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THE DEVELOPMENT OF THE PLANNING FUNCTION AND THE DISCOURSE STRUCTURE OF `PRIVATE´ SPEECH

by

PETER FEIGENBAUM

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, the City University of New York.

1989

This manuscript has been read and accepted by the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

THE DEVELOPMENT OF THE PLANNING FUNCTION AND THE DISCOURSE STRUCTURE OF `PRIVATE´ SPEECH

by

Peter Feigenbaum

Advisor: Professor John Dore

This study inventoried the cognitive functions and linguistic forms of `private´ speech and, using these descriptive data, tested three particular claims about private speech development. Two claims were put forward by Vygotsky--private speech develops into an instrument for planning, and, simultaneously, its syntax fragments and abbreviates--while the third claim was put forth by this author-- the discourse structure of private speech grows in size and complexity with development. Subjects included 30 children who were approximately 4, 6, and 8 years of age and whose native language is English. Five girls and five boys at each age level were randomly selected from child-care centers and schools located mainly in Brooklyn, New York.

The experiment, which consisted of two problem-solving tasks in plane geometry (one difficult, one very difficult), involved the construction of different roads using wooden tracks. To help motivate the children, the tasks were couched in the form of a game. The subjects were tested individually, and their performances were videotaped for subsequent analysis. Previous methods of differentiating private from social speech were revised, and new methods were invented to describe the planning functions and discourse structure of private speech.

A repeated measures Analysis of Variance was used to test the observed differences between the three age groups and the two tasks. Highly significant differences were detected with regard to the fragmentation and abbreviation of the syntax of private speech: there was a marked increase from age 4 to age 8, and from Task 1 (the difficult problem) to Task 2 (the very difficult problem). As for the development of the planning function of private speech, the observed increase with age narrowly missed significance, while the increase from Task 1 to Task 2 was highly significant. Other results, though not significant, provided support for the view that private speech develops into an instrument for planning. With regard to the claim that the discourse structure of private speech grows in size and complexity with development, the findings, although not statistically significant, evidenced support for the claim.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS iv

ABSTRACT v

LIST OF TABLES xi

CHAPTER I: REVIEW OF LITERATURE 1

Introduction and Overview 1

Empirical Studies of `Private´ Speech Development 3

Piaget´s Theory and Empirical Studies of Egocentric Speech Development 3

Vygotsky´s Theory and Empirical Studies of Egocentric Speech Development 5

Development of Self-Regulation by Means of the Vocal Properties of Private Speech 8

Development of Self-Regulation by Means of the Semantic Properties of Private Speech 10

Summary 13

Conditions That Foster the Spontaneous Production of Private Speech 13

Summary 15

Classification Systems for Categorizing Types of Private Speech 15

Summary 22

Methods for Differentiating Private Speech from Social Speech 22

Summary 25

Summary of Literature Review 26

CHAPTER II: STATEMENT OF AIMS 29

Overview 29

Development of the Planning Functions of Private Speech 30

Summary 32

Development of the Syntactic Structure of Private Speech . . . 33

Summary 35

Development of the Discourse Structure of Private Speech . . . 35

Summary 37

Empirical Hypotheses 37

CHAPTER III: METHODS 40

Subject Population 40

Materials 41

Pre-test 41

Task 41

Videotape 44

Setting 44

Procedures 46

Pre-Testing 46

Testing 47

Videotaping 48

Procedures for Analyzing Data 48

Scoring Task Performance 48

Partitioning Speech into Utterance Units 52

Differentiating Utterances of Private Speech from Utterances of Social Speech 53

Determining the Planful and Non-Planful Functions of Utterances 53

Determining the Conversational Functions of Utterances 54

Determining the Discourse Structure of Sequences of Utterances 55

Reliability 56

CHAPTER IV: RESULTS 58

Intelligence Tests 58

Task Performance 59

Time Spent on Problem-Solving 60

Successful and Failed Attempts at Problem-Solving 60

Private Speech and Social Speech 61

Planful and Non-Planful Functions of Speech 62

Planful Private Speech 63

Planning Functions 63

Syntactic Structure 64

Discourse Structure 65

Reliability 67

Scoring Task Performance 67

Partitioning Speech into Utterance Units 68

Differentiating Utterances of Private Speech from Utterances of Social Speech 68

Determining the Planful and Non-Planful Functions of Utterances 69

Summary of Results 69

Does Private Speech Develop into a Means for Planning Solutions to Problems? 72

Hypothesis 1 72

Hypothesis 2 73

Hypothesis 3 73

Does the Syntactic Structure of Planful Private Speech Fragment and Abbreviate with Development? 75

Hypothesis 4 75

Hypothesis 5 76

Does the Discourse Structure of Planful Private Speech Grow in Size and Complexity with Development? 76

Hypothesis 6 76

Hypothesis 7 77

Summary of Results Relating to Empirical Hypotheses 77

CHAPTER V: DISCUSSION 80

Results 80

Conclusion 84

TABLES 87

APPENDIX I: SCORING SYSTEMS AND INSTRUCTIONS TO SUBJECTS 106

Piaget's (1955) System for Classifying Egocentric and Socialized Speech 107

Kohlberg, Yaeger, and Hjertholm's (1968) System for Classifying Private Speech 109

Fuson's (1979) System for Classifying Private Speech 110

Problem-Solving Attempts: Scoring Procedure, Codes, and Definitions 111

Private and Social Speech: Scoring Procedure, Codes, and Definitions 112

Planning and Non-Planning Functions: Codes and Definitions 113

Dore's (1977) Decision Procedure for Determining Conversational Acts 115

Dore's (1979) Conversational-Act Codes and Definitions . . . 116

Verbatim Transcript of Instructions to Subjects 118

APPENDIX II: EXAMPLES OF SCORED DATA 119

Scored Performance Data: 8-Year-Old Boy 120

Scored Verbal Data: 4-Year-Old Girl 121

Scored Verbal Data: 6-Year-Old Girl 122

REFERENCES 124

LIST OF TABLES

Table 1: Intelligence Test Scores 88

Table 2: Time Spent on Problem-Solving 89

Table 3: Attempts at Problem-Solving 90

Table 4: Successful Attempts at Problem-Solving 91

Table 5: Failed Attempts at Problem-Solving 92

Table 6: Private Speech and Social Speech 93

Table 7: Private Speech 94

Table 8: Planful and Non-Planful Functions of Speech 95

Table 9: Planful Speech 96

Table 10: Planful Private Speech 97

Table 11: Planful Private Speech Utterances Co-Occurring with Attempts at Problem-Solving 98

Table 12: Complete and Fragmented Sentences of Planful Private Speech 99

Table 13: Complete Sentences of Planful Private Speech 100

Table 14: Fragmented Sentences of Planful Private Speech 101

Table 15: Number of Words Comprising Planful Private Speech . . . 102

Table 16: Narratives of Planful Private Speech 103

Table 17: Number of Conversational Exchanges Comprising Planful Narratives 104

Table 18: Number of Utterances Contained in Planful Narratives 105

CHAPTER I

REVIEW OF LITERATURE

Introduction and Overview

The phenomenon of "egocentric speech" has challenged investigators in developmental psychology ever since it was first documented in 1923 by Piaget (1955). Initially, the challenge was to construct developmental theories that could explain why this speech emerges at around age 3 and then virtually disappears at roughly age 8. This challenge was met swiftly and brilliantly by Piaget (1955, 1968) and Vygotsky (1987), who framed the key developmental issues for subsequent theorists such as A. R. Luria (1932, 1957), G. H. Mead (1934), and J. H. Flavell (1966). Next, the challenge was to devise experiments that could test the basic hypotheses put forward by Piaget and Vygotsky (e.g., Kohlberg, Yaeger, and Hjertholm, 1968). The central focus for much of this research was the conflict between Piaget's claim that the coefficient of egocentric speech declines monotonically with age, and Vygotsky's claim that the amount of egocentric speech increases gradually with age before declining abruptly. The evidence that has been gathered to date, which is reviewed below, substantiates Vygotsky's (1987) most basic claims about egocentric speech-- i.e., its development follows a curvilinear path, and it functions as a means of self-regulation under certain conditions. But now investigators confront yet another challenge. New experiments are needed to test Vygotsky's more

particular claims about the "function" and "fate" of egocentric--or, following Flavell (1966)--`private' speech.

There were two aims to this study: 1) to describe and inventory the various forms and functions of private speech that are manifested by children at 4, 6, and 8 years of age; and 2) to use these descriptive data in order to test three particular claims about private speech development. Two of these claims were advanced by Vygotsky (1987), while the third is put forth here. Vygotsky's claims concern the development of the planning function and the syntactic structure of private speech, while the claim put forward by this author concerns the development of the discourse structure of private speech.

More precisely, Vygotsky made the following theoretical claims: 1) initially, private speech serves as an accompaniment_to_action and as a means for discharging_emotion, but later develops into an instrument for seeking and planning solutions to problems-- that is, it becomes a means for directing_actions and thoughts toward consciously intended goals (1987, pp. 70-73); and 2) as private speech develops, its syntax becomes increasingly fragmented_and_abbreviated, and the number of words uttered is markedly reduced (1987, pp. 267-269). The third claim, which is put forward by this author, states that: 3) as private speech develops into an instrument for planning, the relative number of discourse_sequences that serve the planning process is likely to increase, despite the fragmentation and abbreviation of the syntactic structure of the utterances.

To understand what motivates these particular claims, some background information on the history of private speech research is needed. The literature on private speech is reviewed here from four different

perspectives. First, the theories of egocentric speech development proposed by Piaget and Vygotsky are briefly reviewed, along with the empirical studies that they and others conducted to test their theories. Second, the social conditions and experimental tasks that foster the spontaneous use of private speech are reviewed. Third, the classification systems that have been used to categorize different types of private speech are evaluated. Finally, the methods that experimenters have developed in order to differentiate private speech from social speech are reviewed.

Empirical Studies of 'Private' Speech Development

Piaget's Theory and Empirical Studies of Egocentric Speech Development

Piaget (1955), who was the first to record, describe, and analyze 'private' speech, was also the first to call it "egocentric" speech. Speech is "egocentric" when a child "...does not bother to know to whom he is speaking nor whether he is being listened to. He talks either for himself or for the pleasure of associating anyone who happens to be there with the activity of the moment. This talk is egocentric, partly because the child speaks only about himself, but chiefly because he does not attempt to place himself at the point of view of his hearer" (Piaget, 1955, p. 32). Theoretically, Piaget interpreted this speech as an epiphenomenon, or manifestation, of egocentric thought. He regarded egocentrism as a transitional stage in development, one that occupies a position "...halfway between autistic and logical thought" (Piaget, 1955, p. 170). Because egocentric thought is eventually displaced by socially adapted thought, according to Piaget (1955, pp. 64-65), egocentric speech faces a similar fate-- it is

eventually displaced by socially adapted speech.

The method Piaget employed in collecting his empirical data was to follow a child around as he or she engaged in unstructured play, and then write down the child's speech as it was being uttered. Later, the transcribed speech was segmented into separate sentences so that each sentence could be classified according to its function (1955, pp. 28-30). The classification system Piaget (1955, pp. 32-34) invented separated speech into eight types (see Appendix I). Three of his categories pertained to private speech; the other five pertained to "social" speech (see Zivin, 1979 for critique). The three private speech categories--"Repetition," "Monologue," and "Collective Monologue"--accounted for roughly 40-70 percent of the speech produced by Piaget's subjects in the course of their spontaneous conversations. These figures declined significantly, however, for children 7-8 years of age (Piaget, 1968, p. 257), supporting Piaget's view that private speech is displaced by social speech as a child matures.

Piaget's two most important categories of private speech, from both a theoretical and empirical standpoint, are "Monologue" and "Collective Monologue." A monologue serves as an accompaniment to action, or as a means of commanding animate and inanimate objects (1955, pp. 36-40). In a monologue, a child "...talks to himself as though he were thinking aloud. He does not address anyone" (1955, p. 32). In a collective monologue, however, a child <u>does</u> address his or her monologue to a listener, but does <u>not</u> adapt it to the listener's point of view (1955, p. 33). Considered in terms of the development of a child's ability to converse, the monologue is both functionally and structurally "primitive and infantile," according to Piaget (1955, p. 40), whereas the

collective monologue is socially immature in function, but not in structure. Piaget regarded the collective monologue as "...the most social of the ego-centric varieties of child language" (1955, p. 40), chiefly because it has a turn-taking structure similar to that found in adult conversations. The developmental sequence he postulated-- first monologue, then collective monologue, and then dialogue (1955, p. 72)-- is consistent with his view that the path of development proceeds from the individual to the social.

Vygotsky's Theory and Empirical Studies of Egocentric Speech Development. Vygotsky's (1987) theory of 'private' speech, which was the second theory to appear, contrasts sharply with Piaget's on five crucial issues. First, Vygotsky regarded private speech as an initially social mode of thinking that subsequently develops into a personal mode of thinking (one that remains social in function). "The actual movement in the development of the child's thinking occurs not from the individual to some state of socialization but from the social to the individual" (1987, p. 76). Second, rather than regarding it as a transitional stage between autistic and logical thought, Vygotsky regarded private speech as "...a form critical to the transition from external to inner speech" (1987, p. 75). According to Vygotsky, external speech is fundamentally different in function and structure from inner speech. External speech is vocal and audible and serves as an instrument for interpersonal communication, whereas inner speech is subvocal and silent and serves as an instrument for planning and solving problems (1987, p. 74). Third, Vygotsky proposed that private speech is the form in which the "planning" function first arises. "...Besides the purely expressive

function of egocentric speech, besides its function as a form of discharge or accompaniment of the child's activity, it can become a means of thinking in the true sense of the term. It functions in the formation of a plan for solving the task that is encountered in behavior" (1987, p. 70).

A fourth point of contrast between Vygotsky's theory of private speech and Piaget's is the process whereby private speech atrophies. Vygotsky proposed that, once the planning function has developed, the syntactic structure of private speech becomes fragmented, abbreviated, and condensed in a very special way. This is an outward indication that private speech is being transformed into inner speech (1987, p. 274). The fifth and final issue that differentiates the two theories is the role that environmental conditions play in eliciting private speech. "Whether the child speaks egocentrically or socially depends not only on his age but on the conditions in which he finds himself" (Vygotsky, 1987, p. 90). Vygotsky's own empirical research (1987, pp. 69-70) indicated that private speech is most likely to arise when there are other people present (to act as a stimulus for speaking), and when there is a problem in need of solution (to act as a stimulus for thinking).

As with Piaget's theory, Vygotsky's theory of private speech must be placed within the context of his more general theory of human development (1987, 1978) if it is to be properly understood. Briefly, Vygotsky hypothesized that there are four stages in the development of the relationship between speaking and thinking. At first, speech and thinking develop independently of one another-- i.e., there is a "pre-intellectual" stage in the development of speaking, alongside a "pre-speech"

stage in the development of thinking (1987, p. 112). At a certain point, these two separate lines of development converge and form a relationship: "thinking becomes verbal and speech intellectual" (1987, p. 112). Vygotsky referred to this relationship as "verbal thinking" or "word meaning" (1987, pp. 47-49). At this stage, a child's speech is external in form and social in function; it is a vocal means for communicating and interacting with others.

The third stage is defined by the differentiation of social speech into two different functional types: one for speaking (social speech) and one for thinking (private speech). Although private speech has the same initial structure as social speech, functionally it develops into a personal means for thinking and planning, and therefore is restructured in accordance with its new function. Thus, the development of private speech involves "...a movement of social forms of collaboration into the sphere of individual mental functions" (Vygotsky, 1987, p. 74). After a child has learned to converse with herself aloud in such a way that she can plan the solution to a problem, private speech begins to atrophy. This marks the beginning of the fourth stage, which is characterized by the development of "inner" speech (1987, pp. 261-262).

Unlike social speech, inner speech is internal in form and personal in function; it is a silent, subvocal means by which individuals can think and plan. The atrophy of private speech furnishes clues as to the structure of inner speech. As private speech atrophies, the words that are omitted (which are peripheral to thinking), and the words that are vocalized (which are central to thinking) exhibit a predictable pattern, according to Vygotsky. This pattern is characterized by "...increasing manifestations of the tendency for abbreviation, continual

reduction in the levels of syntactic differentiation, and increasing tendencies for condensation" (1987, p. 274). Once the development of inner speech has been completed, inner speech and social speech can interact. Development has come full circle. Inner speech can be silently invoked when problems arise in the course of social speech-- problems such as planning and executing the next sentence to be spoken, for example. In connection with this, Goldman-Eisler (1968) has provided convincing evidence that sentence-planning (through inner speech?) occurs during "hesitation pauses" in the spontaneous social speech of adults.

Development of Self-Regulation by Means of the Vocal Properties of Private Speech. Vygotsky's distinction between the vocal and the semantic properties of speech (1987, p. 250) provides a useful framework for reviewing the research on the self-regulatory capacity of private speech. Because speaking is a motor (vocal) activity as well as an ideational (semantic) activity, private speech has the potential to regulate other motor behaviors--via the cortex--in two ways: either by means of its vocal (i.e., tonal and rhythmic) properties, or by means of its semantic (i.e., representational and symbolic) properties. While this study is mainly concerned with the semantic aspect of private speech, those studies that have investigated the self-regulatory potential of the vocal aspect are briefly reviewed below.

Research conducted by Luria and his co-workers (Luria, 1932, 1957, 1959, 1969; Luria and Yudovich, 1959; see Tikhomirov, 1975-1976 for review) explored the possibility that the impulsive, rhythmic properties of speech can reinforce or inhibit other ongoing motor acts. The

preschoolers participating in this research were instructed to press (or refrain from pressing) a rubber bulb in response to various kinds of visual or auditory stimuli (e.g., colored lights, or a bell). The subjects were also instructed to utter certain words or nonsense syllables (e.g., "Press twice," or "tu tu") in response to the stimuli. By means of this methodology, Luria and his associates were able to demonstrate that the rhythmic component of speech can exert control over other motor behavior, particularly when the rhythm of the speech is the same as the rhythm of the behavior. However, self-regulation was generally achieved only in those circumstances where speech served to reinforce, rather than inhibit, ongoing behavior. According to Luria (1961), inhibiting a motor action using speech involves the development of the semantic aspect of speech.

Following Vygotsky (1987), Luria outlined his own neurobiological theory of the development of self-regulation through private speech (see Tikhomirov, 1975-1976). Private speech is conceptualized as a transitional stage between regulation by adults' speech and regulation by one's own internal speech. In the first stage of development (ages 1;6 to 3), a child's behavior is under the control of adults' speech, which is capable of initiating a child's action, but not of inhibiting one that is already in progress. In the second stage (ages 2;6 to 4;6), a child can initiate-- but not inhibit-- her own action using private speech, whereas her actions can be inhibited by adults' speech. In the third stage (age 4;6 on), a child can use private speech to both initiate and inhibit her own action. As the vocal manifestations of private speech are gradually inhibited neurologically, self-regulating private speech becomes internal speech.

