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Microgenetic development in preschoolers' private speech

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MICROGENETIC DEVELOPMENT

IN PRESCHOOLERS' PRIVATE SPEECH

By

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Abstract

Vygotsky's theory of the development of children's private (or egocentric) speech is discussed, and related empirical research is reviewed. A pilot study demonstrates the viability of a microgenetic experimental approach to the problem of private speech. The research detailed herein consists of a three-session repeated-measures microgenetic experiment involving 40 five-year-old children, investigating questions which arise both from Vygotsky's original work on private speech and from contemporary research. Participants in this study were videotaped while working on both paper-folding and story-sequencing tasks.

Results showed greater quantities of private speech while participants worked on paper-folding tasks compared with story-sequencing tasks, on difficult task items compared with easy items, and on novel items compared with familiar items. A decline across sessions in private speech production was observed when participants worked repeatedly on the same items, but not on novel items during the second and third sessions.

Three systems for classification of private utterances according to various characteristics were applied. Private speech preceding action (planning speech) increased across sessions. Descriptive speech (which usually accompanies or follows action) declined from the second to the third session. An attempt to track microgenetic changes in the degree of psychological predication evident in participants' private speech was hindered by the high percentage of private utterances considered unclassifiable with regard to this characteristic. Correlational analyses, including examination of between-session as well as within-session associations between private speech and task performance, detected little evidence of predicted relationships. The advantages of a microgenetic experimental approach to the study of preschoolers' private speech are discussed.

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Vygotsky's Cultural-Historical Psychology

As part of the societal upheaval following the Russian Revolution of 1917, Soviet science was enjoined by the new government to shape scientific theory and practice into a form fully consistent with the Marxist worldview. Psychologists were faced with the challenge of circumventing the inadequacies of both Russian idealist psychology and early twentieth-century materialist physiology and neurology, and formulating a new approach to psychological investigation. The most notable of these efforts by Soviet psychologists of this turbulent period is known as the cultural-historical or social-historical school, founded by L. S. Vygotsky, working with collaborators including A. N. Leontyev and A. R. Luria. Unlike many of his contemporaries, Vygotsky was wary of the attempt "'to discover the nature of mind by patching together a lot of quotations'" (Vygotsky, quoted in Cole & Scribner, 1978, p. 8) from the works of Marx, Engels and Lenin. Instead, he regarded the project at hand as requiring fundamental mastery of the Marxist analytical method: in applying Marx's method to psychological subject matter, Vygotsky wrote, it would be necessary "'to create one's own Capital'" (p. 8).

This method, known as dialectical materialism, posits that the primary ontological nature of the world is material but unlike other kinds of materialism, stresses that not all phenomena can be explained (or even adequately described) in physical-chemical terms. Dialectical materialism is nonreductive: it is framed in accordance with the concept of integrative levels of organization of matter, and explicitly asserts that different organizational levels give rise to emergent properties operating in accordance with unique explanatory laws specific to each level. It is tied together into a solidly monist ontology by the assertion that these multiform manifestations are all derivative properties of matter, and that in isolation from their material bases they have no existence. Thus, dialectical materialism recognizes diversity, but in that diversity it ascertains a fundamental unity. In this light, mind or psyche is regarded as an emergent property of matter at a specific high

level of organization; though not identical with the brain. psyche nonetheless has no existence independent of the brain. Underlying the dialectical materialist position is an understanding of matter as existing in a perpetual state of motion or change; scientific explanation in the fullest sense is arrived at through analysis of the conditions determining change.

For Vygotsky's psychology, the dialectical materialist emphasis on analysis of change is encapsulated in the 'principle of development' (translated also as 'historism' or 'historicity'), "the principle of cognition of things and phenomena in the process of their becoming and development, in connection with the conditions determining them" (Frolov, 1984, p. 175). According to this precept, knowledge of a given object of investigation is to be gained through knowledge of its historical changes; descriptive analysis is superseded and explanatory analysis achieved only by elucidation of the developmental conditions and relations producing the object, in its present form. Thus, an explanatory account is necessarily an historical account. North American psychology is coming to know Vygotsky as a student of child development; that Vygotsky in fact specified a programmatic theory of general psychology is less commonly recognized. Vygotsky's approach to psychology was a developmental approach; its subject matter, as Vygotsky saw it, was the subject matter of general psychology. Vygotsky's work can be seen as an effort to provide psychological inquiry with the broadly paradigmatic framework which was lacking in the psychology of his time, and which most would agree is still lacking today; the Vygotskian paradigm is a developmental paradigm. Vygotsky concerned himself with child psychology not as a circumscribed field of study, but because it was clear to him that the principal questions of human psychology were to be resolved through examination of processes of change occurring as learning and psychological development during childhood. He "emphasized the study of development because he believed it to be the primary theoretical and methodological means necessary to unravel complex human

processes" (John-Steiner & Souberman, 1978, p. 128).

To contemporary psychological researchers, the term 'method' most commonly refers to specific means of empirical hypothesis-testing, such as experimentation and correlation. For Vygotsky, though, issues of methodology comprise a much broader category: as well as the concrete procedures of empirical investigation, 'method' in this sense includes also matters of hypothesis generation, theory, metatheory, and even epistemology. Thus, Vygotsky saw methodological considerations as crucial to all aspects of the scientific research process.

One of the specific methodological problems which Vygotsky addressed was the question of heuristics for a basic analytical approach. He observed that the researcher employing the typical mode of analysis in psychology "analyzes complex psychological wholes into elements" (Vygotsky, 1934/1986, p. 4), isolating parts of wholes for the sake of seeming precision of study. The consequence for psychologists of this approach, as pointed out by Vygotsky, is that "having studied each apart from the other, they are forced to see the relation between them merely as a mechanical, external connection between two distinct processes" (p. 3). Such an analytical method, by definition, leads the investigator away from the study of emergent properties of psychological wholes; different mental functions, studied apart from one another, are simply assumed to be related as elements of psyche. Interfunctional relations are rarely made the subject of psychological inquiry, and the fact that different functions interpenetrate in complex and changing ways has not been treated as a matter of much scientific interest. For Vygotsky, it is this interpenetration, the complex developmental intermingling of psychological functions, that contains the most crucial information for human psychology.

