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The regulation of task activities in natural and idealized dyadic interactions with adults and preschool children: A Vygotskyian approach

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City University of New York, 1989

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THE REGULATION OF TASK ACTIVITIES IN NATURAL AND IDEALIZED DYADIC INTERACTIONS WITH ADULTS AND PRESCHOOL CHILDREN: A VYGOTSKYIAN APPROACH

by

CAESAR PACIFICI

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

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Abstract

The Regulation of Task Activities
in Natural and Idealized Dyadic Interactions
with Adults and Preschool Children:
A Vygotskyian Approach
by
Caesar Pacifici

Advisor: Professor David Bearison

A Vygotskyian perspective, framing a theoretical and methodological basis for understanding the social origins of knowledge, was used in examining relationships between aspects of adult-child interaction activities and pre-to-post-interaction improvements in children's independent learning. Preschool children (2.6 to 3.5 years) were randomly assigned to either a natural dyadic interaction condition (n = 20) in which mothers provided instructional assistance (regulations) on a puzzle task, or an idealized dyadic interaction condition (n = 9) in which a trained experimenter provided theoretically optimal instructions. All dyads completed two trials of puzzle activity. Pre- and post-interaction trials included two tasks; an analogous puzzle task (near transfer), and a block design task (far transfer).

Adults' regulations were hierarchically categorized

into levels of explicitness. Contingency measures reflected whether adults appropriately modified their ongoing task regulations, by making them more explicit or implicit, in response to children's cognitive competencies. The magnitude of regulations measured the average number of levels adults shifted from one intervention to the next.

Findings generally supported the major hypotheses. Consistent with Vygotsky's idea of the zone of proximal development, interactions that were proportionately more contingent, and therefore more directed toward children's learning potentials, were positively associated with greater gains in children's independent learning in pre- and post-interaction performances. Regression analyses showed that regulations that were not contingent, or were contingent and represented shifts of more than two levels of explicitness, were not predictive of children's independent functioning. Also, the average number of levels mothers moderated their regulations from one intervention to the next, whether they were contingent or not, was negatively associated with gains in children's independent learning.

Children in the idealized instructional group showed greater pre-to-post-interaction gains than children in the natural interaction condition.

Findings in the above hypotheses were limited to the near transfer task. In addition, no evidence was found for microgenetic improvements in interactions across trials.

A set of ancillary analyses explored aspects of mother-

child activities during interactions. Contingent regulations were followed by more correct, compared with incorrect, children's activities. Also, mothers intervened more often after children's incorrect, compared with correct, activities.

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I wish to acknowledge the blessings I have received from creation, with the deep desire that I will share them with all living things.

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Chapter 1

Introduction

Research of children's development has increasingly recognized the importance of understanding the social nature of cognition (Damon, 1983). Yet, until recently, paradigms investigating social-cognitive development met with limited success. Findings were often contradictory, they said little or nothing about how changes in social behavior and social reasoning were related, what the cognitive mechanisms for such changes were, or how social-cognitive knowledge varied as a function of context (Bearison, 1982).

A corpus of newly translated works in Soviet psychology has sparked the interest of American psychologists because of its primary focus on cognition as a social process (Bearison, in press; Cole, 1985; Kozulin, 1984; Van der Veer, 1986). The upsurge in interest in Soviet psychology is surprising when considering it derives from a vastly different tradition of thought and scientific inquiry, and that the major works of its progenitor, Lev Vygotsky (1962, 1978), were originally written over 50 years ago. Despite this, the work of Vygotsky and his successors has not only provided a compelling conceptual framework for addressing urgently felt priorities in current Western psychological research, but has proved to be methodologically useful.

Research that has developed in response to contemporary

Vygotskyian interests has taken two basic interrelated approaches. One approach has investigated the impact of broad socio-historical factors, such as culturally or institutionally learned forms of literacy (Scribner, 1985; Scribner & Cole, 1981) on cognitive skills; while another approach, introduced by Wertsch (1985), has traced developmental processes within brief experimental sessions using fine-grained observational analyses of naturalistic adult-child interactions. The interaction, or transaction, occurs as a problem-solving situation where each individual affects and coordinates the intentions and actions of the other (Bruner, 1984a). A social microcosm is created in which development can be studied during, and as a result of, interactive processes (Bearison, 1986).

Empirical studies using either approach are still rare, for a number of reasons. Once the literature began to be translated, a conversion of the theory into contemporary understandings and terms needed to be made. The theory is far-reaching in its scope and implications, and has required extensive theoretical discourse. Methodologies derived from or based on the theory have been only recently developed and thus far have yielded data that have been either descriptive or subject to basic methodological reformulations. The aim of the present study, therefore, was to empirically extend current understandings of the functional relationships between cognitive-developmental processes and social

interactions according to Vygotskyian theory.

Theoretical Dichotomies in Social Cognition

Traditionally, research about children's cognition was characterized by two fundamental conceptual dichotomies: First, different and separate systems of knowing were presumed--the individual versus the social (Glick, 1974, 1985), and second, a false polarity existed between the acquisition of knowledge concerning physical versus social objects (Butterworth, 1982).

Studies based on individual determinants of cognition were typified by psychometric, and early Piagetian research (Doise & Mugny, 1984). The psychometric model depicted intelligence as a trait that, while understood to vary within individuals according to categorical domains of cognition, was essentially a stable biological end-product (Wilkinson, 1983). Piagetian, or cognitive-developmental psychology, saw development in more dynamic terms as the construction of internal logico-mathematical structures of intelligence via interactions between the individual and its object environment. Dissatisfaction with this approach, in its earlier formulation, had to do with its portrayal of the environment as relatively passive and unstructured (Butterworth & Light, 1982), and with its neglect of social factors, both as mediators and objects of interactions (Turiel, 1983). For example, children

typically were asked to perform in or reflect on hypothetical situations, which ignored the social contexts in which knowledge is constructed, shared, and used (Bearison, 1982).

Traditional theories emphasizing social or environmental aspects of development presented other distortions. In social psychology studies, children's understanding of how they perceived others' attributes, or their relationships with others lacked any organizing cognitive principles. Other theories based on mechanistic, reductionist approaches viewed development as an accretion of behavioral associations largely controlled by environmental factors--either physical objects (behaviorism) or social objects (social learning). These theories considered the role of the environment, social or object, to the relative exclusion of what role individuals played in their own development.

Integrating Social and Cognitive Approaches

Social-cognitive psychologists have now begun to recognize the importance of integrating a spectrum of social-environmental factors in the study of the development of cognition (Doise & Mackie, 1981). Current theoretical treatments of how social factors and cognition are related have gone beyond simply apposing the two, and have radically redefined the relationship as a unified system of

interactions comprised of two constituent parts (Cole, 1985). Thus, according to Bearison (1982) "social cognition not only reflects the development of social knowledge but also the social development of knowledge" (p. 202).

The use of social interactions, as a concept and in experimental methodology, constitutes a dynamic process-oriented approach, similar to Piagetian theory in the epistemological sense that knowledge is viewed as being actively constructed. Knowledge is not simply a reflection of an objective, independent structure or content, but a process in which people interact with information in the context of acting with others (Zinchenko, 1981). Human mental processes are themselves products of processes that include how and where, developmentally, they occur (Wertsch, 1984). An aspect of the social interaction approach that departs from the Piagetian model, but which is a cornerstone of the Vygotskyian model, is the idea that knowledge is shared, or co-constructed (Glick, 1983; Leont'ev, 1981). According to this view, social interactions provide naturally occurring settings in which the primary phenomena of constructing knowledge takes place between individuals (Forman & Kraker, 1985).

Chapter 2

Vygotskyian Theory: The Social Construction of Knowledge

Vygotsky was dedicated to innovating a psychology of human behavior rooted in Marxist philosophy (Bruner, 1984b; Kozulin, 1984; Lee, 1985). He did this, not by artificially mapping Marxist thought onto existing psychological theory, but rather, by using key interrelated principles as a basis for framing an epistemology and a psychology that was fundamentally social. A central tenet of Marx's thesis, adapted by Vygotsky, was that human nature could only be understood in the context of social relations. Marx recognized labor as the basic practical activity that brings individuals into social relations with others. It is through conditions of collaboration that knowledge or consciousness is created and transmitted (Kozulin, 1986). A primary characteristic of practical activity is the use and invention of physical tools. Tools mediate activity, as well as emerge from it in new forms. In its most primitive sense, culture can be viewed as the process and product of tools used in shared human activity. Through a continuous dialectic of individual consciousness and shared activity humans learn to plan, and use tools, in order to alter the environment (Wozniak, 1980). Subject (human) and object (tool) become mutually interdependent and affect each other through their interaction in practical activity; as human

activity invents tools, it is also transformed by it.

These basic ideas were incorporated and developed well beyond their original form by Vygotsky and his successors in their formulation of a theory of human development. How were they incorporated? and what were the major components?

The application of the explanatory principle--the role of social activity as the generator of consciousness--shifted from economic realities to the realm of human thought. Interactions with others became the basis for understanding the genesis of higher mental processes. According to Vygotsky, "humans' psychological nature represents... internalized social relations that have become functions for the individual and forms of the individual's structure" (Wozniak, 1981b p. 164). Mead (1934), a contemporary of Vygotsky, also linked cognition to social origins. Mead saw the reciprocity of actions between individuals as providing the basis for symbolic thought. In the individual's attempts to understand the meaning of the other's actions or words, shared meanings become internalized. Despite differences in certain areas, both views conceived of human activity as a medium rather than an aggregate of actions.

The concept and method of <u>activity</u> as it was used by Vygotsky and, later, generally by Soviet psychologists, does not simply mean external behavior (Wertsch, 1981). Conceptually, activity refers to a psychologically organized

unit of consciousness that can be either practical (external) or symbolic (internal), and which can only be understood in relation to its social nature: "Activity is social from the very beginning and develops only under conditions of cooperation and social contact among people" (Davydov, 1985, p.34). Furthermore, activity is purposeful, in the sense that it transmits culturally meaningful knowledge, rather than expressing biologically based adaptive reactions or responses to abstract stimuli (Kozulin, 1986; Scribner, 1985).

Activity, as it is used in Soviet psychology, also comprises a method of analysis, as well as a psychological medium. Leont'ev referred to activity as a "unit of life that is mediated by mental reflection" (1981, p.46). He abstracted activity, as a unit of study, into three component levels: 1) motives, the energizing force behind activity, 2) actions, segments of activity--observable or covert--which serve goals and satisfy motives, and 3) operations, the relatively automatic means and conditions under which actions are performed (Cole, 1981; Wertsch, 1979a). Thus far, American psychology has been preoccupied with the level of actions, primarily by studying the development of children's goal-directed actions in interactions with adults.

The functional aspect of activity is to allow individuals to <u>mediate</u> relations with their reality.

Individuals are the active, but not the sole, agents in creating their reality; it must be processed through a matrix of existing, culturally defined activities and ways of knowing. The specific means individuals use to mediate activity are psychological tools. The use of tools in the psychological, rather than the physical, sense refers to symbolic (semiotic) systems of communication, primarily language and gestures, but which encompass a wide range of phenomena, such as: systems of counting, mnemonic techniques, algebraic symbolic systems, works of art, writing, schemes, and diagrams (Vygotsky, 1981a). Psychological tools are "artificial" means that develop in response to controlling or mastering behavioral processes, either one's own or someone else's; artificial in the sense that they are socially constructed rather than organically given (Davydov & Radziknovskii, 1985). Thus, tools, or signs, are culturally determined devices through which humans regulate activity and construct knowledge. Since individuals consist of internalized aggregates of different activities, they reflect diverse systems of communication and knowing. Activity, in bringing together individuals with differing systems, extends the possibilities of behavior by introducing knowledge that would otherwise not be available through individual discovery (Glick, 1985).

Interaction between the individual and society is not only a setting where they meet, but one in which specific

and profound relationships exist between the two. The ways humans mediate their activity directly determine the developing structure of thought, both in its immediate and practical sense, and later in its internalized form (Wertsch & Rogoff, 1984). "Every function in the child's cultural development appears twice: First, on the social level, and later, on the individual level; first between people (interpsychological), and then inside the child (intrapsychological)" (Vygotsky, 1978, p. 57). What appears as autonomous forms of internal activity is actually derived from earlier forms of joint activity. According to Vygotsky, the activity that takes place in an individual's interactions with others, for example between a mother and child, becomes the organizational structure of higher mental functions: "Children begin to use the same forms of behavior in relation to themselves that others initially used in relation to them. Children master the social forms of behavior and transfer these forms to themselves" (Vygotsky, 1981b, p. 157).

But the relationship between the social and the individual, the external and the internal, is not due to any formal isomorphism in structures between the two (Wertsch & Stone, 1985; Davydov, 1985). The process of internalization, or the individual's interiorization of activity, is itself a process producing change. Internalization is not a simple transfer of activity to a

pre-existing plane, but a transformational process in which individual meaning is formed and which then becomes the basis for new modes of activity (P. V. Zinchenko, 1985; P. I. Zinchenko, 1981). In the process of internalization external processes become generalized, abbreviated, and can be further developed (Leont'ev, 1981). Already existing (given) information assumes a deeper "sense" and supplants factual recounting of it (Wertsch, 1979a; 1979b). What was once inextricably linked to a social context becomes decontextualized and takes on a more directive function in the planning of action. Therefore, although social and individual functioning are genetically similar, and changes in social functioning are indicators of change in individual functioning, what was once social cannot be reduced in form to specific points of origin (Wertsch, 1985).

The concept of internalization underscores the necessity of understanding development as a socially mediated process, which incorporates a sense of the individual's experiential history. For Vygotsky and his successors development could only be understood by tracing its origins (Luria, 1982), whether it concerned cultural, phylogenetic, ontogenetic, or microgenetic (brief periods) change. Vygotsky did not describe, nor does his theory imply, development as a series of stage-related changes. Development is seen, rather, as the progressive incorporation of systems of representation that are socially

constructed and internalized (Glick, 1983; Portes, 1985).

Despite the cultural diversity attributed to human cognition by a socially motivated theory, development was also viewed by Vygotsky as having transcendent patterns of change. The most basic of these is the transformation of elementary, or natural, functions to higher mental functions (Wertsch, 1985; Van der Veer & van IJzendoorn, 1985). Elementary functions are totally dependent on environmental stimulation, are non-social, and include involuntary memory, preverbal thinking, and direct perception. Higher mental functions are social and voluntary, or self-regulated, and include logical memory, creative imagination, and verbal thinking. According to Vygostky (1978), a revolutionary conversion from elementary to mental functions begins at the intersection of two distinct lines of early development. In the infant, speech and practical activity function as independent systems. Speech is devoid of thought, and practical activity is as yet non-symbolic. Both function as limited responses to situational exigencies. Speech is constrained to rudimentary sign systems of gesture or indication, and practical activities such as searching and testing remain external and sensory, much like the use of tools in higher primates. When the two lines merge in development (at approximately 2 years of age), each transforms the other. Thought becomes linguistic and spoken, and speech becomes intelligent and representational.

Vygotsky declared this the single most important event in the development of human intelligence that separates it from all other lower forms of intelligence.

As speech becomes thought it undergoes characteristic structural and functional transformations. Throughout development speech becomes increasingly differentiated from activity, less dependent on context (Hickman, 1985), and functionally, it shifts from a system of external to internal regulations. Vygotsky posited three developmental phases of speech: indicatory, egocentric, and inner.

In the first phase of development the child's attention is regulated by indication and gesture (Vygotsky, 1981c). Objects and their features are not categorized or abstracted in any symbolic way. Instead, speech activity is sympractical (Luria, 1982), that is, completely fused with the current activity and the context in which it occurs. Pointing is the most prevalent means of directing attention to objects, but even words at first have a purely indicatory function by simply labeling or referring to objects with minimal characterizations. The child then begins to manifest indication as a way of self-regulating activity. What was once spontaneously produced by the child, for example a grasping movement, becomes a gesture for others by virtue of the adult's actions in directing it (Kozulin, 1984). In this, as well as in subsequent phases, the very means which at first were used by others to regulate

activity are then used by the individual to regulate the self. Speech activity continues to evolve on the social plane as it becomes more semiotic, and involves schemes for classifying and generalizing objects and their relations (Wertsch, 1985). Correspondingly, the child also mediates the self in increasingly verbal ways.

The appearance of egocentric speech is an important phenomenon that marks the transition from purely external to inner speech, and extends the individual's capacity for self-regulated activity (Wertsch, 1980). It refers to the spontaneous utterances that children, from about the ages of 4 to 10 years (Berk, 1985), make to themselves. Egocentric is a term that has been associated with speech in quite a different way by Piaget (1952). Piaget interpreted children's self-directed talk as non-social, evidence that children are not yet able to extricate themselves from their own perspective. However it is already clear that, from Vygotsky's point of view, speech originates in social contexts and that egocentric speech, therefore, must also be social. The key difference between the two theories is that, while both agree that egocentric speech is not directed to a physical other, Piaget assumed it had no social function, whereas Vygotsky saw it as a transition in which the child is beginning to assume the previously held function of the adult in regulating activity. The child plays both roles in the dialogue, that of regulator and

regulated; because the process is not yet sufficiently differentiated the child plays it out externally. Speech is thus always social and always functions to regulate activity--at first from without, then from within. Egocentric speech is the surrogate for external speech and functions in the same way for the child, as it did for the adult in relation to the child, by allowing the child to plan and organize the self's actions (Levina, 1981).