Western replications of Luria's research tend, with few exceptions (e.g., Bronckhart, 1973), to uphold the finding that there is a relationship between the rhythmic component of private speech and the initiation of discrete motor actions (e.g., Harris, 1976; Rondal, 1976; Zivin, 1976). The overall developmental picture provided by this line of research is one of an initial lack of coordination of the vocal and motor systems, with speech being "an extra thing to do" (Fuson, 1979, p. 189). When the vocal and motor systems become coordinated (around age 4), vocalizations that are rhythmically identical to the desired motor response can aid performance. By age 5, however, the semantic content of words becomes more influential in regulating motor activity than the rhythmic aspect (Fuson, 1979).

Development of Self-Regulation by Means of the Semantic Properties of Private Speech. In contrast to the methodology used to investigate the vocal qualities of private speech (wherein subjects are given particular words to say by an experimenter), the method preferred by investigators working with the semantic qualities of speech is to allow subjects to produce private speech spontaneously while engaged in free-play or performing a task. By means of this method, it is possible to chart the "natural" developmental course of the forms and functions of private speech. Furthermore, when children are allowed to speak spontaneously, they are placed in the position of having to decide not only what to say and how to say it, but also when to say it-- that is, under what circumstances. While there is practically no research on the development of self-regulating speech that focuses directly on these decision processes, it has been suggested that the process of choosing

the words to say may be a very important step in psycholinguistic development (Olson, 1970).

Those studies that have investigated the self-regulatory potential of the semantic properties of spontaneous private speech have had to grapple with several serious methodological obstacles. For one thing, there are practical problems in differentiating private speech from social, interpersonal speech. This problem arises, at least potentially, whenever a child is studied with another person present in the testing situation (Fuson, 1979), which is typically the case. Another difficulty is that these studies differ widely in terms of the linguistic procedures that were used to identify and code speech, as well as the criteria that were used to define the different speech functions. In addition, many variables are involved-- e.g., task, task difficulty, setting, age of subject, persons present, familiarity with experimenter, familiarity with task-- but their effects on private speech production have not been examined systematically (Fuson, 1979). Despite these obstacles, some tentative conclusions can be drawn from this body of research.

The amount of private speech that children produce increases between the ages of 3 and 5 (Berner, 1971) and decreases between the ages of 5 and 8 (Beaudichon, 1973; Dickie, 1973; Kohlberg, Yaeger, and Hjertholm, 1968). Also, there is some evidence that, although the absolute amount of private speech decreases after age 5, the proportion of private speech that is self-regulating increases with age (e.g., Beaudichon, 1973; Klein, 1964). However, this increase in self-regulating speech seems to vary both with age and the type of difficulty the task presents (Deutsch & Stein, 1972; Kohlberg et al., 1968; Yaeger,

1968). It is not just difficulty per se, but the type of difficulty that is important (Fuson, 1979). If the task seems difficult to the child because his efforts do not solve it, private speech increases; but if the source of difficulty lies elsewhere, private speech decreases. Beaudichon (1973) found that, for children 5;6 to 6 years old, difficult tasks elicited more private speech of all types than easy tasks, with a notable increase in "self-guiding comments." By contrast, children between 6;6 and 7 years of age exhibited a slight decrease in private speech of all kinds, and in self-guiding speech in particular. This supports Vygotsky's (1987, p. 263) claim that self-regulating private speech is reduced in quantity as it becomes progressively internalized.

A consistent, positive relationship has been found between self-regulatory private speech and successful task performance (Beaudichon, 1973; Feigenbaum, 1985; Klein, 1964; Roberts, 1977). A positive relationship has also been found between non-regulatory types of private speech (e.g., affective expressions) and failure at a task (Feigenbaum, 1985; Yaeger, 1968). Non-regulatory forms of private speech increase with task difficulty for children 5;6 to 6 years old, while it decreases for children 6;6 to 7 years old (Beaudichon, 1973).

Data on the overt and covert uses of speech provided by research in other areas of psychology, such as "verbal mediation" (e.g., Kendler and Kendler, 1959; see Stevenson, 1972 for review), "delay of gratification" (e.g., Mischel and Baker, 1975; Mischel and Moore, 1973), and "rehearsing to remember" (e.g., Flavell, Beach, and Chinsky, 1966; Locke and Fehr, 1970), are consistent with these findings. For example, Conrad (1971) reported that about half of his sample of 4-year-old

children spontaneously verbalized such phrases as "Cat goes with cat." or "Cat here." on a picture-sorting task. Similarly, Kuenne (1946), using a size transposition task, found that about half of his sample population (age 2;6 to 6) who had generalized a rule for making a transposition verbalized this rule spontaneously during the trials.

Summary. Although the natural developmental course of children's spontaneous use of self-regulating private speech is not yet clear, there appears to be a complex qualitative change around age 5, with overt regulatory speech becoming covert between the ages of 5 and 7 (Fuson, 1979). In general, the research indicates that self-regulating private speech tends to increase in amount or relative proportion under the following conditions: 1) a task rather than free-play; 2) a difficult task rather than an easy task; and 3) failure at a task (when a child considers himself the agent). Less is known about the linguistic forms that private speech takes at different developmental stages, or the relationship between linguistic forms and functions at different stages.

Conditions That Foster the Spontaneous Production of Private Speech

Vygotsky proposed that private speech is most likely to occur when: 1) there is another person present, who can serve as a stimulus for speaking (1987, p. 266); and 2) there is a problem to be solved, which serves as a stimulus for planning (1987, pp. 69-70). As noted above, difficult tasks (ones that require problem-solving) evoke more private speech in general, and more self-regulating speech in particular, than easy tasks (ones that are unproblematic). The kinds of

difficult tasks that have been used include: puzzles (e.g., Berner, 1971; Deutsch and Stein, 1972; Dickie, 1973; Goodman, 1977, 1979; Hjertholm, 1968; Kleiman, 1974; Klein, 1964; Meichenbaum and Goodman, 1979; Rubin, 1979; Yaeger, 1968; Wertsch, 1979), building_block_towers (e.g., Hjertholm, 1968; Kohlberg et al., 1968), enactive_play (e.g., Feigenbaum, 1981, 1985), and verbal_academic_tasks (e.g., Roberts, 1977). Unproblematic activities, such as coloring, stringing_beads, and unstructured_free-play, tend to elicit very little private speech (e.g., Kohlberg et al., 1968; Rubin and Dyck, 1980), but even these activities can sometimes stimulate a large amount of speech (e.g., Furrow, 1980, 1984).

Regarding his hypothesis that the presence of another person tends to elicit private speech, Vygotsky (1987, pp. 264-266) reported that his own empirical investigations confirmed this view. Recent studies also support this position. For example, studies that examined the production of private speech in circumstances where the child is left alone (e.g., Beaudichon, 1973; Kleiman, 1974; Klein, 1964; Roberts, 1977) report levels of production that are relatively small. In contrast, most of the studies that have reported high levels of private speech have included at least one other person in the testing situation (usually the experimenter). However, the presence of another person also creates complications. Consequently, in order to ensure that the experimenter's presence would not significantly interfere with the production of private speech, many researchers instituted practices designed to minimize the possibility of interaction between the subject and experimenter (e.g., Deutsch and Stein, 1972; Feigenbaum, 1985; Furrow, 1980; Rubin, 1979; Rubin and Dyck, 1980). One method that has

been used to accomplish this is to seat the subject and experimenter on opposite sides of the room; another method is to have the experimenter ostensibly engaged in work, which the subject is instructed not to disturb.

Summary. The optimal conditions for eliciting private speech are situations in which: 1) there is a problem to be solved; and 2) there is another person present. Private speech tends to increase when problems are encountered because it serves as a tool for planning the solutions to problems. In general, the more difficult the problem, the greater the tendency for private speech. Also, if private speech is insufficiently differentiated from social speech, the presence of another person is likely to elicit private speech.

Classification Systems for Categorizing Types of Private Speech

In their review of the research on private speech, Kohlberg, Yaeger, and Hjertholm (1968) proposed a comprehensive category system for developmentally classifying different types of private speech (see Appendix I). This classification system has been widely used in private speech research. What is unique in their position is the suggestion of a hierarchy of stages (Zivin, 1979). Kohlberg and his associates (1968) suggested the following developmental ordering:

Level 1: Presocial self-stimulating language

1. Word play and repetition.

Level 2: Outward-directed private speech

2. Remarks addressed to nonhuman subjects.
3. Describing own activity.

Level 3: Inward-directed or self-guiding private speech

4. Questions answered by the self.

5. Self-guiding comments.

Level 4: External manifestations of inner speech

6. Inaudible muttering.

Level 5: Silent speech or inner thought

Each level represents a stage in the development of private speech, moving from early practice with words and sounds (Level 1) to inner speech (Level 5). The first three categories are derived from Piaget (1955), while the fourth category reflects the influence of the theory of G. H. Mead (1934); the fifth category is drawn from Vygotsky (1987), and the final category is based on observations made by Kohlberg and his associates.

This category system was analyzed in detail by Fuson (1979). She noted that this classification scheme has been widely used by researchers, even though it suffers from methodological and conceptual weaknesses. The chief methodological difficulty with the Kohlberg categories concerns the reliability of the classification of utterances into the categories. For example, in one of the studies by Kohlberg and his associates (1968), there appeared to be a considerable difference between the two raters with regard to two important categories: "Describing activity" and "Self-guidance". Some earlier studies that also used the Kohlberg category system reported low inter-rater agreement (Berner, 1971; and Rubin, Hultsch, & Peters, 1971), while others (Dickie, 1973; and Deutsch & Stein, 1972) reported rather high inter-rater reliability. Since none of these studies reported their operational definitions of the categories, the cause of these differing reliabili-

ties is unknown.

Another methodological problem with these categories is that they do not adequately cover all types of private speech, according to Fuson (1979). Several investigators (Klein, 1964; Yaeger, 1968; Goodman, 1977, 1979; Meichenbaum & Goodman, 1979; Rubin, 1979; and Kleiman, 1974) found it necessary to provide additional categories. Two categories in particular have gained general acceptance: "Expressions of affect" and "Fantasy role-play". Kleiman (1974) substantially rearranged and expanded the Kohlberg et al. system to include twelve categories, and some studies (Rubin, 1979; Rubin & Dyck, 1980) have used this revised version. Fuson (1979) argues that, although the conceptualization of these categories shows considerable insight and promise, the operational definitions of the categories are unclear and imprecise, and some of the contents of the categories are questionable.

One of the chief conceptual difficulties with the Kohlberg, Yaeger, and Hjertholm (1968) classification system, according to Fuson (1979), is the lack of precise descriptions that would enable an investigator to differentiate one functional type of self-regulation from another while preserving, at the same time, the overall conceptual unity of the system. Thus, she argues, what are needed are categories that are connected by the same overall description (reflecting conceptual continuity), but that are also capable of identifying speech that is definitely serving a planning function.

Kohlberg and his colleagues (1968), basing themselves on Mead's (1934) theory that the child builds a differentiated self through conversations with aspects of the self that represent the "generalized other," proposed that all private speech is characterized by poor

differentiation of self from other. In addition, Kohlberg and his associates regarded all private speech as "acommunicative" speech (Zivin, 1979). However, there are several difficulties inherent in the proposed system. For one, there is a lack of justification of the developmental order suggested; i.e., the criteria for determining why these particular types (and no others) are included is not provided. Also, the coding scheme indirectly distorts Vygotsky's entire theory of the development of thought and language because it implicitly (and incorrectly) assumes that Vygotsky's theory cannot account for instances of private speech that occur approximately after age seven (Zivin, 1979).

The Kohlberg developmental hierarchy is inconsistent with Vygotsky's theory in the following specific respects: 1) Kohlberg, Yaeger, and Hjertholm (1968) proposed all six speech categories as developmental steps reflecting each type's prevalence; 2) they considered each type to be transitional to the next type in the hierarchy; and 3) they considered social isolation to be a centrally defining condition or feature of the type of speech elicited. The presence of a real other to whom one could speak appears, in their view, to prevent overt speech that is truly directed to the self (Zivin, 1979). Vygotsky, however, saw private speech as functionally connected to social speech, and social speech naturally occurs in the presence of others. Therefore, in its early stages (before a child realizes that it is for thinking, not talking), private speech is more likely to occur in the presence of others.

As the first practical coding system for developmentally categorizing private speech, the Kohlberg system has significantly promoted

the investigation of private speech. Many studies have used this system unchanged (e.g., Berner, 1971; Deutsch and Stein, 1972; Dickie, 1973; Rubin, Hultsch, and Peters, 1971); others have used a revised version of it (e.g., Feigenbaum, 1981, 1985; Goodman, 1977, 1979; Meichenbaum and Goodman, 1979; Rubin, 1979). Some investigators, however, have developed category systems of their own (e.g., Beaudichon, 1973; Furrow, 1980; Kleiman, 1974; Roberts, 1977, 1979; Rubin and Dyck, 1980; Wertsch, 1979).

Furrow (1984) keenly observed that researchers have tended to assign (by definition) certain functions to social speech and other functions to private speech. Consequently, social speech and private speech have never been adequately compared because speech functions have not been analyzed into categories independently of their presumed intended audience. Furrow (1984) suggested that the interdependence between function and categories of presumed audience has existed because previous studies (e.g., Halliday, 1975; Kohlberg et al., 1968) have made assumptions about functions that determined a priori whether some utterances were assigned a social or private audience.

To correct this problem, Furrow scored the social or private character of utterances (using eye contact, pitch, and other signals of interpersonal speech) independently of their functional type, which was classified according to a system of twelve categories (drawn essentially from Halliday, 1975, and Kohlberg et al., 1968). Furrow reported that the "regulatory," "attentional," and "informative" uses of language all appeared more frequently in speech addressed to another, while "self-regulatory," "describing one's own activity," and "expressive" functions had an increased incidence in private speech. This study not

only supported Vygotsky's notion that private speech has social origins, but it demonstrated differences in the functions of social and private speech, and methods for studying them.

In another study (Feigenbaum, 1985), an attempt was made to overcome the problem of low inter-rater reliability with the Kohlberg classification system. Specifically, the problem of differentiating the category "Describing own activity" from the category "Self-guiding comments" was tackled by constructing an experimental task in which each utterance could be assigned either a "routinized" or "strategic" function with respect to the completion of the task. By using a task analysis to supply contextual information regarding an utterance's cognitive function, scoring decisions were facilitated and inter-rater reliability for these two categories was greatly increased. As in the study by Furrow (1984), private and social speech (on the one hand), and the functions or uses of speech (on the other hand) were regarded as independent factors.

Finally, Fuson (1979) proposed a coding scheme that overcomes some of the other difficulties and shortcomings of the Kohlberg system. Fuson's categories (see Appendix I) are specifically designed to handle data in the form of private speech utterances from 2- through 5-year-olds who are performing tasks while they are alone in a room in their school. The private or social status of speech is regarded independently of speech functions, and the various speech functions are more articulated than in the Kohlberg system. The four major categories Fuson (1979) proposes are: "Regulating," "Affective," "Fantasy/Role Playing," and "Incomprehensible."

The major difference between the Kohlberg and Fuson category sys-

tems is in their assumptions about the functional unity of private speech. Unlike the Kohlberg system, which assumes that private speech is a relatively unitary category with a common functional meaning, the Fuson system assumes that private speech serves three main functions: a regulating function, an emotional/ expressive function, and a fantasy/ role-playing function (Fuson, 1979). Each major category presumably appears early and remains throughout life. Of particular importance here is the assumption that developmental changes will be reflected in differences in distributions within the categories. Thus, shifts in function will show up as changes in the distributions within categories over time. The amounts of speech within each main category are hypothesized to vary considerably with situational variables (e.g., task difficulty, familiarity of setting).

In essence, the Fuson category system encompasses a broader range of speech functions than does the Kohlberg system, and it also provides a structure for scoring utterances in a way that does not decide their developmental order a priori. Also, speech functions and private or interpersonal status are considered independently of one another. However, Fuson's system does not adequately reflect the conceptual continuities and discontinuities between private and social speech that are at the heart of Vygotsky's theory. Nonetheless, this system appears to be one of the more useful systems for developmentally categorizing private speech types.

Despite its flaws, the Kohlberg category system has produced a consistent pattern of results, even when used with children from different cultures and different socio-economic strata. Kohlberg et al. (1968) found no cultural differences between middle-class Norwegian and

American children. Berk and Garvin (1984) found that there were no differences between low-income Appalachian children and previously studied middle-class children in terms of developmental patterns, but that the rate of development was slower for the Appalachian sample. Similarly, Feigenbaum (1985) compared middle-class and working-class five-year-olds from New York City and found that, with respect to Kohlberg's categories, the working-class sample displayed the same pattern of development as the middle-class sample, but at a delayed rate.

Summary. The classification system created by Kohlberg, Yaeger, and Hjertholm (1968) has raised many fundamental issues and contained bold insights, but the omission of important categories of function, the problems with lack of reliability, and the failure of evidence to fully support their suggested developmental sequence suggest the need for a revised system of categories (Fuson, 1979). The inconsistent use of category names and definitions, imprecise definitions of newly added categories, and the continuing problem of low reliability are among the chief causes for the differing findings among private speech studies, most of which use the Kohlberg system-- or some version of it.

Methods for Differentiating Private Speech from Social Speech

As was mentioned above, the need to differentiate private speech from social speech arises, at least potentially, whenever there is another person present in the testing situation, which is typically the case. Unfortunately, more than half of the studies that examined private speech failed to report the linguistic criteria that were used to make this differentiation (Fuson, 1979). Those studies that did report

criteria (e.g., Berner, 1971; Dickie, 1973; Feigenbaum, 1985; Furrow, 1980; Goodman, 1977, 1979; Meichenbaum and Goodman, 1979; Rubin, 1979) did not use the same criteria. Regardless of which criteria were used, however, most researchers tended to follow the same basic logic in constructing their decision procedure. Essentially, the procedure was to first examine each utterance (retrospectively) for indications of its `social' intent; if no such indications could be found, then the utterance was presumed to be `private' in intent.

Basically, the reason why different criteria have been used to identify private speech is because private speech can be defined in two essentially different ways-- functionally and structurally. From a functional perspective, the most significant feature of private speech is that it is not intellectually "adapted" to a listener. From a structural perspective, the most salient feature of private speech is that it is not conversationally "addressed" to a listener. Methodologically, the `functional' view generally involves an examination of the semantic content of a given utterance, whereas the `structural' view generally involves an analysis of the vocal delivery of an utterance. The phenomenon of "collective monologue" is a dramatic illustration of this distinction between conversation that is "addressed" to another, and conversation that is "adapted" to another.