Vygotsky (1934/1987, p. 45) offers a simple analogy with chemical analysis: a water molecule can be reduced to two hydrogen atoms and one oxygen atom, but since both hydrogen and oxygen have radically different effects on fire than does water, it is clear that

the effect of water on fire cannot be explained purely in terms of the elements of water, and that explanatory information related to specific properties of the whole (that is, the water molecule) has been lost in the reduction. Vygotsky's alternative to this deceptive analysis into elements is analysis by units:

> Unlike elements, units do not lose the characteristics inherent to the whole. The unit contains, in a simple, primitive form, the characteristics of the whole that is the object of analysis. (1934/1987, p. 244)

In his investigation of the interrelation of speech and thinking, for example, Vygotsky chose as his unit of analysis "word meaning as a unit of both generalizing thought and social interchange" (1934/1986, p. 9). In word meaning Vygotsky saw the simplest unit in the relation of speech and thinking which had not lost essential properties of the whole through the process of analytical reduction. The concept of word me. .ing involves both language and thought; it "is the unit of verbal thought that is further unanalyzable and yet retains the properties of the whole" (p. 5). The utterance of a word is an act of both speech and thinking - a unity of language and cognition. Explanatory analysis of human conduct cannot be achieved by means of a method which cannot account adequately for relational processes between different psychological functions; using such an approach, "the door is closed on the issue of the causation and origin of our thoughts" (p. 10). Vygotsky argued that psychology "must replace the method of decomposing the whole into its elements with that of partitioning the whole into its units" (1934/1987, p. 47).

Differences among various schools of scientific psychology arise in matters of theoretical interpretation of empirical data, and not on the point of basic methodological approach; in fact, Vygotsky argued, they share a common approach, the "stimulus-response framework" (1978, p. 58). The application of this method involves two phases: presentation to the experimental subject of a specific stimulus situation, and examination of the subject's responses to this situation. Vygotsky complained that

"psychological processes have long been understood within a reactive context" (p. 59).

Analysis in accordance with this method is a common instance of elemental analysis:

'stimulus' and 'response' are studied as disparate parts, and summed together in an

extrinsic union to form 'behaviour.' The overall meaning of human conduct, the

culturally-embedded needs that motivate it, are difficult to discern among the results of such

analysis. The product of stimulus-response analysis is a view of "the relation between

human behavior and nature as unidirectionally reactive" (p. 61), with no recognition of

human capacities to actively relate to their surroundings by bringing about transformational

changes in objects in accordance with human needs. Such analysis clearly will fail to

capture the most essential specifically human characteristics.

In place of the stimulus-response regimen, Vygotsky (1978) proposed what he

described as an "experimental-developmental" (p. 61) method. He explicated three

interrelated principles pertaining to this method. The first of these is that investigation of

higher psychological functions entails "the analysis of processes, which requires a dynamic

display of the main points making up the processes' history" (p. 61), in the full complexity

of their changing interrelations. Vygotsky asserted that "the psychological development of

humans is part of the general historical development of our species and must be so

understood" (p. 60).

Second, Vygotsky stipulated that this method aims for explanatory analysis, rather

than description of the superficial, static characteristics of an object of investigation which

is frozen in time, as it were. The objective of Vygotsky's approach is to "reveal the actual

causal-dynamic relations" (1978, p. 62), the developmental relations which have produced

the object of investigation in its current form. In this connection Vygotsky discussed

Lewin's "distinction between the phenotypic (descriptive) [or "phenomenological"] and

genotypic (explanatory) viewpoints to psychology," a difference between investigating the

"current features and manifestations" found in the object of investigation, and investigating

the object's "genesis" (p. 62). Vygotsky explains, "two phenotypically identical or similar processes may be radically different from one another in their causal-dynamic aspects and vice versa; two processes that are very close in their causal-dynamic nature may be very different phenotypically" (p. 62), pointing out that phenotypic analysis can be quite misleading.

Vygotsky's (1978) third principle is a caution against the naive study of "fossilized behavior," instances of which "are most easily found in the so-called automated or mechanized psychological processes" (p. 63). These processes have become routine through practice and repetition, and have thus "lost their original appearance, and their [current] outer appearance tells us nothing ... about their internal nature" (p. 64). In the case of such fossilized behaviour descriptive analysis is difficult to escape, using conventional stimulus-response methodology.

Vygotsky (1978) advised that "special means of scientific analysis are necessary in order to lay bare internal differences that are hidden by external similarities" (p. 63). Vygotsky's experimental method has been called microgenetic (see, for instance, Wertsch, 1985) because it is intended to produce and render observable processes of psychological development which are very brief in duration. In response to the problem of avoiding study of fossilized processes, Vygotsky (1978) wrote that "the aim of dynamic analysis" is "to alter the automatic, mechanized, fossilized character of the higher form of behavior and to turn it back to its source through the experiment" (p. 64). This method "artificially provokes or creates a process of psychological development" (p. 61), in an effort to "telescope the actual course of development of a given function" (Cole & Scribner, 1978, p. 12), and thus to engender what is normally a long and gradual process in a shortened, artificially-invoked form.

The Vygotskian view does not call for exclusive use of causal-genetic methodology. Vygotsky (1978) wrote:

Analysis is not limited to a developmental perspective. It does not repudiate

the explanation of current phenotypical idiosyncracies, but rather

subordinates them to the discovery of their actual origin. (p. 63)

Vygotsky supported methodological pluralism, with the proviso that historical explanation

must be actively sought as a superordinate goal of scientific investigation. Phenotypic

methodology - carefully employed - can often provide a means toward the overall end of

historical explanation.

Vygotsky's historical methodology is characterized by apprehension of three distinct

yet interpenetrating lines of development that are of direct relevance to human psychology:

ontogeny, social history, and phylogeny. Cultural-historical theory holds that human

phylogeny slowed to a virtual standstill when social-historical development began - that is,

with the advent of culture. The cultural-historical explanation of this transition - the

transition which separates humans from other animals, and accounts for human uniqueness

in all its forms - involves both highly-developed forms of social organization, and the

concept of 'labour.' Animal species are, of necessity, continually becoming better adapted

to particular ecological niches in their environments; humans, on the other hand, began

instead through the labour process to actively adapt their objective environments to

themselves, in accordance with their specific needs. In transforming nature, humans

fundamentally transform their relation to nature, qualitatively changing both the conditions

of human life and the essential character of human psychological processes.

An essential feature of the labour process is that it is mediated by tools. Developing

this basic mediational paradigm. Vygotsky arrived at the concept of 'psychological tools,'

the role of which he saw as "analogous to the tool in labor" (1981, p. 136). Examples of

psychological tools include "language; various systems for counting; mnemonic techniques;

algebraic symbol systems; works of art; writing; schemes, diagrams, maps, and mechanical

drawings; all sorts of conventional signs; etc." (p. 137). Thus, Vygotsky analyzed "the

role of sign systems as mediating devices ... as an extension of Marx's notion of how the tool ... mediates labor activity" (Wertsch, 1981, p. 134). The most important human ontogenetic changes, for Vygotsky, are changes in which the child comes to incorporate psychological tools into what are initially natural (that is, noncultural) psychological processes, reorganizing their structure and transforming them into semiotically-mediated 'higher psychological processes.' As Wertsch points out, "when a process becomes mediated, this does not simply mean that the same mental ... process is carried out more efficiently or faster; rather, it means that this process is restructured into something qualitatively different" (p. 280).

