape), you point to this (examiner points to correct picture)." Three different sounds (and photos) are included in the test, a bark (dog), a ring (phone), and running water (sink). Once the subject learns the associations, sequences of the sounds are played, and the subject must point to the photos in the correct order. The sequences range in length from 1 to 8 items.

2. Visual Short-term Memory

The Knox Cube test involves two unsharpened pencils and four equally spaced linearly arranged wooden blocks glued to a strip of wood. The examiner taps out a series (from two to seven taps) with the eraser end of one pencil and the subject is to tap the correct blocks in the correct sequence with her pencil. Published norms cover the age range of 4 1/2 to 15 1/2 years, and Curtiss, Kempler, and Yamada have collected norms from 2 to 4 year olds.

F. Rule abduction

1. On the Rule/Nonrule Governed Learning Test (Muma and Muma, 1979): The individual is shown 50 cards, each containing 2 pictures of simple objects. The subject is instructed to "try to guess the picture I'm thinking of". The rule to be learned is based on either color or size (e.g., the subject must point to only blue items). With each guess the subject is told whether her choice was correct or incorrect.

2. Simple Rule Acquisition (inspired by tasks described by Furth 1966): This test consists of 4 subtests with 20 trials each. The subject is presented with 2 cards, one card containing figures which are the same and one card containing figures which are different. The subject is instructed to "Try to guess the one I'm thinking of," and is told whether her guess was correct or incorrect.

G. Memory:

1. Auditory Short-term Memory: On the Wepman-Morency Auditory Memory Span test (Wepman and Morency, 1973) the subject is to repeat a sequence of unrelated words. The sequences increase in length from two to six words. The test is normed on 5 to 8 year olds (but Wepman and Morency claim that memory span does not change markedly after 8). Curtiss and Yamada (unpublished) collected additional normative data from 2 to 5 year olds.

In addition, the Auditory Sequential Memory Span test from the Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk, McCarthy, and Kirk, 1968) was administered. In this test, on each item the

The Corsi Blocks test is similar to the Knox Cube test but includes 9 blocks in a random array on a board (described in Milner, 1971).

On each item of the ITPA Visual Sequential Memory (Kirk, McCarthy, and Kirk, 1968) subtest, the subject is shown a linear sequence of "nonsense" (not easily verbally codeable) designs for 10 seconds. The subject is then to reproduce the sequence using small white tiles imprinted with the designs. The sequences range in length from two to eight designs.

The Memory for Designs Test (Graham and Kendall, 1960). On this test the individual is presented with a series of 15 cards consisting of geometric designs. Each design is presented for 5 seconds, then taken away. The subject is to draw the designs from memory.

The Benton Visual Retention test: On this test 10 designs are presented and the subject is either to draw the designs from memory (either immediately or after a delay, depending upon the administration used), to copy the designs, or to indicate the design shown by pointing to a multiple choice card.

Memory with Verbal Mediation: Marta was shown sets of four cards with simple line drawings (drawn by the author), e.g., pen, watch, rose, shoe. As the pictures were presented to Marta, the examiner labeled each one aloud. There were three types of card sets shown. Type 1 included sets where all four words were similar phonemically (rhymed). Type 2 included sets where all four words were unrelated, and Type 3 included sets where all four words were conceptually

associated. The cards were shown to Marta and then turned over. She was then shown a duplicate of one of the four cards in the set and was asked to recall the other three members of the set. Because Type 1 cards within a given set were phonemically similar, and Type 3 cards had conceptual similarity, these features were assumed to function as potential mnemonic devices in recalling the face-down cards. Five items of each type were given.

H. Neuropsychological tests:

1. Gestalt Perception:

The Mooney Faces test consists of a series of black and white pictures of faces in very high contrast with many details obliterated such that perceiving the faces requires closure. The individual's task is to specify whether each of 40 items is an old man, an old woman, an adult man, an adult woman, a boy, or a girl.

2. Disembedding

a. On the Perceptual Integration Test (Elkind et al., 1964) the subject is given, one at a time, a series of seven line drawings. Each drawing depicts identifiable objects arranged so that their configuration and juxtaposition comprises a larger, identifiable object (e.g., various kinds of candy arranged to look like a bicycle, fruits arranged to look like a man). On each item, subjects are asked, "What do you see?" Young children up to age 6 tend to focus on either the parts or the whole when labeling the pictures (with parts perceived at an earlier age than wholes), while older children demonstrate part-whole integration, i.e., "It's a man made out of

fruit"). Elkind et al. tested 195 children from 4 to 9 years of age and found that 75% of 9 year olds tested showed part-whole integration.

b. On the ITPA Visual Closure subtest (Kirk, McCarthy, and Kirk, 1968), the child must find partially hidden items in a complex line drawing.

c. The Southern California Figure-Ground Perception Test (Ayres, 1966). On this test the subject's task on each item is to identify, from an array of six simple objects or designs, which three are contained or "embedded" in a larger complex figure. The first part of the test includes familiar objects while the second part involves geometric figures.

d. The Preschool Embedded Figures Test (Coates, 1972) is a modified, simplified version of the children's embedded figure test (Witkin, Oltman, Raskin, and Karp, 1971) for use with preschoolers.

On this test the child must locate a simple figure within larger, more complex figures. The methodology is geared specifically to young children, e.g., the child must find a "teepee" (triangle) in the picture of a butterfly.

3. Familiar Sounds Recognition: Marta was presented with a tape of familiar environment sounds and simply asked to identify the sounds.