With regard to the `structural' criteria for differentiating private speech from social speech, one of the most reliable indicators that an utterance is intended as social speech is the accompanying eye contact (see Bates, Benigni, Bretherton, Camaioni, & Volterra, 1977). Typically, when a speaker addresses his speech to another, he turns both his body and his head toward the addressee and establishes

eye contact. But because interlocutors are not always in a convenient line of sight, speakers make use of additional signals to indicate that their speech is addressed to another. Specifically, when eye contact is difficult or inconvenient, speakers tend to: 1) make explicit verbal reference to the other person (e.g., Berner, 1971; Dickie, 1973); 2) repeat their remark (e.g., Meichenbaum and Goodman, 1979); 3) demand a response (e.g., Goodman, 1977, 1979); and 4) initiate physical contact (e.g., Furrow, 1980).

Furrow (1980) investigated, among other things, how young children intone their utterances differently to indicate the social intent of their speech in the absence of eye contact. He reported that increases in intonational stress, pitch, and intensity (loudness) of speech were positively related to social speech situations in which eye contact was absent, while decreases in these qualities were related to social speech situations in which eye contact was present. That is, he found that even very young speakers tend to "broadcast" their social speech "over their shoulders" when listeners are not directly in sight. Thus, in addition to repeating, demanding, and calling by name, speakers make changes in intonation, pitch, and loudness to indicate that their speech is addressed to others.

With regard to the `functional´ criteria for differentiating private speech from social speech, many different features have been employed. Basically, the semantic content of an utterance contains key information needed to determine whether the speech was "adapted" or "unadapted" to a listener´s point of view. However, the conversational context in which speech is uttered also provides information concerning its function, as does the context of activity. In addition, Vygotsky

(1962) enumerated several other specific features of private speech functioning that can be expected to change with development. Specifically, the timing of an utterance (with the action to which it refers) is likely to shift from after or during the action to before the action (1962, p. 17). Also, the referential content is expected to change from references about the surrounding milieu to references about the speaker's own activities (Levina, 1978, p. 8).

Recently, a controversy has developed over which of these criteria are most appropriate for defining private speech empirically. According to Frawley and Lantolf (1986), for example, all utterances of private speech are self-regulatory by definition, and that what matters (with regard to the 'private' status) is the semantic content, not a taxonomy of its functions. In contrast, Frauenglass and Diaz (1985) argue that the classification of private speech should include types that are not self-regulatory. Furthermore, Diaz (1986) claims that the self-regulatory functions of private speech cannot be determined solely on the basis of the semantic content. Finally, Berk (1986) argues that the evidential base needed in order to score an utterance as private speech must include not only the utterance's content and possible functions, but also its form.

Summary. Researchers can identify or infer the existence of private speech on the basis of certain physical qualities related to an utterance's 'delivery.' Specifically, it has been shown that speakers generally use eye contact to signal the person to whom they are communicating. In the absence of eye contact, several other signals are available to speakers to indicate that their speech is intended for

others. These include: 1) the increased use of vocatives; 2) repetition of the utterance; 3) demand for a response; 4) the initiation of physical contact; and 5) changes in the intonation, pitch, and intensity (loudness) of speech. In the absence of all these indicators, analysts could reasonably infer that the speech in question was intended as private speech.

In addition, researchers have tried to identify or infer the existence of private speech on the basis of an utterance's 'function.' Although it is difficult to isolate the constellation of features that reliably indicates when an utterance is intellectually "adapted" to a listener's perspective, many different functions have been studied. The most important source of evidence with regard to the function of private speech is the semantic content of an utterance. The semantic content of speech contains information about the topic that is in the speaker's consciousness, and initially consists mainly of references to the surrounding milieu, but later consists largely of references to the speaker's own activity (Levina, 1978, p. 7). Also, the timing of speech and action provides information as to an utterance's 'private' status. Finally, functional analyses of private speech are further strengthened when information regarding the context, both in terms of conversation and activity, is included.

Summary of Literature Review

The theories of private speech development put forward by Piaget and Vygotsky have had a tremendous impact on the history of private speech research. Although Piaget's (1955) theory of egocentric speech and thought has generated many studies, it is Vygotsky's (1987) theory

that has received general empirical support. First, the literature indicates that private speech tends to follow a curvilinear path of development rather than a monotonic one. Specifically, private speech increases in relative amount until about age 5, at which point it begins to decrease gradually before disappearing at about age 8 or 9. Furthermore, private speech is produced overtly up until about age 5, at which point there is evidence to suggest that it begins to transform into a covert activity.

With regard to the self-regulatory functions of private speech, the literature offers additional support for Vygotsky's theory. Although the absolute amount of private speech that children produce tends to decrease after age 5, the proportion that is used for self-regulation continues to increase with age. Moreover, the proportion of private speech that is self-regulatory also tends to increase in particular social situations-- specifically, in situations where there is a difficult problem to solve. Thus, the literature generally upholds Vygotsky's basic claim that private speech develops into an instrument for seeking and planning solutions to problems. However, further research is needed in order to identify all of the different types of self-regulation that are possible using private speech, as well as the specific linguistic forms of private speech that are typically associated with particular self-regulating functions.

The most widely used classification system for categorizing private speech functions is the system invented by Kohlberg and his associates (1968). From a practical point of view, this system has done a great deal to promote research on private speech. From a methodological point of view, however, there are many problems. Specifically, impor-

tant categories of function have been omitted, there are problems concerning lack of reliability with certain categories, and there is little evidence to support the developmental sequence that Kohlberg and his colleagues postulated. Furthermore, the inconsistent use of category names and definitions, and the imprecise definitions of certain categories, have all contributed to the differing findings of private speech studies that have used this system. Despite these problems, the pattern of results from private speech studies that have tested children from different cultural and socioeconomic backgrounds has been remarkably consistent. Nonetheless, the call for a revised classification system for categorizing types of private speech has already been issued (Fuson, 1979).

Finally, the methods that have been developed to differentiate private speech from social speech fall into two basic categories: those that are based on `structural' criteria, and those that are based on `functional' criteria. The term `structural' refers here to certain physical qualities related to an utterance's `performance,' such as eye contact, repetition, and intonation. These qualities provide a basis for an analyst to decide (retrospectively) whether an utterance was `addressed' conversationally to oneself or another. In contrast, the term `functional' refers here to certain intellectual qualities related to an utterance's `meaning,' such as the semantic content, the context of conversation and activity in which it is embedded, and its timing with action. It is these particular qualities that provide a basis for determining (retrospectively) whether an utterance was `adapted' intellectually to another person's thought.

CHAPTER II

STATEMENT OF AIMS

Overview

There were two basic aims to this research: 1) to describe and inventory the various linguistic forms and cognitive functions of private speech that are manifested by children at 4, 6, and 8 years of age; and 2) to use these descriptive data in order to test three particular claims about the development of private speech. Because the second aim is of primary interest here, the discussion that follows centers on these three claims. Before considering them in detail, a brief summary of each is presented.

Two of the claims were put forward by Vygotsky. Specifically, he proposed that: 1) initially, private speech serves as an accompaniment to action and as a means for discharging emotion, but later develops into an instrument for seeking and planning solutions to problems--that is, it becomes a means for directing actions and thoughts toward consciously intended goals (1987, pp. 70-73); and 2) as private speech develops, its syntax becomes increasingly fragmented and abbreviated, and the number of words uttered is markedly reduced (1987, pp. 267-269).

The third claim is put forth here. Specifically, it is proposed that: 3) as private speech develops, there is likely to be an increase in the relative number of discourse sequences that serve as `planning' narratives, or `goal-oriented' narratives. Also, the relative number of utterances (i.e., sentences) constituting a `planning' narrative is likely to increase. These developments at the level of discourse are presumed to occur despite the simultaneous fragmentation and abbreviation of the syntax of individual sentences.

Development of the Planning Functions of Private Speech

According to Vygotsky, there is a close connection between problem-solving activity and private speech activity that can be seen in both phylogenetic and ontogenetic development. With regard to phylogenetic development, Vygotsky (1978) posed the question: "What is it that really distinguishes the actions of the speaking child from the actions of an ape when solving practical problems?" (p. 26) His reply: "In the process of solving a task the child is able to include stimuli that do not lie within the immediate visual field. Using words (one class of such stimuli) to create a specific plan, the child achieves a much broader range of activity, applying as tools not only those objects that lie near at hand, but searching for and preparing such stimuli as can be useful in the solution of the task, and planning future actions" (1978, p. 26).

With regard to ontogentic development, Vygotsky observed a qualitative change in the relationship between speech and action as children matured: "Initially speech follows actions, is provoked by and dominated by activity. At a later stage, however, when speech is moved to

the starting point of an activity, a new relation between word and action emerges. Now speech guides, determines, and dominates the course of action; the planning function of speech comes into being in addition to the already existing function of language to reflect the external world" (1978, p. 28).

To understand more concretely how private speech can serve as an instrument for planning, it would be helpful to define more precisely what the process of planning is, and what the different functions or skills are that comprise the process. What follows is a brief summary of the research on the development of planning skills.

According to Pea (1982, pp. 6-7), theorists of planning distinguish four general steps in the planning process: 1) representing the planning problem situation; 2) plan construction; 3) plan execution; and 4) planning-process remembering. The first step (representing the planning problem situation) requires a planner to: a) define the goal; b) define the problem; c) note the differences between the problem and goal; and d) determine the constraints on planning (e.g., space and time limitations). The second step (plan construction) requires a planner to formulate a plan that will eliminate the differences between the problem and goal. Step 3 (plan execution) requires a planner to monitor his or her implementation of the plan, and step 4 (planning-process remembering) may be required at any point in the entire operation.

Unlike earlier models of the planning process, in which planners were essentially conceptualized as robots who formulated and executed plans in a `top-down' sequence, more recent models recognize the dynamic nature of planning and are designed to incorporate a `bottom-up'

sequence as well. At present, the plan-construction process is conceptualized in terms of "cycles of proposal, simulation, evaluation, and revision" that operate until an adequate plan is formulated (Pea, 1982, p. 11). The same kind of flexibility is also needed in the plan-execution process. Because planners may become aware of new problems in their attempts to execute a plan, they may need to redefine the problem and the goal accordingly. In fact, it is typically the case that problems are not discovered until practical attempts are made to implement a plan. What is important to note here is that, since the planning process involves a cyclic movement between plan-execution and plan-construction activity, it is likely that the planning functions of speech would be distributed throughout the entire course of a problem-solving activity rather than only at the beginning.

In order to test the developmental claim that private speech becomes increasingly bound up with the planning process, the planning functions that were enumerated by Pea (1982) in his review were organized into a system of categories (see Appendix I). These categories were designed to apply to utterances of speech (either private or social) that met the criterial definitions. That is, planning functions were conceptualized as functions of speech. By designing this classification system so that it could be applied to speech, the possibility of identifying the specific planning functions of individual private speech utterances was created.

Summary. Although previous research has established a general link between the development of private speech and the development of the planning process, specific links between particular private speech

forms and particular planning functions have yet to be established. In order to identify if a given utterance of private speech serves a planning function (and if so, which function(s) in particular), a system of categories was invented. These categories were based on the planning functions enumerated by Pea (1982) in his review of the literature on the development of planning skills. Basically, there are four steps in the planning process: 1) representing the planning problem situation; 2) plan construction; 3) plan execution; and 4) planning-process remembering.

Development of the Syntactic Structure of Private Speech

With regard to the developmental relationship between the function and structure of private speech, Vygotsky (1987) wrote: "Our genetic and experimental studies demonstrated that what is initially only a functional differentiation of egocentric and social speech leads directly and systematically to structural changes as well. With the development of functional differentiation, we find structural changes in egocentric speech that gradually approach the complete abolition of the syntax of oral speech" (p. 274).

The syntactic structure of private speech is "abolished" in a very specific manner, however. "Initially, the structural characteristics of egocentric speech are identical to those of social speech. As egocentric speech develops and becomes functionally isolated from social speech, as it becomes an independent and autonomous speech form, we find increasing manifestations of the tendency for abbreviation, continual reduction in the levels of syntactic differentiation, and increasing tendencies for condensation" (1987, p. 274).

In addition, there is a marked reduction in the quantity of words (Vygotsky, 1987, p. 269). One possible reason for this is that certain words no longer play a vital role in the action, and are therefore no longer voiced. Another reason for the reduction of words is the development of agglutination, wherein several words are fused into one. As private speech is transformed into inner speech, "...agglutination emerges with increasing frequency and clarity as a means of forming unified complex words that are used to express complex concepts. The increasing manifestations of this tendency for an asyntactic fusing of words in the child's egocentric expressions parallels the drop in the coefficient of egocentric speech" (1987, p. 277).

The process of abbreviation also reveals the character of inner speech. "By analyzing what drops out in the developmental process, we can identify what is inessential to inner speech. Correspondingly, by analyzing what tends to be strengthened, what emerges more and more clearly in the developmental process, we can identify what is essential to it" (Vygotsky, 1987, p. 258). The idea here is that, prior to its abbreviation and ultimate disappearance, private speech is a fully blown speech form that consists of grammatically well-formed, syntactically complex sentences. The process of abbreviation reflects a deeper process, one in which decisions are being made about what is (and is not) essential to say and know in a given situation.

What is striking about this particular aspect of private speech development is that the syntactic structure presumably disappears at the very same time that the planning process emerges. Intuitively, it seems reasonable to expect that planning would be best served by fully expanded speech as opposed to abbreviated speech. That is, one would

assume that the development of a higher-order cognitive process such as planning would be supported by more speech rather than less. Of course, it is clearly more economical to use an abbreviated speech form rather than an expanded speech form whenever possible. Suffice it to say that this paradox between decreasing form and increasing function has yet to be reconciled.

Summary. As the linguistic structure of private speech develops, it moves in an opposite direction from that of the planning function. Whereas the planning process develops from part to whole, the syntactic structure of private speech develops from whole to part. Specifically, Vygotsky (1987) observed that the syntax of private speech manifested an increasing tendency to become fragmented and abbreviated with development. Furthermore, he observed a marked reduction in the quantity of words produced. Vygotsky proposed that the process of abbreviation supplies clues as to the character of inner speech. More precisely, the words and phrases that drop out in the developmental process reflect a decision-making process as to what is essential and inessential to say and know in a given situation.

Development of the Discourse Structure of Private Speech

Thus far, only two levels of linguistic structure have been considered: words and sentences. Now it is time to consider the development of the discourse structure of private speech. It is postulated here that, as private speech develops, there is likely to be an increase in the relative number of planful, or goal-directed, discourse sequences. More precisely, the relative number of `planful conversa-

tional exchanges' and `planful narratives' is expected to increase with development.

According to Stubbs (1983, p. 131) a conversational exchange is a minimal interactive unit in which an `initiation' is followed obligatorily by a `response,' and optionally by further utterances (e.g., question-answer-comment). A `planful conversational exchange' is defined here as a conversational exchange that serves the planning process. A `planful narrative' is defined here as a sequence of utterances that serves the planning process and is united by a common topic or directed toward a common goal. The technical definition given here to the term `narrative' is very different from the definition used by researchers who study the development of children's narratives (e.g., Labov, 1972; Labov and Waletsky, 1967; Rumelhart, 1977). Most investigators use the term `narrative' to refer to the kinds of discourse that tell a tale of past events (see Peterson and McCabe, 1983, for review). The `planful narratives' described here serve a prospective rather than a retrospective function, and are therefore very different in character from the kinds of narratives typically studied.

In addition to what has been stated so far, it is claimed that the relative number of utterances constituting a planful narrative is also likely to increase with development. The rationale for this claim is that, because planning is a complex process, the structure of private speech should in some way reflect this increasing complexity. Since the syntactic structure develops into a simpler structure rather than a more complex one, the presumed increase in complexity is most likely shifted to the discourse structure of private speech. It is predicted that, as children develop the planning function of private

speech, they should produce longer and longer sequences of private discourse, sequences that consist of multiple utterances connected by a common topic, or directed toward a common goal. Again, this progress at the level of discourse is predicted to occur despite the fragmentation at the syntactic level.

Summary. Because planning is a complex process, and because private speech develops into an instrument for planning, private speech should become more complex with development. Since this complexity is not reflected in the syntax of private speech, it is most likely reflected in the discourse structure. The claim has been put forward here that the relative number of `planful conversational exchanges' and `planful narratives' should increase with development. Furthermore, the relative number of utterances constituting a planful narrative should also increase with development.

Empirical Hypotheses

To test these claims empirically, seven hypotheses were generated. Regarding Vygotsky's claim that private speech develops into an instrument for planning, the following three hypotheses were constructed:

Hypothesis 1. It is predicted that the relative number of utterances of `planful' private speech will increase significantly from age 4 to age 8.

Hypothesis 2. The relative number of utterances of `planful' private speech is expected to increase as the level of difficulty of the problem-solving activity is increased. This pattern should be roughly the same for all subjects, regardless of age.

Hypothesis 3. It is predicted that the planning functions associated with the process of plan-execution will decrease with age, whereas the planning functions associated with the process of plan-construction will increase with age. This hypothesis is based on Vygotsky's (1987, pp. 70-71) observation that private speech is initially used for attending to the transition points or the end results of a problem-solving activity, and is only later used for analyzing problems and formulating intentions and plans in advance of action.

With regard to Vygotsky's claim that, as private speech develops, its syntactic structure is systematically fragmented and abbreviated, and the quantity of words is reduced, the following two hypotheses were proposed:

Hypothesis 4. The relative number of utterances of 'planful' private speech that consist of complete sentences (i.e., grammatically well-formed sentences) is expected to decrease with age; conversely, it is predicted that the relative number of 'planful' private speech utterances that consist of sentence fragments (i.e., ungrammatical sentences) will increase with age.

Hypothesis 5. It is predicted that the relative number of words contained in utterances of 'planful' private speech will decrease with age.

Regarding the claim put forth by this author about the discourse structure of 'planful' private speech, the following two hypotheses were generated:

Hypothesis 6. It is predicted that the relative number of 'planful conversational exchanges' and 'planful narratives' will increase from age 4 to age 8. Few exchanges or narratives are expected at age 4,

whereas numerous oral "texts" are expected at age 8.

Hypothesis 7. The relative number of utterances constituting `planful narratives´ is expected to increase with age. Again, few utterances per narrative are expected at age 4, whereas lengthy oral "texts" comprised of numerous utterances is expected at age 8.

CHAPTER III

METHODS

Subject Population

Thirty children were recruited for this study. They ranged in age from 3;3 to 8;8. Eligibility to participate was restricted to children approximately 4, 6, and 8 years of age whose native language is English. Because of the differing ages, it was necessary to recruit at several different schools. The 4-year-olds were recruited from three different sites: a child-care center in New York City, a child-care center in Brooklyn, and a preschool in Brooklyn. About half of the 6-year-olds were also obtained at this preschool, while the other half were recruited at a Brooklyn parochial school. The 8-year-olds were also recruited at this parochial school.