External and egocentric speech eventually go underground; that is, speech becomes internalized. Soviet psychologists refer to it also as speech turned in on itself (Bibler, 1983). Speech that was once external is now speech for oneself, while still preserving its social, dialogical nature. As discussed, internalization is a process that transforms tools. If inner speech were somehow made audible, it would probably be unrecognizable. It would be condensed, fragmentary, disconnected; syntactically the subject would be fused with predicate; phonetically, words would not even be distinct entities. Instead, sense and semantics would prevail, what Luria (1982) termed synsemantic systems. In sum, "inner speech is the movement of sense, the verbal element in the formation of a new thought" (Bibler, 1983, p. 50), and "contains the seed of future cultural forms that are presently folded into the subjective senses of words" (Kozulin, 1984, p. 119).

Chapter 3

Research Methodology Based on Vygotskyian Theory

Vygotsky's instrumental method provided a general approach for conducting research. He referred to it as a "historico-genetic" method because it specified that behavior must be understood and studied as a history of the individual's social construction of knowledge (Vygotsky, 1981a). The term "instrumental" implied the individual's capacity to invent (artificial) tools, or instruments. Instruments were seen as means of not only altering the environment, but the individual as well, by changing the entire structural flow of information. Tool and object combine to produce knowledge. The instrumental method suggested, therefore, a research program in child development directed at uncovering the evolving structure and function of psychological tools as children learn to master themselves and their environment.

The zone of proximal development (ZPD), a concept consonant with the instrumental method, has been at the center of most Vygotskyian research in educational/ developmental psychology. Vygotsky introduced it as a way of assessing children's learning potential by including the range in functioning from the interpsychological to the intrapsychological plane (Wertsch & Addison, 1985). Vygotsky defined the ZPD as: "the distance between the

actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (1962, p. 86). The lower and upper boundaries of development were measured separately since they could vary independently. This kind of assessment presented a more dynamic picture of cognitive development than those of individual functioning, which only reflected cognitive end-products, rather than products-in-process. The ZPD has been used to evaluate children's current levels of competence--retroactive development--as well as their instructional readiness--proactive development (Campione, Brown, Ferrera & Bryant, 1984), across a variety of mental functions, at various ages, and under different conditions, e.g., peer versus adult-child interaction (Rogoff & Wertsch, 1984).

Paradigms investigating the ZPD typically involve instructional interactions between children and teachers or parents, who are primary interactors in real cultural settings. The problem-solving situation is made to exceed the children's current cognitive limits, which engages adults in attempts to give assistance, or regulate the task activity. The interaction is not treated as an independent function of either teacher or learner, but a collective property based on an emergent and self-organizing type of negotiation between interactive members (Renninger &

Winegar, 1984). According to Bearison (1982),

> "In the collective situation, children are pressed not only to satisfy themselves regarding the best solution, but to satisfy other members of the group as well. This need to verify one's own actions in coordination with another's structures the process of social interaction in ways which promote cognitive growth. Thus, systematic observations of how children socially interact in attempting to solve cognitive problems have the potential to reveal more about the process of cognitive change than the verbal products of children's solitary reflections" (p. 206).

However, the roles of participants in an interaction are not symmetric: one member of the interaction is the relative expert, and the other the relative novice (Rommetveit, 1985). In adult-child dyads, for example, children's understanding is highly dependent on context (sign-object relations), whereas adults use highly developed semiotic systems (sign-sign relations) (Wertsch & Addison, 1985). Because the expert can conserve the procedural logic and goal of the task activity, adjustments in the activity can be made in order to make it cognitively assimilable for the novice. Through a reciprocity of actions and efforts, the dyad's activity undergoes a developmental progression toward <u>intersubjectivity</u>, a shared social world of mutually understood representations of objects and events (Wertsch, 1985). Although the definition of the task situation becomes increasingly shared, the dyadic asymmetry remains. According to Rommetveit (1985), intersubjective states involve achieving joint attention through the intrinsic dichotomy of expert communication privileges and listener

commitment in adopting the speaker's perspective. Intrapsychological self-regulation becomes possible only through asymmetric patterns of interaction. The asymmetry in roles should not suggest a hegemonic relation. Rather, the adult's participation requires ongoing interpretations of children's competence. By operating at the leading edge of the ZPD, children become motivated toward self-regulation; and with learning, instructional regulations concomitantly cede. However, how this transfer takes place is a critical determinant for successful learning to occur. Regarding this, Vygotsky said "the only 'good learning' is that which is in advance of development" (Vygotsky, 1962, p. 89). By it he meant that the developmental process (the lower boundary of the ZPD) lags behind the learning process (the upper boundary of the ZPD). In order for development to take place, first learning must occur; learning, in turn, depends on the delivery of appropriate instructional interaction. The instruction, or regulation, that best impels learning is that which is just ahead of development (Wertsch & Rogoff, 1984). The expert's regulations, in effect, act as a surrogate upper boundary, or leading edge, of the child's ZPD. Where the adult is, the child will soon be. Thus, regulations that are below the child's current level of learning do not promote development. Similarly, regulations that overextend the child's potential development cannot be incorporated by the child and lose

their effect in promoting development. A true appreciation of this as an interactive process requires understanding how the dyad jointly organizes and paces the shift in task activity from expert to novice (Bearison, 1986).

Two attributes of interactions, based on Vygotsky's work, have served this purpose. The contingency of activity refers to the mechanism of dyadic interrelating, while the dialogue comprises the medium in which the interaction takes place. The adult's primary role during an instructional interaction is to discover the leading edge of the ZPD, and to adjust assistance to that level (Wood & Middleton, 1975). Contingent regulations are interventions in activity that provide information of reference or logic just beyond children's current level of competence, which thereby serve to "stretch" current levels of learning and development. The establishment and adjustments in activity is all a function of communication. The dialogue, or speech activity, represents the basic dialectical tool for defining and redefining interdependent realities. Shatz (1983) saw the contingency in ongoing communicative activity as the critical determinant in language development:

> "A mother who continually responded to her child's questions with a complete change of topic would fail by any reasonable measure of communicative skill, no matter how appropriate the topics introduced were, to her child's age or stage... Such knowledge depends not only on assessing a particular partner's abilities and intentions but also on recognizing and using the ways in which the language provides opportunities

> for creating and marking shared knowledge" (p. 856).

The ZPD has offered an exciting perspective in the dynamics and evaluation of development in social interactions. Despite the ZPD's potential value as a research tool for understanding human development, it has met with difficulties in attempts at operationalization, producing a variety of methods and measures.

Chapter 4

A Review of Research Relating to Vygotsky's Approach

While the scientific translation and implementation of the ZPD has varied, related research has been guided by a core set of assumptions. The basic purpose of research investigating the ZPD has been to measure the effect of instructional interactions on children's learning and development. Interaction is the social and external component of activity that represents children's potential development, or what is in process of being internalized and individualized. Therefore, providing a truly interactive situation has been a necessary aspect in studying the ZPD. According to Vygotsky, social processes involve dynamic exchanges of activities between people that reflect ongoing contingencies, and are not simply one-sided didactic transmissions. Interactions become social when adult and child participate in a dialogue of shared involvement. The adult contributes by regulating, or mediating, the child's activity via signs (indication and speech). Adults' regulations occur as attempts to assist children in the planning, monitoring, and executing of a task (Bruner, 1985), and undergo continual revision in response to ongoing perceptions of children's competencies (Valsiner, 1984). Correspondingly, children make efforts to understand and respond to other-regulations and, as a result, learn to

self-regulate, or subordinate their activities to their own control (Vygotsky, 1981b). Another, but not always explicit, research intent has been to quantify the interrelation and movement of task regulation. This entails 1) providing a task analysis (Wertsch, 1981) that identifies the logical aspects of a task and organizes them into units of practical activity, and 2) creating measures that go beyond how each individual is regulating activity along lines of logical task requirements, to those which reflect composite, dyadic involvement in fulfilling task goals.

Most of the studies concerning the ZPD have been conducted by two research groups headed by James Wertsch and David Wood, respectively. Although Wood's first study (Wood & Middleton, 1975) did not make reference to Vygotsky, or use any of the common Vygotskyian terminology that characterized later research, including his own, the ideas and methods were directly relevant to the ZPD. The study videotaped 12 mothers and children, from 3.2 to 4.2 years old, putting together a three-dimensional pyramid puzzle that was assembled out of 21 blocks arranged in six interlocking tiers. Mothers were instructed to provide assistance to their children whenever they needed it, and in whatever way seemed natural. After the interaction trial, children were asked to assemble the puzzle on their own, as a measure of independent functioning.

The study was interested in how mothers adjusted their

instruction in relation to their children's performances, and what overall effect this had on children's independent, post-interaction functioning. The adjustment of mothers' interventions, or contingency, was ingeniously devised by first organizing interventions into five ordinal levels, ranging from specific to general (see also scoring manual, Wood, 1975). The most specific type of intervention was when mothers demonstrated a puzzle assembly for their children. The next level was less specific and consisted of bringing together the necessary parts, but letting children assemble them. In the next level of generality mothers only indicated the pieces needed. The remaining two levels were specific or general verbal instructions, respectively. Next, children's activities were scored for whether they were correct (successes) or incorrect (failures). The measure of contingency depended on both the level of mothers' interventions and children's performances, according to the following rule: "If the child succeeds, offer less help when next intervening. If he fails, offer more help" (Wood & Middleton, 1975, p. 185). Mothers' interventions that adhered to this rule were scored contingent. Another, more composite, measure of joint activity was called the "region of sensitivity". This was computed by first tabulating the frequency each level of regulation led to children's successes. The region of sensitivity was the proportion of interventions occurring at

the most specific level of intervention that led to the most successes. In Vygotskyian terms, this reflected how much of the time mothers were regulating at the leading edge of the ZPD.

The study found that children of mothers who followed the contingency rule a greater proportion of the time, as well as children whose mothers operated in the region of sensitivity a greater proportion of the time, performed proportionately more correct independent task activities following the interaction. The study concluded that children benefit by contingent instruction by demonstrating higher levels of related competencies in unassisted functioning. The importance of using proportion scores was noted by showing that frequency scores for contingent intervention and post-interaction performances were unrelated. Thus, the quality, and not the quantity of instruction was the critical factor.

"Scaffolding," a construct that is directly analogous to the ZPD (Rogoff & Wertsch, 1984) was employed in Wood's next study (Wood, Bruner, & Ross, 1976). The term, first introduced by Jerome Bruner, was defined as:

> "...the process that enables a child or novice to solve a problem, carry out a task, or achieve a goal which would be beyond his unassisted efforts. This scaffolding consists essentially of the adult "controlling" those elements of the task that are initially beyond the learner's capacity, thus permitting him to concentrate upon and complete only those elements that are within his range of competence" (p. 90).

The instructional dynamic between the mother and child is essentially the same as in the ZPD. The mother's interventions are inversely related to the child's competence--the more difficulty the child has, the more specific and directive the scaffolding should be (Griffin & Cole, 1984). The study (Wood, Bruner, & Ross, 1976) used trained tutors to provide contingent responses. This time the interventions were collapsed into three levels of generality; direct assistance, verbal correction, and verbal direction. Using the same pyramid task, tutors only intervened when children's puzzle activities were incorrect. Children were split into three age groups of 3, 4, and 5 year-olds. Results showed that the youngest children required much more assistance, and at more specific levels, than older children. It was concluded that because older children were developmentally advanced they required more generalized forms of scaffolding with less input. The three year-olds also rejected a greater number of suggestions by the tutor than older children, even though they recognized as many instances where their activity was incorrect. This finding was interpreted as evidence that comprehension precedes production, or in Vygotsky's terms, learning precedes development.

Wood's next study (Wood, Wood, & Middleton, 1979) combined elements of both previous studies. Children between 3 and 4 years old were exposed to one of four

tutorial strategies based on the more elaborated 5-level scheme of intervention generality (Wood & Middleton, 1975). Each strategy represented a pattern of intervention used by mothers that had been observed in previous studies. A "contingent" strategy provided interventions that continuously followed the contingency rule by one level. For example, if a tutor gave an intervention at Level 3 and it was followed by an incorrect operation by the child, the tutor then gave a Level 4 intervention (more specific). This strategy was contrasted with three other non-contingent strategies: 1) "demonstrational": only demonstration interventions, 2) "verbal": only verbal interventions, and 3) "swing": only demonstrational or general verbal interventions. After the tutorial session children were asked to do the pyramid puzzle without assistance, and several aspects of their post-interaction activity were scored. The outcome score was the sum of correct activities. Task efficiency was measured as the proportion of the outcome score divided by the total number of all activities. Children in the contingency group had greater outcome and efficiency scores than children in any of the other three strategy groups. However, children in the the verbal and swing groups had higher efficiency scores than the demonstration group. The study confirmed that patterns of interaction that are contingent have relative benefits for children's learning over other kinds of teaching strategies.

Westerman (1979), using Wood's scoring scheme, compared interactions of "healthy" versus compliance problem children with their mothers. Three to four-and-a-half year-old children were screened and diagnosed for disturbed social behavior when interacting with their mothers. It was expected that, since the interactions of compliance problem dyads were characterized by unevenness and discontinuity, compliance problem mothers would use proportionally fewer contingent interventions than healthy interaction mothers. Wood's region of sensitivity was used as an added measure of contingency. Compliance problem dyads were expected to show proportionally fewer interactions in this region, compared to healthy interaction dyads. Compliance problem dyads were also expected to employ more instances of the swing strategy--providing levels of instruction at floor and ceiling levels (Level 1 or Level 5)--than healthy interaction dyads. Finally, contingent behaviors were divided into two categories: those following correct child activity (successes), and those following incorrect child activity (failures). Healthy interaction dyads were expected to show a greater proportion of contingent interventions than compliance problem dyads following children's successes, as well as following children's failures.

The hypotheses were confirmed, with two exceptions. The groups were not different in the proportion of

interventions in the region of sensitivity. Also, healthy interaction dyads were characterized by proportionally more contingent behavior following children's successes, but not following children's failures, than compliance problem dyads. Westerman showed that mothers and children characterized by disturbed patterns of interaction also demonstrate limitations in their ability to adapt to each other's communications in practical instructional activities. However, since a post-interaction task was not used, no conclusions could be made about what effect this had on children's independent learning.

Wertsch's studies, in addition to explicitly invoking Vygotskyian terms and constructs, were more guided by theoretical issues. For example, Wertsch, Hickmann, McLane, & Dowley (1978) used a "microgenetic" approach to study the shift from inter- to intrapsyocholgical functioning. Microgenesis refers to brief segments of the developmental process (Catán, 1986). Microgenetic approaches involve experimental techniques that analyze activity into units of change, but which also reflect developmental processes (Zinchenko & Gordon, 1981). In Wertsch's study (Wertsch, Hickmann, McLane, & Dowley, 1978), children (3.5 and 4.5 years) were instructed to put together a copy puzzle from a duplicate model puzzle with assistance from their mothers. Each puzzle consisted of six identically-shaped cargo pieces of different colors. Children had to match the color scheme

of their puzzle to the model puzzle. Task activity was subdivided into units, or frames, that included all the activity surrounding the correct placement of a puzzle piece. Each frame was coded for whether activities in each of six areas of task responsibility were self- or other-regulated. Areas of task responsibility were arranged, as in the Wood studies, by levels of specificity, or explicitness, and included; 1) consulting the model puzzle, 2) identifying a relevant puzzle piece, 3) making the appropriate selection of a puzzle piece, 4) attending to the copy puzzle, 5) deciding the correct placement, and 6) correctly placing the puzzle piece. Determinations of who regulated activity were based on children's and mother's utterances, gazes, gestures (pointing), and handling of puzzle pieces.

The expectation was that there would be a gradual, but observable shift from other- to self-regulation by frame, and by level of explicitness. That is, children would increasingly self-regulate by frame, and self-regulations would occur first in more explicit, or goal-directed, areas of task responsibility.

Unfortunately, only data from two subjects were reported, and the criteria for scoring whether activities were self- or other-regulated were not described in detail. However, the data showed the expected patterns of transition from other- to self-regulation over the course of the task.

In addition, the younger child needed considerably more regulation than the older child and the transition to self-regulation was less evident. Despite the anecdotal nature of the study, a technique for observing a brief, context-specific aspect of development in process was presented.

A subsequent study (Wertsch, McNamee, McLane, & Budwig, 1980) formally tested microgenesis by employing a different system for coding other- and self-regulations based on children's gazes. Using the same task situation, gazes were scored as other-regulated if mothers pointed to, mentioned, or directed the child to the model puzzle before the child looked at the model. Conversely, children's gazes were scored as self-regulated if they were not preceded with attempts by mothers to direct attention to the model puzzle. In addition to microgenesis, ontogenetic changes were tested by comparing children in three age groups (2.7-2.11, 3.6-3.9, and 4.5-4.7 years) on how well they were able to utilize other-regulations in making correct puzzle placements. This was measured as the proportion of times adults did not further intervene between an other-regulated gaze and the correct placement of a puzzle piece.

The study reported that the proportion of other-regulations decreased with age, due to older children's relative advances in development. Also, older children were better able to utilize other-regulations to correctly place puzzle pieces. Younger children, it was concluded, were not

able to extract relevant features of the model, whether their gazes were self- or other-regulated. Finally, there was no evidence for microgenesis, which was tested by comparing the proportions of self-regulations for the first three frames of activity (placing three pieces correctly) with the second three frames.

The technique of using gazes to determine regulations does not appear to have emanated from theoretical considerations. In fact, subsequent studies returned to using the previous method of using utterances and gestures to determine whether task activities at differing levels of explicitness were other- or self-regulated.