4. Familiar Voices Recognition: The task was quite simple and brief. The voices of people familiar to Marta, i.e., her father, mother, sister J., a family friend, and myself, were taped. Each person was

instructed to say one sentence which did not cue Marta as to the identity of the speaker, e.g., "Hi, Marta. How are you? I like you very much." The tape was then played for Marta and she was asked to identify the speakers.

5. The Benton Test of Facial Recognition:

The test consists of these parts:

1. Matching of identical front-view photographs: On each item the subject is presented with a single, front-view photograph of a face and is asked to find the same face in an array of six front-view photographs.

2. Matching of front-view photograph with three-quarter-view photographs: On each item the subject is presented with a front-view photograph of a face and must locate the same face three times in an array of six three-quarter view photographs.

3. Matching of front-view photographs under different lighting conditions: On each item the subject is presented with a fully-lit front-view photograph of a face and must pick the same face three times in an array of six photographs of faces which have been taken under varying lighting conditions.

6. Dichoric listening test: The stimulus tape consisted of six pairs of syllables, [bi] bee, [di] dee, [gi] gee, [pi] pee, [ti] tee, [ki] kee. Use of these syllables rather than the usual [ba], [da], [ga] syllables was judged advantageous since each could be more readily illustrated with a concrete item, e.g., [bi] can be pictured

as a "B," or "bee" (insect). The tape was produced at Haskins labs from natural tokens. Marta listened via headphones to 1) 30 pairs of training items, in which identical stimuli are transmitted to each ear, and 2) to two "blocks" of 60 dichotic pairs. Marta's task was to point to the item she heard on the tape from a six-picture array depicting a bee, a girl named "Dee," a boy named "Gee," a pea, tea, and a key. Marta was trained to associate the picture of the girl with the name "Dee," and the picture of the boy with the name "Gee."

APPENDIX III

10/19/79

J: Come on, finish your drawing of your family and then we've got a present [i.e., for you]

Yeah, I really love my parents, they're so nice.

I, my mom 'n dad,

They seem wonderful.

Yeah, well my mom 'n dad, an' this friend (there was like nine-unin-tall, friend who was) a really good friend that does, uh, what does the mother do? She, does paintings. This really good friend of the kids who I went to school with last year, and really loved. Just the second friend I've ever had. And, this mother (I said) oh I wanna get 'em to play with y' know . . .

S: Are you done now?

2/21/80

J: You seem a little sad today, Marta.

It's a little sad they have left. An' I told the head leader they're not sure if (they're) gonna set it for, for eighth, eight, our time which will be as, [pauses abruptly] our time an', the girl arrives where it's one, which is in school right now.

S: What country?

She's going to An-mission [i.e., Ann Arbor, Michigan] with her um, crocodiles, threw up, or threw (or something--unintellig.) that much, that much (unintellig.) yeah, so, you know (I'm) not,

Who left?

A., and Jn., (some) kids, they're now (unint.) speaking Irvine accent. One is in Eureka another accent, I think, it's very soon that they asked us to fly out. ('e) said "No, sit down!" [c]! It was funny too 'cause they won't let us fly (telling us)

'til when?

Until um, there's time.

J: [Setting up things for test] Marta, let's talk about these things. What's this?

A fire flight.
See, (unintellig.) match the colors.

(unintellig.) a flight?

It's like a flight I came from. Out of our time, which was like, what time it was [question intonation] when we were arriving. It was one-thirty. One-thirty. An' I set it back from the very wrong time. (They got messed around with a [pilot], on that, too much, (or) messed with it. Kinda went, it's not electric, it used [tə] do [implosive] that (sun) he got me, when I was visiting somebody..an' she just died, very sudden(ly) (unint.) an' she gave me this really nice, it was gold like [hcs] [i.e., this?], but (the sign said) the

husband can't get fixed

It means that my grandmother an' [m?] what s that [hamci]? It's some nursing, or the nursing home, or the [mope?], [mome?], (unint.) [mis?], right near my school, old school. (Good) now it's right near m' (Well--unint.) my school, (actually 'e) should know that.

S: What does it mean, to die?

S: So, what does it mean to die?

Yeah, Is it right near Mendocino? It's right near Escalon in fact. They closed down when my grandmom just left. (It's a) old nursing home, she used to. I can't remember her name, she just died, she died, a month. An' I, an' I can't remember 'er name. (unint.). I think it was [sikə] they put in that nursing home, right near Mendocino.

Well, what happens when somebody dies?

Well, my grand, mother died, in [manshtn]. You know that [manshtn] locked in home (unint.) grandmom got out, 8:30 in the morning, she got out. She got out o' [manshtn] lodge. Huh? D'you hear she misescaped out 'o [manshtn] lodge? Huh? (d'you hear) they misescaped out! So did the gramm.. the gramm, Mendocino. [sisrt] (told) the wife, the wife, met the husband. He was 82. 82! 'n threw up. They 'ad [ə] [i.e. to] bury 'in. [chuckle in her voice] He threw up sick. That was a time. Ever had (unintellig.) in ('is) apartment. I think it was when I had my last fish, my friend or something (unint.) 'n I went, an' there was newcomer 'y know, all (street, they were talking 'bout) them dying ... they're new to us (an' we haven't had a) meet. They decided to go away, so they're, they know us. Hey, I know it's our next door neighbors? Our French neighbors flew in! That what I heard, this happened

(if) they got their in partment, an'
they know us, they knowing' us. Ah!
I'm not kiddin' they got an 'partment.
They found it they were gonna fly
back. Fly back.

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ADDENDUM

Errata:

---page 106/1st full paragraph (i.e. Givon (1979) maintains...) This paragraph should be moved to page 98 just prior to the 1st full paragraph (The range of knowledge...)