Teachers or care-givers at each of the sites identified to the experimenter those children who were eligible to participate in the study. From the population of children who returned permission slips, five girls and five boys at each age level (thirty children in all) were randomly selected by drawing names from a hat. The mean age for each of the three groups was 4;1, 6;0, and 7;10, respectively.

Nearly half of the 4-year-olds selected were white and came from predominantly middle-class backgrounds. The other 4-year-olds were

Black or Hispanic children who came from predominantly working-class backgrounds. The overwhelming majority of 6- and 8-year-olds were also Black and Hispanic children from working-class families.

Materials

Pre-Test. The Wechsler Preschool and Primary Scale of Intelligence (WPPSI) and the Weschsler Intelligence Scale for Children--Revised (WISC-R) were used to pre-test all subjects. The 4-year-olds were administered the WPPSI, while the 6- and 8-year-olds were administered the WISC-R. The purpose of the pre-test was to provide an independent assessment of each subject's verbal and performance skills so that there could be a point of comparison with the other verbal and performance measures. The rationale for selecting these particular tests was that they are widely used, standardized, reliable, and well-studied. Furthermore, because the WPPSI is essentially a downward extension of the WISC-R, comparisons of the results from the two tests are facilitated.

Task. To increase the likelihood that the planning functions of private speech would be elicited, a problem-solving task was used. The task chosen was initially used by Piaget (1976, pp. 252-273) to study the development of concrete operations. Specifically, the task was to construct different roads by means of connecting wooden tracks. Essentially, the task involved two separate problems in plane geometry, problems that required for their solution a co-ordination of mental perspectives. In the first problem (Task 1), each subject was provided with five wooden tracks-- one straight and four curved ones. In the

second problem (Task 2), subjects were given two additional curved tracks with which to build roads.

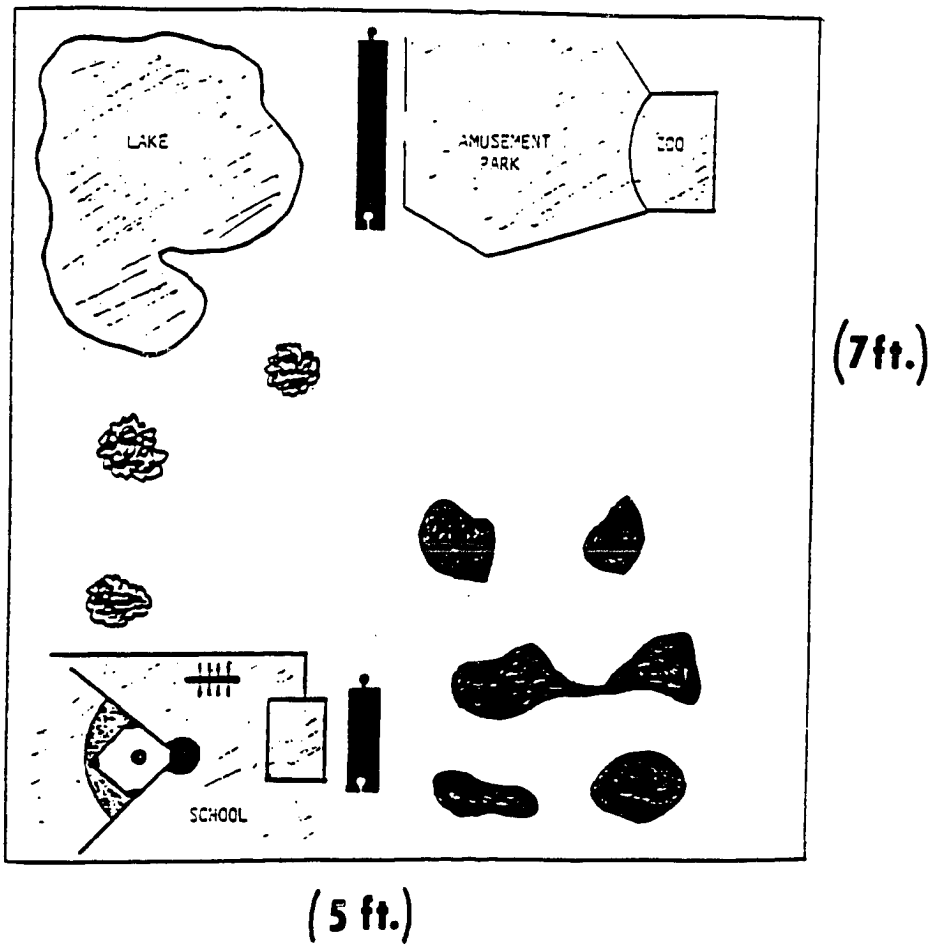
Following Piaget (1976, p. 253), the wooden tracks used in this experiment had the following special properties: 1) each track had a male and female end; 2) each track could be placed either side up; 3) each curved track, therefore, could make either a right-hand or left-hand bend by turning it about the two axes of symmetry; 4) it was therefore possible to turn any road about its longitudinal axis to obtain the symmetrical road without dismantling anything; 5) it was also possible, without disturbing the construction, to turn any road about its transverse axis to obtain the inverse road; and 6) it was possible to construct a road of a given length either with n straight tracks or with $2n$ curved tracks.

To increase the likelihood that the `non-planning' functions of private speech (e.g., accompaniment to activity, and emotional release) would be elicited as well, the problem-solving task was couched in the form of a game. This game, which involved a fantasy story and accompanying toy props, provided subjects with an incentive and a rationale for doing the problem-solving tasks. Essentially, the story-line enjoined subjects to construct different roads that would enable a schoolbus filled with schoolchildren to reach its destination: an amusement park.

The toy props consisted of: 1) a toy school bus that was specially fitted to slide along the wooden tracks; 2) a toy school house; 3) a toy ferris wheel; 4) eight toy zoo animals; and 5) three toy boats. In addition, a lightweight rectangular foamboard (5 feet by 7 feet) was converted into a "landscape" using colored felt, paint, wooden sticks,

toy rubber trees, paper, and glue. When the toy props and wooden tracks were placed on this "landscape," a miniature model town was created. Two straight tracks were glued to the surface of the board a fixed distance apart. In Figure 1, a sketch of the game board is presented.

Figure 1



The objects dotting the center-left and lower right sections of the board represent clumps of trees and rocks, while the black vertical objects at the top and bottom of the board represent the two tracks fixed to the board's surface.

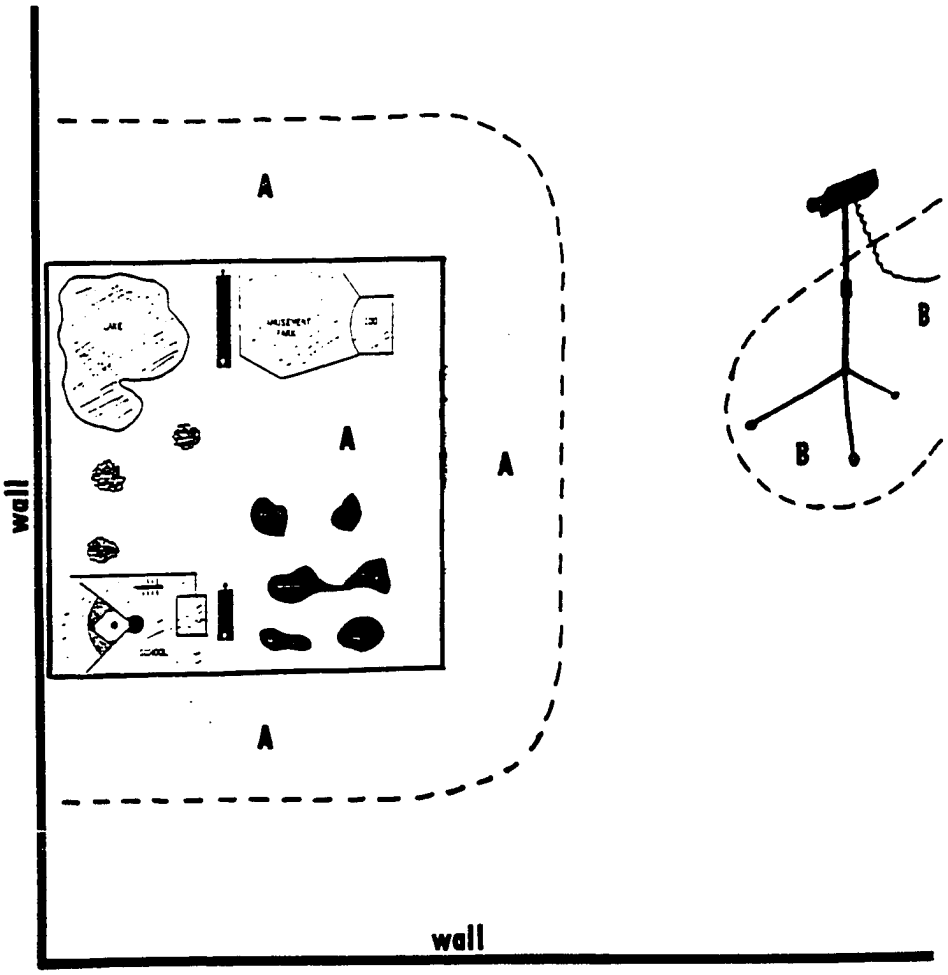
Videotape. The recording equipment consisted of: 1) a Panasonic portable VHS videotape recorder; 2) a color camera; 3) a closed-circuit color monitor; 4) a directional microphone; and 5) a ten-foot tripod. The camera was mounted on the tripod at a height of about ten feet, and the tripod was placed on the opposite side of the room from the game board containing the task materials. From its fixed position atop the tripod, the camera could view the entire game board plus a two-foot corridor surrounding the board on both sides and in front. To increase the quality of the audio recording, the directional microphone was positioned right over the center of the board at a height of approximately nine feet.

Setting

Subjects were tested individually in a private room located within their own school or child-care center. Both the pre-test and the experimental test were conducted in a private room so as to avoid disturbance, particularly with regard to noise created by other children.

The spatial relationship between the videotape camera and the materials, subject, and experimenter played a crucial role in the production of the videotapes that formed the data base of this study. The camera was mounted atop the tripod at a height of about ten feet, and the tripod was positioned about fifteen feet away from the game board, which was always pushed up against one wall of the room. In Figure 2, a rough sketch of the relationship between the game board and the camera is presented. The zone marked "A" indicates the area where the subjects were located and where the camera was focused. Across the room, in the zone marked "B," is where the camera, the portable recording unit, and

Figure 2



the closed-circuit monitor were located. Seated underneath and out of view of the camera was the experimenter, who faced away from the subjects. This design of the physical situation pressured subjects, who generally faced away from the camera, to orient directly toward the camera when trying to communicate with the experimenter. The rationale for this positioning was that the differentiation of private speech from social speech would be facilitated if the difference between the subject's and experimenter's physical orientation was more pronounced.

Measures were also taken to minimize the amount of social interaction that could occur between subject and experimenter. One method that researchers have used to minimize potential social interaction in private speech studies is to have the experimenter sit in another part of the room and refrain from becoming involved (e.g., Deutsch and Stein, 1972; Rubin, 1979; Rubin and Dyck, 1980). Another method is to instruct the subjects not to disturb the experimenter, who is ostensibly engaged in other work. Both of these methods were employed here.

Essentially, the experimenter's role in this research was: 1) to introduce subjects to the task materials; 2) to demonstrate the different ways that curved and straight tracks could be linked together to construct different roads; 3) to recite the prepared story that furnished the background information that defined the problem; 4) to define the goals of Task 1 and Task 2; and 5) to repeat or clarify instructions if needed. Thus, the experimenter was restricted from conversing about any matters other than those concerned with administering the task. Similarly, subjects were instructed to avoid asking the experimenter for help in executing the task. These practices were designed specifically to limit social interaction and to pressure subjects into resolving the task problems on their own.

Procedures

Pre-Testing. The pre-test and the experimental test were administered on separate occasions. Each subject was pre-tested individually by the experimenter in a private classroom located within the school attended by the subject. 4-year-olds received the WPPSI, while all others received the WISC-R. The instructions given to each subject were

the standardized instructions provided in the manual accompanying each test. Nearly an hour was needed to administer each pre-test. All pre-tests were scored soon after completion in accordance with the procedure set down in the respective reference manual.

Testing. Each subject was tested separately by the experimenter, who remained in the testing room throughout the session. Because Task 1 was generally less intimidating to the subjects than Task 2, it was always presented first, immediately followed by Task 2. Fifteen minutes was alloted for each task. Prior to presenting Task 1 to each subject, the experimenter introduced the "play" materials-- i.e., the miniature town and the toy props. Then the experimenter introduced the wooden tracks and demonstrated how the curved and straight tracks fit together, and how they could be used to construct different kinds of roads. Then each subject was given an opportunity to practice working with the tracks.

Finally, the experimenter presented the instructions and specific materials needed for Task 1. At the conclusion of Task 1, the experimenter gave each subject two additional curved tracks and the instructions needed to perform Task 2. A verbatim transcript of the instructions given to subjects is provided in Appendix I.

On several occasions, it was necessary for the experimenter to intervene and restate the instructions. This occured only when there was no attempt made to perform the task after a period of ten minutes. The experimenter intervened on seven occasions: three involving 4-year-olds, three involving 6-year-olds, and one involving an 8-year-old.

Videotaping. Each subject's performance during the experiment was videotaped for subsequent analysis. These recordings formed the data-base of this study. After all of the subjects had been videotaped, each videotape was copied. Onto each frame of each copy, a running time-clock was electronically inserted using a computer-driven time-code generator. The running time-clock was subsequently used in the scoring of data.

Procedures for Analyzing Data

Scoring Task Performance. A task analysis was undertaken because, according to Vygotsky, it is impossible to understand a child's private speech "...if you do not see what the child is doing and seeing" (1987, p. 278). Furthermore, a task analysis can provide measures of a child's problem-solving abilities that are independent of verbal measures of a child's planning abilities. This information is of particular value in those cases where little or no overt speech is produced during the course of activity.

In this experiment, subjects had the option of either attempting to solve the problems posed by the tasks, or engaging in some other activity, such as play. Thus, task performance was divided into problem-solving efforts and non-problem-solving activities. Problem-solving efforts were measured here in terms of Attempts to Construct Roads. An Attempt to Construct a Road was defined as a discrete activity in which a subject linked at least two tracks together. Non-problem-solving activities were defined here as any activities other than engaging in an Attempt to Construct a Road. The procedure that was developed to identify the initiation, development, and conclusion of an Attempt is

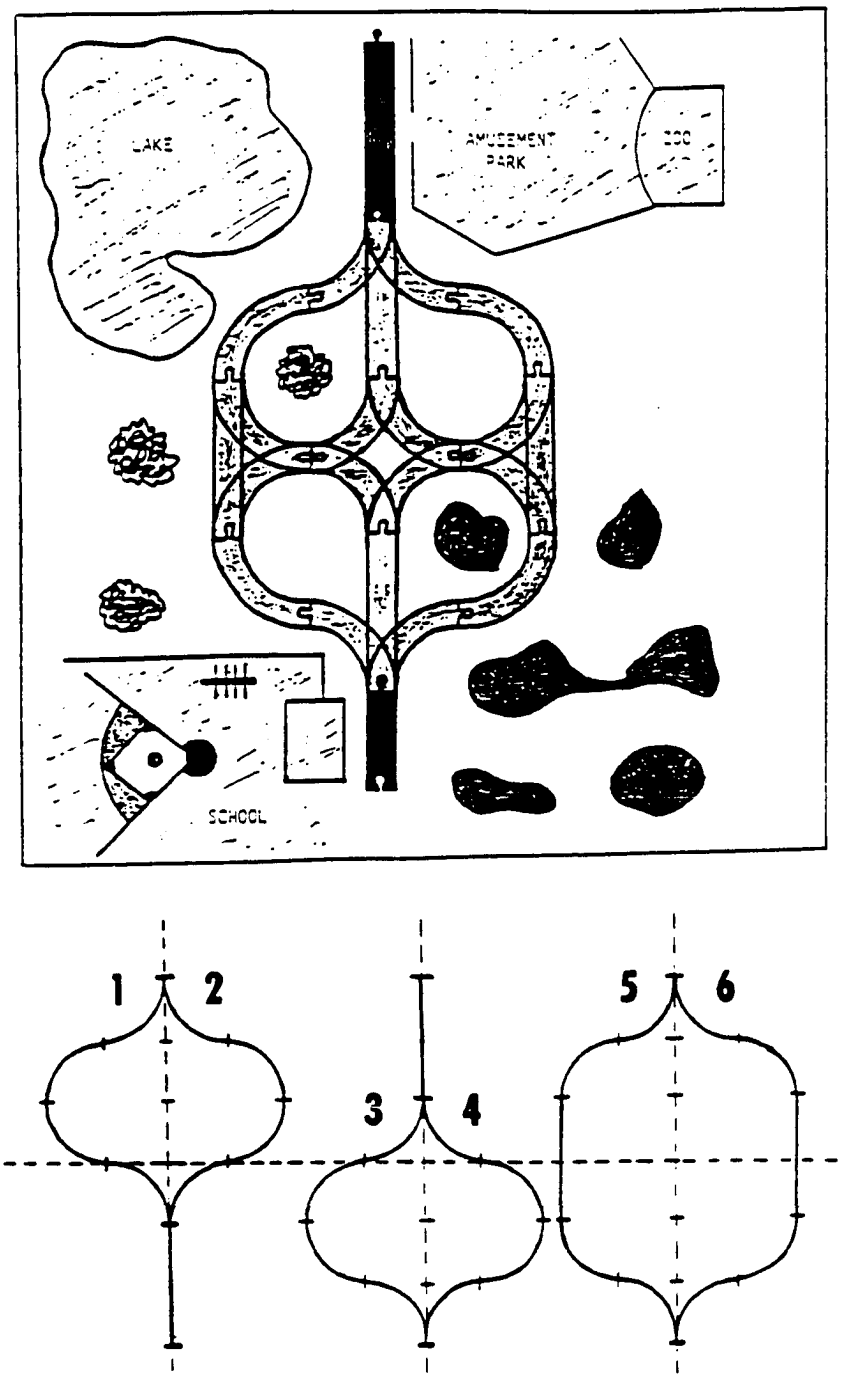
presented in Appendix I.

Attempts at problem-solving fell into two basic categories: Successful and Failed. A Successful Attempt was one that resulted in a "target" road. A target road was one that: 1) linked up to both endpoints (i.e., the two tracks glued to the board), and 2) utilized all of the given tracks. A Failed Attempt was one that did not result in a target road because it either did not link up to both endpoints, or did not utilize all of the tracks.