In each of three studies, patterns of transition from other- to self-regulations were compared as a function of various group characteristics: peer versus mother-child interactions (McLane, 1981), mothers interacting with normal children versus children with language disorders (Sammarco, 1984), and rural mothers versus teachers interacting with children (Wertsch, Minick, & Arns, 1984). Several common patterns were reported. Rural mothers, peer tutors, and mothers of children with language disorders regulated activity at more explicit levels by, for example, physically doing the task for the tutees, than their respective comparison groups. The children who were given greater amounts of regulation, and at more explicit levels, showed less distinct progressions toward self-regulation than

children in moderately regulated groups. Despite this, all children showed a common tendency to, at first, only participate in specific goal-directed activities, such as placing puzzle pieces, and then to function within less explicit levels of strategic responsibility, such as consulting the model puzzle, or selecting an appropriate puzzle piece. The studies showed that tutors characterized by very different group attributes, but who share common patterns of interaction, affect microgenesis by either facilitating or limiting tutees' participation.

The study involving children with language disorders raises some interesting questions about atypical development. Vygotsky's theory posits that development manifests in culturally-specific ways, but that it is also motivated by universal organizing principles that apply to atypical as well as normal populations. Vygotsky acknowledged that many atypically developing children lack the natural, or organic, processes that are normally required for the emergence of higher mental processes. However, he viewed the cultural and social aspects of development--that which is at first external and involves others--as able to serve as substitutes in creating indirect paths to internal development (Vygotsky, 1981b). In fact, the facilitative role of socio-cultural interactions in development can also be applied to atypical populations with problems of non-organic origins; for example, with

disadvantaged children, whose developmental histories are often marked by relative absences of or inconsistencies in mediated learning (Brown & Ferrera, 1985). Conversely, precocity can also be seen to reflect optimal conditions of interaction (Portes, 1985). Although the specific relation of organic and social components in determining atypical conditions is complex and not specifically addressed by Vygotsky, the theory underscores the importance of interactive remediation and provides a framework of optimism for educationally promoting developmental processes.

A case in point is a study by Stone & Wertsch (1984). In this anecdotal report, a child with reading disabilities was given remediation in word discrimination. The remediation process was given interactively by a clinician who adapted instruction to the child's specific errors. The flexible instructional approach was based on patterns of contingency. A task analysis organized the learning of word discrimination into sequences of skill acquisition. A correctly spelled target word was shown to the child and kept on display. Successive cards with different spellings were presented, and the child had to decide whether the two cards matched. If the child's responses were incorrect, the clinician gave increasingly explicit regulations by first acknowledging the error, then giving an overall strategy, followed by specific directives concerning problem-solving steps omitted by the child, such as how to compare the

cards. The examples of dialogues reported showed the child needed increasingly less explicit forms of regulations with each successive presentation of display cards.

Recent studies of the ZPD and scaffolding have investigated the development of children's number concepts (Saxe, Gearhart, & Guberman, 1984), individual differences (Campione, Brown, Ferrera, & Bryant, 1984), and infant-mother interactions (Hodapp & Goldfield, 1985; Hodapp, Goldfield, & Boyatzis, 1984).

In a study on the development of number concepts, Saxe, Gearhart, and Guberman (1984) divided children (2.5-5 years old) into groups of low and high ability after assessing their independent number skills. Children and mothers were then given a number correspondence task in four trials with increasing difficulty levels. In addition to dividing mothers' regulations into levels of explicitness, children's goal-directed activities were organized into four developmental levels. Mothers' activities were then scored for contingency; in this case, whether their level of regulation changed as a function of children's developmental level of goal activity. Results showed that, similar to the Sammarco study (1984), mothers of children with low ability used subordinate task goals (i.e., explicit regulations) more often than mothers with high ability children. As task difficulty increased, mothers in both groups used more subordinate goal directives; for mothers of low-ability

children this meant phasing out the use of superordinate task goals completely. Also, within task trials, all mothers tended to respond contingently by shifting their regulations downward when children responded inaccurately, and upward with correct children's responses. Thus, the study was successful in tracing patterns of transfer from inter- to intra-psychological functioning as a function of children's ability characteristics and task difficulty.

Infant researchers have also been especially interested in understanding more about how mothers adapt their behaviors to their infants in very early structured game activities. Two related studies (Hodapp & Goldfield, 1985; Hodapp, Goldfield, & Boyatzis, 1984) looked at longitudinal changes in interaction patterns of mothers and 8-month old infants over nine months. A large variety of behaviors were coded during monthly rounds of games such as peek-a-boo and roll-the-ball. Other-regulations included such behaviors as: attention-getting, physically setting the stage (getting face contact), and a range of simple to complex task-specific activities. Infants were also scored for their skills levels. The studies were interested in showing how interactions changed within game rounds, and with age. Results produced compelling evidence of how mothers and infants mutually adjust to developing levels of scaffolding. Mothers shifted to more complex forms of activity both within play rounds, and across months. In turn, as infants'

skills developed, mothers repeated games more often and used more kinds of facilitative activities. This finding was particularly interesting because it tapped an aspect of the dyad's activity that had not been directly addressed in other research, namely, something about how the novice can affect the expert's activities.

The most widespread application of the ZPD in Soviet literature has been as a psychoeducational measure of learning readiness, especially among atypical populations (Wozniak, 1980). Unfortunately, these studies remain either untranslated or are reported in summary form in theoretical discussions of translated works. A study reported in some detail by Wozniak (1980) will be given as an example of how the ZPD is typically studied in Soviet psychology. Egorova (1969) compared how nine-year-old learning disabled, mentally retarded, and normal children benefited from assisted instruction on a task involving visual analytic ability. Children's initial independent competencies were first measured. Then they were given task trials with an instructional interactor who gave series of prompts when children showed they were having difficulty with the task. Although the scheme for giving prompts was not reported, it appeared to have the same general approach of providing regulations in increments of explicitness where children were not as yet self-regulating. After the interaction session, children's independent competencies on

the original task were assessed again to measure improvements as a function of interactional instruction. Results showed that normal children had higher initial skills and benefited more from instruction than both other groups. Also, learning disabled children showed higher initial scores, as well as greater improvements than mentally retarded children. The study gives a classic Vygotskyian rendering of learning readiness by showing how the "width" of the ZPD, defined as the benefit derived from interaction, varies as a function of learners' characteristics.

A very similar approach in measuring learning readiness was taken by a group of American researchers (Campione, Brown, Ferrara, & Bryant, 1984). Two experiments were reported which involved three learning phases: 1) A learning session brought children to a criterion level of independent functioning on a task. 2) A maintenance session included giving children novel versions of the same task. 3) A transfer session presented children with a series of near and far transfer tasks. During each session children were given increasing levels of assistance where they required help. The dependent measure was the number of instructional prompts needed by children in each phase. In the first experiment, 8-10 year-old children with average versus high IQ's were compared in a letter completion task. While children with high IQ's needed fewer prompts in the

learning session, there were no differences in maintenance, and near transfer performances between groups. However, high IQ children needed increasingly fewer prompts for far transfer items. In the second experiment, retarded and non-retarded children who were matched on mental age (10.5), were given Raven's matrices tasks. Here, no differences existed between groups in the learning phase, but retarded children needed increasing amounts of prompts in the maintenance, and near and far transfer sessions. The studies provided additional evidence of the utility of the ZPD as an educational instrument able to give a more dynamic picture of children's learning potentials.

Chapter 5

Development of the Current Study

The current study sought to integrate methodological features of previous studies in a theoretically meaningful way, and to introduce novel measures and conditions to further understandings about the construction and transition of knowledge in social contexts. The studies discussed in the previous section all pointed to a fundamental process of establishing conditions of mutuality, or contingency, in interactions involving instruction. The extent to which interactions were contingent was also related to broad indicators of development such as age and ability levels. However, very little is still known about what constitutes contingent conditions, or how changes in children's learning are direct functions of those conditions.

The general strategy used in previous studies, which was adapted to different task conditions and to the acquisition of a variety of logical skills, categorized adults' regulations into levels of explicitness. The levels corresponded to developmental states of internalization: development and its regulation proceed from explicit to implicit form. This principle defined the basic interactive dimension of change in previous coding schemes. However, a difficulty which schemes overcame to different degrees, was in deciding how to define and order levels of explicitness

according to valid theoretical criteria.

A common criterion for explicitness in other schemes, and one also used in the current scheme, is the developmental relation of speech and gestures, the signs used to mediate activity. As discussed, at first, they exist as relatively fused means of indication. With development, speech becomes more abstract and less dependent on immediate context, while gestures remain developmentally more basic forms of signs.

Two other criteria in the current scheme used to organize other-regulations into levels of explicitness were task goals and referents. The study conducted by Saxe, Gearhart, & Guberman (1984) provided a good example of how children first participate in goal-directed activities, then later begin to understand the significance of other activities as means in achieving goals. Thus, the developmental priority of speech and gestures was interpolated by considering their relation to task goals. Referents were also factored into the current coding scheme because their use also indicates developmental changes in how adults convey meanings to children. By continually redefining words adults create a referential context (Wertsch, 1985). Referents are first tied to indicatory functions, then are used to establish the categorization of objects and more generalized meaning (Wertsch & Addison (1985).

The application of these criteria can only be understood in relation to the specific task situation. The cargo truck puzzle from the Wertsch studies (e.g., Wertsch, Hickman, McLane, & Dowley, 1978) was used in the current study, in which children were asked to complete a copy puzzle from a model puzzle with assistance from their mothers. The puzzle consisted of "cargo" pieces that were of different colors, but identically shaped. Children had to complete the copy puzzle so the color scheme matched the model puzzle. This puzzle was particularly well suited because the identically-shaped puzzle pieces controlled for the difficulty level of activity throughout the task. With pieces of different shapes, the extent the task was regulating activity would be confounded with adults' regulations. For the purposes of the current study, the task was tested in a pilot study (Pacifici & Bearison, 1987) and proved to be sufficiently challenging for children two-and-a-half to four years old. Tasks that were either too difficult or not difficult enough, led to a rapid loss of children's attention, or provided no opportunities for other-regulation.

The coding scheme for the cargo truck puzzle grouped other-regulations into nine categories, or levels, each containing speech directives or gestures, or combinations of both. The first criterion for determining explicitness was what aspect of achieving the puzzle goal the regulation

acted on. The puzzle goal was the correct placement of puzzle pieces. Levels of regulation were arranged into four areas of goal-specific activity. The first and most explicit area concerned the physical placement of puzzle pieces. The next most explicit area of activity involved the physical selection of puzzle pieces. The third area referred to activities leading to puzzle piece selection or placement. The fourth area mentioned referents used in establishing certain logical relations or as indirect prompts for activity. Finally, the least explicit category included only the most general prompts, without supplying any task information. The second criterion of explicitness was the use gestures. Gestures, either alone, or accompanying speech indicated more explicit levels of regulation. Thus, if the adult physically placed the puzzle piece for the child, it was coded as more explicit than when the adult only mentioned the correct place for a puzzle piece. Similarly, if gestures accompanied regulations referring to task activities, or accompanied regulations making use of only referents, they were coded as more explicit than when they occurred without gestures. The remaining level of regulation included demonstrations of correct puzzle placements. Although this level of regulation concerned the correct physical placement of a puzzle piece, the activity stopped short of doing it for the child. Therefore, demonstrating correct puzzle piece

placement was coded as one level less explicit than placing the piece for the child. In sum, the levels of explicitness were:

1. Correct puzzle piece placement.
2. Demonstrate correct puzzle piece placement.
3. Refer to correct puzzle piece placement.
4. Correct puzzle piece selection.
5. Other task activities with gestures.
6. Other task activities without gestures.
7. Task referents with gestures.
8. Task referents without gestures.
9. General prompts.

Another form of externalized activity that is an important theoretical link in the chain toward internalization is egocentric speech. According to Glick (1983), "It is only the external form that allows us to see (in egocentric speech) the structural peculiarities of internal speech, that disappears" (p. 46). It might be argued then that the process of internalization could additionally, or more directly, be assessed by analyzing children's use of egocentric speech. This would, of course, depend on the production of egocentric speech in an experimental setting. However, in the pilot study (Pacifici & Bearison, 1987), the occurrence of egocentric speech was rare. According to Berk (1985) the extent young school children use egocentric speech varies tremendously, from 5%

to as much as 20% of their speech. Although task conditions of collaboration and instruction should promote its occurrence, the pilot study did not bear this out. In addition, it appeared extremely difficult to differentiate utterances that could be construed as egocentric from those that were in some way directed to adults simply because they were present. In conclusion, egocentric speech was not used as a criterion for determining the explicitness of activity.

Contingency was measured in two steps. First, Wood's (Wood & Middleton, 1975) contingency rule was applied to the current coding scheme. Regulations were contingent if they were more explicit following children's incorrect activity, or less explicit following children's correct activity. However, previous research has also shown that the range of adjustment in regulation may be just as important a factor as the direction of adjustment (Westerman, 1979). An adult can provide a contingent regulation by changing by one level, a couple of levels, or the full range of levels. Other studies have addressed this by limiting the number of levels regulations could change in determining contingency. In the current study, therefore, regulations were grouped into those that were contingent within a narrow margin (no more than two levels of change), and those that were contingent within a wide margin (more than two levels of change). Narrow contingent regulations were the salient

measure of contingency, whereas wide contingent regulations fluctuated over a greater range and were, in effect, not contingent.

The range, as opposed to the direction, of change in regulations was also measured by the average number of levels regulations changed, whether they were contingent or not. The average amount of change in regulations, or magnitude, was a measure of "sensitivity" in regulations. Mothers who used lower magnitude regulations were therefore adapting better to their children's responses.

The current study investigated the effect of the contingency of interactions on children's learning by comparing children's unassisted performances before and after the interaction trials. Measures of children's improvements in independent functioning have been noticeably absent in other research. In previous studies, children's learning was assessed either as a function of how much regulation they needed during assisted instructional trials (e.g., Campione, Brown, Ferrara, & Bryant, 1984), or of independent functioning after interactions (e.g., Wood & Middleton, 1975). The current study measured within-subject gains in children's independent competence by administering pre- and post-interaction trials. The pre- and post-interaction trial puzzle closely resembled the interaction trial puzzle, allowing assessments of improvements on a uniform set of skills. In addition, a condition of learning

transfer was also introduced. Children were given a matching block design task, pre- and post-interactively, that was more varied than the interaction puzzle, and included graded levels of difficulty. For both near (analogous) and far transfer (related) tasks of independent functioning, children who received more contingent interactions were expected to show greater improvements.

Studies have suggested that experimenters can be trained to employ highly contingent instructional strategies, and that children benefit from such instruction more than from less contingent or non-contingent strategies (Wood, Wood, & Middleton, 1978). In the current study children's independent learning was compared as a function of two interaction conditions: natural mother-child interactions, or idealized interactions--given by an experimenter trained to provide regulations within narrow margins of contingency. Children who were given idealized interactions received continuous regulations within a narrow margin of contingency, and were therefore expected to show greater improvements in learning outcome than children in natural interactions, where the extent of activity given by mothers would be less contingent.

Finally, in order to test for progressions in the contingency of interactions, dyads were given two interaction trials in which they had to complete the cargo truck puzzle. As dyads attempted to establish mutual bases

of understanding, or intersubjectivity, interactions were expected to become more contingent.

Summary Statements of Hypotheses

The current study investigated three basic theoretical aspects of the contingency of adult-child interactions.

The first concerned the association between the contingency of mother-child interactions and pre-to-post-interaction improvements in children's independent functioning. It was hypothesized that positive associations would exist between the use of narrow contingent regulations and children's pre-to-post-interaction improvements, on a similar puzzle task and a task of skills transfer. Another dimension of adults' efforts to adapt to children's task competence was the magnitude of their regulations. The average magnitude of regulations was expected to be negatively associated with children's pre-to-post-interaction improvements--children of mothers who moderated their regulations by fewer levels would benefit more, pre- and post-interactively, than children whose mothers' regulations fluctuated by more levels of change.

Second, comparisons were made of natural and idealized interactions to test for the effect of different interaction conditions on children's pre-to-post-interaction improvements. Children's activities in the idealized interaction condition were regulated according to a

theoretically optimal pattern, whereas children in the natural interaction condition were expected to receive proportionately fewer contingent regulations from mothers. Children in the idealized interaction condition, therefore, were expected to benefit from the regulations they received to a greater extent than children in the natural interaction condition by showing greater pre-to-post-interaction improvements.

The short-term developmental process of skills acquisition, or microgenesis, was also tested by comparing interaction trials. It was hypothesized that the contingency of adults' regulations would be greater in the second trial than in the first trial. Concomitantly, the average magnitude of regulations was expected to decrease from the first trial to the second trial.

Ancillary Analyses

In addition to the above set of hypotheses, several aspects of the relationship between mothers' and children's activities during interactions were explored that were of empirical interest, but not central to the theory. First, the study explored whether children responded correctly more of the time to contingent rather than to non-contingent regulations. It was expected that contingent regulations would promote more correct responses from children than non-contingent regulations during the interaction. In other

words, regulating contingently would have an immediate payoff: correct task activity.

The second question was a variant of the above: When children received contingent regulations, did it lead to more correct or incorrect activity? Again, the expectation was that contingent regulations would lead to more correct than incorrect responses from children.

A third question explored when mothers intervened in their children's activities. The contingency rule did not include as a criterion for contingency whether interventions took place at points of correct or incorrect children's activity. However, during piloted observations it appeared that mothers who regulated contingently tended not to interrupt their children's activities when it was correct. Such patterns are theoretically consistent with the notion of adult diminutions in scaffolding as children become increasingly competent. An indication of children's competence is their ability to perform correctly. Therefore, the expectation was that mothers would intervene more of the time after incorrect children's activities than after correct children's activities.

A final question explored whether children of mothers who provided more contingent interactions were correctly regulating their own activity during interactions than children of mothers who regulated less contingently. The extent children correctly regulated their own activities was

expected to be associated with the contingency of mothers' regulations, and with mothers who provided lower magnitude regulations. Also, children's self-regulations were expected to increase from trial one to trial two, as they acquired task skills.