Fundamental transformations of this kind occur during joint collaborative action involving the child and other people. It is in such interpersonal contexts that the child comes to make use of psychological tool systems. One of Vygotsky's most well-known critical commentaries on mainstream psychology centred on his observation that psychological inquiry focuses primarily on the individual, on psychological processes as they are seen to occur in the activity of a single person. Such an approach, taking the psychology of the individual as the predominant subject matter, is in Vygotsky's eyes doomed to failure due to its inevitable arrival at descriptive, nonexplanatory blind alleys. To take as the primary focus of psychological study processes restricted to the individual is to begin one's inquiry with a methodologically-produced abstraction. As Leontyev noted, "'it is the activity of others that provides an objective basis for the structure of individual activity'" (quoted in Kozulin, 1986, p. xlix). Human actions are socially constituted, and their full human meaning becomes apparent only with consideration of the cultural, interpersonal contexts in which they are carried out. The individual person considered in isolation is an object of investigation removed completely from its context, precluding crucial consideration of developmental and historical relations. Clearly, for Vygotsky, truly explanatory psychology is beyond the grasp of such an approach, from the outset.

Vygotsky argued that "the individual dimension of consciousness is derivative and secondary, based on the social and construed ... in its likeness" (1981, p. 30). He asserted that distinctively human psychological functions are created through interiorization (or internalization) of the mediational means operating in collaborative joint action, and of the rudimentary mediated structure of such action. According to cultural-historical theory, "internalization does not consist in the shift of external activity to the internal plane ... that precedes it, but in the very formation of this plane" (Davydov, Zinchenko, & Talyzina, 1982, p. 34).

Vygotsky regarded this sort of genetic movement from external, interpersonal or cultural processes to internal, individualized functions as a pervasive, continually recurring process in human ontogeny. This underlying notion is discernable in many cultural-historical theoretical constructs; it is reflected, for instance, in what Vygotsky referred to as the 'general genetic law of cultural (or higher psychological) development:'

> Any function in the child's cultural development appears twice, or on two
>
> planes. First it appears on the social plane, and then on the psychological
>
> plane. First it appears between people as an interpsychological category,
>
> and then within the child as an intrapsychological category. (Vygotsky,
>
> 1981, p. 163)

Although he asserts that "social relations ... genetically underly all higher functions," Vygotsky also claims that the emergence of a given process as an intrapsychological category fundamentally "transforms the process itself and changes its structure and functions" (1981, p. 163). The form a function takes on the internal plane obviously is not directly isomorphic to its original external form. Vygotsky's approach provides a highly concrete historical account of this transformation of social to individual processes; as Wertsch explains, "Cognitive processes in individuals do not somehow magically emerge out of social interaction; rather, by coming to master the mediational means of social

interaction, the child masters the very means needed for later independent cognitive processing" (1981, p. 190-191). With the incorporation of psychological tools, the child's mental processes are changed into a form which is subject to conscious, intentional control.

For the cultural-historical school, everything encountered by the child in his or her environment is pervaded with a sociocultural character. Luria (1987) observes that "from the beginning, the infant's activity is permeated by an orientation to adults, by social interaction with them" (p. 361). Furthermore, as Leontyev (1981) points out, "From its very birth a child is surrounded by the objective world created by people" (p. 422) in the process of their active transformation of nature in accordance with human needs, that is, the world of cultural objects. The active character of this process also must be emphasized: in contrast to the relation of the animal to its environment, "the child does not adapt itself to the world of human objects and phenomena around it, but makes it its own, i. e. appropriates it" (p. 422). In the course of acquiring fluency in the language of his or her culture, for instance, the child does not develop language ability through passive reception of speech processes from others; rather, "the child makes this its language" (p. 422) through a series of innumerable creative acts.

Thinking and Speech

An important aspect of Vygotsky's theory concerns the relation between thinking and speech. Anthropoid apes, he believed, exhibit abilities which can be termed thinking; in this connection he cited evidence obtained by Kohler in his well-known research with chimpanzees (see Vygotsky, 1934/1987, p. 101). Furthermore, apes also possess quite advanced vocalization abilities. However, in apes, thinking and vocalization are essentially unrelated: the "speech" of apes is purely affective and nonintellectual, and conversely, anthropoid cognition does not make use of speech or other signs as tool systems. In humans, on the other hand, speech and intellect enter into a relation which profoundly alters the basic character of both. Initially, the child's speech is nonintellectual, and his or her cognition is completely nonverbal. Vygotsky wrote, "the genetic roots and the course of development of thinking and speech are different," but only "up to a given point" (p. 119). As speech and thinking develop, there arises a complex functional relation between them: "What is unique to human ontogenesis is the intersecting of these paths of development" (p. 119). Vygotsky considered this "the most important moment in the course of intellectual development" (1978, p. 24).

An eventual result of this complex intermingling of developmental paths is the emergence of what Vygotsky calls 'inner speech.' Inner speech is a cornerstone of Vygotsky's theoretical system; his account of it is quite complicated and sometimes rather cryptic. With the interiorization during ontogeny of semantic aspects of speech, a form of verbal thinking develops which produces immense qualitative changes in the child's capacities for abstraction and generalization, fundamentally reorganizing the structure of the child's higher cognitive processes. Inner speech is a mediational system, a system of psychological tools which mediates the relation between thought and word. It facilitates systematic semantically-related, goal-directed action of a comparatively autonomous nature. The emergence of inner speech enables the child to represent both goals and potential

means in a novel culturally-structured, parasocial manner. Language takes on a leading, structuring role in higher psychological functioning. So pervasive, in fact, is this semantic mediation of human cognition that in the adult, we can say that inner speech "is thought itself" (Vygotsky, 1934/1987, p. 188). A complete analysis of human thinking does not, of course, end with the level of inner speech, but must ultimately continue to more basic, underlying processes. Vygotsky wrote that "the affective and volitional tendency stands behind thought" - cognition "has its origins in the motivating sphere of consciousness" (p. 282). Vygotsky's work both on inner speech and on problems of motivation was cut short by his untimely death, and left incomplete.

Watson's (1919) account of internal speech bears a degree of outward resemblance to Vygotsky's concept of inner speech. Watson theorized that human thinking is essentially speech with complete inhibition of the vocal component - "speech minus sound" (Vygotsky, 1934/1987, p. 284), or "silent speaking" (p. 267). According to Watson, there occurs during childhood in certain situations a progressive inhibitory diminution of the acoustic, phonetic aspect of speech, leaving only covert linguistic processes. This development includes an intermediate form, between internal speech and fully pronounced external speech: children's whispering. Vygotsky notes, "Watson writes that young children 'truly think out loud'" (p. 112). Vygotsky pointed out that this account reflects a purely quantitative view of development. He was critical of Watson's failure to acknowledge qualitative, transformational changes; according to Watson, Vygotsky wrote, "inner speech is precisely the same as external speech with the exception that it is not completed" (p. 256). In his own research, Vygotsky could find no functional similarity between mature inner speech and children's whispering. Further, Vygotsky reasoned that if whispering is a transitional form between external and internal speech, differences should be discernable between external speech and whispering in terms of linguistic and grammatical structure; he was unable to find any such differences. Finally, Vygotsky

found that "in genetic terms, whispered speech can be elicited very early, but there is no evidence of development or change in its nature from this point through school age" (p. 113).