In Task 1, each subject was given one straight track and four curved tracks. With these tracks, it was possible to construct six different "target" roads. In Figure 3, a rough sketch of these six target roads is presented. It should be noted that the sketch superimposes all of the roads simultaneously, whereas in actual fact, only one road could be built at a time. Also appearing in Figure 3 are schematic drawings of the six different geometric configurations that correspond to the six target roads. Some of the road configurations are symmetrical to one another around the vertical axis (e.g., patterns 1 and 2), while others are inverses of each other (e.g., patterns 1 and 4), which are derived by rotating these figures 180 degrees.

In Task 2, each subject was furnished with two additional curved tracks. With one straight and six curved tracks, it was possible--in principle--to construct six different target roads. But because the problem presented in Task 2 was extremely difficult for most subjects, it was necessary to limit the goal to only four target roads. Therefore, two of the six possible roads were deliberately precluded by strategically positioning the game board right up against the wall, and by blocking access to those particular roadways with trees and other

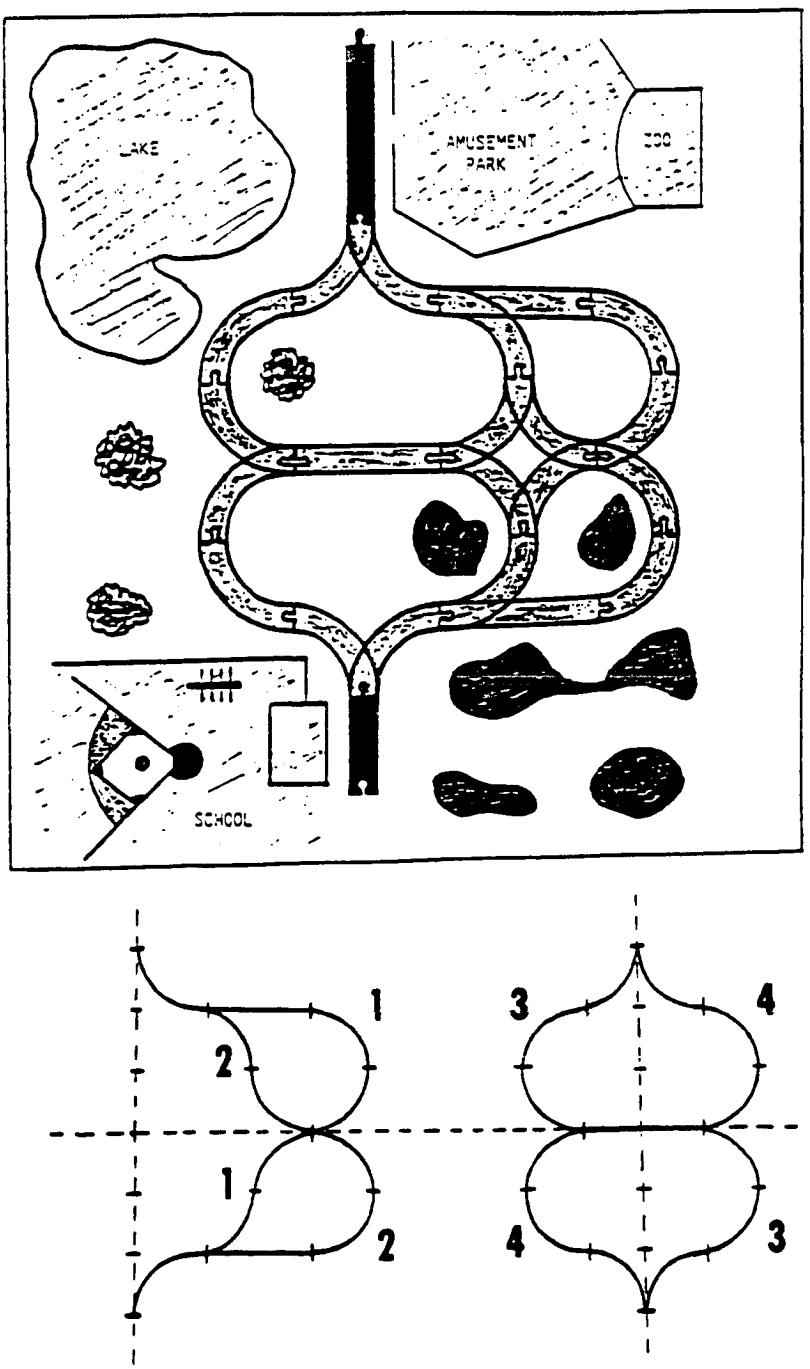
Figure 3



toy props. In Figure 4, a rough diagram of the four target roads in Task 2 is presented. Again, all four roads are shown superimposed upon one another simultaneously. Also appearing in Figure 4 are schematic

drawings of the four geometrical configurations that correspond to the four target roads.

Figure 4



An example of scored performance data appears in Appendix II. This example provides a minute-by-minute account of one 8-year-old boy's Attempts to Construct Roads. (The code numbers listed under the column entitled "Targets" refer to the code numbers on the schematic drawings that appear in Figures 3 and 4).

Partitioning Speech into Utterance Units. First, the stream of speech recorded on each videotape was transcribed. The purpose in having a transcription was not to substitute it for the videotaped recording, but rather to use it as a record-keeping device when scoring the data. This written "chart" of the sequence of words was subsequently used to record the boundary lines between utterance units, as well as the codes applying to each unit.

To determine where the boundary lines between one utterance and another were located, a procedure was developed based on the intonational contours of speech. This decision procedure is based on the assumption that intonational contour is a device commonly used by speakers to mark the completion of a sentence, sentence fragment, or idiomatic expression. Thus, it provides a means for identifying the end of one utterance and the beginning of the next. This study used three different intonational contours as markers for identifying the completion of an utterance: 1) a "falling" intonational contour; 2) a "rising" intonational contour; and 3) a "rising-falling" intonational contour. If, upon further examination, an utterance was found to contain more than one independent or dependent clause, the utterance unit was further divided. Each clause was then scored as a separate utterance unit.

Differentiating Utterances of Private Speech from Utterances of Social Speech. Social speech and private speech can be differentiated on the basis of certain physical qualities related to an utterance's 'delivery.' Specifically, it has been shown that speakers generally use eye contact to signal the person to whom they are communicating. In the absence of eye contact, several other signals are available to speakers to indicate that their speech is intended for others. These include: 1) the increased use of vocatives; 2) repetition of the utterance; 3) demand for a response; 4) the initiation of physical contact; and 5) changes in the intonation, pitch, and intensity (loudness) of speech.

These features were organized into the identification procedure that appears in Appendix I. Essentially, utterances were scored as private speech only when all social speech indicators were absent. The videotaped data were crucial to this analysis, which could not be performed without them. Also presented in Appendix I are the codes and definitions that were used to score private and social speech. Note that social speech was divided into two categories: Initiated speech and Responsive speech. This distinction was made in order to determine if the experimenter's speech to subjects strongly affected the subjects' social speech production. Two examples of how this scoring system is applied to verbal data appear in Appendix II.

Determining the Planful and Non-Planful Functions of Utterances. To ascertain whether an utterance served a planning function or a non-planning function, a decision procedure was developed (see Appendix I). To carry out this procedure, it was necessary to examine the videotaped data in conjunction with the transcript. Decisions were based on both

an utterance's content and its role in the activity. This analysis was performed independently of the private versus social speech analysis. Essentially, an utterance was defined as performing a planning function if it met any of the criterial definitions of the category system. If it did not satisfy any of the definitions, it was scored as performing a non-planning function. Most of the non-planning categories were adapted from Kohlberg et al. (1968) and Fuson (1979), whereas most of the planning categories (with the exception of "Emotional Release") were adapted from Pea's (1982) summary of the literature on the development of planning skills.

Specifically, seven categories of planning were used: 1) defining the problem; 2) defining the goal; 3) defining discrepances (between the problem and goal); 4) formulating a plan; 5) monitoring the execution; 6) remembering (the planning process); and 7) emotional release (associated with planning). The first four categories belong to the plan-construction process, while the fifth belongs to the plan-execution process. The last two categories can occur at any point in the planning process. Two examples of how this scoring system is applied to verbal data appear in Appendix II.

Determining the Conversational Functions of Utterances. In order to determine the discourse structure of a sequence of utterances, it was first necessary to determine the conversational functions performed by each individual utterance. That is, in order to determine if an utterance was part of a discourse sequence or was isolated, it was first necessary to determine how the utterance functioned conversationally in relation to surrounding utterances. The method employed here

was Dore's (1977, p. 143) Conversational-Act analysis, which was used in conjunction with Dore's (1979, pp. 354-5) category system for classifying conversational acts (see Appendix I). His methodology is particularly appropriate here because it takes into account the context of activity as well as the context of conversation, and according to Vygotsky, "conversation without action is incomprehensible" (1987, p.88).

Determining the Discourse Structure of Sequences of Utterances. Based on the conversational analysis of utterances, it was possible to determine the discourse structure of sequences of utterances. Two types of sequences were examined: `planful conversational exchanges' and `planful narratives.' Following Stubbs (1983, p. 131), a conversational exchange was defined as a unit in which an `initiation' is obligatorily followed by a `response,' and optionally followed by further utterances (e.g., question-answer-comment). A `planful conversational exchange' is defined here as an exchange that serves the planning process. In other words, it is a conversational exchange that is oriented specifically toward solution of the experimental tasks.

A `narrative' of private speech is defined here as a discourse sequence consisting of multiple utterances that are dominated by a common topic or directed toward a common goal. A `planful narrative' of private speech is defined here as a narrative serving the planning process-- i.e., a narrative oriented specifically toward solution of the experimental tasks. When the data were analyzed in accordance with these definitions, it was possible to determine which utterances belonged to a planful discourse sequence and which utterances existed in

conversational isolation from one another. Presented in Appendix II is an example of scored verbal data in which a 6-year-old girl produces some `planful conversational exchanges'.

Reliability. Reliability analyses were performed on the following procedures: 1) scoring task performance; 2) partitioning speech into utterance units; 3) differentiating utterances of private speech from utterances of social speech; and 4) determining the planful and non-planful functions of utterances.

With regard to scoring task performance, data from twenty percent of the population (two subjects from each age group) were analyzed for inter-rater reliability. The number of Attempts to Construct a Road were scored by two independent scorers, and the ratio of agreements to disagreements was used to calculate the reliability. The number of Successful and Failed Attempts were analyzed separately, and the ratio of agreements to disagreements was again calculated to produce a reliability coefficient.

With regard to the procedure for partitioning speech into utterance units, twenty percent of the total number of utterances scored by the experimenter were scored independently by another scorer. The data from three subjects (one from each age group) were selected for this analysis. The reason for using data from only three subjects was because these particular data sets contained a wide variety of scoring situations and problems, and because together they contained a sufficient number of utterances for reliability analysis. Reliability was determined on the basis of the ratio of agreements to disagreements.

The procedure for differentiating utterances of private speech

from utterances of social speech was checked for reliability using the same three data sets mentioned above. Because this procedure applied to the very same utterance units referred to in the previous procedure (only the qualities under examination were different), the same three data sets could be used efficiently to test reliability. Again, reliability was determined by calculating the ratio of agreements to disagreements.

Similarly, the procedure for determining the planful and non-planful functions of utterances was checked for reliability using the same three data sets as before. Once again, because the very same utterances were involved (only different qualities were being considered), the process of reliability was made more efficient. The ratio of agreements to disagreements supplied the basis for determining the reliability coefficient.

It should be noted that the reliability of Dore's (1977) procedure for determining the conversational functions of utterances, and Dore's (1979) system for classifying particular conversational acts, has been established in previous research. Earlier studies by this author (Feigenbaum, 1981, 1985), for instance, obtained reliability figures in which more than ninety percent agreement was achieved between two independent scorers.

CHAPTER IV

RESULTS

Intelligence Tests

The raw scores obtained on the WPPSI and WISC-R were converted to equivalent scaled scores using the procedures outlined in the respective reference manuals. The scaled scores for both Performance IQ and Verbal IQ are presented in Table 1. Although the group means display a slight curvilinear trend (there is an increase from age 4 to age 6, and then a decrease from age 6 to age 8), this trend was not statistically significant.

A correlational analysis was performed in order to establish the degree of relationship between IQ and the other measures central to this research. Specifically, Performance IQ and Verbal IQ were examined in relation to four performance measures (Successful Attempts at Problem-Solving, Failed Attempts, Time Spent on Problem-Solving, and Time Spent on Non-Problem-Solving activities) and four verbal measures (Number of Private Speech Utterances, Social Speech Utterances, Planning Functions, and Non-Planning Functions). Curiously, no significant correlations were obtained with regard to any of these measures. The

correlation between Verbal IQ and Successful Attempts at Problem-Solving missed significance by a small margin (r = .26, p<.08). In addition, there was a negative correlation between Verbal IQ and the number of Planning Functions that also missed significance by a small margin (r = -.27, p<.07). Otherwise, the only significant correlation obtained was between Performance IQ and Verbal IQ (r = .71, p<.001), as would be expected.

A one-way Analysis of Variance (ANOVA) was also conducted on the Performance and Verbal IQ measures, but no significant differences between the age groups were found in regard to either measure.

Task Performance

The maximum amount of time allotted to each subject was thirty minutes (fifteen minutes per task). Although most subjects participated in the experiment for the full thirty minutes, some left early. Two subjects in particular wished to leave the experiment after spending only seven or eight minutes on each task. In order to determine if the total amount of time spent in the experiment influenced the results obtained on other measures, a correlational analysis was performed. The only significant correlation that emerged was between Total Time Spent and Failed Attempts at Problem-Solving (r = .39, p<.02). The correlation between Successful Attempts and Total Time missed significance by a small margin (r = .28, p<.07). None of the correlations involving the verbal measures even approached significance. Because there was no correlation with any of the verbal measures, and because it is reasonable to assume that the chances of making an attempt to solve the task (whether successful or not) would increase in accordance with the

amount of time exposed to the task, the issue of total time spent was pursued no further.

Time Spent on Problem-Solving. The total amount of time subjects spent in the experiment was divisible into two parts: time spent on Attempts at Problem-Solving, and time spent on Non-Problem-Solving activities. Not only did the groups differ greatly with regard to the time spent attending to problem-solving, but Tasks 1 and 2 differed as well. In Table 2, the number of minutes per task that each group expended on Attempts at Problem-Solving is presented. Also appearing in this table are the results from a repeated measures ANOVA. The increase from age 4 to age 8 in terms of time spent on Attempts at Problem-Solving was significant ($F(2, 27) = 22.28$, $p<.001$), as was the increase from Task 1 to Task 2 ($F(1, 27) = 13.04$, $p<.001$).

Successful and Failed Attempts at Problem-Solving. The total number of Attempts at Problem-Solving made by each group in each of the tasks is presented in Table 3. There was a substantial increase in problem-solving activity with age and from Task 1 to Task 2. When these data were broken down into Successful and Failed Attempts, a somewhat different picture emerged. Table 4 reports the number of Successful Attempts, which increased from age 4 to age 8 but decreased from Task 1 to Task 2. A repeated measures ANOVA for the number of Successful Attempts (also appearing in Table 4) revealed that the age group differences were significant: $F(2, 27) = 13.0$, $p<.01$. The difference from Task 1 to Task 2 was also significant: $F(1, 27) = 26.14$, $p<.001$.

The number of Failed Attempts is presented in Table 5. In contrast

to Successful Attempts, the number of Failed Attempts increased not only with age ($F(2, 27) = 17.12$, $p<.001$), but also from Task 1 to Task 2 ($F(1, 27) = 14.40$, $p<.001$). Although it is not possible to say with certainty that the increase in Failed Attempts from Task 1 to Task 2 is attributable to an increase in task difficulty (because the tasks were always presented in the same order), it is a reasonable inference. It is also reasonable to expect that, if the problem became more difficult, successes would decrease in number while failures would increase in number.

Private Speech and Social Speech

The basic corpus of speech data was broken down into three categories: Private Speech Utterances, Social Speech Utterances, and Unscoreable Utterances (see Table 6). With regard to the total number of utterances produced (regardless of category), a repeated measures ANOVA was performed, but no significant differences between ages or tasks were found. With regard to Private Speech in particular, the number of utterances produced by each age group in each of the tasks is presented in Table 7. Surprisingly, a repeated measures ANOVA for Private Speech (see Table 7) revealed no statistically significant differences between the age groups or the two tasks.

A repeated measures ANOVA for Social Speech utterances also found no significant difference between the age groups, but it did uncover a statistically significant difference between the two tasks: $F(1, 27) = 9.82$, $p<.001$. At age 4, the mean number of Social Speech utterances in Task 1 and Task 2 (respectively) were 28.6 and 49.8; at age 6, the means were 41.8 and 54.6; and at age 8, the means were 5.6 and 24.6.

In other words, there was a significant increase in the production of Social Speech (but not Private Speech) from Task 1 to Task 2.

Social Speech was divided into two types: Initiations and Responses. The reason for this subdivision was to account for that portion of Social Speech that was not spontaneously produced by the child, but was instead induced by the experimenter. Dore's (1977, 1979) system for analyzing conversational functions was applied to the subjects' Social Speech utterances. The percentage of Social Speech that was scored in the category "Responses to the Experimenter" (i.e., experimenter-induced) at age 4, 6, and 8 was: .23, .19, and .30 (respectively). Inversely, the percentage of Social Speech that was scored in the category "Initiated by the Child" (i.e., spontaneously uttered social speech) at age 4, 6, and 8 was: .77, .81, and .70 (respectively).

Planful and Non-Planful Functions of Speech

The basic corpus of speech data was again broken down, this time into the following three categories: Planful utterances, Non-Planful utterances, and Unscoreable utterances. The number of Planful, Non-Planful, and Unscoreable utterances is presented in Table 8. With respect to utterances serving a Planful function in particular, the number produced by each group in each task is reported in Table 9.

Surprisingly, a repeated measures ANOVA for Planful utterances revealed that the increase with age was not statistically significant. There was, however, a significant main effect for task: $F(1, 27) = 16.13$, $p < .001$. In addition, the analysis revealed a significant interaction effect: $F(2, 27) = 4.02$, $p < .03$. In other words, there was a significant increase in the number of utterances serving a Planful

function as the level of difficulty increased; furthermore, this increase from Task 1 to Task 2 was much higher for the 8-year-olds than it was for the 4- or 6-year-olds.

With regard to utterances serving Non-Planful functions, the group means at ages 4, 6, and 8 were: 184.7, 125.8, and 88.0, respectively. A one-way ANOVA for Non-Planful utterances was performed, but this analysis turned up no significant differences between the age groups.