Chapter 6: Method

Subjects

Twenty-nine children participated in the study and were randomly assigned to one of two interaction groups. Twenty children interacted with their mothers, and 9 interacted with the experimenter (the author) who was trained to provide idealized regulations that assisted children in completing a puzzle task. Children ranged in age from 2.6 to 3.5 years, with a mean of 3.0 years for the mother-child interaction group, and 3.1 years for the idealized interaction group. There were 18 males and 11 females; the mother-child interaction group was comprised of 12 males and 8 females, and the idealized interaction group had 6 males and 3 females. Fourteen of the subjects in the mother-child interaction group were white, and 6 were black or hispanic. All 9 subjects in the idealized interaction group were white.

Subjects were recruited on a voluntary basis from nine middle-income day care centers on the Upper West Side in New York City. As shown in Appendix A, consent letters asked mothers and their children to participate in a study of how children learn while playing in an activity that involved instructional assistance from the mother or the experimenter. They were informed that the experimental session would be videotaped.

Materials

The interaction problem-solving task shown in Figure 1, adopted from Wertsch, McNamee, McLane, and Budwig (1980), involved a child completing a puzzle of identically shaped, but differently colored square "cargo" pieces of a truck puzzle in accordance with a model puzzle of the same truck with the identical color scheme.

Six additional cargo pieces (the square pieces) of randomly chosen colors (purple, white, orange, green, red, and blue) were taken from a third puzzle and served as extra pieces. The material of the puzzle was a flexible crepe foam rubber. The face of the pieces had a textured surface, while the underside was untextured. The square cargo pieces were of identical dimensions and were therefore interchangeable in their placement. In the copy puzzle, pieces other than the square cargo pieces were glued in place to preclude activity with differently shaped puzzle pieces. All pieces on the model puzzle were glued in place to keep children's activities confined to the copy puzzle. All the cargo pieces had small knobs in the center to facilitate their handling by children.

The pre- and post-interaction puzzle task shown in Figure 2 was analogous to the truck puzzle in that it contained identically shaped, but differently colored pieces, and required children to arrange the pieces to match

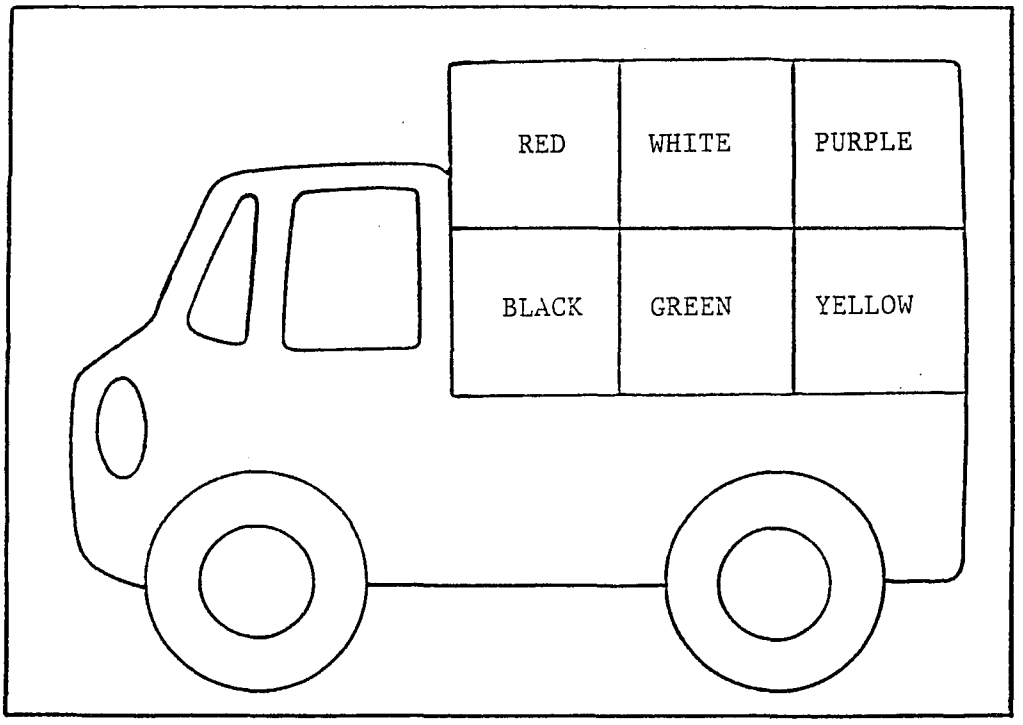

Figure 1. Interaction Task: Cargo Truck Puzzle.[a]

[a]Manufactured by Lauri, Inc., Truck: #2150.

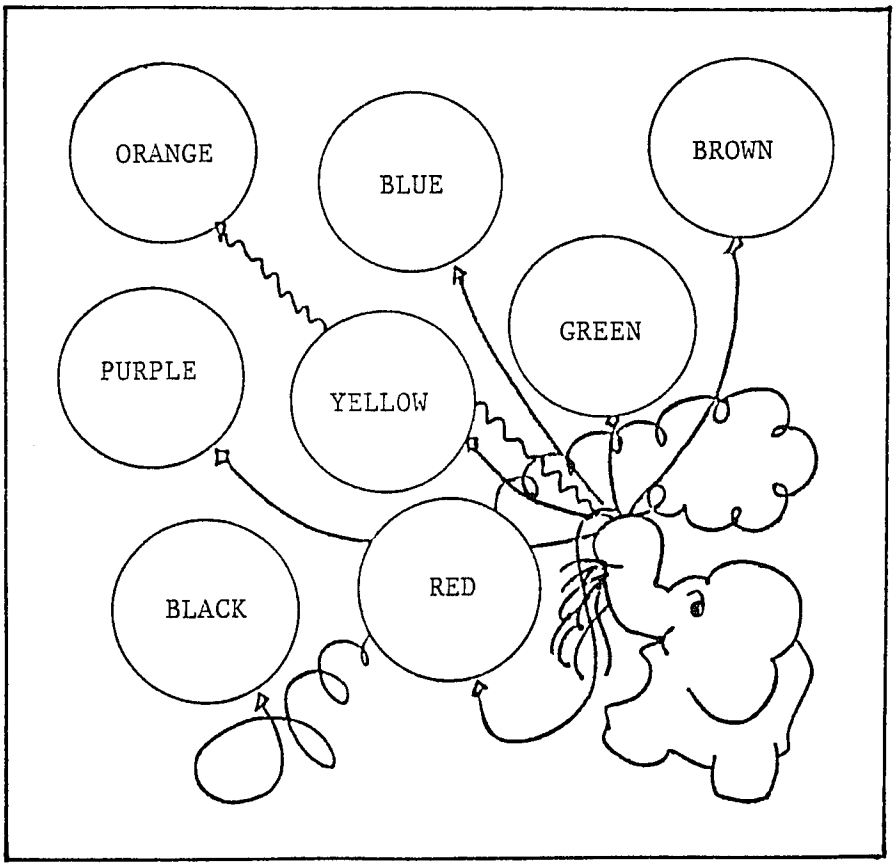

Figure 2. Pre- and Post-interaction Puzzle Task: Balloon Puzzle.[a]

[a]Manufactured by The Puzzle People, #1975-116.

the color arrangement of a model puzzle. The puzzle was of an elephant holding eight differently colored round balloons (orange, blue, brown, purple, yellow, green, black, and red). The puzzle was made of wood, and also had grips placed in the center of each piece to facilitate handling. The balloon pieces were the only removable pieces in the copy puzzle. All pieces were glued in place in the model puzzle. Six additional balloon pieces of random colors (red, green, blue, black, yellow, and purple) were taken from a third puzzle and served as extra pieces.

The block design subtest of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) (Wechsler, 1967) was adapted as a measure of task transfer. The block design task tests children's perceptual-motor skills (from 3.10 years) by presenting them with a series of models made up of flat blocks. Figure 3 shows the block patterns presented to children in their order of presentation. Children were asked to copy the exact pattern shown on a model from an unarranged group of blocks. Since the present study included children younger than 3.10 years the range of difficulty of the patterns was downgraded by omitting the three most difficult designs.

Procedure

The data collection took place in three phases at daycare centers where the children were currently attending. Each location provided a suitable testing environment, with

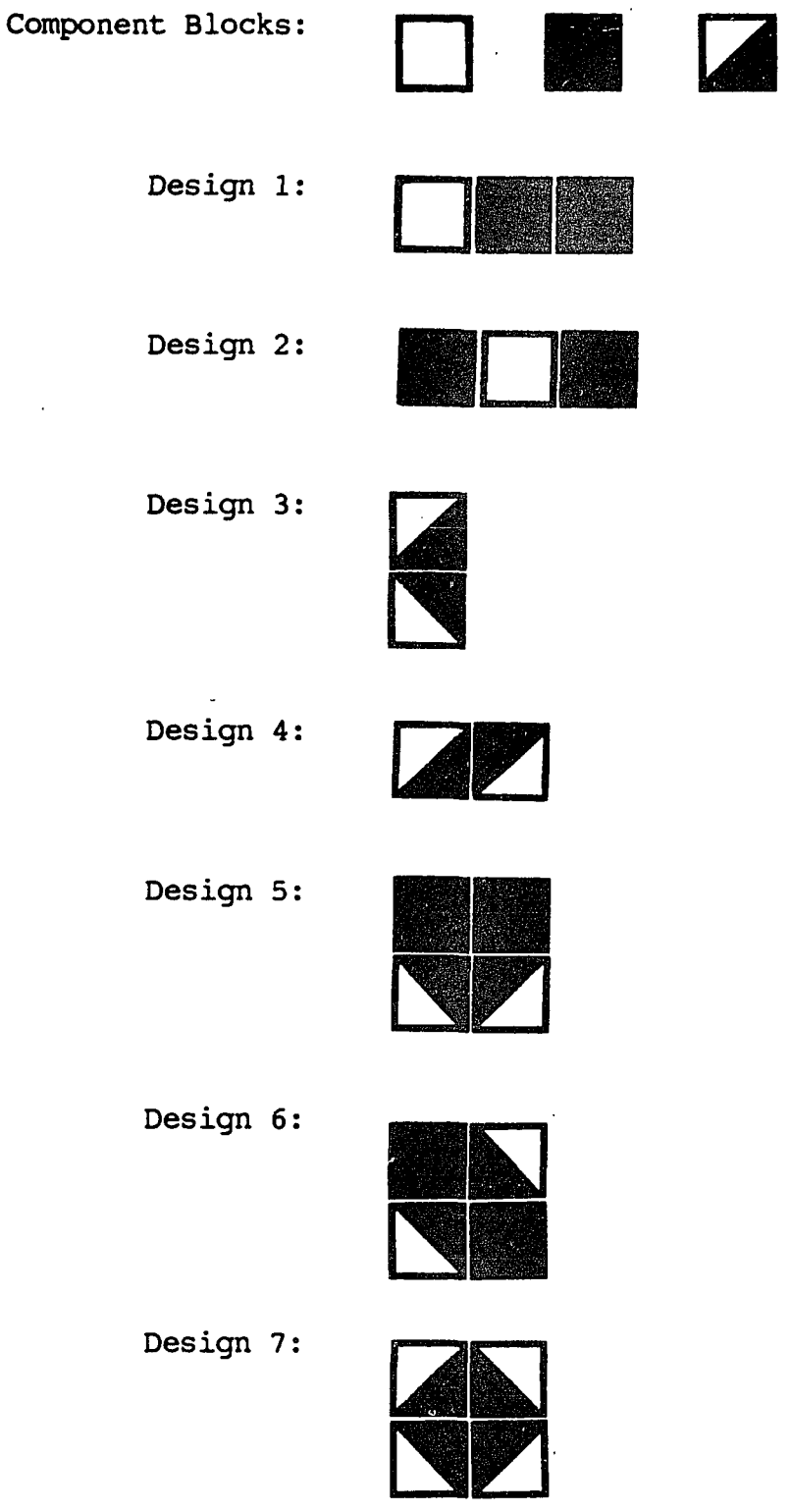

Figure 3. Pre- and Post-interaction Transfer Task.

a child's desk and chairs in a room which was free from distractions during experimental sessions. During the first session, children were given the WPPSI and then the balloon puzzle. During the second session children were videotaped completing two trials of the cargo truck puzzle; children in the mother-child interaction group interacted with their mothers, and children in the idealized interaction group interacted with the experimenter. During the third session children were asked to complete the balloon puzzle given at the first session, and were also readministered the WPPSI transfer task. Sessions for each subject took place within 10 days of the previous session. The mean number of days between pre-interaction and interaction sessions for the natural and idealized interaction groups was 7.6 and 4.8, respectively; and between interaction and post-interaction sessions, 6.2 and 4.1, respectively.

Pre- and Post-interaction Transfer Task.

Children were given a task adapted from the WPPSI block design subtest to complete, without assistance, before and after the interaction trials. Materials included six flat blocks painted red on one side and white on the other, and eight flat blocks painted red on one side and one-half red and one-half white on the other side.

The administration of the block design subtest followed the standardized instructions provided in the WPPSI test manual (Wechsler, 1967). The experimenter was seated facing

children, and presented prearranged models of designs, as shown in Figure 3, beginning with Design 1. The set of blocks used in each pattern only included blocks that were needed to construct the model and copy of that particular design. The blocks used for the copy design were placed to one side of the model. The experimenter demonstrated how to correctly make a copy of the model design (initial demonstrations were not given for Designs 2, 6, and 7). The instructions were as follows:

To the child: Look, see what a nice puzzle I have! (pointed to model). Look here now (pointed to unarranged blocks). You see these blocks, they are painted red and white (showed colors on both sides of one block). I'm going to put them together to make them look like my puzzle (pointed to model). Watch me (slowly copied the model directly underneath the model, explaining each step). Look, now this puzzle (pointed to copy) is just like this one (pointed to model). (After a brief pause, the blocks from the copy were unscrambled and returned to their original unarranged grouping.) Now you make me one just like this, just like I did (pointed to model).

Children were given 30-60 seconds to complete the design, depending on the difficulty of the design (30 seconds for Designs 1 through 4; 45 seconds for Designs 5 and 6, and 60 seconds for Design 7). If children did not complete the design within the time limit or arranged the

blocks incorrectly, they were shown again how to make the copy puzzle from the unarranged pieces. The pieces were then rescrambled and children were told to do it again on their own. The second trial ended when children correctly completed the design, or after the time limit for the activity elapsed.

Following the scoring technique specified in the WPPSI test manual (Wechsler, 1967), each design was given a score of 2 if completed correctly on the first trial, a score of 1 if completed correctly on the second trial, or a score of 0 if completed incorrectly on both trials, yielding a maximum score of 14 across all seven designs.

Pre- and Post-interaction Puzzle Task.

Children were asked to complete, without assistance, the balloon puzzle shown in Figure 2, before and after the interaction trials.

Two identical balloon puzzles were placed side by side on a child's school desk. Children were seated facing the puzzles. The puzzle on the children's left served as the model puzzle, the puzzle on the children's right served as the copy puzzle.

Children were escorted to the room and told the following set of instructions:

I'd like to play a game with you. Let's see if you can tell me who this is (pointing to the elephant in the copy puzzle, CP). (Children typically answered that it was an

elephant. If they were unsure, the experimenter told them it was an elephant). Let's give the elephant a name. What shall we call the elephant? (Children typically gave a name. If they were unsure, the name "Dumbo" was used.) What is Dumbo (or name used by child) doing today (pointing to balloons in CP)? (Children typically answered that the elephant was carrying balloons. If they were unsure they were told the elephant was carrying balloons.)

Look here now (pointed to the model puzzle, MP). My puzzle has an elephant too. And my elephant is carrying balloons too. My puzzle (pointed to the MP) is just the same as your puzzle (pointed to the CP). All the balloons are the same, and all the colors are in the same places in your puzzle and in my puzzle (pointed to the corresponding colors of each balloon in the CP and MP, and named each color).

Let's take the balloons away from your puzzle. Can you take the balloon pieces and put them here (pointed to bottom edge of CP)? Here are some extra balloons; let's put them with the other balloons (handed children six extra pieces). You know what? Dumbo said he wants his balloons back. Can you give him his balloons back? But Dumbo wants his balloons to look just like my Dumbo's balloons, with all the colors in the same places (pointed to balloon pieces in MP). Let me see how you make your puzzle look just like my puzzle (pointed to MP, then CP).

Children's activity was timed from the end of the

instructions until they stopped task activity, or indicated that they were finished. The number of correct final placements of puzzle pieces (out of a possible eight), as well as the elapsed time in seconds, was recorded.

Mother-Child Interactions.

Mothers and children were videotaped while they completed two trials of the cargo truck puzzle.

Two identical cargo truck puzzles were placed on a child's school desk, each one directly in front of a chair. Both seats were on the same side of the desk so that the mother and child faced the camera. Mothers sat on the children's right. The puzzle in front of the mother was the model puzzle, and the puzzle in front of the child was the copy puzzle. The camera was mounted on a tripod about 10 feet away from the subjects and visible to them. During videotaping in a pilot study children did not comment about the camera, and fixed visual contact with the camera was rare.