Vygotsky concluded that although Watson's theory manages to "identify a feature basic to a scientific concept of inner speech," his "conception does not exhaust the concept inner speech nor even correspond to it entirely" (1934/1987, p. 256). Watson's approach may, however, contain "the basis for a correct methodological resolution to the whole problem" (p. 113) of the interiorization of speech. This basis lies in the recognition of the need to "find a middle link" (p. 113) between external and internal speech forms. For Vygotsky, this link is not whispering, but the child's egocentric speech.

Egocentric speech (also referred to in contemporary work as 'private' speech) is speech which is not functionally directed at other people, or which does not contain all the information necessary for its meaning to be understandable to a listener. In this latter sense, egocentric speech can be said to be inadequately adapted to the perspective of the listener.

The researcher prior to Vygotsky who devoted the most attention to children's egocentric speech was Piaget. Piaget assumed that the incidence of egocentric speech coincides with the developmental period during which the child's psychological processes are characterized by cognitive egocentrism, a psychological orientation in which the child is able to cognize the world only from his own point of view, without awareness that other people hold other points of view. Egocentrism is "the inability to decenter" (Piaget, 1962, p. 3), the inability to take the perspectives of others, engendered by "a lack of differentiation of viewpoints" (p. 5). Piaget "describes egocentrism as occupying an intermediate position, genetically, structurally, and functionally, between autistic and directed thought" (Vygotsky, 1934/1986, p. 16).

Piaget's notion of autistic thought - strongly influenced, as Vygotsky notes, by

psychoanalysis - denotes a "'subconscious,'" individualistically self-absorbed form of thinking which is "'not adapted to reality, but creates for itself a dream world of imagination,'" and which "'tends ... not to establish truths, but to satisfy desires'" (Piaget, quoted in Vygotsky, 1934/1987, p. 57). For the neonate, "the real is simply that which is wished" (Vygotsky, 1934/1987, p.84), because "'Freud's "pleasure principle" deforms and refashions the world to its liking'" (Piaget, quoted in Vygotsky, 1934/1987, p. 84). In more characteristically Piagetian terms, there is in autistic thought "a predominance of assimilation over accomodation" (Piaget, 1962, p. 4). Directed thought, on the other hand, is mature socialized thought which is conscious and "'adapted to reality,'" and which "'can be communicated by language'" (Piaget, quoted in Vygotsky, 1934/1986, p. 16). Thus, the child's egocentrism is seen by Piaget as a transitional phase between early individualistic cognition and later socialized cognition.

Piaget believed that the child's egocentric speech was a reflection of the child's egocentric thinking. He recorded observations of egocentric speech in the activity of children aged three to seven years; he found that among five- and six-year-olds, 40 to 70 percent of children's spontaneous conversations were predominantly egocentric in character (see Kohlberg, Yaeger, & Hjertholm, 1968, p. 692). Piaget did not regard egocentric speech as being dynamically involved in the child's psychological development; instead, he regarded it as epiphenomenal, "a by-product" (Vygtosky, 1934/1986, p. 28) of egocentric thought. Vygotsky paraphrased this view metaphorically: "Egocentric speech changes nothing in the leading melody of activity" (p. 28). Vygotsky also noted, "According to Piaget, the function of egocentric speech is to 'chant' one's thoughts or actions" (p. 27) - "it plays no essential role in child behavior" (p. 29). Serving no specific purpose, egocentric speech gradually diminishes, and eventually vanishes altogether, to be replaced by socialized speech.

For Piaget, egocentric speech is a manifestation of the child's "lack of cognitive skill

in communicating," and, more fundamentally, a manifestation of "a lack of social will to communicate and to integrate social differences" (Kohlberg et al., 1968, p. 693). A major condition of egocentrism is "'the absence of any sustained social intercourse between children of less than 7 or 8,'" before which age, Piaget believes, the child has "'no real social life'" (Piaget, quoted in Vygotsky, 1934/1987, p. 67). Piaget's model of the development of egocentric speech can be represented as a monotonic decline in the coefficient of egocentrism (the percentage or proportion of a child's speech which is egocentric) with accumulating social experience, between the ages of three years and seven or eight years.

Vygotsky (1934/1986) criticized Piaget's assertion of the priority of autistic thought, arguing that in accordance with evolutionary, historical processes, and in accordance with the necessary relation of living creatures to their objective environments, thought that is not primarily oriented toward external reality cannot precede reality-oriented thought. Instead, the conditions of human living require that psychological processes be addressed from the beginning in an object-related, directed manner toward the objective fulfillment of the individual's human needs. Vygotsky quotes Bleuler: "'I cannot imagine a living creature who would not be concerned first of all with the reaction to reality'" (p. 21). Vygotsky (1934/1987) argues that psychological theory "cannot place the satisfaction of needs and the process of adaptation to external reality in opposition to one another" (p. 77) - of necessity, needs must be satisfied through some relation to the objective world.

The context of human living is a social context, and the child's earliest psychological processes are, in Vygotsky's view, a dialectical reflection of this social reality. The neonate's needs are provided for exclusively through interpersonal contact, and the baby's need for stimulation is satisfied almost exclusively in interpersonal situations, frequently involving cultural objects such as toys. Thus, the child's initial forms of thinking are necessarily social in character. If autistic thought cannot be considered historically primary

in the ontogenetic development of thinking, then doubt arises concerning the other two of the three phases in Piaget's sequence, and "egocentric thought ... may not be considered as an intermediary between such a hypothetical beginning and the higher stages of the development of the mind" (Vygotsky, 1934/1986, p. 25).

Vygotsky believed that although Piaget recognized that this speech form was of theoretical importance, "he remained entirely blind to the most important characteristics of egocentric speech" (1934/1987, p. 257). Vygotsky argued that egocentric speech is an emergent system of psychological tools, "an instrument of thought" (1934/1986, p. 31), undergoing a transformational process of interiorization. In accordance with the movement from external or social to internal or individual processes outlined in the 'general genetic law of cultural development,' Vygotsky proposed that egocentric speech is derived from interpersonal communication, and that it is gradually interiorized as a verbal form of thought. Vygotsky pointed out that his "theory suggests that the child's egocentric speech is one aspect of the general transition from inter-mental functions to intra-mental functions, one aspect of the transition from the child's social, collective activity to his individual mental functions" (1934/1987, p. 259). Whereas "in Piaget's view, egocentric speech arises from the inadequate socialization of what was originally an individual function," Vygotsky's position holds that "it arises from the inadequate individualization of an initially social speech" (p. 262). If the original function of speech is a social function, it follows that the very "notion that speech is socialized is incorrect in that it implies that speech was originally non-social" (p. 74).