Planful Private Speech

Planning Functions. The number of utterances that were scored as both Planful and Private simultaneously are presented in Table 10. The mean number of Planful Private Speech utterances at age 4, 6, and 8 was: 17.4, 32.0, and 74.9, respectively. When this increase with age was tested using a repeated measures ANOVA (see Table 10), it narrowly missed significance. Nonetheless, the magnitude of the increase does suggest that private speech becomes more planful with age, particularly in light of the fact that the amount of private speech per se does not increase significantly with age. When viewed in terms of proportions, the percentage of private speech that was planful increased markedly with age: .12, .32, and .44 (at age 4, 6, and 8, respectively). At the same time, the percentage of planful speech that took the form of private speech fell and rose with age: .66, .50, and .81 (at age 4, 6, and 8, respectively).

Although the increase in planful private speech with age narrowly missed significance, there was a significant increase from Task 1 to Task 2, and a significant age by task interaction (see Table 10). That is, all of the age groups produced a significantly larger amount of

planful private speech in Task 2 than in Task 1, but this increase was much more pronounced for the 8-year-olds than it was for the younger subjects.

To add further to this view, the number of Planful Private Speech utterances that co-occurred with Successful and Failed Attempts at Problem-Solving is presented in Table 11. Clearly, Planful Private Speech co-occurred much more frequently with Failed Attempts than with Successful Attempts; of course, this is not surprising insofar as there were many more Failed Attempts than Successful ones. However, when the ratio of Successful Attempts to Failed Attempts is compared with the ratio of Utterances accompanying Success to Utterances accompanying Failure, the proportions are not exactly equivalent. The ratio of Successful Attempts to Failed Attempts (at age 4, 6, and 8) was: .08, .12, and .25 (respectively), whereas the ratio of Utterances accompanying Success to Utterances accompanying Failure was: .04, .16, and .16 (respectively).

Syntactic Structure. The corpus of Planful Private Speech utterances was divided into two categories: utterances comprised of Complete Sentences, and utterances comprised of Fragmented Sentences (see Table 12). A breakdown by age and task of the number of Complete Sentences appears in Table 13. Although there was a modest increase with age, a repeated measures ANOVA did not find this increase to be significant (see Table 13). However, the ANOVA did reveal a significant increase with respect to task: $F(1, 27) = 10.88$, $p < .001$. Also, an age by task interaction just missed significance: $F(2, 27) = 3.02$, $p < .07$. This was due to the dramatic increase in the number of Complete Senten-

ces for the 8-year-olds in Task 2.

With regard to the number of Fragmented Sentences of Planful Private Speech, Table 14 contains a breakdown by age and task. When a repeated measures ANOVA was performed (see Table 14), a significant main effect for age was found: $F(2, 27) = 3.40$, $p<.05$. A significant main effect for task was also uncovered: $F(1, 27) = 6.09$, $p<.02$. Furthermore, a significant interaction effect was revealed: $F(2, 27) = 3.81$, $p<.03$. In other words, the number of Fragmented Sentences increased significantly from age 4 to age 8, and from Task 1 to Task 2, and rose sharply for the 8-year-olds in Task 2.

As for the number of Words contained in utterances of Planful Private Speech, a breakdown by age and task is presented in Table 15. The number of words increased modestly from age 4 to age 6, but then rose markedly from age 6 to age 8, approximately doubling in size. Similarly, the number of words increased modestly from Task 1 to Task 2 between ages 4 and 6, but jumped dramatically from Task 1 to Task 2 between ages 6 and 8. Nevertheless, when the ratio of Words to Utterances of Planful Private Speech was computed, there was a steady decrease in the proportion of words per utterance.

Discourse Structure. In Table 16, the number of Narratives of Planful Private Speech is broken down by age and task. Although there was a steady increase in the number of Planful Narratives produced between ages 4, 6, and 8 (24, 47, and 53, respectively), this increase was not statistically significant (see Table 16). However, the increase from Task 1 to Task 2 did yield a significant statistic: $F(1, 27) = 9.51$, $p<.01$. To appreciate the magnitude of the individual differences

in the production of Planful Narratives, it is interesting to note that five of the thirty subjects produced more than 10 Planful Narratives each, whereas eleven of the subjects produced no Planful Narratives at all.

Planful Conversational Exchanges consisted of a sequence of two or more utterances linked together by a common conversational structure. Essentially, most Planful Conversational Exchanges consisted of a request-response (i.e., question-answer) sequence or an assertion-response (i.e., declarative-comment) sequence. The number of Planful Conversational Exchanges that were produced by each age group is presented in Table 17. Although there was a definite increase with age, this increase was not statistically significant.

To determine if Planful Conversational Exchanges increased in relative proportion to Planful Narratives, the ratio of Planful Exchanges to Planful Narratives was computed. As Table 17 shows, there was a small but steady increase with age in the relative number of Planful Exchanges per Planful Narrative. This indicates that basic conversational structures played an increasing role in the development of Planful Private Speech.

Not all utterances of Planful Private Speech were subsumed within the discourse structure of Planful Narratives or Planful Conversational Exchanges. Some Planful Private Speech utterances existed as individuals in conversational isolation from other utterances. The absolute number of Planful Private Speech utterances that did belong to Planful Narratives (see Table 18) increased steadily with age: 155, 300, and 740 (at age 4, 6, and 8, respectively). Although this increase is sizeable, it narrowly missed significance (see Table 18). However,

there was a significant increase from Task 1 to Task 2, as well as a significant age by task interaction. That is, there was an increase from Task 1 to Task 2 for all ages, and a pronounced increase for the 8-year-olds in Task 2.

When considered in terms of proportions, the percentage of Planful Private Speech utterances that were subsumed within Planful Narratives at age 4, 6, and 8 also showed an increase with age: .89, .94, and .99 (at age 4, 6, and 8, respectively). Finally, the ratio of Planful Private utterances to Planful Narratives was computed for each age group in order to determine the relative rate of growth: 6.5, 6.4, and 14.0 utterances per Narrative, (at age 4, 6, and 8, respectively).

Reliability

Scoring Task Performance. There were two separate procedures involved in the analysis of reliability with regard to scoring task performance. The first involved determining the number of overall Attempts at Problem-Solving; the second was concerned with the categorization of Attempts into Successful and Failed Attempts. To ascertain the reliability of the first procedure, 25% (i.e., 94) of the total number of overall Attempts (i.e., 382) were scored independently by a second scorer. The number of agreements (i.e., 81) was then transformed into a percentage, yielding a reliability statistic of 86% agreement between scorers.

Similarly, the procedure for categorizing Attempts into types was analyzed for reliability by taking 21% (i.e., 81) of the total number of Attempts and having that portion scored independently by another coder. The number of agreements between coders (i.e., 80) was then

transformed into a percentage, producing a reliability coefficient of 99%.

Partitioning Speech into Utterance Units. Of the total number of utterance units produced by the sample population (i.e., 6296), about 27% (i.e., 1669 utterances) were scored independently by a second coder. The process of computing reliability for this particular procedure, and for two of the other verbal scoring procedures as well, used the data sets from three different subjects--one from each age level. Thus, these same three data sets were used several times in calculating reliability, but different qualities were being examined in each pass through the data.

With regard to the reliability of the procedure for partitioning the stream of speech into utterance units, of the 1669 utterances that were scored by an independent coder, 1440 coincided with the units scored by the experimenter, thus producing a reliability figure of roughly 86%.

Differentiating Utterances of Private Speech from Utterances of Social Speech. To determine the reliability of the procedure for distinguishing Private Speech from Social Speech, the same data sets referred to above were used. Of the 1669 utterance units that were coded by an independent scorer, agreement was achieved on 1563 units. This yielded a reliability coefficient of nearly 94%. The largest number of disagreements (i.e., 73 utterances) occurred over the data set belonging to the 4-year-old subject, who slipped back and forth frequently between private speech and social speech. In contrast, the

6- and 8-year-old subjects generally tended to stick with one speech type or the other for long periods; and when they did make transitions from one type to the other, the signals were more clear-cut than with the 4-year-old.

Determining the Planful and Non-Planful Functions of Utterances. Using the same data sets as before, an analysis of reliability was performed on the procedure for identifying the Planful and Non-Planful Functions of utterances. Out of the 1669 utterances scored by an independent coder, the scores for 1537 utterances were in agreement with the scores obtained by the experimenter. This translated into a reliability coefficient of 92%.

Summary of Results

No statistically significant correlations were found between the two IQ measures and any of the other variables of interest. Although it missed significance by a small margin, a weak negative correlation was found between Verbal IQ and the Planning Functions of speech. Time Spent on Problem-Solving increased significantly with age and from Task 1 to Task 2. Inversely, Time Spent on Non-Problem-Solving activities decreased with age and from Task 1 to Task 2. This suggests that children's ability to pay attention to the task at hand improves with age, and that children are more likely to pay attention when there is a new or difficult problem to solve. As for Successful Attempts at Problem-Solving, there was a significant increase with age, but a significant decrease from Task 1 to Task 2. Failed Attempts at Problem-Solving displayed a slightly different pattern of development: they increased

significantly from age 4 to age 8, and also increased significantly from Task 1 to Task 2.

The corpus of speech was first broken down into Private and Social Speech utterances. There were no statistically significant differences between the age groups or the two tasks with regard to Private Speech. As for Social Speech, no significant difference was found between the age groups, but there was a significant increase from Task 1 to Task 2. This is most likely due to the fact that more children tried to enlist help from the experimenter as the task became more difficult.

The corpus of speech was next broken down into Planful and Non-Planful Speech. With regard to Planful Speech, there was no significant change from age 4 to age 8; there was, however, a significant increase in Planful Speech from Task 1 to Task 2. In addition, a significant interaction of age by task was discovered. The increase in Planful Speech was much higher for the 8-year-olds in Task 2 than it was for the 4- or 6-year-olds. With regard to Non-Planful Speech, no significant differences were found.

The subset of speech data that was scored as both Private and Planful displayed a marked increase from age 4 to age 8. Although it missed by a narrow margin, this increase was not significant. When proportions were considered, further support for an increase with age was found. While the amount of private speech per se did not increase with age, the percentage of private speech that served a planful function did increase markedly with age. As for differences between the tasks, the increase in planful private speech from Task 1 to Task 2 was highly significant, as was the age by task interaction. 8-year-olds in Task 2 produced the greatest amount of planful private speech.

With regard to Planful Private Speech utterances that co-occurred with Successful and Failed Attempts at Problem-Solving, it was found that Planful Private Speech was just as likely to occur during Attempts that resulted in success as it was to occur during Attempts that resulted in failure.

In addition to the planning function of private speech, the development of the syntactic structure was analyzed. In terms of the number of Complete Sentences, the increase from age 4 to age 8 was not statistically significant, but the difference from Task 1 to Task 2 was. As for Fragmented Sentences, there was a significant increase with age, a significant increase from Task 1 to Task 2, and a significant interaction of age by task as well. This interaction was the result of a sharp increase in Fragmented Sentences by the 8-year-olds in Task 2. In essence, fragmented sentences increased dramatically with age and task in proportion to complete sentences. The number of words comprising Planful Private Speech was also analyzed. Although there was a marked increase with age and from Task 1 to Task 2, the relative number of words per utterance tended to decrease slightly with age.

Concerning the discourse structure of private speech, the number of Planful Narratives increased with age, but this increase was not significant. There was a significant increase in Planful Narratives from Task 1 to Task 2, however. With regard to the number of Planful Conversational Exchanges, there was a modest but nonsignificant increase with age. The relative number of Exchanges per Narrative also increased regularly with age. In addition, the relative number of Planful Private Speech utterances per Narrative increased regularly with age. In fact, some of the older subjects produced rather lengthy

Planful Narratives. This occurred despite the simultaneous fragmentation of the syntax of planful private speech.

Finally, reliability analyses were performed on the scoring procedures. The inter-rater agreement for identifying Attempts at Problem-Solving was 86%; the agreement for categorizing Attempts as either Successful or Failed was 99%. With respect to the procedure for partitioning speech into utterance units, a reliability coefficient of roughly 86% was obtained. As for the procedure for differentiating Private Speech from Social Speech, a reliability statistic of 94% was obtained. The greatest number of disagreements occurred over the data set from the 4-year-old subject. Finally, when the procedure for determining the Planful and Non-Planful Functions of speech was analyzed, an inter-rater reliability coefficient of 92% was obtained. All of these reliability coefficients were considered within acceptable limits.

Does Private Speech Develop into a Means for Planning the Solutions to Problems?

Hypothesis 1. It was predicted that the relative number of utterances of Planful Private Speech would increase significantly with age. This hypothesis was not upheld, although the observed increase with age only missed significance by a narrow margin (see Table 10). However, the proportion of private speech that served a planful function also tended to increase regularly with age, despite the fact that the amount of private speech per se did not significantly change with age. In other words, it was not the quantity but the quality of private speech utterances that changed with development.

Furthermore, the number of Social Speech utterances that served a

planning function decreased steadily with age, indicating that the planful functions of speech were shifted from Social Speech to Private Speech as children matured.

Hypothesis 2. It was predicted that the relative number of utterances of Planful Private Speech would increase significantly as the task became more difficult. This prediction was strongly supported. There was a significant increase in planful private speech from Task 1 to Task 2, as well as a significant age by task interaction (see Table 10). Of all the subjects, the 8-year-olds in Task 2 displayed the greatest amount of planful private speech. Although the increase from Task 1 to Task 2 cannot be attributed unambiguously to an increase in the level of task difficulty because of the design of the study (i.e., the tasks were always presented in the same order), it is nontheless a reasonable explanation under the circumstances.

Hypothesis 3. It was predicted that the particular planning functions associated with the process of plan-execution would decrease proportionally with age, while the planning functions associated with the process of plan-construction would increase proportionally with age. This hypothesis was not confirmed. The planning category most closely associated with plan-execution was "Monitoring Execution," and the number of utterances constituting this category increased dramatically from age 4 to age 8. Specifically, the number of utterances scored as "Monitoring Execution" at age 4, 6, and 8 was: 116, 218, and 559, respectively.

As for the categories associated with the plan-construction pro-

cess, they tended to increase with age, but not in relative proportion to "Monitoring Execution." Specifically, the categories associated with plan-construction included "Defining the Problem," "Defining the Goal," "Defining Discrepancies" (between the problem and the goal), and "Formulating a Plan." Taken together, the number of utterances constituting the plan-construction process at age 4, 6, and 8 was: 28, 24, and 44, respectively.

The two planning categories that could apply to either the plan-construction process or the plan-execution process were "Remembering" and "Emotional Release." The number of utterances constituting the category "Remembering" at age 4, 6, and 8 was: 4, 8, and 10, (respectively), while the number of utterances constituting the category "Emotional Release" at age 4, 6, and 8 was: 53, 127, and 229, respectively. Utterances scored as "Emotional Release" were generally related to plan execution at ages 4 and 6, whereas they were generally associated with plan construction at age 8.

In general, utterances coded as belonging to the plan-construction process did not occur regularly at the beginning of the problem-solving activity as might be expected. At least with this particular task, the general tendency was for subjects to begin by launching themselves into the activity of connecting tracks together; only after a problem was encountered did they begin to stop and reflect (if at all). Thus, subjects typically began the task with the stage of plan-execution, and only when confronted with an obstacle did they begin to engage in the plan-construction process.

For the younger children, the problems that most occupied them were of a practical sort, generally involving plan execution. The kinds

of practical problems that arose typically concerned logistical activities such as locating misplaced tracks, and making the tracks fit together properly. For some of the older children, however, the problems that concerned them tended more toward the process of plan construction. The kinds of theoretical problems that typically arose concerned decision-making activities such as how to design the next road, and keeping count of the roads already executed and dismantled. Given the intricacies of the task, utterances involving plan construction were typically interspersed with utterances serving the plan-execution process. There was very little in the way of "planning in advance."

Does the Syntactic Structure of Planful Private Speech Fragment and Abbreviate with Development?

Hypothesis 4. It was expected that the number of Planful Private Speech utterances consisting of Fragmented Sentences would increase with age in relative proportion to the number of utterances consisting of Complete Sentences. This hypothesis was strongly confirmed. The number of fragmented sentences increased significantly not only with respect to age, but also from Task 1 to Task 2. When this is coupled to the fact that the increase in planful private speech was nearly significant for age and highly significant for task, it strongly suggests that the fragmentation of the syntactic structure of private speech is systematically related to the development of the planning function of private speech. That is, the growth of the planning function and the fragmentation of the syntactic structure occur simultaneously, and can reasonably be viewed as different aspects of the same developmental

phenomenon.

Hypothesis 5. It was predicted that the relative number of Words constituting utterances of Planful Private Speech would decrease with age. This hypothesis was weakly supported. Although the absolute number of words constituting utterances of Planful Private Speech increased with age, the relative number of words per utterance decreased slightly with age. In general, the fragmentation of sentence structure also involved the omission of certain words from the grammatical structure. Some typical examples of the omission of words are: "...this... ...here..." or "...put that...". These kinds of sentence fragments would often arise while a child was putting tracks together one at a time.

Does the Discourse Structure of Planful Private Speech Grow in Size and Complexity with Development?

Hypothesis 6. It was expected that the number of Planful Narratives and Planful Conversational Exchanges would increase with age. This hypothesis was weakly confirmed. Although the number of Planful Narratives did not increase significantly with age, the number of Planful Narratives produced at each age did increase significantly from Task 1 to Task 2, indicating that the development of the discourse structure of private speech is related to the development of planning. As for Planful Conversational Exchanges, there was a non-significant increase with age in the number of Exchanges. Furthermore, the relative number of Exchanges per Narrative increased steadily with age, indicating that Conversational Exchanges were playing a greater role in the formation of Planful Narratives as children matured.

Those children who produced Planful Narratives (mostly 6- and 8-year-olds) typically tended to parlay separate Conversational Exchanges into one long stretch of discourse. For example: "Will this fit here? No, it has to go...Let's see...where should I put this one? Okay. That one here...Oh, man! Look at that! It's stuck." This suggests that conversational exchanges are a device that can be used to create a larger discourse structure that is capable of guiding one through a sometimes lengthy goal-directed process.

Hypothesis 7. It was predicted that the relative number of utterances of Planful Private Speech constituting Planful Narratives would increase significantly with age. This hypothesis was not supported. However, the observed increase with age only missed significance by a narrow margin. There was a significant increase from Task 1 to Task 2, however, and a significant age by task interaction. Once again, it was the 8-year-olds in Task 2 who displayed the greatest increase. In sum, the general trend was toward an increase in the number of utterances constituting planful narratives, despite the fact that the utterances themselves tended to become more fragmented and abbreviated with development.