Dyads were escorted to the room and given the following set of instructions:

To the child: I'd like to show you a game. Look at this puzzle (pointed to the CP). Can you tell me what's in this puzzle? (Children typically answered car or truck, but were told it was a truck if they were unsure.) And what is this truck carrying today (pointed to cargo pieces in CP)? (Children typically said boxes, but were told boxes if they

were unsure.) Now let's look at this puzzle (pointed to the MP). This is a puzzle of a truck, and it's carrying boxes too (pointed to cargo pieces in MP). And you know what? This puzzle (pointed to the CP) is just the same as that puzzle (pointed to the MP). All the colors (pointed to the CP) are just the same as that puzzle (pointed to the MP). Let's take the square pieces out of your puzzle and put them underneath your truck (pointed to area underneath the CP). Let me see how you do that. (Children typically removed the pieces and lined them up underneath the CP, but if they seemed unsure they were assisted in removing the pieces.) I'm going to leave the rest of the pieces in for now. I just want you to play with the square pieces. Now here are some extra square pieces, all different colors. Let's put them with the other pieces (handed the child the extra square pieces). I'm going to mix them up with the other square pieces (intermingled the square pieces). Here's what I want you to do. I want you to make this puzzle (pointed to the CP) look just like this one (pointed to the MP), just like it was before, with all the boxes in the same places, and all the colors in the same places. Let me see how you do that. Make this puzzle (pointed to the CP) look just like this one (pointed to the MP).

To the mother: (Mother's name), help (child's name) the way you normally would--whenever you think he (she) needs the help, or when he (she) asks for it.

Once the interaction began, the experimenter stepped away from the desk, and stayed out of the immediate view of the dyad until the puzzle was completed. At that point the experimenter returned and gave the following further instructions:

To the child: That was terrific! You did that so well. Let's take these pieces out again and see if you can do that again. (Children removed the cargo pieces and placed them underneath the CP.) I'm going to mix the pieces up again (intermingled the cargo pieces with the extra cargo pieces). Let me see if you can make this puzzle (pointed to the CP) look just like that one (pointed to the MP) again, with all the colors in the same places.

To the mother: Again, help (child's name) the way you normally would--whenever you think he (she) needs the help, or when he (she) asks for it.

The experimenter left the area again until the dyad completed the puzzle once again.

Idealized Experimenter-child Interactions.

Interactions between children and the experimenter were considered idealized if 90 percent of the regulations children received were contingent within narrow margins of contingency--i.e., adjustments in regulations changed by no more than two levels.

The interactive sessions with the experimenter proceeded essentially the same as with the mother-child

interactions. Since interacting with the mother was considered a familiar situation, children did not appear inhibited about asking for help during a pilot study. Children interacting with the experimenter were told they could ask for help if they wanted to, as a way of making the conditions more equivalent in this one respect.

The experimenter was seated to the children's right and provided regulations. The experimenter interacted with children in an idealized way by meeting two criteria at least 90% of the time: 1) following the contingency rule and 2)changing the explicitness of regulations by two levels or less from one intervention to the next. The complete set of criteria for scoring the contingency and magnitude of regulations are discussed in the following section and in Appendix C.

Scoring Interactions

Videotapes of the interactions were transcribed and scored for: the level of explicitness of regulations, whether the regulations were contingent or non-contingent, by how many levels a regulation changed from a previous regulation, whether children's activities were responses to other-regulations or self-regulations, and whether responses or self-regulations were correct or incorrect.

Levels of Regulations.

Mothers', or the experimenter's, activities were hierarchically categorized into nine levels of regulation,

ranging from explicit to implicit. Each level defined criteria for coding the explicitness of a regulation as it applied to the cargo truck puzzle. Examples of activities included in each level of regulation are given in Appendix B.

For the following definitions,

1) puzzle activities refer to:
   - picking up a puzzle piece
   - placing a puzzle piece in the copy puzzle
   - picking up an incorrectly placed puzzle piece
2) puzzle referents refer to:
   - a puzzle piece
   - a puzzle segment
   - the copy or model puzzle

Level 1: Correct Placement

The adult correctly placed a puzzle piece, with or without verbalization.

Level 2: Demonstrating Piece Placement

The adult demonstrated, by doing and undoing, the correct placement of a puzzle piece, with or without verbalization.

Level 3: Referring to Correct Placement

The adult provided statements and/or gestures specifying a puzzle piece and its appropriate placement on the copy puzzle.

Level 4: Puzzle Piece Selection

The adult selected a puzzle piece, or picked up an incorrectly placed puzzle piece, with or without verbalizations.

Level 5: Task Activity (Language and Gesture)

The adult provided statements specifying a puzzle activity for the child to follow (except the correct placement of a puzzle piece), which were accompanied by pointing or motioning to a puzzle referent.

Level 6: Task Activity (Language Only)

The adult provided statements specifying a task-related activity for the child to follow (except the correct placement of a puzzle piece), which were not accompanied by pointing or motioning to a puzzle referent.

Level 7: Task Referents (Language and Gesture)

The adult provided statements specifying only puzzle referents, and not an activity and a referent, which were accompanied by pointing or motioning to a puzzle referent.

Level 8: Task Referents (Language Only)

The adult provided statements specifying only puzzle referents, and not an activity and a referent, which were not accompanied by pointing or motioning to a puzzle referent.

Level 9: Orienting and Feedback

The adult provided general orienting statements which did not specify an activity or a referent; or provided feedback on whether an activity was correct or incorrect.

Contingency of Regulations.

The contingency of regulations were determined in two steps. First, as in the Wood coding scheme (Wood, Wood & Middleton, 1975b), sequences of interaction activities were used to determine whether or not the contingency rule was followed. If the adult provided a regulation that was followed by a correct response from the child and the next regulation was less explicit, then the regulation was scored contingent. Or, if the adult provided a regulation that was responded to incorrectly by the child and the next regulation was more explicit, it was also scored contingent. All regulations that did not follow the contingency rule were scored non-contingent. When adults provided a series of uninterrupted regulations, only the most explicit regulations in the series were scored in computing contingency measures. When adults provided regulations at the same level as a previous one, they were scored contingent if children's previous responses or self-regulations were incorrect.

Regulations were then divided into narrow and wide categories, based on the magnitude of regulations. The magnitude of regulations was the changes in levels of

regulations--either contingently or non-contingently--from a previous regulation. Thus, narrow regulations were regulations with magnitudes of two or less, and wide regulations were regulations with magnitudes of more than two. A detailed description of the scoring criteria and examples of scoring the contingency and magnitude of regulations are provided in Appendix C.

Child Responses and Self-regulations.

Children's activities were scored as either responses to regulations or self-regulations, and whether they were correct or incorrect. Children's activities that immediately followed an adult's regulation were scored responses to regulations, and were scored correct if they were correct in relation to the adult's regulation just given. Children's activities after their first response to a regulation but before the adult's next regulation were scored self-regulations, and were scored correct if they contributed toward the correct placement of a puzzle piece. A detailed description of the scoring criteria and examples of responses to regulations and self-regulations, are provided in Appendix C.

Scoring Reliabilities.

Transcriptions of interactions from 5 dyads in the mother-child interaction group (20% of the sample) and 3 dyads from the experimenter-child interaction group (33% of the sample) were randomly chosen and coded by a second

observer. Inter-observer agreement was based on the two categories of coded interaction activity that all measures were derived from: level of regulations, and whether children's responses or self-regulations were correct or incorrect. For the mother-child interaction group, 559 acts were coded (29.5% of group total), and for the experimenter-child interaction group, 280 acts were coded (42.9% of group total). Across both groups, inter-observer agreement for acts coded for level of regulation was 96.6%, and 97.1% for acts coded for correctness of responses or self-regulations. Appendix D provides a complete summary of inter-observer agreement statistics by group.

Measures

The following measures were derived from: scoring the contingency of regulations, whether children's responses and self-regulations were correct or incorrect, and from children's performances without assistance on pre- and post-interaction tasks. Measures that applied to interactions were computed as proportion scores since the length of interactions varied considerably.

Contingency of Regulations Scores.

1. Proportion of Contingent Regulations. The number of contingent regulations divided by the number of contingent and non-contingent regulations.

2. Proportion of Narrow Contingent Regulations. The number of narrow contingent regulations divided by the

number of contingent and non-contingent regulations.

3. Proportion of Wide Contingent Regulations. The number of wide contingent regulations divided by the number of contingent and non-contingent regulations.

4. Proportion of Non-contingent Regulations. The number of non-contingent regulations divided by the number of contingent and non-contingent regulations.

Magnitude of Regulations Score.

The summed magnitude of contingent and non-contingent regulations divided by the number of contingent and non-contingent regulations.

Puzzle and Transfer Task Gain Scores.

1. Puzzle Gain Score. The number of correct puzzle piece placements during the post-interaction puzzle minus the number of correct puzzle piece placements during the pre-interaction puzzle.

2. Transfer Task Gain Score. The summed score for correct trials during the post-interaction transfer task minus the summed scored for correct trials during the pre-interaction transfer task.

Timed Puzzle Gain Score.

Puzzle task scores were also divided by the number of seconds taken to complete the puzzle. The timed pre-interaction puzzle score was then subtracted from the timed post-interaction puzzle score.

Measures Used in Ancillary Analyses

These analyses included a measure of children's self-regulation and a series of measures that were derived by extending the unit of activity for scoring contingency scores.

Children's activities during interactions were divided into responses to adults' regulations or self-regulations, according to the following rule: Children's activities immediately following mothers' regulations were coded as responses. Children's activities that followed responses, but came before a next adults' regulation, were coded as self-regulations. The following score was derived:

The Proportion of Correct Self-regulations Score.

The number of correct self-regulations divided by the number of correct and incorrect self-regulations.

Measures extended the unit of analysis for determining the contingency of regulations in two ways. In order to determine the contingency of regulations, the following sequence of activity was needed,

mother's regulation -> child's response -> mother's regulation

The first set of measures below extended the sequence of activities to,

mother's regulation -> child's response -> mother's regulation **-> child's response.**

The following scores were derived:

1. The Proportion of Contingent Regulations Succeeded

by Correct Responses. The number of contingent regulations succeeded by correct responses divided by the number of contingent and non-contingent regulations succeeded by correct and incorrect responses.

2. The Proportion of Narrow Contingent Regulations Succeeded by Correct Responses. The number of narrow contingent regulations succeeded by correct responses divided by the number of narrow contingent and non-contingent regulations succeeded by correct and incorrect responses.

3. The Proportion of Non-contingent Regulations Succeeded by Correct Responses. The number of non-contingent regulations succeeded by correct responses divided by the number of contingent and non-contingent regulations succeeded by correct and incorrect responses.

4. The Proportion of Narrow Non-contingent Regulations Succeeded by Correct Responses. The number of narrow non-contingent regulations succeeded by correct responses divided by the number of narrow contingent and non-contingent regulations succeeded by correct and incorrect responses.

5. The Proportion of Contingent Regulations Succeeded by Incorrect Responses. The number of contingent regulations succeeded by incorrect responses divided by the number of contingent and non-contingent regulations succeeded by correct and incorrect responses.

6. The Proportion of Narrow Contingent Regulations Succeeded by Incorrect Responses. The number of narrow contingent regulations succeeded by incorrect responses divided by the number of narrow contingent and non-contingent regulations succeeded by correct and incorrect responses.

The next set of measures below extended the previous unit for determining contingency to,

child's response -> mother's regulation -> child's response -> mother's regulation.

The following measures were derived:

1. The Proportion of Contingent Regulations Preceded by Correct Responses or Self-regulations. The number of contingent regulations preceded by correct responses or self-regulations divided by the number of contingent and non-contingent regulations preceded by correct and incorrect responses or self-regulations.

2. The Proportion of Narrow Contingent Regulations Preceded by Correct Responses or Self-regulations. The number of narrow contingent regulations preceded by correct child responses or self-regulations divided by the number of narrow contingent and non-contingent regulations preceded by correct and incorrect responses or self-regulations.

3. The Proportion of Contingent Regulations Preceded by Incorrect Responses or Self-regulations. The number of contingent regulations preceded by incorrect responses or

self-regulations divided by the number of contingent and non-contingent regulations preceded by correct and incorrect responses or self-regulations.

4. The Proportion of Narrow Contingent Regulations Preceded by Incorrect Responses or Self-regulations. The number of narrow contingent regulations preceded by incorrect responses or self-regulations divided by the number of contingent and non-contingent regulations preceded by correct and incorrect responses or self-regulations.

Measures employed in ancillary analyses may not have clearly distinguished between mothers' and children's activities. Because mothers continually intervened by regulating children's activities, the dyad's activities were intrinsically confounded. Measures of children's activities during interactions might have been a function of their own efforts, their mothers' regulations, or some combination of both. Thus, measures used in the ancillary analyses reflect composite, or dyadic, aspects of the interaction, rather than independent functioning.

Chapter 7: Results

Following a summary of the data, the results relevant to each of the hypotheses will be organized in three sections. In the first section, significant associations between narrow contingent regulation scores, as well as the magnitude of regulations scores, with learning outcome scores--puzzle task gain scores, timed puzzle task gain scores, and transfer task gain scores--will be reported. Associations were tested using Pearson correlations. This section also will report significant differences between narrow contingent scores, wide contingent scores, and non-contingent scores in predicting outcome scores based on stepwise regression analyses. In the second section, the effects of interaction condition--idealized versus natural--on learning outcome scores will be reported using independent t-tests. Finally, the effect of trial--Trial 1 versus Trial 2--on narrow contingent regulation scores and magnitude of regulation scores will be reported based on paired-sample t-tests. Following these sections, results of ancillary analyses will be reported.

Two subjects, in addition to the 29 reported in the method section, were dropped from the study after the first session because the tasks were too difficult. Also, five experimenter-child interactions in the idealized interaction condition, in addition to the nine reported in the method

section, did not reach criterion level (90% narrow contingent regulations). Therefore, data from those subjects were not included in the study. Two children in the natural interaction group did not finish correctly placing all puzzle pieces, and did not further respond to their mothers' regulations. However, since at least four of the six pieces were correctly placed, and the interactions were comparable to others in length, the data were kept.

As shown in Table 1, mothers used a significantly greater amount of regulations per trial than the experimenter, $t(56) = 2.46$, $p < .05$ ($M = 15.90$ and $M = 9.89$, respectively). The mean number of regulations decreased from Trial 1 to Trial 2, by .70 for the natural interaction group and by 1.56 for the idealized interaction group. Table 2 reports that children in the natural interaction group used an average of 31.55 responses or self-regulations to complete a trial, while children in the idealized interaction group used an average of 26.39 responses or self-regulations per trial. The mean number of responses and self-regulations increased from Trial 1 to Trial 2 by 1.80 for the natural interaction group, and decreased from Trial 1 to Trial 2 by 7.44 for the idealized interaction group.

The overall frequency of levels of regulations was similar for each interaction condition and within each

Table 1

Means and Standard Deviations of Frequencies of Adult Regulations by Trial and Condition

		Adult Regulations					
		Trial 1		Trial 2		Across Trials	
Condition	n	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)
Natural	20	16.25	(9.95)	15.55	(9.38)	15.90	(9.55)
Idealized	9	10.67	(4.74)	9.11	(7.00)	9.89	(5.83)
Across Conditions		14.52	(8.97)	13.55	(9.10)		

Table 2

Means and Standard Deviations of Frequencies of Children's Responses or Self-regulations by Trial and Condition

		Children's Responses or Self-regulations					
		Trial 1		Trial 2		Across Trials	
Condition	n	M	(SD)	M	(SD)	M	(SD)
Natural	20	30.65	(13.22)	32.45	(12.40)	31.55	(12.68)
Idealized	9	30.11	(11.19)	22.67	(7.78)	26.39	(10.10)
Across Conditions		30.48	(12.43)	29.41	(11.95)		

trial. Figure 4 illustrates that, in general, regulations tended to increase in frequency as they became more implicit, until level 7, then decreased through level 9. Interlocutors in either interaction condition did not use level 2 regulations (demonstrating piece placement).

The percentage of narrow contingent regulations across both trials ranged from 92% to 100% for dyads in the idealized condition (M = 95%), and from 38% to 85% for dyads in the natural interaction condition (M = 59%). There was a significantly greater proportion of narrow contingent regulations in the idealized interaction condition than in the natural interaction condition $t(27) = 8.99$, $p < .001$.

Table 3 reports the length of time, in seconds, children took to complete the pre- and post-interaction puzzle task. Children in both the natural and idealized interaction groups spent more time on the task after the interaction (M = 6.85 more seconds versus M = 17.67 more seconds, respectively).

Arc sine transformations were used to normalize the distribution of proportion scores before conducting the statistical analyses below (Neter & Wasserman, 1974).