Vygotsky believed that the linguistically-mediated guiding or regulatory influences which other people exercise on the actions of the child come to be applied by the child to his or her own actions. Thus, Vygotsky discerned a developmental transition from regulation of the child's conduct by others to increasingly effective self-regulation and self-control. Further, he asserted "that when egocentric speech disappears, it does not

simply atrophy but 'goes underground,' i. e., turns into inner speech" (1934/1986, p. 32-33), and that "the same mental operations that the preschooler carried out through voiced egocentric speech are ... [in the process of being] relegated to soundless inner speech in schoolchildren" (p. 30). Vygotsky observed that the "thinking aloud of an adult has a striking similarity to the egocentric speech of children" (p. 32). Vygotsky (1978) summarized the role of egocentric speech in terms of four interrelated functions: it "enables children to provide for auxiliary tools in the solution of difficult tasks, to overcome impulsive action, to plan a solution to a problem prior to its execution, and to master their own behavior" (p. 28). In contrast to Piaget's model of monotonic decline, Vygotsky's theory instead implies a curvilinear pattern of development (equivalent to a cubic trend), in the shape of an inverted U (see Kohlberg et al., 1968), with a positive slope to about five years of age (as the new instrumental functions of speech emerge), and a negative slope after approximately five or six years (as what had earlier been egocentric speech is increasingly carried out internally).

Vygotsky and his student Levina carried out a variety of experimental research which illuminated several characteristics of children's egocentric speech. They found, for instance, that when children encounter obstacles or complications in the execution of a task, large increases occur in their production of private speech. Vygotsky (1978) performed experiments in which he incorporated a series of obstacles and difficulties into tasks carried out by children, and discovered "that in these difficult situations the coefficient of egocentric speech almost doubled" (p. 30), both compared to Piaget's reports, and compared to Vygotsky's own control data. This observation was made in a variety of different task contexts. For instance, in a drawing task, the child might find that he "did not have the colored pencil, paper or paint that he needed" (Vygotsky, 1934/1987, p. 69). Upon making such a discovery, Vygotsky reported, many children began to use speech to evaluate alternative colours or to formulate alternative drawing strategies.

Vygotsky (1978) and Levina (1981) describe experiments in which preschool-aged children tried to obtain candy placed out of reach in a tall cupboard, using aids such as sticks, and chairs to stand on. They found that as the child became increasingly engaged in the task of obtaining the candy, speech became incorporated into the task as a problem-solving instrument - verbal regulation and planning "began to manifest itself as part of her active striving" (Vygotsky, 1978, p. 25). The more complexly mediated or abstract the psychological strategies required in a given task situation, the more important becomes the function of private speech. If a child is prevented from making use of private speech at a complex or difficult moment in a task, the child may not be able to carry on with the task. Frequently, it was discovered, attempts to prevent children from producing private speech upon encountering difficultie are futile.

This research also showed that as a child becomes increasingly practised at or familiar with a task or action, the occurrence of private speech shifts from the end of the action to the beginning. Vygotsky (1934/1986) reported: "We observed how egocentric speech at first marked the end result or a turning point in an activity, then was gradually shifted toward the middle and finally to the beginning of the activity, taking on a directing, planning function and raising the child's acts to the level of purposeful behavior" (p. 31). With such a shift, speech "starts serving as a mediator in purposive activity and in planning complex actions" (p. 39).

Levina (1981) refers to egocentric speech that follows or accompanies an action as 'constituting speech.' She suggests that this form of speech, though not actually directing or planning actions, "fulfills a useful role as a device for exploration and accumulation of experience" (p. 284). Levina's observations showed that "in the speech that follows an action one does not usually find a reflection of details ... ; rather, one finds the schema for the ... action and the essential elements" (p. 288). Speech which occurs simultaneously with action is initially a part of the action itself, rather than a diversifed form of description

or analysis; this latter form is involved in the transition to planning speech. Dynamic transitions among these various forms can, Vygotsky notes, occur rapidly: "The structural relation can shift even during an experiment" (1978, p. 27). Vygotsky compared these observations to the well-known change in children in the point at which they will name a drawing. Initially, the child first draws, and then names the product; next, he or she names the drawing while producing it; and finally, the child verbally plans the picture by naming it before starting to draw. Vygotsky pointed out a close similarity between this pattern and the changes in the structural relation of speech and action in his experiments, and proposed that this naming-drawing relationship is "a particular case of this more general law" (1934/1987, p. 71).

Levina (1981, p 295) recounts an experiment in which preschool- and school-aged children were asked to remember sentences by drawing pictures to use as memory aids. Neither the youngest nor the oldest children used speech in planning their drawings. Many of those in the intermediate age range did not spontaneously produce any speech, either. However, among this intermediate age group (late preschool age), it was easy for the experimenter to evoke verbal planning by asking the child a question, such as "Tell me, what is it that you're drawing?" This interjection led the child to formulate a verbalized plan, in order to answer; it often produced a sustained qualitative change in the structure of the child's actions, as he or she began to apply language in a purposefully-directed way.

Vygotsky's view of egocentric speech as self-oriented speech which is not yet fully differentiated from social speech led him to conduct experiments demonstrating that young children have a higher coefficient of egocentrism in a social situation, a situation where social speech is appropriate and effective, compared to situations in which it is not. In the social situation, the child tends to confuse his or her own thinking with social interaction, so the child's thinking tends to be verbalized; this is a direct manifestation of the young child's limited differentiation of egocentric speech from social speech. When the child is

isolated, there are no other people present to stimulate the child to speak, and if the child is not engaging in social speech, then his or her thinking will tend to be unverbalized and carried out internally; thus, the coefficient of egocentrism decreases. Vygotsky observed this decrease in a variety of situations, including: complete isolation from social contact; seated "behind a table in the corner of a room in isolation from other children;" in play settings with other children who were unfamiliar to the subject, or who were deaf, or who spoke a foreign language; when children were "forbidden to speak loudly," and "instructed to carry on conversation only quietly or in a soundless whisper;" and when "an orchestra or some other loud noise was used to drown out the child's own voice as well as the voices of others" (1934/1987, p. 265). Vygotsky's reports of these experiments do not include sufficient detail to assess numerous possible methodological problems, including observational and recording techniques. Furthermore, his precise position regarding the hypotheses tested in these studies is not entirely clear: elsewhere, Vygotsky writes that increases in egocentric speech occurring with heightened task difficulty are

> best seen when the experimenter leaves the room or fails to answer the
>
> child's appeals for help. Upon being deprived of the opportunity to engage
>
> in social speech, children immediately switch over to egocentric speech.
>
> (1978, p. 27)

This suggestion appears inconsistent with other findings discussed above.