Summary of Results Relating to Empirical Hypotheses

In response to the question "Does private speech develop into a means for planning the solutions to problems?", the answer is a qualified "Yes." As children mature, the number of utterances of private speech that serve a planning function tends to increase regularly. Furthermore, the planning functions of speech tend to shift from social

speech to private speech with age. However, it was not typically the case here that planning was done prior to engaging with the task. In most instances, plan-construction activity by means of private speech occurred episodically throughout the course of the experimental session, and only when a problem cropped up. Likewise, plan execution tended to occur first, setting the stage for plan-construction activity.

In response to the question "Does the syntactic structure of planful private speech fragment and abbreviate with development?," the answer is an emphatic "Yes." The relative number of planful private speech utterances that were fragmented increased significantly with age, while the relative number of complete sentences decreased with age. Also, there was a significant increase in fragmented sentences from Task 1 to Task 2, suggesting that task difficulty is involved. When these findings are considered alonside the findings related to planful private speech, they strongly suggest that the fragmentation of the syntactic structure of private speech is systematically related to the development of the planning function of private speech.

Finally, in response to the question "Does the discourse structure of planful private speech grow in size and complexity with development?," the answer is a qualified "Yes." Although the number of planful narratives did not increase significantly with age, and although the relative number of utterances per narrative did not increase significantly with age, the basic trend for narratives was in the direction of increasing size. While the increase in the number of utterances contained in planful narratives narrowly missed significance, the increase from Task 1 to Task 2 was found to be highly significant, as was the

age by task interaction.

As to the issue of complexity, there was a modest but non-significant increase in the number of planful conversational exchanges with age. Considering that these planful conversational exchanges were, in fact, increasingly incorporated into planful narratives as children matured, and that they played an increasing role in constituting these planful narratives, it is reasonable to suggest that the discourse structure of private speech becomes more complex with development.

CHAPTER V

DISCUSSION

Results

While there was strong support for Vygotsky's claim that the syntax of private speech tends to fragment and abbreviate with development, there was less support for his claim that private speech develops into an instrument for planning solutions to problems, and only weak support for the claim put forth here that the discourse structure of private speech develops with age. One possible reason why the hypotheses were not all supported was the small size of the sample population. From a statistical perspective, ten subjects per age group is minimal, particularly when dealing with a phenomenon such as private speech, which is very sensitive to conditions.

A second, and perhaps more important, reason why the hypotheses were not all supported was the fact that there were striking individual differences with regard to speech production. A significant proportion of children at each age never spoke at all, and may have been solving

the problems visually as opposed to verbally. In fact, nearly half of the children who succeeded in the task did so non-verbally, and could have been solving it visually. Therefore, this study ought to have confined its analysis to just that sub-group of subjects who did their problem-solving by verbal means. However, this would have reduced the sample size critically from a statistical point of view.

Future private speech research should look into why some children produce private speech abundantly when they are problem-solving, while other children never utter a word when they solve problems. It could well be that the polarization of subjects into two types--verbal and visual problem-solvers--has contributed to the difficulty researchers have had in eliciting samples of private speech that are sufficiently large for study. It may be useful in the future for researchers to pre-test subjects so that the verbal problem-solvers can be identified and targeted for further study.

Furthermore, with regard to the observed individual differences, it could be that planning through private speech involves differences in personality and cognitive style. Perhaps those children in the experiment who never spoke would produce self-regulating private speech under different circumstances. For example, some of the younger children may need to be in more familiar surroundings or in the presence of a familiar person in order to feel comfortable thinking out loud; in contrast, some of the older children may need to be completely alone in order to feel comfortable thinking out loud. It could well be that some of the children in this study who never spoke at all were silent because they felt embarrassed about speaking aloud to themselves in front of a stranger. Future research should consider this problem in

greater depth, theoretically as well as methodologically.

What is the picture of private speech development that emerges from this study? Basically, the findings lend support to Vygotsky's theory that private speech develops into a tool for self-regulation, and that its syntactic structure fragments and abbreviates with development, opening the way for the development of inner speech. Although Vygotsky's claim that private speech becomes more planful with age was only weakly supported, the observed trends are consonant with the results obtained by Beaudichon (1973) and Klein (1964), who reported that the proportion of private speech serving a self-regulatory function increased with age, although private speech per se did not.

The rather large corpus of private speech data obtained here provides strong support for Vygotsky's assertion that planful private speech is most likely to be elicited when there is a difficult problem to be solved. Previous studies that used difficult tasks--namely, puzzles (e.g., Berner, 1971; Goodman, 1977, 1979; Wertsch, 1979), building tall block towers (e.g., Hjertholm, 1968; Kohlberg, et al., 1968), and verbal academic tasks (e.g., Roberts, 1977)--also tended to elicit relatively large amounts of private speech. In contrast, studies in which children performed simple tasks or engaged in unstructured free-play (e.g., Kohlberg et al., 1968; Rubin and Dyck, 1980) tended to elicit little or no private speech. This suggests that private speech development may be more closely related to social conditions than to biological maturity.

The strongest finding to emerge from this study was that the syntax of private speech fragments and abbreviates at the very same time that the planning function develops. As Vygotsky predicted,

children tend to omit particular words from their private speech sentences as they mature. On one hand, this can be explained in terms of the development of a more economical use of words. On the other hand, it is somewhat paradoxical that the linguistic structure of private speech should be simplifying at the same time that its cognitive function is becoming more complex. To shed further light on this matter, this study looked at the discourse structure of private speech. Although the hypotheses put forth here concerning the discourse structure of private speech were only weakly supported, the findings do suggest that the increased complexity associated with the development of planning may be reflected in the length and conversational quality of the discourse structure.

Unfortunately, it is difficult to compare these findings with the results of other private speech studies, mainly because there have been so few studies in this area. In fact, the number of private speech studies in general began to taper off dramatically around 1979, and only recently has there been a resurgence. One possible explanation for the temporary decline of private speech research is the host of difficulties surrounding the methods used to differentiate private speech from social speech, and the methods employed in categorizing the different types of private speech. In fact, a disagreement has recently arisen over the kinds of evidence needed to determine if an utterance is private speech. Frawley and Lantolf (1968), for example, argue that all utterances of private speech are self-regulatory by definition, and therefore it is the semantic content that must be examined. Frauenglass and Díaz (1985), however, contend that the classification of private speech should include types that are not self-regulatory. Furthermore,

Díaz (1986) claims that the self-regulatory functions of private speech cannot be determined solely on the basis of an utterance's semantic content. And Berk (1986) contends that, in order to determine if an utterance is private speech, not only must its content and functions be considered, but also its linguistic form.

The high degree of inter-rater reliability that was obtained in this study with regard to the procedure for differentiating private speech from social speech suggests that the 'performance' features of an utterance (i.e., cues as to the intended addressee) are more useful than the semantic content (i.e., cues as to the social and intellectual adaptation of the message) in determining if an utterance was private or social speech. Similarly, the high degree of inter-rater reliability that was obtained here with regard to the procedure for categorizing the different cognitive functions of private speech suggests that this system may have some advantages over the Kohlberg et al. (1968) classification system.

Conclusion

It has been established here that the planning function of private speech tends to increase with age, as well as in response to situations that require problem-solving activity. Private speech was used by the children in this study as a lever against the practical and theoretical problems that they were confronted with. Although there are a number of different problem-solving strategies that could have been employed here, the overwhelming majority of children chose to simply launch into this task without thinking about it first. Thus, constructing a plan, which is generally regarded as a mental activity one performs in ad-

vance of action, tended to occur only after a child encountered problems in executing the task. In other words, plan-execution tended to arise first, setting the stage for plan-construction, which occurred only when needed.

It has also been established here that the syntax of private speech sentences becomes fragmented and abbreviated with development. The process of fragmentation occurs despite the fact that the very same utterances are developing into a means for planning, which is a complex activity. There is evidence to suggest that the fragmentation and abbreviation of private speech is systematically connected to the development of the planning function-- specifically, both the planning function and the fragmented sentence structure increase simultaneously when the problem at hand is made more difficult. One possible explanation for the abbreviation of planful private speech is that it is more economical (in terms of time and effort) to utter fewer words in order to get the job done. However, it is unclear as to how the job could get done with fewer words, especially since planning is a complex activity.

To account for this, the discourse structure of private speech was examined as well. It has been established here that the discourse structure of private speech tends to grow both quantitatively as well as qualitatively with development. As children mature, they tend to produce longer and longer sequences of planful private speech discourse. By means of simple conversational exchanges that are parlayed into planful narratives (lengthy oral "texts" that serve the planning process), it is possible for children to carry out lengthy goal-directed activities.

In sum, this study provides some evidence suggesting that private

speech develops into an instrument for carrying out the planning process; there is strong evidence that, simultaneously, its syntactic structure fragments and abbreviates, paving the way for planning through inner speech; there is also some evidence to suggest that, at the very same time, its discourse structure develops in the direction of longer and longer sequences, sequences consisting of multiple utterances that are organized into conversational exchanges or planful `narratives´ oriented toward common topics or directed toward common goals.

TABLES

Table 1

Intelligence Test Scores

Performance and Verbal IQ Scores

		Age 4	Age 6	Age 8
Performance IQ Scores		85	114	114
		96	89	114
		97	108	90
		126	111	101
		103	104	72
		84	111	106
		99	110	111
		124	100	93
		112	115	92
		107	110	91
Group Means for Performance IQ	M	103.3	107.2	98.4
	SD	14.34	7.79	13.34
Verbal IQ Scores		84	120	131
		107	124	123
		92	101	91
		132	102	95
		101	110	86
		82	107	103
		90	95	98
		136	80	86
		119	125	96
		119	116	105
Group Means for Verbal IQ	M	106.2	108	101.4
	SD	19.58	14.13	14.99

Table 2

Time Spent on Problem-Solving

Raw Number of Minutes Spent on Problem-Solving

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
2	9.5	12	5	13	15
2	4	6	6	7.5	1.5
7	4	15	15	12	13
1.5	3	9	14	8	12
4	6	9	14	5	1.5
0	6	5	11	15	14
1.5	0	5	8	4.5	15
4	8	5	14	10	14
2	2	4	14.5	6.5	13.5
2	3	11.5	12	14	15
M	2.6	4.55	8.15	11.35	9.55	12.8
SD	1.94	2.85	3.74	3.73	3.80	4.1

Repeated Measures ANOVA
For Time Spent on Problem-Solving

Source of Variation	SS	DF	MS	F	p.
Age	652.81	2	326.40	22.28	0.001
Between-Group Error	395.53	27	14.65		
Task	117.60	1	117.60	13.04	0.001
Age X Task	5.43	2	2.71	0.30	0.74
Within-Group Error	243.47	27	9.02		

Table 3

Attempts at Problem-Solving

Raw Number of Attempts at Problem-Solving

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
1	2	8	3	8	3
1	2	4	5	7	17
6	3	14	16	9	13
1	1	5	11	7	9
4	4	5	10	6	2
0	3	4	9	10	13
2	0	4	3	3	13
2	4	3	9	8	9
1	1	4	10	5	12
2	2	8	8	6	8
M	2.0	2.2	5.9	8.4	6.9	9.9
SD	1.76	1.41	3.31	3.95	2.02	4.70

Table 4

Successful Attempts at Problem-Solving

Raw Number of Successful Attempts at Problem-Solving

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
1	0	2	0	4	3
0	0	1	0	5	3
0	0	4	1	0	0
0	0	1	0	0	0
0	0	1	0	0	0
0	0	0	0	5	2
0	0	0	0	3	0
1	0	1	0	3	1
0	0	2	0	0	0
1	0	2	0	3	3
M	0.3	0.0	1.4	0.1	2.3	1.2
SD	0.48	0.00	1.17	0.32	2.11	1.40

Repeated Measures ANOVA
For Successful Attempts at Problem-Solving

Source of Variation	SS	DF	MS	F	p.
Age	26.13	2	13.0	5.83	0.01
Between-Group Error	60.55	27	2.24		
Task	12.15	1	12.15	26.14	0.001
Age X Task	2.80	2	1.40	3.01	0.07
Within-Group Error	12.55	27	0.46		

Table 5

Failed Attempts at Problem-Solving

Raw Number of Failed Attempts at Problem-Solving

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
0	2	6	3	2	11
1	2	3	5	2	14
6	3	10	15	9	13
1	1	4	11	7	9
4	4	4	10	6	2
0	3	4	9	5	11
2	0	4	3	0	13
1	4	2	9	5	8
1	1	2	10	5	12
1	2	6	8	3	5
M 1.7	2.2	4.5	8.3	4.4	9.8
SD 1.89	1.32	2.37	3.74	2.67	3.85

Repeated Measures ANOVA
For Failed Attempts at Problem-Solving

Source of Variation	SS	DF	MS	F	p.
Age	386.63	2	193.32	17.12	0.001
Between-Group Error	304.85	27	11.29		
Task	114.82	1	114.82	14.40	0.001
Age X Task	39.43	2	19.72	2.47	0.10
Within-Group Error	215.25	27	7.97		

Table 6

Private Speech and Social Speech

Raw Number of Private and Social Speech Utterances

	Age 4	Age 6	Age 8
Private Utterances	1463	1010	1686
Social Utterances	784	964	302
Unscoreables	60	23	4
Total Number of Utterances	2307	1997	1992

Table 7

Private Speech

Raw Number of Utterances of Private Speech

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
2	2	26	44	0	0
27	6	170	234	0	2
106	77	0	0	167	155
0	14	10	20	129	186
230	350	0	0	0	0
46	92	47	16	0	4
21	136	68	64	109	188
10	12	13	27	229	198
0	7	42	25	203	116
248	77	124	80	0	0
M 69.0	77.3	50.0	51.0	83.7	84.9
SD 95.11	106.45	56.59	69.27	94.28	91.02

Repeated Measures ANOVA
For Private Speech Utterances

Source of Variation	SS	DF	MS	F	p.
Age	11865.23	2	5932.62	0.44	0.65
Between-Group Error	367038.25	27	13594.01		
Task	183.75	1	183.75	0.12	0.74
Age X Task	172.90	2	86.45	0.05	0.95
Within-Group Error	42950.85	27	1590.77		

Table 8

Planful and Non-Planful Functions of Speech

Raw Number of Planful and Non-Planful Utterances

	Age 4	Age 6	Age 8
Planful Utterances	263	645	930
Non-Planful Utterances	1847	1258	880
Unscoreables	197	94	182
Total Number of Utterances	2307	1997	1992

Table 9

Planful Speech

Raw Number of Planful Utterances

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
0	0	28	25	0	0
0	0	39	54	16	22
22	24	0	0	75	131
0	0	1	20	23	75
17	61	0	0	3	0
0	46	2	7	0	5
14	21	33	31	28	54
8	0	43	77	73	169
5	0	6	38	26	99
6	39	121	120	4	27
M 7.2	19.1	27.3	37.2	24.8	68.2
SD 7.99	22.92	37.23	37.84	28.03	66.32

Repeated Measures ANOVA
For Planful Utterances

Source of Variation	SS	DF	MS	F	p.
Age	11200.63	2	5600.32	2.31	0.12
Between-Group Error	65465.30	27	2424.64		
Task	7085.07	1	7085.07	16.13	0.001
Age X Task	3530.83	2	1765.42	4.02	0.03
Within-Group Error	11858.10	27	439.19		

Table 10

Planful Private Speech

Raw Number of Planful Private Speech Utterances

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
0	0	13	2	0	0
0	0	33	42	0	2
17	22	0	0	75	108
0	0	1	15	23	72
17	60	0	0	0	0
0	36	2	7	0	4
1	5	27	17	27	150
0	0	7	18	69	110
0	0	4	10	26	83
6	10	66	56	0	0
M 4.1	13.3	15.3	16.7	22.0	52.9
SD 7.05	20.37	21.27	18.56	28.83	58.09

Repeated Measures ANOVA for
Planful Private Speech Utterances

Source of Variation	SS	DF	MS	F	p.
Age	8933.03	2	4466.52	2.97	0.07
Between-Group Error	40641.65	27	1505.26		
Task	2870.42	1	2870.42	9.04	0.006
Age X Task	2336.63	2	1168.32	3.68	0.04
Within-Group Error	8568.45	27	317.35		

Table 11

Planful Private Speech Utterances Co-Occurring with Attempts at Problem-Solving

Raw Number of Planful Private Utterances Co-Occurring with Successful and Failed Attempts at Problem-Solving

Age 4		Age 6		Age 8	
Success	Failed	Success	Failed	Success	Failed
0	0	0	9	0	0
0	0	2	73	1	1
0	39	0	0	0	183
0	0	0	16	0	95
0	77	0	0	0	0
0	36	0	9	2	2
0	6	0	44	27	150
0	0	7	18	75	104
0	0	2	12	0	109
6	10	32	90	0	0
M 0.6	16.8	4.3	27.1	10.5	64.4
SD 1.90	25.95	9.98	31.46	24.17	71.68

Table 12

Complete and Fragmented Sentences of Planful Private Speech

Raw Number of Complete and Fragmented Sentences of Planful Private Speech

	Age 4	Age 6	Age 8
Complete Sentences	101	124	314
Fragmented Sentences	73	196	435
Total Number of Sentences	174	320	749

Table 13

Complete Sentences of Planful Private Speech

Raw Number of
Complete Sentences of Planful Private Speech

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
0	0	2	0	0	0
0	0	15	19	0	0
8	9	0	0	20	40
0	0	0	8	4	26
10	42	0	0	0	0
0	20	0	0	0	1
0	3	10	8	11	71
0	0	5	8	28	60
0	0	0	5	13	40
3	6	20	24	0	0
M 2.1	8.0	5.2	7.2	7.6	23.8
SD 3.78	13.54	7.33	8.40	10.07	27.59

Repeated Measures ANOVA
For Complete Sentences of Planful Private Speech

Source of Variation	SS	DF	MS	F	p.
Age	1366.63	2	683.32	2.23	0.13
Between-Group Error	8260.85	27	305.96		
Task	968.02	1	968.02	10.88	0.001
Age X Task	538.23	2	269.12	3.02	0.07
Within-Group Error	2403.25	27	89.01		

Table 14

Fragmented Sentences of Planful Private Speech

Raw Number of
Fragmented Sentences of Planful Private Speech

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
0	0	11	2	0	0
0	0	18	23	0	2
9	13	0	0	55	68
0	0	1	7	19	46
7	18	0	0	0	0
0	16	2	7	0	3
1	2	17	9	16	79
0	0	2	10	41	50
0	0	4	5	13	43
3	4	46	32	0	0
M	2.0	5.3	10.1	9.5	14.4	29.1
SD	3.33	7.36	14.36	10.32	19.49	31.40

Repeated Measures ANOVA
For Fragmented Sentences of Planful Private Speech

Source of Variation	SS	DF	MS	F	p.
Age	3388.23	2	1694.12	3.40	0.05
Between-Group Error	13457.50	27	498.43		
Task	504.60	1	504.60	6.09	0.02
Age X Task	632.10	2	316.05	3.81	0.03
Within-Group Error	2237.30	27	82.86		