1. Correlations between Contingency of Interaction Scores and Learning Outcome Scores.

Hypothesis 1. As predicted, narrow contingent regulation scores were significantly correlated with puzzle gain scores $r = .53$, $p < .01$, and timed puzzle gain scores,

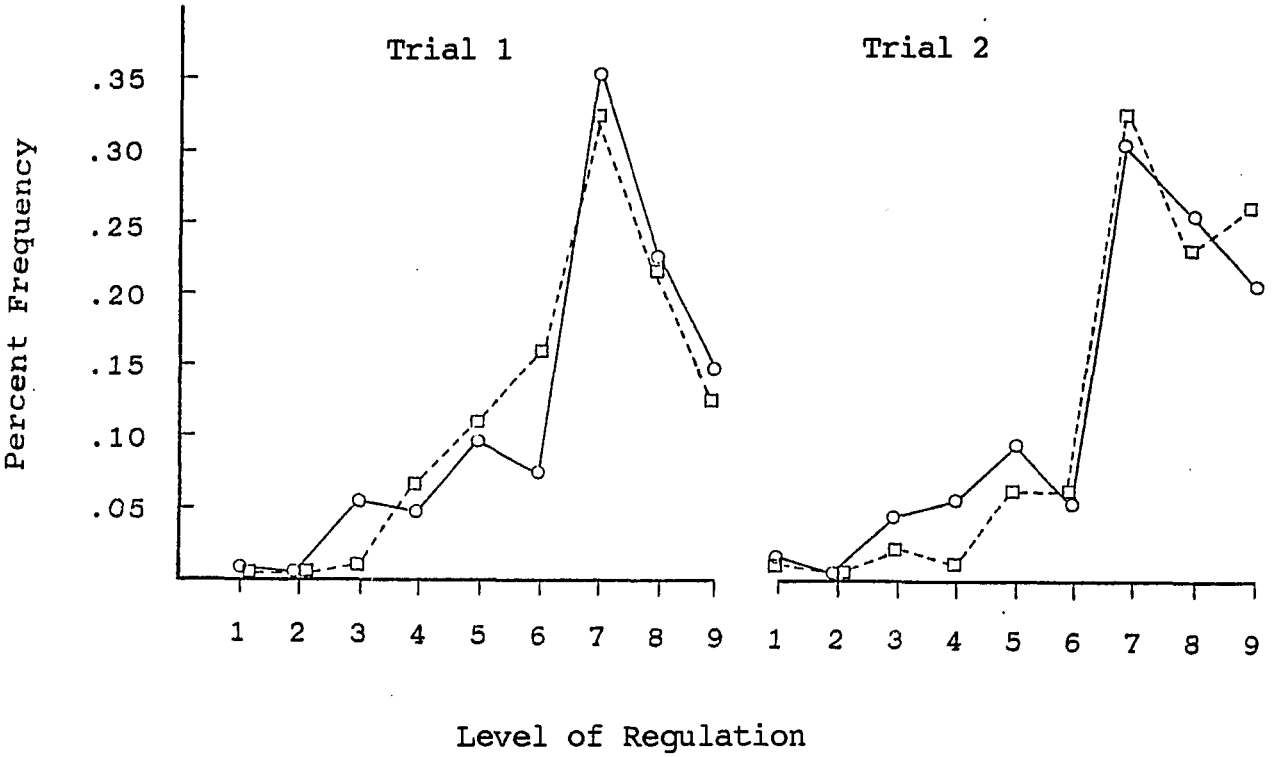

Figure 4. Percent Frequency of Levels of Regulation, by Condition and Trial.

Table 3

Means and Standard Deviations for Length of Time (in seconds) Taken to Complete the Pre- and Post-interaction Puzzle Task

		Time (in seconds)				
		Pre-interaction		Post-interaction		Pre/Post-interaction Difference
Condition	n	M	(SD)	M	(SD)	M
Natural	20	53.00	(46.84)	59.85	(35.16)	- 6.85
Idealized	9	51.44	(32.23)	69.11	(29.19)	-17.67

$r = .38$, $p < .05$.

Hypothesis 2. Analyses were conducted to determine whether narrow contingent regulation scores were significantly better predictors of gain scores than wide contingent regulation scores and/or non-contingent regulation scores. Predictor variables were entered into a regression analysis based on a hierarchical step-wise procedure. Missing values for wide contingent regulations scores were substituted with the variable mean. As expected, narrow contingent regulation scores significantly predicted puzzle gain scores, $F(1,18) = 6.93$, $p < .02$, $R^2 = .28$. Neither wide contingent regulation scores nor non-contingent regulation scores significantly accounted for additional variance in predicting puzzle gain scores. In addition, narrow contingent, wide contingent, and non-contingent regulation scores did not significantly predict either timed puzzle gain scores or transfer task gain scores.

Hypothesis 3. Mean magnitude scores were significantly negatively correlated with puzzle gain scores, $r = -.59$, $p < .01$, and timed puzzle gain scores, $r = -.50$, $p < .01$. This was in the expected direction, since magnitudes with smaller values were an index of narrower contingent regulations.

2. Differences in Learning Outcome Scores by Interaction Condition (Natural versus Idealized).

Hypothesis 4. As reported in Tables 4, 5, and 6 puzzle gain scores were significantly greater for children in the idealized interaction group than in the natural interaction group $t(27) = 2.60$, $p < .05$; however, timed puzzle gain scores and transfer task gain scores were not significantly different when comparing natural and idealized interaction groups.

There were no a priori reasons to test for differences in gain scores as a function of either gender or race. However, an independent t-test showed a significant difference between males and females in puzzle gain scores, $t(27) = 2.19$, $p < .05$ (males: $M = 1.5$, $(SD) = 2.3$; females: $M = 3.27$, $(SD) = 1.74$). Further analyses showed that there were no significant differences in narrow contingent regulation scores or magnitude of regulation scores.

3. Differences in Contingency of Interaction Scores by Trial.

Hypothesis 5. There were no differences from Trial 1 to Trial 2 in narrow contingent regulation scores, or mean magnitude scores.

Ancillary Analyses

The first three sets of ancillary analyses explored additional aspects of the natural interaction condition. Independent t-tests were conducted to test for differences between: 1) contingent regulations succeeded by correct

Table 4

Means and Standard Deviations for Puzzle Task Scores

		Puzzle Task Scores					
		Pre-interaction		Post-interaction		Gain	
Condition	n	M	(SD)	M	(SD)	M	(SD)
Natural	20	2.30	(1.26)	3.95	(2.16)	1.65	(2.48)
Idealized	9	2.67	(1.50)	6.00	(2.12)	3.33	(1.00)

Table 5

Means and Standard Deviations for Timed Puzzle Task Scores

		Timed Puzzle Task Scores		
		Pre-interaction	Post-interaction	Gain
Condition	n	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Natural	20	.07 (.06)	.07 (.04)	.01 (.07)
Idealized	9	.07 (.05)	.10 (.05)	.03 (.04)

Note. Timed Puzzle scores were computed by dividing the number of correct puzzle placements by the number of seconds taken to complete the puzzle.

Table 6

Means and Standard Deviations for Transfer Task Scores

		Transfer Task Scores					
		Pre-interaction		Post-interaction		Gain	
Condition	n	M	(SD)	M	(SD)	M	(SD)
Natural	20	5.35	(1.98)	6.85	(2.46)	1.50	(2.19)
Idealized	9	7.11	(2.15)	9.11	(2.89)	2.00	(1.22)

responses versus non-contingent regulations succeeded by correct responses, 2) contingent regulations succeeded by correct responses versus contingent regulations succeeded by incorrect responses, and 3) contingent regulations preceded by correct responses or self-regulations versus contingent regulations preceded by incorrect responses or self-regulations.

1. Scores for contingent regulations succeeded by correct responses were significantly greater than scores for non-contingent regulations succeeded by correct responses, $t(18) = 5.64$, $p < .001$ ($M = .45$, $SD = .14$ vs. $M = .21$, $SD = .09$, respectively). Also, scores for narrow contingent regulations succeeded by correct responses were significantly greater than scores for narrow non-contingent regulations succeeded by correct responses, $t(18) = 8.85$, $p < .001$ ($M = .51$, $SD = .13$ vs. $M = .18$, $SD = .09$, respectively).

2. Scores for contingent regulations succeeded by correct responses were significantly greater than scores for contingent regulations succeeded by incorrect responses, $t(19) = 4.96$, $p < .001$ ($M = .46$, $SD = .14$ vs. $M = .23$, $SD = .10$, respectively). Also, scores for narrow contingent regulations succeeded by correct responses were significantly greater than scores for narrow contingent regulations succeeded by incorrect responses, $t(19) = 5.60$, $p < .001$ ($M = .52$, $SD = .13$ vs. $M = .24$, $SD = .12$,

respectively).

3. Scores for contingent regulations preceded by incorrect responses or self-regulations were significantly greater than scores for contingent regulations preceded by correct responses or self-regulations, $t(20) = 4.86$, $p < .001$. Also, scores for narrow contingent regulations preceded by incorrect responses or self-regulations were significantly greater than narrow contingent regulations preceded by correct responses or self-regulations, $t(20) = 5.66$, $p < .001$.

The next analyses tested for correlations of self-regulation scores with narrow contingent scores, and with mean magnitude scores.

1. Narrow contingent regulation scores were significantly associated with correct self-regulation scores, $r = .59$, $p < .01$, ($M = .62$, $SD = .15$, before arc sine transformation).

2. Mean magnitude scores were significantly negatively associated with correct self-regulation scores, $r = -.62$, $p < .01$.

Chapter 8: Discussion

Theoretical Context and Presentation of Findings

The purpose of the present study was to investigate the effects of adult-child instructional interactions on children's independent cognitive functioning, consistent with a Vygotskyian perspective. A basic tenet of Vygotsky's theory was that knowledge is intrinsically social, and therefore its genesis must be examined and understood in the context of social forms of activity. Interactions, such as those between adults and children in the present study, represented social microcosms in which knowledge was constructed through a collaboration and coordination of activity.

A theoretically important characteristic of the interactions was the asymmetry in participant roles. Because the task difficulty was set to exceed children's current competencies, it required adults, as task experts, to regulate task activity, while children, as task novices, subordinated their activities to adult regulations. The regulation of activity created, in a social context, a cognitive structure for accomplishing the task, which, according to the theory, becomes the basis for children's independent activities. Thus, children's activity that was at first external and bound to the immediacy of context, becomes internalized, decontextualized, and, therefore, can

be self-regulated.

During interactions, adults provided regulations by mediating activity through the use of culturally defined sign systems, including gesture and speech, that related to the goals and objects of the task. A coding scheme organizing regulations into levels of explicitness was developed that was theoretically based, and followed a logical task analysis. However, the interaction, as an essentially social system, did not only consist of adults' regulations. Instead, interactions involved ongoing interrelationships between children's abilities to understand adults' regulations, as well as adults' attempts to adjust their regulations to those abilities.

The zone of proximal development (ZPD), a construct introduced by Vygotsky, was used in the present study as a framework for capturing the interrelationship of adults' and children's activities during interactions. The ZPD comprised a range of development representing, at the lower boundary, children's current independent knowledge, and at the upper boundary, children's potential knowledge, as evidenced by their cooperative efforts with adults during interactions. Activity within the ZPD reflected knowledge which was in the process of being transformed from the interpsychological to the intrapsychological plane of functioning.

How adults and children interacted, therefore, was

critical in determining development. The effectiveness of adults' regulations depended on being able to identify, and regulate activity at, the upper boundary of children's development. In the present study, the effectiveness of adults' regulations was measured in terms of their contingency. Contingency was determined by interrelated sequences of adult and child activities: A regulation was contingent if it was more explicit following children's incorrect activity, or if it was less explicit following children's correct activity. Based on previous studies (Wood, Wood, & Middleton, 1979), a qualification was introduced on the rule for contingency, which distinguished between two types of contingent regulations. Regulations that changed contingently by no more than two levels were categorized as narrow, and contingent regulations that changed by more than two levels were categorized as wide. The distinction was important because wide contingent regulations represented relatively large fluctuations and, therefore, were not considered theoretically contingent, in the sense that they were not adaptive responses to children's competencies.

Another measure of dyadic interaction that reflected the effectiveness of adults' regulations was the magnitude of regulations, or the average number of levels changed from one regulation to the next, whether or not it was contingent.

The contingency and magnitude of regulations measured how much of the time adults were operating at the upper boundary of the ZPD. At the other, lower boundary of the ZPD, children's independent functioning was based on measures of children's pre-to-post interaction improvements on an analogous puzzle task (near transfer), and a block design task (far transfer). The major hypotheses of the study examined relationships between the effectiveness of adults' regulations during interactions and children's pre-to-post interaction improvements. Interactions characterized by more effective regulations were expected to lead to greater improvements in children's independent functioning.

A second aspect of the study compared children in two interaction conditions, natural interactions with mothers, or idealized interactions with an experimenter trained to provide narrow contingent regulations at least 90% of the time. Since children in the idealized condition received optimally effective regulations, they were expected to benefit more--in their abilities to perform independently--from the interactions than children interacting with their mothers.

Finally, evidence for microgenesis was tested by having dyads repeat the interaction puzzle, and comparing changes in the contingency and magnitude of regulations from the first to the second trial. Theoretically, the

contingency and magnitude of regulations indicated the degree that task representations were shared by the dyad, termed intersubjectivity. Intersubjectivity was expected to increase with task trials.

The present study found a significant positive relationship between the proportion of times mothers regulated children's activities within narrow margins and children's pre-to-post interaction improvements on the analogous puzzle task. Furthermore, a regression analysis showed that narrow contingent regulations, but not wide contingent regulations or non-contingent regulations, significantly predicted children's pre-to-post interaction improvements on the analogous puzzle task. Findings also confirmed a significant negative relationship between the magnitude of mothers' regulations and children's pre-to-post interaction improvements for the analogous puzzle task.

Children who received idealized interactions showed significantly greater pre-to-post interaction improvements on the analogous puzzle, compared with children who interacted with their mothers.

Finally, no evidence for microgenesis was found. The proportion of times narrow contingent regulations were used by mothers did not significantly differ from Trial 1 to Trial 2. Also, the magnitude of mothers' regulations was not significantly different between trials.

Interpretation and Implications of Findings

The present study supports and extends previous Vygotskyian research regarding the social processes involved in cognitive development. The finding that mothers' use of narrow contingent regulations was related to children's puzzle task improvements indicated that effective instruction was based on an interactive process in which mothers modified their regulations in response to children's activities. Changing regulations contingently, and within a narrow margin, sustained activity at the leading edge of children's development. Thus, mothers who displayed greater sensitivity in changing their instructions, based on whether their children's activities were correct or incorrect, concentrated the interaction within a critical region of learning, as defined in the ZPD.

Operating in this region provided information to children about the appropriateness of specific task actions that previously had been beyond their limits of unaided activity. When mothers' instructions were consistent with children's actions, children were better able to interpret the relevance of those instructions in relation to their current activities and the goals of the task. Logical components of task activities, which had been missing from their previous independent functioning, were brought into children's current levels of competence. Interactions that were contingently regulated provided children with

meaningfully organized task activities that became internalized, thus allowing children to regulate their own activities more successfully.

This accords with Vygotsky's theoretical premise linking learning processes with social activity, and replicates findings from previous studies concerning the facilitative role of contingent instruction on children's cognitive performances (Campione, Brown, Ferrara, & Bryant, 1984; Saxe, Gearhart, & Guberman, 1984; Westerman, 1979; Wood, Bruner, & Ross, 1976; Wood & Middleton, 1975; Wood, Wood, & Middleton, 1979). However, the present study clarified the relationship of contingent instruction to children's <u>independent</u> learning. Previous studies (Wood & Middleton, 1975; Wood, Wood, & Middleton, 1979) tested for relationships between interactions and children's independent functioning with only post-interaction performances on the same task, which did not allow researchers to make statements about how children's competencies changed as a function of the interaction. The present study was based more on the classic Soviet design (e.g., Ergova, 1969) of assessing improvements pre- and post-interactively. Thus, findings in the present study extended previous research by reporting <u>changes</u> in children's independent functioning in relation to the contingency of interactions.

A theoretically important feature of the measures of

contingency, in this and in previous studies, is that they are composites of dyadic activity and represent, therefore, instrinsically social aspects of interactions. Thus, improvements in children's pre-to-post interaction performances, were not attributed to the actions of the child or the mother, but to their mutual efforts in coordinating their activity in relation to one another's task representations.

Findings regarding the prediction of children's improvements based on narrow contingent regulations, pointed to the importance of distinguishing contingent regulations based on their range of change. Schemes used in previous studies for coding the explicitness of regulations ranged from two levels (e.g., Wertsch, Minick, & Arns, 1984) to five levels (Wood & Middleton, 1975). In the present study, the scheme was elaborated to include nine levels. It was necessary, in this study, as in previous studies using elaborated schemes, to identify regulations that not only were contingent, but that occurred within narrow ranges of change. Wood, Wood, & Middleton (1979) identified patterns of regulation that were based on greater shifts as "swing" strategies. Interactions characterized by this strategy were not related to children's correct performances. The present study identified similarly based patterns as wide contingent regulations. Findings confirmed that only narrow contingent regulations were significant predictors of

children's puzzle task improvements. Wide contingent regulations did not predict children's improvements. This finding indicates, that, while mothers' contingent and non-contingent regulations occurred over a large range of explicitness, their effectiveness in promoting children's pre-to-post interaction improvements was based on two criteria: 1) whether they were contingent, and 2) whether they also occurred within narrow margins of change.

The finding that lower magnitude regulations were related to greater pre-to-post interaction puzzle task improvements showed that mothers who changed their instructions by fewer levels were effective in conveying task information to children. This finding extends previous understandings about the facilitating aspects of regulations. Previous investigations of the ZPD only compared the benefits of contingent versus non-contingent instruction, which was consistent with Vygotsky's notion that only instruction that was just beyond children's levels of competence promoted development. However, in the present study, because regulations were organized into a more elaborated scheme, changes in regulations by one or two levels represented very small amounts of change in practical activity. Thus, even when mothers' instructions changed in a non-contingent direction, if the number of levels of change was small, it still indicated a sensitivity to children's actions. Children were able, therefore, to

successfully interpret mothers' instructions and incorporate them into their current task competencies.

The present study did not further clarify the relative importance of the magnitude of regulations and the contingency of regulations in promoting children's independent functioning. For example, it is not clear whether children would have equally benefited from instruction that was of low magnitude, but exclusively non-contingent. A more consistent theoretical expectation would be that non-contingent regulations of low magnitude are effective only when they are departures from interactions that are otherwise predominantly contingent.

An important contribution of the present study was the finding that children receiving idealized interactions showed greater pre-to-post interaction improvements on the analogous puzzle task than children who interacted with their mothers. Children in the idealized condition were consistently regulated at the upper boundary of the ZPD, with very slight moderations in regulations, whereas children in the natural interaction condition received regulations from mothers that were moderated over a greater range. Thus, an instructional protocol based on theoretically contingent instruction was effective in increasing children's independent functioning.