Vygotsky's interest in the development of egocentric speech was related to his desire to avoid studying 'fossilized behaviour' and focus instead on objectively-observable external forms of processes which usually occur internally. Egocentric speech cannot be regarded as an externalized form of an internal 'fossilized' process, because it is verbal thinking in a form which has not yet been interiorized. Nonetheless, in accordance with the basic rationale of studying processes in external rather than internal forms, Vygotsky regarded the investigation of egocentric speech "as a means for studying inner speech

experimentally" (1934/1987, p. 258). He noted both a functional similarity and a related structural similarity between children's egocentric speech and mature inner speech. Functionally, both are 'speech-for-oneself,' speech employed as a cognitive tool system in the subject's psychological orientation to the world. Egocentric speech is speech-for-oneself in an external form; inner speech is internal speech-for-oneself. As Vygotsky explains, this speech function "becomes mentally 'inner' earlier than physically 'inner'" (1934/1987, p. 75). Structurally, both egocentric and inner speech are highly predicative.

Vygotsky distinguished between the grammatical subject and predicate of a sentence, and the psychological subject and predicate. Unlike the grammatical categories, the psychological subject and predicate are determined not by the formal grammatical structure of the sentence, but by the specific object-related context of the activity in which the sentence is embedded. To illustrate this distinction, Vygotsky used the sentence, "The clock fell." The grammatical subject of this sentence is 'clock,' the grammatical predicate, 'fell.' In interpersonal speech, however, the psychological subject and predicate may or may not correspond with the grammatical categories, depending on the concrete context of the utterance. The sentence, "The clock fell," has a different psychological structure if it is uttered as a response to the question "What happened to the clock?" than to the question, "What fell?" (Vygotsky, 1934/1987, p. 252).

In speech-for-oneself, there is a tendency toward abbreviation of the linguistic form such that the psychological predicate is accentuated. Inner speech, in fact, "consists entirely of psychological predicates" (Vygotsky, 1934/1987, p. 273). In interpersonal speech, the degree of predication depends on the degree of intersubjectivity, on how much knowledge about the situation is shared by the interlocutors. For example, the question "Do you want some tea?" might be abbreviated to the word "Tea?," between two people sitting at a table upon which rests a steaming teapot. The developmental course of

children's egocentric speech includes increasing emphasis of the psychological predicate and a gradual omission of the remainder of the utterance, since the child's intrapsychological intersubjectivity, as it were, is complete. Vygotsky explains that egocentric speech "is condensed, having a marked tendency to omit or abbreviate what is before the eyes" (p. 72) of the speaking child.

Vygotsky's distinction between psychological subject and predicate is closely parallelled by the distinction in current linguistic theory between 'given' (or 'old') information and 'new' information (see Wertsch, 1985). The given information in an utterance is presumed by the speaker "to be in the consciousness of the addressee at the time of the utterance" (Wertsch, 1985, p. 142); new information is that which is introduced into the addressee's consciousness by way of the utterance. Research in linguistics has shown that compared to the rest of the utterance, "the portion ... conveying given information is characterized by lower pitch, weaker stress, and a tendency for nouns to be pronominalized" (p. 142). Children's egocentric speech is composed largely of new information; given information - "what is before the eyes" - tends to be deleted, since it is already part of the child's conscious awareness. Wertsch points out that "the development of egocentric and inner speech is characterized by increasing contextualization" (p. 108): the meaning of a child's private utterance becomes progressively more dependent on the particular objective context in which the speech is produced. As predication increases, Vygotsky notes, it becomes "impossible to understand the child's egocentric expression if you do not see what is referred to by the predicates that constitute it, if you do not see what the child is doing and seeing" (1934/1987, p. 278).

A Review of Contemporary North American Research

on Children's Private Speech

With increasing availability over the past three decades of Soviet developmental

psychology in English-language translation, interest in the development of children's

private speech has grown among North American researchers. There is a small but

growing body of contemporary research on private speech; the results of this work have

been quite supportive of Vygotsky's account.

Private Speech Classification Systems

Many researchers investigating Vygotsky's theory of private speech development

have made use of systems for categorizing children's private speech according to various

functional, structural and phonological criteria. A number of investigators have made use

of modified or unmodified forms of a categorical system introduced by Kohlberg, Yaeger,

and Hjertholm (1968), in one of the earliest reports of private speech research in the North

American literature. It was these authors who proposed use of the term 'private' rather

than 'egocentric' speech, arguing that the latter term is inappropriate for use in

contemporary work, loaded as it is with Piagetian conceptions. In deriving their

classification system, Kohlberg et al. tried to incorporate Vygotsky's theory along with

both Piagetian ideas and inferences drawn from Mead's (1934) social psychological theory.

Application of this system includes first classifying units of speech as private or social,

then classifying each private utterance into one of six categories:

Category 1: Word play and repetition;

Category 2: Comments to nonhuman objects;

Category 3: Describing own activity (generally in present

verb tense);

Category 4: Questions answered by the self;

Category 5: Self-guiding comments (typically goal-related; often references

to nonvisible aspects of the situation);

Category 6: Inaudible or indecipherable muttering.

(Kohlberg et al., 1968, p. 707-708)

Kohlberg et al. (1968) suggested that these categories can be regarded as a developmental sequence of stages, progressing from relatively ineffective early forms such as 'Word play' through to 'Muttering,' an increasingly less understandable form of speech occurring just before private speech is fully interiorized. In general, this claim of developmental sequentiality seems at face value to be somewhat dubious. Kohlberg et al. provide evidence (in the third of their four studies) that between the ages of five and nine years, the first, second and fourth categories comprised a very small proportion of total private speech, the proportion in the third category declined steadily, and the fifth and sixth categories contributed high proportions. Such a pattern occurring in this age range, while not perfect, provides a degree of support for the suggestion of developmental sequentiality.

As part of their fourth study, Kohlberg et al. (1968) combined the first and second categories and subjected the data for the resulting five categories to a Guttman simplex analysis. The reasoning underlying the Guttman simplex is that sequentially-ordered categories should each be quite highly correlated with other categories near them in the order, and uncorrelated with more distant categories. (Ideally, a given category should be associated with immediately preceding and following categories; this expectation is based on the assumption that private speech of several different categories will be observed at any one point in development.) To the extent that this is the case, the set of categories is said to form a Guttman simplex order. The data obtained by Kohlberg et al. appeared to conform loosely to this pattern, with the exception of the third category, which did not fit anywhere within the sequence. Overall, though, results of this analysis provide only very weak support for the sequentiality claim; the highest intercorrelation accounted for less than 13 % of the variability in question, and failed to reach statistical significance.

This private speech classification system does, however, have several interesting characteristics. The forms referred to by Levina (1981) as 'constituting speech' and 'planning speech' are loosely represented in the Kohlberg et al. (1968) system by the third and fifth categories ('Describing own activity' and 'Self-guidance'), in a sequence agreeing with the original Soviet observations. The "word play" character of the first category is consistent with Vygotskian theory, since in the case of the very young child for whom the process of functional differentiation of speech-for-oneself from social speech has only recently begun, much private speech would be expected to be largely playful and rather ineffective in a task-related sense, and not especially purposive or intentional.