Table 15

Number of Words Comprising Planful Private Speech

Raw Number of
Words Comprising Planful Private Speech

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
0	0	27	6	0	0
0	0	77	138	0	1
59	65	0	0	129	209
0	0	27	15	34	171
68	237	0	0	0	0
0	86	2	6	0	3
1	11	50	55	53	331
0	0	26	44	161	289
0	0	3	22	67	226
14	31	153	152	0	0
M 14.2	43.0	36.5	43.8	44.4	123.0
SD 26.43	74.81	47.91	56.47	58.97	135.71

Ratio of Words to Utterances
Of Planful Private Speech

	Age 4	Age 6	Age 8
Words	572	803	1674
Utterances	174	320	749
Words per Utterance	3.29	2.51	2.23

Table 16

Narratives of Planful Private Speech

Raw Number of
Narratives of Planful Private Speech

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
0	0	3	0	0	0
0	0	3	6	0	0
2	3	0	0	6	8
0	0	0	2	4	8
3	10	0	0	0	0
0	3	1	2	0	1
0	1	4	2	2	4
0	0	1	4	3	10
0	0	1	2	3	4
1	1	6	10	0	0
M 0.6	1.8	1.9	2.8	1.8	3.5
SD 1.07	3.12	2.02	3.15	2.15	3.92

Repeated Measures ANOVA
For Narratives of Planful Private Speech

Source of Variation	SS	DF	MS	F	p.
Age	23.43	2	11.72	0.94	0.40
Between-Group Error	336.30	27	12.46		
Task	24.07	1	24.07	9.51	0.01
Age X Task	1.63	2	0.82	0.32	0.73
Within-Group Error	68.30	27	2.53		

Table 17

Number of Conversational Exchanges Comprising Planful Narratives

Raw Number of
Conversational Exchanges Comprising Planful Narratives

Age 4	Age 6	Age 8
0	4	0
0	20	0
3	0	46
0	2	22
11	0	0
11	2	0
2	8	27
0	9	51
0	6	26
1	29	0
M 2.8	8.0	17.2
SD 4.44	9.46	20.13

Ratio of Conversational Exchanges
To Planful Narratives

	Age 4	Age 6	Age 8
Exchanges	28	80	172
Narratives	24	47	53
Exchanges Per Narrative	1.17	1.70	3.24

Table 18

Number of Utterances Contained in Planful Narratives

Raw Number of Utterances Contained in Planful Narratives

Age 4		Age 6		Age 8	
Task 1	Task 2	Task 1	Task 2	Task 1	Task 2
0	0	10	0	0	0
0	0	32	41	0	0
17	22	0	0	74	108
0	0	0	14	23	72
12	56	0	0	0	0
0	30	2	7	0	2
0	4	26	16	26	150
0	0	7	15	67	110
0	0	2	8	25	83
6	8	65	55	0	0
M 3.5	12.0	14.4	15.6	21.5	52.5
SD 6.20	18.74	21.10	18.45	28.23	58.48

Repeated Measures ANOVA For Utterances Contained in Planful Narratives

Source of Variation	SS	DF	MS	F	p.
Age	9280.83	2	4640.42	3.15	0.06
Between-Group Error	39835.25	27	1475.38		
Task	2760.82	1	2760.82	8.57	0.007
Age X Task	2412.63	2	1206.32	3.75	0.04
Within-Group Error	8693.05	27	321.96		

APPENDIX I

SCORING SYSTEMS AND INSTRUCTIONS TO SUBJECTS

Piaget's (1955) System for Classifying Egocentric and Socialized Speech

Egocentric Speech

1. Repetition (echolalia).

   The child repeats words and syllables for the pleasure of talking, with no thought of talking to anyone, nor even at times of saying words that will make sense. This is a remnant of baby prattle, obviously devoid of any social character.

2. Monologue.

   The child talks to himself as though he were thinking aloud. He does not address anyone.

3. Collective (Dual) Monologue.

   The contradiction contained in the phrase recalls the paradox of those conversations between children...where an outsider is always associated with the action or thought of the moment, but is expected neither to attend nor to understand. The point of view of the other person is never taken into account; his presence serves only as a stimulus.

Social Speech

4. Adapted Information.

   Here the child really exchanges his thoughts with others, either by telling his hearer something that will interest him and influence his actions, or by an actual interchange of ideas by argument or even by collaboration in pursuit of a common aim. Adapted information takes place when the child adopts the point of view of his hearer, and when the latter is not chosen at random.

5. Criticisms.

   This group includes all remarks made about the work or behavior of others, but having the same character as adapted information; in other words, remarks specified in relation to a given audience. But these are more affective than intellectual, i.e., they assert the superiority of the self and depreciate others.

(continued)

Social Speech

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6. Commands, Requests, and Threats.

   In all of these there is definite interaction between one child and another.

7. Questions.

   Most questions asked by children among themselves call for an answer and can therefore be classed as socialized speech, with certain reservations.

8. Answers.

   By these are meant answers to real questions and to commands. They are not to be compared to those answers given in the course of conversation, to remarks which are not questions, but information (see category 4).

Kohlberg, Yaeger, and Hjertholm's (1968) System for Classifying Private Speech

Level I. Presocial Self-Stimulating Language.

1. Word play and repetition.
   Repeating words or phrases for their own sake.

Level II. Outward-Directed Private Speech.

2. Remarks addressed to nonhuman subjects.
   For example, "Get back there," addressed to a piece of sticky paper clinging to the child's finger.

3. Describing own activity.
   Remarks about the self's activity which communicate no information to the listener not apparent from watching him, that is, describing aspects of the self's activity which are visible to the other person whose attention does not need to be directed to it. The description is in a form which has no task-solving relevance or planning function. It is present tense rather than past tense.

Level III. Inward-Directed or Self-Guiding Private Speech.

4. Questions answered by the self.
   For example, "Do you know why we wanted to do that? Because I need it to go a different way?

5. Self-guiding comments.
   The difference between this category and 3, describing own activity, is that these comments are task or goal oriented. Speech precedes and controls activity rather than follows it. Such speech often involves cognitive analysis or inferring, for example, reasons for action, analysis of the situation, or references to nonvisible attributes of the activity.

Level IV. External Manifestations of Inner Speech.

6. Inaudible muttering.
   Statements uttered in such a low voice that they are indecipherable to an auditor close by.

Level V. Silent Speech or Inner Thought.

Fuson's (1979) System for Classifying Private Speech

1. Regulating

A. Statement Form
    1. Present/past or 2. Future tense
        a. Describing the surrounding world.
            (i) Describing a thing (sentence using verb "to be," noun, adjective).
            (ii) Describing one's own external state ("I have...", "Me got duck").
        b. Describing actions (sentence, adverb).
        c. Describing one's own mental internal state ("I need to...", "I want...", "I think that...").
B. Social Form
    1. Command.
    2. Question (that does not get answered).
    3. Question and its answer.
    4. Responding form (for example, "OK", "Yes", "No").

2. Affective

A. Play
    1. Word play: nonsense words, rhyming words and jingles.
    2. Singing.
B. Emotional expressive (for example, "Oooh", "Damn", "Um", a sigh).

3. Fantasy/Role-Playing

A. Imitating persons.
B. Imitating objects, sound effects.

4. Incomprehensible/Inaudible

Problem-Solving Attempts: Scoring Procedure, Codes, and Definitions

Scoring Procedure

1. An Attempt to Construct a Road is initiated when a subject correctly links any 2 tracks together (including a track glued to the board).

2. That Attempt is developed if the subject:
   a) correctly links additional tracks to the initial road; and/or
   b) removes or re-directs no more than the very last track placed.

3. That Attempt is concluded when the subject:
   a) successfully produces one of the target roads; or
   b) removes or re-directs the penultimate track placed, or any other preceding track; or
   c) abandons work on the road for 60 seconds or more.

Codes and Definitions

Codes	Definitions
SA Successful Attempt to Construct a target Road.	An attempt at road construction is successful when it produces a road that is linked up to both endpoints and that utilizes all of the tracks provided.
FA Failed Attempt to Construct a target Road.	An attempt at road construction is failed when it produces a road that is either not linked up to both endpoints or does not utilize all of the given tracks.

Private and Social Speech: Scoring Procedure, Codes, and Definitions

Scoring Procedure

Social Speech	Private Speech
1. Social Speech is indicated when the speaker turns face and gaze toward another person.	1. Private Speech is indicated when all Social Speech signals are absent: specifically, no turning of the face and gaze toward another person, no repetition of an utterance and/or demand for a response, and no increase in pitch and volume indicating a "broadcast" of the utterance.
2. Social Speech is indicated when the speaker repeats an utterance and/or demands a response.	2. An additional indication is when the speaker gazes toward his or her own manipulations of objects.
3. Social Speech is indicated when the speaker intones an utterance using increased pitch and volume so as to "broadcast" it without having to look at the hearer.	

Codes and Definitions

Social Speech		Private Speech	
SSI	Social Speech Initiated by the child.	**PS**	Private Speech.
SSR	Social Speech in Response to the experimenter.	**US**	Unscorable Speech.

Planning and Non-Planning Functions: Codes and Definitions

Non-Planning Functions	Planning Functions
NFWD Word Play consists in saying words or nonsense syllables for the sake of their sounds; humming; singing.	**PNDP** Defining the Problem consists in describing or clarifying those aspects of the existing situation that bear on the problem.
NFSE Sound Effects are vocalizations that simulate the sounds made by real objects.	**PNDG** Defining the Goal consists in describing or clarifying the situation that is to be achieved.
NFVC Voice Characterizations are changes in intonation that indicate the speaker is role-playing or play-acting.	**PNDD** Defining Discrepancies consists in describing or clarifying the differences between the problem and the goal.
NFER Emotional Release involves the use of phrases, words, or intonation to express feelings of success, failure, or frustration related to non-planning activities; laughing; swearing.	**PNFO** Formulating a plan that eliminates discrepancies involves the use of words to: propose courses of action; simulate actions; evaluate results; revise plan accordingly.
NFRO Remarks about Others are phrases or words that tell (or ask) about objects or the actions of others that are related to non-planning activities.	**PNME** Monitoring the Execution of a plan involves the use of words to monitor each step carried out and to check it against the plan; to note any constraints.
NFDA Descriptions of Activity consist of phrases or words that describe a speaker's own non-planning activity, whether past, present, or future.	**PNRM** Remembering uses words to recall any aspect of planning: the problem, the goal, discrepancies, proposed solutions, steps completed, etc.
NFFA Fantasy involves overt activity or the use of phrases or words indicating that the activity is intended as pretend-play or make-believe.	**PNER** Emotional Release uses phrases, words, or intonation to express feelings of success, failure, or frustration over planning; laughing; swearing.

(continued)

Non-Planning Functions	Planning Functions
NPME Monitoring the Execution of play involves the use of phrases or words to describe or regulate the course of play activity.	**UNSC** Unscorable actions consist of phrases, words, or overt behaviors that are not classifiable as either planning or non-planning.

Dore's (1977) Decision Procedure for Determining Conversational Acts

To determine the Conversational Act(s) performed by an utterance unit, the following decision procedure was used:

1. For utterance units with a grammatical form, determine the literal reading of the proposition, based on its logical subject, predicate, adverbial phrases, and other constituents.

2. Determine the conventional illocutionary force underlying a proposition or an idiomatic expression.

3. Determine the implied conversational functions (if any) based on relations with other utterance units in the same conversational sequence.

4. Determine the implied conversational functions (if any) based on marked illocutionary devices, such as intonational stress and prosodic features.

5. Determine the implied conversational functions (if any) based on contextual relations, such as relations to ongoing activity, to other people, to objects, to time, etc.

Dore's (1979) Conversational-Act Codes and Definitions

Assertions

ASID Identifications label objects, events, people, etc.

ASDC Descriptions predicate events, properties, locations, etc., of objects or people.

ASIR Internal Reports express emotions, sensations, intents, and other mental events.

ASEV Evaluations express personal judgements or attitudes.

ASAT Attributions report beliefs about another's internal state.

ASRU Rules state procedures, definitions, "social rules," etc.

ASEX Explanations state reasons, causes, justifications, predictions.

Requests

RQCH Choice Questions seek either-or judgements relative to propositions.

RQPR Product Questions seek information relative to most "Wh"interrogative pronouns.

RQPC Process Questions seek extended descriptions or explanations.

RQAC Action Requests seek the performance of an action by the hearer.

RQPM Permission Requests seek permission to perform an action.

RQSU Suggestions recommend the performance of an action by hearer and/or speaker.

Performatives

PFCL Claims establish rights for the speaker.

PFJO Jokes cause humorous effect by stating incongruous information, usually patently false.

PFTE Teases annoy, taunt, or playfully provoke a hearer.

Expressives

EXCL Exclamations express surprise, delight, etc.

EXAC Accompaniments maintain contact by supplying information redundant with respect to context.

EXRP Repetitions repeat prior utterances.

(continued)

Performatives	Miscellaneous
PFPR Protests express objections to hearer's behavior.	**NVRS** Nonverbal Responses are for silent compliances and other gestures.
PFWA Warnings alert hearer of impending harm.	**UNTP** Uninterpretables are for uncodeable speech.

Regulatives	Responsives
ODAG Attention Getters solicit attention.	**RSCH** Choice Answers provide solicited judgements.
ODSS Speaker Selections label speaker of next turn.	**RSPR** Product Answers provide information related to "Wh"-questions.
ODRQ Rhetorical Questions seek acknowledgement to continue.	**RSPC** Process Answers provide solicited explanations.
ODCQ Clarification Questions seek clarification of prior remark.	**RSCO** Compliances express acceptance, denial; acknowledgement of requests.
ODBM Boundary Markers indicate openings, closings, and shifts in the conversation.	**RSCL** Clarification Responses provide solicited confirmations.
ODPM Politeness Markers indicate ostensible politeness.	**RSQL** Qualifications provide unsolicited information to a request.
ODPF Pause Fillers maintain speaker's turn during hesitation pauses.	**RSAG** Agreements agree or disagree with prior nonrequestive act.
	RSAK Acknowledgements recognize prior nonrequestives.

Note. The category "Pause Fillers" was added by this author.

Verbatim Transcript of Instructions to Subjects

Task 1

As you can see, I brought a big game with me. It's a make-believe town with a toy schoolhouse, a toy schoolbus, a lake, an amusement park and a zoo. There's also a story about this town: the schoolchildren are planning to go on a trip to the amusement park and the zoo. In fact, the bus that is going to take them is waiting right now in front of the school. But there's a problem-- the road isn't finished yet, so the bus can't take the children to the amusement park. Would you like to help the children by building the road for them? If I give you the wooden tracks, then you could build the road, and then you could drive the bus to the amusement park! Does that sound like fun?

Here are five tracks; one is straight and the other four are curved. Using all five of these tracks, it is possible to build not only one road, but six different roads that will go from here (pointing to the track in front of the school) all the way over to here (pointing to the track in front of the amusement park). Try to build all six roads, or as many of them as you can. There's one more thing, and this is very important-- you have to build the roads all by yourself. I can't help you because I have important work to do over there. But you take your time, and after you've built as many roads as you can that go from here over to there, I'll show you another way you can play this game. Does that sound like fun? (Assuming assent is given:) Alright, go ahead and try, and have fun!

Task 2

How are you doing? Is it easy or is it difficult? Well, maybe it will help if I give you two more tracks; now you have one straight and six curved tracks. Using all seven of these tracks, it is possible to build not only one road, but four different roads. Why don't you see if you can build all four roads, or as many of them as you can? I'm still busy, so I can't help you-- you have to try and build them all by yourself. But take your time, and after you've finished, you can just play with the toys for a while if you want to, and then I'll bring you back to your classroom. Does that sound like fun? (Assuming assent is given:) Okay! Go ahead and try, and have fun!

APPENDIX II

EXAMPLES OF SCORED DATA

Scored Performance Data: 8-Year-Old Boy

Task 1

Minutes	# Links	# Tracks	Codes	Targets
1	2	5	SA	2 *
2				
3				
4				
5				
6				
7	2	5	SA	4
8	2	5	SA	6
9	0	5	FA	
10				
11	0	3	FA	
12	0	1	FA	
13				
14	1	1	FA	
15	1	1	FA	

Task 2

Minutes	# Links	# Tracks	Codes	Targets
1				
2	1	7	FA	
3	1	5	FA	
4	0	2	FA	
5	1	2	FA	
6	1	7	FA	
7				
8				
9	1	5	FA	
10	0	5	FA	
11	2	7	SA	1
12				
13	2	5	FA	(3) **
14				
15				

* Code numbers for "Targets" appear in Figures 3 and 4 (pp. 50 and 51).

** Parentheses indicate Task 1 "Targets" constructed in Task 2.

Scored Verbal Data: 4-Year-Old Girl

Utterance Units	Private Speech	Social Speech
187. And they´re in the woods.	NFRO NFFA NFME	
188. So they´re....	NFRO NFFA	
189. They´ve gotta go to the zoo.	PNDG	
190. ...An´ the zoo...	NFRO	
191. It´s gonna be almost ready.	PNME	
192. I´ll use this one now.	PNME	
193. Hmmm...	NFER	
194. Now they see the rocks.	NFRO NFFA NFME	
195. But the zoo is far, far away.	NFRO NFFA	
196. ...An´ the picnic.	NFRO NFFA	
197. There!	PNME	
198. Now they´re going around in circles!	NFRO NFFA NFME	

Scored Verbal Data: 6-Year-Old Girl

Utterance Units	Private Speech	Social Speech
220. Alright.	PNME	
221. That goes....	PNME	
222. That´s good.	PNME PNER	
223. But they have to wait/	PNDP PNRM	
224. /for the road to be built.	PNDG PNRM	
225. Let´s go to the schoolyard.	NFVC NFRO NFFA NFME	
226. The...	UNSC	
227. ...uh...	UNSC	
228. ...teeter totter teeter totter....	NFWD NFRO NFFA	
229. ...teeter totter....	NFWD NFRO NFFA	
230. This is my third road.		PNME PNRM
231. I did it!		PNME PNER
232. This is my fourth one.		PNME PNRM
233. This is my fourth road.		PNME PNRM
[E: Oh, good.]		

(continued)

Utterance Units	Private Speech	Social Speech
234. Heh!	PNER	
235. Whew!	PNER	
236. One to go over there...	PNME	
237. ...An´ one to go over....	PNME	
238. An´ now the bus can go!	PNME PNER	
239. What a nice road.	PNER	
240. How nice it looks.	PNER	
241. Oooooooh....	PNER	
242. I put one track upside down.		PNME
243. I put this straight one upside down.		PNME

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