This finding accords with Wood, Wood, & Middleton's (1979) study that, relative to other types of less

contingent, or non-contingent strategies, instructional protocols based on highly contingent regulations optimally affected children's competencies. Stone & Wertsch's study (1984) implemented an idealized instructional strategy in an applied setting to help children who needed remediation in reading. The protocol was only given to a few children and was not empirically tested, however, the researchers reported that children showed acquisitions of relevant skills.

It is unlikely that teachers, in general, can be taught to interact in instructionally idealized ways. However, the findings in previous studies and in the present study suggest that, in one-on-one teaching situations that require highly focused interventions, such as with children who need remediation, theoretically optimal teaching strategies can be successfully implemented.

Limitations of the Present Study

The present study did not find evidence for microgenesis. There were no differences in the proportion of times mothers used narrow contingent regulations, or in the magnitude of regulations, from Trial 1 to Trial 2. Microgenesis refers to the acquisition of skills over brief periods of time that mirror developmental changes. In previous studies (Wertsch, Hickman, McLane, & Dowley, 1978; Wertsch, McNamee, McLane, & Budwig, 1980) microgenesis was

tested by comparing the amount of children's self-regulations across units of activity, such as the correct placement of puzzle pieces. These studies, however, did not show statistical increases in children's self-regulations across units of activity.

In the present study, microgenesis was primarily tested with interaction measures of contingency and magnitude, rather than measures of self-regulation. This was justified for two reasons. First, the contingency and magnitude of regulations indicated the degree to which dyads established mutual bases for communication, which is a theoretical requirement for learning. According to Vygotsky, in the context of a social interaction, dyads are engaged in a process of reciprocal adaptation. Thus, it was expected that, as the interaction proceeded, dyads would, in general, adapt to each other by showing increases in narrow contingency and decreases in magnitude. Second, measures of self-regulation are confounded, to some extent, with other-regulations. Because they are not independent measures, they cannot be accurately used to make statements about children's activities during interactions.

Wertsch's previous studies attributed, in part, the lack of evidence for microgenesis to the uneven nature of the developmental process. It was, they concluded, unrealistic to expect to see a clear linear development of activity over very brief periods of time. The present study

attempted to address this problem by extending the unit of activity from the correct placement of one puzzle piece, to the activity over an entire trial (six puzzle piece placements); however, even larger units of activity did not yield evidence for microgenesis.

In future research, increasing the number of interaction trials may reveal microgenetic shifts, but raises the prospect of other difficulties; for example, overtaxing children's attention spans, and increasing the likelihood of practice effects. The continuing lack of results in this and other studies casts doubts on the feasibility of testing for microgenesis with the current paradigm.

Another limitation of the present study was the absence of results concerning pre-to-post interaction improvements in the far transfer task. The contingency of regulations, the magnitude of regulations, and interaction condition (natural versus idealized) were not related to improvements in the block design task. A previous study using near and far transfer tasks (Campione, Brown, Ferrara, & Bryant, 1984) measured changes only in the context of interactions, and not as measures of children's independent functioning. Other studies (Wood & Wood, 1975; Wood, Wood, & Middleton, 1979) examined children's independent functioning by using the same task in both the interaction and post-interaction trials.

The present study, therefore, combined previous research designs by introducing transfer tasks of independent functioning. The lack of results for the far transfer task was attributed to the greater array and difficulty of cognitive skills it required. Although most children did show some improvements, they were not statistically significant. Future research can further examine the extent of transfer by including pre- and post-interaction tasks that systematically increase the level of difficulty by smaller increments. The amount children benefit by interactions, as measured by tests of transfer, is also an important indicator of children's potential development. Increases in children's task transfer abilities have been interpreted as showing greater task-related learning potential (Campione, Brown, Ferrara, & Bryant, 1984).

A third limitation in the findings of the present study concerned the timed puzzle scores for the near transfer task. Timed puzzle scores were ratios of the number of correct puzzle piece placements divided by the amount of time (in seconds) taken to complete the puzzle. Children who received a greater proportion of narrow contingent regulations were expected to complete the near transfer task in less time, in addition to making more correct placements. However, when time to completion was examined independent of the number of correct placements, children who received a

greater proportion of narrow contingent regulations did not show decreases in time to completion.

The hypothesized decreases in time to completion were based on a misconception that children would, at first, struggle with the task, then, as a result of acquiring task-related skills, perform more quickly. However, since the task did not restrict children from making incorrect placements (all the puzzle pieces were the same size and shape), at first, they often placed the puzzle pieces in as fast as they could, not recognizing their errors. Following the interaction, children who received more highly contingent regulations acquired skills that helped them recognize when their actions were incorrect, which involved them more in processing their actions. However, there was no significant association between increases in the time to completion and pre-to-post interaction improvements.

Findings showed a significant relationship between timed puzzle scores and pre-to-post interaction improvements, and also a significant difference in timed puzzle scores between natural and idealized interaction conditions. However, based on the discussion above, these findings were due only to increases in correct puzzle piece placements, and not to a combination of increases in correct puzzle piece placements and decreases in time to completion.

Ancillary Analyses

A series of ancillary analyses were conducted exploring patterns of activities during interactions. One set of analyses examined the relationship between mothers' regulations and children's activities that immediately followed. Findings showed that mothers' regulations affected children's subsequent activity in two ways. First, when mothers provided narrow contingent regulations they were followed more often by correct, compared with incorrect, children's responses. Second, when mothers provided narrow contingent regulations, compared with when mothers provided narrow non-contingent regulations, they were followed more often by correct children's responses.

These findings suggest that narrow contingent regulations facilitated children's performances during interactions. However, this interpretation is qualified by possible contaminations in the measures. Specifically, what the child is doing during the interaction is confounded with what the mother is doing. Thus, based on these measures, findings in this and the other ancillary analyses are not able to distinguish whether children's responses reflect their own competencies, mothers' regulations, or some combination of both.

The next ancillary analysis examined when mothers intervened in children's activities. In previous studies using predetermined instructional strategies (Wood, Bruner, & Ross, 1976; Wood, Wood, & Middleton, 1979), tutors

intervened only when children made errors because it allowed children to operate at the limit of their functioning, and because tutors could then recognize what that limit was. Theoretically, when children operated at the upper boundary of the ZPD, it was more likely to promote development. In the present study, mothers in natural interactions could intervene at any time.

Findings showed that mothers intervened a significantly greater proportion of times after incorrect activities. Thus, mothers acted similar to tutors in contingent instructional protocols, by waiting for children to make errors before intervening. This finding indicates that mothers also used information about children's competencies in deciding when to intervene in their activities.

Implications for Future Research

The present study contributed to the investigation of the social origins of knowledge by demonstrating relationships between the contingency of instruction during dyadic interactions and children's independent levels of learning. In order for future research to extend these and previous findings, a number of methodological questions and problems must be further addressed.

The current methodologies would have been impossible prior to the technology of videotaping. However, the richness of detail available through repeated viewings of

activity poses other challenges, namely, how to adequately organize activity that is varied and spontaneous.

Vygotsky's theory provides a context for studying social interactions. However, although questions posed by previous research have been theoretically motivated, the methods and measures have not always been. The present study identified a set of theoretical principles used to develop, 1) a coding scheme of children's and adults' interactions in the context of solving a puzzle task, and 2) measures of contingency that interrelated dyads' activities. Using these criteria, future studies can further investigate theoretical components of Vygotsky's theory.

The addition of systematically varied pre- and post-interaction transfer tasks would allow assessments of the extent of transfer, or in terms of the ZPD, the depth of children's learning potential. Techniques yielding information about children's prospective competencies could be used as tools for early diagnosis of domain-specific cognitive strengths and weaknesses.

Vygotsky has stressed that knowledge is not a simple product of the structure or content of information, but emerges from the culturally determined ways in which individuals interact with information. The present study compared how mothers and an idealized instructor interacted with children. Future research needs to also explore the effects other members have in the context of instructional

interaction with children. For example, do mothers and fathers differ in their abilities to regulate contingently? Similarly, do parents, who spend more time with their preschool children, or teachers, who know more about formal learning processes, interact with children more contingently? Furthermore, do children who receive equally contingent instruction from different kinds of interlocutors, benefit equally in their independent functioning?

Thus far, very little research using interactional analyses exists that examines the effect of cultural differences in interactions. Wertsch, Minick, & Arns (1984) showed that rural mothers in Brazil provided more explicit regulations than teachers, however, there have been no studies making direct cultural comparisons of interaction patterns and their effect on children's learning.

In culturally pluralistic societies such as the United States, issues of bilingual education are of increasing concern. Future research using the present paradigm could address some aspects of bilingual education, such as whether children and adults who speak the same language, but are of different cultures interact differently than dyads of the same culture.

The present study showed that, in natural interactions between mothers and children, the proportion of times mothers regulated contingently varied. However,

nothing is known about whether mothers who provide more contingent interactions differ in other respects from mothers who provide less contingent interactions. Conversely, are there children's attributes associated with more contingent interactions, such as IQ, or amount of experience in structured learning situations?

Very little demographic information was collected about dyads in the present study. Findings showed that there were no differences in contingency scores by dyads' race or children's sex. However, future research needs to examine whether other characteristics of dyad members, such as socioeconomic status, or interlocutors' education levels or age, are associated with more contingent interactions.

Westerman (1979) showed that interactions are also affected by the psychological health of dyad members. However, no further relevant research exists concerning the effect of psychological states or traits on social interactive processes. Vygotskyian research has thus far not addressed issues concerning the role of affect in development. More needs to be understood about whether, and how, the effects of stress are evident in the context of adult-child interactions. For example, is the contingency of interactions affected when parents and children are in crises resulting from marital discord, economic difficulties, or family illness?

Still less is known about the role of affect <u>during</u>

interactions. Because the task situation, typified in the present study, involved children and adults in difficult efforts, with sometimes unanticipated results, there were elements of frustration and coercion that were part of the affective dynamic of interactions, but which were not studied. Much more needs to be understood about the the affective conditions of interactions and their relationship to the contingency of interactions, as well as to children's subsequent levels of independent functioning.

Appendix A:

Cover Letters and Consent Form

Cover Letter: Mother-child Interaction Group.

Dear Parent:

As part of fulfilling my doctoral work in Educational Psychology at City University's Graduate Center, I am conducting a study of how adults assist children (2.6 to 3.5 years) during an activity that involves some instruction. I need the cooperation of mothers and their children.

The study consists of administering brief puzzle activities, and takes place at the (day care center name) at three meetings, about one week apart. The first and last sessions include activities just for the child. The second session involves the mother and child being videotaped putting a child's puzzle together. Each session lasts about 15 minutes.

Because the research involves a detailed analysis of language used during the interaction, participating mothers and children must speak english as their first language. Future studies will undoubtedly be interested in researching mothers and fathers in their interactions with children. However, to make the present study more manageable only mother-child activities will be included.

The study is trying to make an important contribution to understanding the everyday processes of how children learn, which will inform educators, psychologists, and parents. In a preliminary study, mothers and children found the activities very enjoyable.

(Supervisor's name) is fully informed about the study and encourages your participation. If you would like to participate in my study please fill in the Parental Consent portion and return it to (supervisor's name). We can then arrange for convenient times to schedule the activities.

If you have any questions about the study you can contact me at 212 787-5776, or please feel free to contact Dr. David Bearison, my academic supervisor, at 212 790-4351. Thank you very much.

Sincerely,

Cover Letter: Experimenter-child Interaction Group.

Dear Parent:

As part of fulfilling my doctoral work in Educational Psychology at City University's Graduate Center, I am conducting a study of how learning occurs during instructional interactions between adults and children (2.6 to 3.5 years). I need your cooperation.

The study consists of administering brief puzzle activities, and takes place at (day care center name) at three meetings, about 1 week apart. The first and last sessions include unassisted activities for the child. The second session involves the child being videotaped putting a puzzle together with my instructional assistance. Each session lasts about 15 minutes.

Because the research involves a detailed analysis of language used during the interaction, participating children must speak english as their first language.

The study is trying to make an important contribution to understanding the everyday processes of how children learn, which will inform educators, psychologists, and parents. In a preliminary study, children found the activities very enjoyable.

(Supervisor's name) is fully informed about the study and encourages your participation. If you would like to participate in my study please fill in the Parental Consent portion and return it to (supervisor's name).

If you have any questions about the study you can contact me at 212 787-5776, or please feel free to contact Dr. David Bearison, my academic supervisor, at 212 790-4351. Thank you very much.

Sincerely,

Consent Form.

Parental Consent

My child would like to participate in your study. I understand that the instructional session will be videotaped, and that the videotape and all information will be kept confidential, and will not be given to, or used by the school for any purposes of evaluation. I also understand that my child is free to leave the study at any time.

Name of parent (print) _____

Signature of parent _____

Name of child _____

Date of birth of child _____

Telephone number (business or home) _____

Appendix B

Coding Manual: A Vygotskyian Approach for Coding the Explicitness of Regulations

The following is a listing defining nine levels of regulations, ordered from explicit to implicit. Each level includes examples taken from data. In the notation employed, A: designates the adult's (mothers' or experimenter's) regulations, and C: designates children's responses or self-regulations. Gestures are designated in parentheses. When language and gestures occur together, language is entered on the first line and the accompanying gesture followed on the next line.

In the following definitions,

1) puzzle activities refer to one of the following:

- picking up a puzzle piece
- placing a puzzle piece in the copy puzzle
- picking up an incorrectly placed puzzle piece

2) puzzle referents refer to one of the following:

- a puzzle piece
- a puzzle segment
- the copy or model puzzle

The copy puzzle is referred to as CP, and the model puzzle as MP.

Level 1: Correct Placement

The adult correctly placed a puzzle piece, with or

without verbalization.

Example:

a. A: This one goes here.

(places green correctly)

b. A: (places purple correctly)

Level 2: Demonstrating Piece Placement

The adult demonstrated, by doing and undoing, the correct placement of a puzzle piece, with or without verbalization.

Example:

a. A: (places black correctly)

A: Now you try.

(takes away correctly placed black)

Level 3: Referring to Correct Placement

The adult provided statements and/or gestures specifying a puzzle piece and its appropriate placement <u>in the copy puzzle</u>.

Examples:

a. A: Put the green here.

(points to correct position in CP)

b. A: The yellow one goes under the purple.

(points to correct position in CP)

c. A: (points to correct position in CP)

Level 4: Puzzle Piece Selection

The adult selected a puzzle piece, or picked up an incorrectly placed puzzle piece, with or without

verbalizations.

Examples:

a. A: Take the green one.

(hands green to child)

b. A: (picks up incorrectly placed red)

Level 5: Task Activity (Language and Gesture)

The adult provided statements specifying a puzzle activity for the child to follow (except the correct placement of a puzzle piece), which were accompanied by pointing or motioning to a puzzle referent. Statements mentioning puzzle activities typically included directives such as: "take," "pick up," "get," "find," "put," etc.

Examples:

a. A: Pick up the other green one.

(points to incorrectly placed extra green)

b. A: Find the yellow.

(points to yellow in MP)

Level 6: Task Activity (Language Only)

The adult provided statements specifying a task-related activity for the child to follow (except the correct placement of a puzzle piece), which were not accompanied by pointing or motioning to a puzzle referent. Statements mentioning puzzle activities typically included directives such as: "take," "pick up," "get," "find," "put," etc.

Examples:

a. A: Put the black one in first.

b. A: Take away the white one?

Level 7: Task Referents (Language and Gesture)

The adult provided statements specifying only puzzle referents, and not an activity and a referent, which were accompanied by pointing or motioning to a puzzle referent.

Examples:

a. A: Is this the same as this?

(points to white in MP then to incorrectly placed extra blue)

b. A: What color goes here in your puzzle?

(points to red in MP)

c. A: Take a look at where the red square is in this little truck.

(points to MP)

Level 8: Task Referents (Language Only or Gesture Only)

The adult provided statements specifying only puzzle referents, and not an activity and a referent, which were not accompanied by pointing or motioning to a puzzle referent; or the adult provided gestures specifying a puzzle referent, but without accompanying statements.

Examples:

a. A: What other colors does my truck have?

b. A: Where does the red one go?

c. A: My truck has a yellow.

d. A: (points to white on MP)

Level 9: Orienting and Feedback

The adult provided general orienting statements which did not specify an activity or a referent, or provided feedback on whether an activity was correct or incorrect.

Examples:

a. A: That's wrong.

b. A: Good.

c. A: (blocks child's arm)

d. A: What's next?

Appendix C

Scoring Manual: Criteria for Scoring the Contingency of Regulations and Children's Responses and Self-regulations

Contingency of Regulations.

Regulations were contingent if they 1) were more explicit than the previous regulation following an incorrect response or self-regulation, or 2) were less explicit than the previous regulation following a correct response or self-regulation. Conversely, regulations were non-contingent if they were more explicit than the previous regulation following a correct response or self-regulation, or 2) were less explicit than the previous regulation following an incorrect response or self-regulation.

Examples of Contingent Regulations:

a. increasing the level of explicitness following an incorrect response:

A: We already have a green.

[Level 8]

C: (picks up extra orange)
(incorrectly places orange)

[incorrect response]

A: Is there an orange in my truck?
(points to MP)

[Level 7]

b. decreasing the level of explicitness following a

correct response:

A: What color's this one?

(points to yellow in MP)

[Level 7]

C: Yellow.

(picks up yellow)

[correct response]

A: So where does the yellow one go?

[Level 8]

When more than one regulation was provided between children's activities, only the most explicit regulation in that set of regulations was scored. In the following example, only the regulation at Level 4 would have been scored and used to determine the contingency of regulations.

Example:

A: Let's take this one away because it doesn't go here.