The sixth Kohlbergian category ('Muttering') bears a degree of similarity to Watson's ideas about children's whispering. Increasingly inaudible muttering involves a reduction in the volume of speech; indecipherable muttering, however, might well be a product of increasing predication in the child's speech. It is important to note that Vygotsky's criticism of Watson's claim focussed less on the fact that Watson posited quantitative changes in children's speech than on his disregard for crucial qualitative changes. Indeed, it is consistent with Vygotsky's approach to suppose that as private speech becomes progressively interiorized, it also becomes less fully vocalized. The more theoretically important changes from the Vygotskian perspective, though, are qualitative changes in structure and function. Thus, this sixth category in the Kohlbergian model can be seen as encompassing both Watson's notion of diminishing vocalization and Vygotsky's observations of increasingly predicative structure.

As mentioned above, this classification system devised by Kohlberg et al. (1968) has been utilized by numerous subsequent researchers, both in its original form and in various modified forms. One study in which the Kohlbergian categories were used in their original form was reported by Deutsch and Stein (1972). These researchers found that their sample of four-year-old children produced more private speech in the second and third categories

than in any others, and that children with higher mental age (MA) tended to use speech in
more advanced categories. Both of these findings provide some support for their
developmental sequentiality of the Kohlbergian categories. These findings are in general
agreement also with Vygotskian theory, in that they support the notion that private speech
is related to mental development.

Rubin, Hultsch, and Peters (1971) used the Kohlbergian system but eliminated the
fourth category ('Questions answered by the self') due to nonoccurrence, and the third and
fifth categories ('Describing own activity' and 'Self-guiding comments') because of low
interobserver reliability in discriminating between the two forms. Using the remaining
three categories, Rubin et al. found that subjects produced more 'Word play' in child-child
dyadic situations than in child-adult dyads, suggesting that children's private uses of
speech may be more mature in the company of an adult than in the company of another
child. Assessing the relationship of birth order to their three categories, they found that
first-born and only children in their sample tended to produce more 'Muttering' than
later-born children. Though based on only three of the six Kohlbergian classifications,
these findings nonetheless provide some support for the status of the model, or at least the
first and sixth categories. The results of this study are readily accounted for by Vygotsky's
theory. The cultural-historical account would lead to the expectation that in the presence of
adults, children's private speech would tend to take on regulative functions, since it is
through joint action with adults that children appropriate self-regulative uses of speech.
Such a tendency would result in the occurrence of lower frequencies of early, relatively
ineffective private speech forms such as 'Word play,' when an adult is present.
Furthermore, to the extent that first-born and only children tend to be more developmentally
advanced in some ways than later-born peers (see, for instance, Luria & Yudovitch, 1959),
it seems reasonable that they should tend also to produce more advanced forms of private
speech than later-born children.

Goodman (1981, 1984) modified the Kohlbergian system by eliminating the 'Muttering' classification and adding the category, 'Emotional expletives' (see Goodman, 1984, p. 129). This additional category cannot be expected to fit within the developmental sequence of private speech forms posited by Kohlberg et al. (1968); certainly there is no theoretical basis for considering it equivalent to the original sixth category. Goodman's (1981) results show that while three categories of private speech (Categories 1 and 2, and Goodman's 'Emotional expletives' category) occurred with very low frequency, the other three were ranked in descending order of proportion, with the fifth category accounting for 34 % of total private speech, the fourth category, 26 %, and the third, 19 % (recovered from Table 3, p. 285). This predominance of higher private speech forms would seem somewhat unexpected, given the young age range of Goodman's sample (3 years, 5 months to 4 years, 10 months).

In a naturalistic observational study of 5- to 10-year-old schoolchildren, Berk and Garvin (1984) expanded the six original Kohlbergian classifications to nine types. They added, among others, Goodman's (1981, 1984) affective category, and combined the third and fifth Kohlbergian categories due to low interobserver reliabilities. This combined classification had the highest frequency in this study (47 %), followed by 'Muttering' (24 %) and 'Word play' (18 %); frequencies of other categories were negligible. Berk and Garvin (1984) report that 'Describing own activity/self-guidance' decreased across the younger ages in their sample, but held steady from ages 7 to 10, whereas 'Muttering' increased steadily with age. The pattern of increase in the muttering category provides some support for the Kohlbergian classification system.

Berk (1986) used a classification system based approximately on the model proposed by Kohlberg et al. (1968), involving both broad and fine categories. Berk's (1986) broad categories comprised three levels: (1) "self-stimulating, task-irrelevant speech," including as fine categories, affective expressions and the first and second Kohlbergian types, 'Word

play' and 'Comments to nonhuman objects'; (2) "task-relevant externalized private speech," including 'Self-answered questions' and 'Describing own activity/Self-guidance;' and (3) "task-relevant external manifestations of inner speech," including 'Muttering' and "lip and tongue movement" (p. 673). Berk recorded naturalistic classroom observations of schoolchildren (grades 1 and 3) during periods of independent arithmetic work. Analyses indicated that speech in the first and second broad categories was associated with motor activity, while the third level was inversely related to movement and associated instead with highly focussed attention.

This variant of the Kohlbergian system was also used in a recent longitudinal study by Bivens and Berk (1990). Children were observed while working on arithmetic in their classrooms, during grades 1, 2, and 3. Bivens and Berk found that across the three years, Level 1 and Level 2 private speech declined linearly. Level 3 private speech, on the other hand, increased linearly with grade level. Trends such as these support the plausibility of at least some aspects of the developmental sequence suggested by Kohlberg et al. (1968), as well as replicating Vygotsky's (1934/1987) observations of reductions in children's overt private speech during the early school years.

The original Kohlbergian system was altered also by Frauenglass and Diaz (1985), who devised four broad private speech categories: (1) self-regulatory; (2) self-reinforcing (including comments about success, failure, frustration, and difficulty); (3) task-irrelevant (including 'Word play'); and (4) muttering and whispering. Frauenglass and Diaz found that in their sample of preschoolers, more self-regulatory utterances were produced while working on semantically-oriented tasks than on perceptual tasks. This category was found to decline with increasing MA (as estimated from Peabody Picture Vocabulary Test scores), whereas 'Muttering' was found to increase.

Overall, results of these studies provide the model proposed by Kohlberg et al. (1968) with modest support. Age-related (Berk & Garvin, 1984; Bivens & Berk, 1990)

and MA-related (Deutsch & Stein, 1972; Frauenglass & Diaz, 1985) differences in frequency, consistent with the hypothesized sequence of private speech forms, have been observed for speech in the first, third, fifth, and sixth categories, constituting evidence at least for this portion of the model. Patterns of distribution of private speech in different categories are also in agreement, for the most part, with Vygotskian theory.