(picks up incorrectly placed green)

[Level 4]

A: Mine doesn't have a green one there.

(points to white in MP)

[Level 7]

A: What piece do we need?

[Level 8]

When children provided more than one activity after an other-regulation, the contingency for the next regulation

was determined by the correctness of the children's activity immediately preceding it.

Magnitude of Other-regulations.

Regulations were also scored for their magnitude. The magnitude of a regulation was the number of levels a regulation changed--either contingently or non-contingently--from a previous regulation. Narrow regulations included regulations with magnitudes of 2 or less. Wide regulations included regulations with magnitudes of more than 2.

Example:

a. contingent response, magnitude of 1

A: What's next to the green?

[Level 8]

C: (picks up extra green from the pile)

[incorrect response]

A: Look at my color.

(points to black in MP)

[Level 7]

Regulations that were the same level as the previous regulation were coded as contingent when the intervening response or last occurring self-regulation was incorrect. According to the scheme for scoring the magnitude of other-regulations, the magnitude for repeat-level regulations would be 0. However, this score would have been misleading since it implied that repeat-level regulations were more

contingent than contingent regulations altered by one level. To correct for this, repeat-level regulations following incorrect responses or self-regulations were also scored as contingent with a magnitude of 1.

Repeat-level regulations following correct responses or self-regulations were scored non-contingent by one level, with a magnitude of 1; regulations that were non-contingent by one level were scored non-contingent, with a magnitude of 2, etc.

If an adult provided a regulation at Level 9 following a correct response or self-regulation it was not scored for contingency if the previous regulation was also at Level 9, since Level 9 as the most implicit level of regulation.

Responses and Self-regulations.

Activities were scored as either responses to regulations, or self-regulations, and whether they were correct or incorrect.

Responses to Regulations.

Responses to regulations were children's activities that immediately followed regulations.

Self-regulations.

Children's activities after a response to a regulation, and before the next regulation, were scored as self-regulations. In the following example the first child activity would have been scored a response to the previous

regulation, and the next two child activities scored as self-regulations.

Example:

A: Well do you think that looks the same as that truck?

C: (picks up purple)

C: This goes right there.

(correctly places purple)

C: (picks up yellow)

Correctness of Responses and Self-regulations.

All responses to other-regulations and self-regulations were scored as correct or incorrect.

1. Incorrect responses or self-regulations included:

a. incorrect actions or statements

Example:

C: (places extra green incorrectly)

b. failing to understand the adult's question

Example:

A: Can you see which one?

C: No.

c. initiating, or responding to a regulation with, a request

Example:

A: What color is this one?

(points to black in MP)

C: Can you help me?

* Note: If the request was made simultaneously with a correct activity, the activity was scored as correct.

d. a response not addressed to the previous regulation

Example:

A: Is this one the same in mine?

C: I don't want to finish this.

* Note: If a child picks up a puzzle piece that has not yet been correctly placed in the puzzle, it is scored as correct, even if the activity follows an unrelated other-regulation.

e. not responding to a regulation for at least 5 seconds.

2. Responses were correct if they appropriately answered or acted on a previous regulation. Self-regulations were correct if they contributed toward the correct placement of a puzzle piece.

Examples:

a. C: (correctly places red)

b. A: Find the green one.

(points to MP)

C: (picks up green)

Ancillary Contingency Scores.

Two sets of measures were derived by extending the unit of interaction activity for scoring contingency scores.

In addition to considering whether an other-regulation followed the contingency rule, the proportions of times responses succeeding contingent or non-contingent other-regulations were correct or incorrect were scored. Also, the proportions of times contingent or non-contingent regulations were preceded by correct or incorrect responses or self-regulations were scored.

1. Other-regulations succeeded by responses
    a. Contingent regulations succeeded by correct responses
    b. Non-contingent regulations succeeded by correct responses
    c. Contingent regulations succeeded by incorrect responses
3. Other-regulations preceded by responses or self-regulations
    a. Contingent regulations preceded by correct responses or self-regulations
    b. Contingent regulations preceded by incorrect responses or self-regulations

Clarification of Coding for the Manipulation of Puzzle Pieces.

Picking Up and Placing Puzzle Pieces.

If a previously placed puzzle piece was shifted over to

another position in the puzzle, the response or self-regulation was scored as one activity--placing the puzzle piece, not picking up and placing the puzzle piece.

If a previously placed puzzle piece was removed from the puzzle and placed back in the puzzle piece pile, it was scored as one activity--taking away the puzzle piece, not picking up and putting back the puzzle piece.

Adjusting the Puzzle Piece Placement.

If a puzzle piece was correctly placed, but was not perfectly flush, and the child or adult attempted to make the piece fit flush, the activity was not scored.

Off-task Activities.

Activities that were not related to the completion of the task were not coded. These included:

- comments about the camera or surrounding activity
- comments about the task such as:

    A: Is this hard for you?

    C: I don't want to do this.

    C: This is a pretty truck.

End of Trial.

A trial ended when all the pieces in the puzzle were correctly placed, or when the child did not want to continue activity even after prompting by the adult. Any activity

following the correct placement of the last puzzle piece was not coded.

Appendix D

Summary of Inter-observer Rating Statistics by Group

Dyads Randomly Selected for Inter-observer Ratings

Mother-child Interaction Group:

Number of dyads: 5 of 20 (20%)
Dyad ID number: 5, 8, 10, 12, 16
Number of acts: 559 of 1898 (29.5%)

Experimenter-child Interaction Group:

Number of dyads: 3 of 9 (33.3%)
Dyad ID number: 23, 28, 33
Number of acts: 280 of 653 (42.9%)

	Inter-observer Ratings	
	Adults' Level of Regulation	Children's Correct/Incorrect Responses or Self-Regulations
Mother-child Interaction Group		
No. Acts Coded	239	320
No. Disagreements	8	12
Percent Agreements	96.7	96.3
Experimenter-child Interaction Group		
No. Acts Coded	114	166
No. Disagreements	4	2
Percent Agreements	96.5	98.8
Combined Groups		
No. Acts Coded	353	486
No. Disagreements	12	14
Percent Agreements	96.6	97.1

References

Bearison, D. J. (1982). New directions in studies of social interaction and cognitive growth. In F. Serafica (Ed.), Social-cognitive development in context. New York: Guilford Press.

Bearison, D. J. (1986). Transactional cognition in context: New models of social understanding. In D. J. Bearison & H. Zimiles (Eds.), Thought and emotion: Developmental perspectives. Hillsdale, NJ: Erlbaum.

Bearison, D. J. (in press). Interactional contexts of cognitive development: Piagetian approaches to sociogenesis. In L. Tolchinsky (Ed.), Culture, cognition, and schooling. Norwood, NJ: Aplex.

Berk, L. E. (1985). Why children talk to themselves. Young Children, 40, 46-52.

Bibler, V. S. (1983). Thinking as creation (introduction to the logic of mental dialogue). Soviet Psychology, 22, 33-54.

Brown, A. L. & Ferrara, R. A. (1985). Diagnosing Zones of proximal development. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Bruner, J. (1984a). Interaction, communication, and self. Journal of the American Academy of Child Psychiatry, 23, 1-7.

Bruner, J. (1984b). Vygotsky's zone of proximal development: The hidden agenda. In Wertsch, J. V. & Rogoff, B. (Eds.), Children's learning in the 'zone of proximal development'. New Directions for Child Development. San Francisco: Jossey-Bass.

Bruner, J. (1985). Vygotsky: A historical and conceptual perspective. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Butterworth, G. (1982). A brief account of the conflict between the individual and the social models of cognitive growth. In G. Butterworth and P. Light

(Eds.), Social cognition: Studies of the development of understanding. Chicago: University of Chicago Press.

Campione, J. C., Brown, A. L., Ferrera, R. A., & Bryant, N. R. (1984). The zone of proximal development: Implications for individual differences and learning. In Wertsch, J. V. & Rogoff, B. (Eds.), Children's learning in the 'zone of proximal development'. New Directions for Child Development. San Francisco: Jossey-Bass.

Catán, L. (1986). The dynamic display of process: Historical development and contemporary uses of the microgenetic method. Human Development, 29, 252-263.

Cole, M. (1981). Preface. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe

Cole, M. (1985). The zone of proximal development: Where culture and cognition create each other. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Damon, W. (1983). The nature of social-cognitive change in the developing child. In W. F. Overton (Ed.), The relationship between social and cognitive development. Hillsdale, NJ: Erlbaum.

Davydov, V. V. (1985). Leont'ev's theory of the relationship between activity and mental reflection. Soviet Psychology, 23, 28-45.

Davydov, V. V. & Radzikhovskii, L. A. (1985). Vygotsky's theory and the activity-oriented approach. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Doise, W. & Mackie, D. (1981). On the social nature of cognition. In J. Fargas (Ed.), Social cognition. New York: Academic Press.

Doise, W., & Mugny, G. (1984). The Social Development of the Intellect. Oxford: Pergamon Press.

Egorova, T. V. (1969). Analiz zretel'no vosprinimaemykh ob'ektov neuspevaiushchimi shkol'nikami mladshikh klassov (Analysis of visually perceived objects by failing students in the early grades). Defektologiia,

2, 29-37.

Forman, E. A. & Kraker, M. J. (1985). The social origins of logic: The contributions of Piaget and Vygotsky. In M. W. Berkowitz (Ed.), Peer conflict and psychological growth. New Directions for Child Development. San Francisco: Jossey-Bass.

Glick, J. (1974). Culture and cognition: Some theoretical and methodological concerns. In G. D. Spindler (Ed.), Education and cultural processes. New York: Holt, Rinehart and Winston.

Glick, J. (1983). Piaget, Vygotsky and Werner. In S. Wapner & B. Kaplan (Eds.), Toward a holistic developmental psychology. Hillsdale, NJ: Erlbaum.

Glick, J. (1985). Culture and cognition revisited. In Niemark, R. DeLisi, & J. Newman (Eds.), Moderators of competence. Hillsdale, NJ: Erlbaum.

Griffin, P. & Cole, M. (1984). Current activity for the future: The Zo-ped. In Wertsch, J. V. & Rogoff, B. (Eds.), Children's learning in the 'zone of proximal development'. New Directions for Child Development. San Francisco: Jossey-Bass.

Hickman, M. E. (1985). The implication of discourse skills in Vygotsky's developmental theory. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Hodapp, R. M. & Goldfield, E. C. (1985). Self- and other regulation during the infancy period. Developmental Review, 5, 274-288.

Hodapp, R. M., Goldfield, E. C., & Boyatzis, C. J. (1984). The use and effectiveness of maternal scaffolding in mother-infant games. Child Development, 55, 772-781.

Kozulin, A. (1984). Psychology in Utopia. Cambridge: MIT Press.

Kozulin, A. (1986). The concept of activity in Soviet psychology: Vygotsky, his disciples and critics. American Psychologist, 41, 264-274.

Lee, B. (1985). Intellectual origins of Vygotsky's semiotic analysis. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Leont'ev, A. N. (1981). The problem of activity in psychology. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe.

Levina, R. E. (1981). The planning function of children's speech. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe.

Luria, A. R. (1982). Language and Cognition. New York: Wiley Press.

McLane, J. B. (1981). Dyadic problem solving: A comparison of child-child and mother-child interaction. Unpublished doctoral dissertation, Northwestern University.

Mead, G. H. (1934). Mind, Self and Society. Chicago: Chicago University Press.

Neter, J. & Wasserman, W. (1974). Applied Linear Statistical Models: Regression, Analysis of Variance, and Experimental Designs. Homewood, IL: Irwin-Dorsey Ltd.

Pacifici, C. & Bearison, D. J. (1987). The regulation of activity in the zone of proximal development: A microgenetic approach. Unpublished study, The Graduate Center of the City University of New York.

Piaget, J. (1952). The Origins of Intelligence in Children. New York: International University Press.

Portes, P. R. (1985). The role of language in the development of intelligence: Vygotsky revisited. Journal of Research and Development in Education, 18, 1-10.

Renninger, E. A., & Winegar, L. T. (1984). Expert-novice systems in knowledge acquisition. Manuscript submitted for publication.

Rommtveit, R. (1985). Language acquisition as increasing linguistic structuring of experience and symbolic behavior control. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Sammarco, J. G. (1984). Joint problem-solving activity in mother-child dyads: A comparative study of normally

achieving and language disordered preschoolers. Unpublished doctoral dissertation, Northwestern University.

Saxe, G. B., Gearhart, M., & Guberman, S. R. (1984). The social organization of early number development. In Wertsch, J. V. & Rogoff, B. (Eds.), Children's learning in the 'zone of proximal development'. New Directions for Child Development. San Francisco: Jossey-Bass.

Scribner, S. & Cole, M. (1981). The Psychological Consequences of Literacy. Cambridge: Harvard University Press.

Scribner, S. (1985). Vygotsky's uses of history. In J. Wertsch (Ed.), Culture, communication and cognition. Cambridge: Cambridge University Press.

Shatz, M. (1983). Communication. In J. Flavell & E. Markman (Eds.), Cognitive development. In P. Mussen (Gen. Ed.), Carmichael's Manual of Child Psychology (4th ed.). New York: Wiley Press.

Stone, C. A., & Wertsch, J. V. (1984). A social interactional analysis of learning disabilities remediation. Journal of Learning Disabilities, 17, 194-199.

Turiel, E. (1983). Domain and categories in social-cognitive development. In W. Overton (Ed.), The relationship between social and cognitive development. Hillsdale, NJ: Lawrence Erlbaum Associates.

Van der Veer, R. (1986). Vygotsky's developmental psychology. Psychological Reports, 59, 527-536.

Van der Veer, R. & van IJzendoorn, M. H. (1985). Vygotsky's theory of the higher psychological processes: Some criticisms. Human Development, 28, 1-9.

Vygotsky, L. S. (1962). Thought and Language. Cambridge: MIT Press.

Vygotsky, L. S. (1978). Mind in Society. Cambridge: Harvard University Press.

Vygotsky, L. S. (1981a). The instrumental method in psychology. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe.

Vygotsky, L. S. (1981b). The genesis of higher mental

functions. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe.

Vygotsky, L. S. (1981c). The development of higher forms of attention in childhood. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe.

Wechsler, D. (1967). Wechsler Preschool and Primary Scale of Intelligence Manual. New York: The Psychological Corporation.

Wertsch, J. V. (1979a). The regulation of human action and the given-new organization of private speech. In G. Zivin (Ed.), The development of self-regulation through private speech. New York: Wiley & Sons.

Wertsch, J. V. (1979b). From social interaction to higher psychological processes: A clarification and application of Vygotsky's theory. Human Development, 22, 1-22.

Wertsch, J. V. (1980). The significance of dialogue in Vygotsky's account of social, egocentric, and inner speech. Contemporary Educational Psychology, 5, 150-162.

Wertsch, J. V. (1981). The concept of activity in Soviet psychology: An introduction. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe.

Wertsch, J. V. (1984). The zone of proximal development: Some conceptual issues. In Wertsch, J. V. & Rogoff, B. (Eds.), Children's learning in the 'zone of proximal development'. New Directions for Child Development. San Francisco: Jossey-Bass.

Wertsch, J. V. (1985). Vygotsky and the Social Formation of Mind. Cambridge: Harvard University Press.

Wertsch, J. V., Hickman, M. E., McLane, J. B., & Dowley, G. C. (1978). A microgenetic analysis of strategy formation. Unpublished manuscript.

Wertsch, J. V., McNamee, G. D., McLane, J. B., & Budwig, N. A. (1980). The adult-child dyad as a problem-solving system. Child Development, 51, 1215-1221.

Wertsch, J. V., Minick, N., & Arns, F. J. (1984). The creation of context in joint problem solving. In G.

Rogoff and J. Lave (Eds.), Everyday cognition: Its development in social contexts. Cambridge: Harvard University Press.

Wertsch, J. V. & Rogoff, B. (1984). Editor's Notes. In Wertsch, J. V. & Rogoff, B. (Eds.), Children's learning in the 'zone of proximal development'. New Directions for Child Development. San Francisco: Jossey-Bass.

Wertsch, J. V. & Stone, A. (1985). The concept of internalization in Vygotsky's account of the genesis of higher mental functions. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Westerman, M. A. (1979). Differences in the organization of mother-child interaction in compliance problem and healthy dyads. Unpublished doctoral dissertation, University of Southern California.

Wilkinson, L. C. (1983). Social intelligence and the development of communicative competence. In M. Lewis (Ed.), Origins of Intelligence (2nd ed.). New York: Plenum Press.

Wood, D. (1975). Analysis of block study. Unpublished scoring manual, University of Nottingham.

Wood D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. Journal of Child Psychology and Psychiatry, 17, 89-100.

Wood, D. & Middleton, D. (1975). A study of assisted problem-solving. British Journal of Psychology, 2, 181-191.

Wood, D., Wood, H., & Middleton, D. (1978). An experimental evaluation of four face-to-face teaching strategies. International Journal of Behavioral Development, 2, 131-147.

Wozniak, R. H. (1980). Theory, practice, and the "zone of proximal development" in Soviet psychoeducational research. Contemporary Educational Psychology, 5, 175-183.

Zinchenko, P. I. (1981). Involuntary memory and the goal-directed nature of speech. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe.

Zinchenko, P. V. (1985). Vygotsky's ideas about units for

the analysis of mind. In J. V. Wertsch (Ed.), Culture, communication and cognition: Vygotskyian perspectives. New York: Cambridge University Press.

Zinchenko, P. V. & Gordon, V. M. (1981). Methodological problems in the psychological analysis of activity. In J. V. Wertsch (Ed.), The concept of activity in Soviet psychology. Armonk, NY: M. E. Sharpe.