Research using quite different private speech classification systems has also been reported. Rubin and Dyck (1980, pp. 221-222), for instance, used a seven-category system, as follows:

Category 1: Analytic statements;

Category 2: Comments about task materials;

Category 3: Comments about activity;

Category 4: Directions to the self;

Category 5: Feedback;

Category 6: Questions and conditional statements;

Category 7: Other.

Unlike the Kohlberg et al. (1968) model, there is no suggestion that this set of categories forms a developmental sequence. These authors' results show that in their sample of preschoolers, the most frequently occurring types of private speech were Category 7 (47 %), Category 2 (18 %), and Category 3 (16 %). The fact that nearly half of children's private utterances were assigned to the miscellaneous "Other" category raises doubts as to the usefulness of this classification system. The moderately high frequencies of utterances concerning task materials and activity are, however, supportive of Vygotskian theory, in that they reflect the close relation of a child's private speech to his or her ongoing actions.

Beaudichon (1973) employed a classification system comprised of 12 fine categories (some of which have several subcategories), grouped under 4 broad categories: (1) long-term regulation; (2) immediate regulation; (3) affective expressions; and (4) incidental

verbal activity (p. 122). Beaudichon found that while the frequencies of utterances in the first, third, and fourth broad categories were higher for five-year-olds than for seven-year-olds, the frequency of the second category was higher at the second age level than at the first.

Furrow (1984) devised a system for classification of all the child's utterances (private or social) into (1) 1 of 12 functional categories and (2) 1 of 3 social context categories ('Private,' 'Eye contact,' and 'Other social'). Reasoning that if private speech is functionally distinct from social speech, differences of distribution in functional categories should be evident across the three social contexts, Furrow examined patterns of co-occurrences between functional and social context categories in two-year-old children during free play with an experimenter. The referential function and the category, 'Incomprehensible utterances,' were the most frequently observed functional categories, in all three social contexts. Furrow found that while 'Informative' utterances were more frequent in the 'Eye contact' context than in either the 'Other social' or 'Private' contexts, and 'Expressive' utterances were more frequent in the 'Other social' context than in the other two contexts, the 'Describing own activity' and 'Self-regulatory' categories were found to occur more frequently in private speech than in the other two contexts. These results support the Vygotskian claim that there are functional differences between private and social speech, and suggest that the progressive differentiation of functions begins early in development - as early as two years of age, in this study.

Goudena (1987) used a categorization system in which each utterance by participants was classified as either private or social, then categorized on each of four other dimensions (independent of their classification as private or social). The first of these dimensions was 'directed at task/directed at own competence.' The second dimension was 'self-guiding/not self-guiding.' Goudena's third dimension was 'interrogative/not interrogative,' and the fourth was 'task-relevant/not task-relevant.' Each utterance was further classified with

regard to its temporal relation to the nearest action, as 'planning,' 'concomitant,' or 'concluding.' Goudena compiled profiles to characterize the utterances according to these five features. The four most commonly-observed profiles were classified alike as 'task-directed,' 'non-interrogative,' and 'task-relevant,' and were further characterized as 'private/self-guiding/planning,' 'private/self-guiding/concomitant,' 'private/self-guiding/concluding,' and 'social/self-guiding/concluding.' This pattern seems to suggest that while participants' private utterances were likely to occur in any of the three temporal relations to an act, social utterances tended to occur at the end of an act.

In summary, versions of the classification system introduced by Kohlberg et al. (1968) have been employed in a number of subsequent studies (Rubin et al., 1971; Deutsch and Stein, 1972; Goodman, 1981, 1984; Berk & Garvin, 1984; Frauenglass & Diaz, 1985; Berk, 1986; Bivens & Berk, 1990). Patterns of frequency consistent with the rationale of Kohlberg et al. (1968) have been reported in connection with the first, third, fifth, and sixth private speech categories, providing support for a portion of the classification system. Different private speech classification schemes were used in four of the studies discussed (Beaudichon, 1973; Rubin & Dyck, 1980; Furrow, 1984; Goudena, 1987). Although no compelling reason other than convention exists for employing the Kohlbergian scheme rather than one of the other systems, continued use of the Kohlbergian system by private speech researchers would facilitate accumulation of more directly comparable research results.

Most of the North American studies on private speech can be classified as either correlational-observational or experimental research. A number of investigators have taken a correlational approach to studying private speech; many of these have examined relationships between private speech and various characteristics of the task situation or the social context. In these studies, private speech has been observed in the classroom and schoolyard (Kohlberg et al., 1968, Study 1; Berk & Garvin, 1984; Berk, 1986), during

free play (Rubin & Dyck, 1980; Furrow, 1984), while children worked on jigsaw puzzles (Goodman, 1981, 1984), and while they made sticker designs (Kohlberg et al., 1968, Study 2). Berk (1986) reported observations of large quantities of private speech while children carried out arithmetic work in their classrooms, indicating that arithmetic may be an activity highly suited for recording private speech. Bivens and Berk (1990) observed private speech production by all 33 children in a similar task context, in their longitudinal study. In the following sections, findings concerning the effects on children's private speech production of varying social contexts, different types of tasks, and tasks of varying difficulty will be discussed.

Social Context

The social context variable has been examined using correlational methods by Berk and Garvin (1984), who found that private speech production was lower in situations where subjects were in the company of adults than in situations with no adults present. Several functional categories, including 'Word play,' 'Describing own activity,' and 'Muttering,' conformed to the pattern of greater occurrence in the absence of adults. Another social variable - the social context of each particular utterance, rather than of the global observational situation - was examined correlationally by Furrow (1984), as discussed above. Furrow verified the existence of specific functional differences between private and social speech, and demonstrated that the differentiation of functions has its origin at a very early point in ontogeny.

Social context has been experimentally manipulated as a within-subjects variable in a study reported by Rubin et al. (1971). These researchers found that preschoolers produced higher proportions of private speech when playing alone than when playing in the company of either another child or an adult. This difference was especially prevalent for speech in the category, 'Word play.'

Behrend, Rosengren, and Perlmutter (1989a), however, found no difference in

proportions of private speech between experimental phases during which children worked on puzzles alone, and in the presence of a parent. A further analysis of a portion of this data set (reported in Behrend, Rosengren, and Perlmutter, 1989b) assessed the relationship between private speech production and 'scaffolding,' a measure of the extent to which an adult, engaged in a dyadic task situation with a child, offers or withdraws task-related support in a manner contingent upon the child's own independent ability or task performance. This analysis revealed that among three-year-old children (the younger children in the sample), degree of spontaneous scaffolding by the parent was positively correlated with children's private speech production (in terms of both number of private utterances and coefficient of egocentrism) during the social phase of the experiment. This association is consistent with Vygotsky's ideas concerning young children's relative lack of differentiation between the private and social speech functions, in that children who were highly involved in interpsychological functioning (that is, those children whose mothers had high scaffolding scores) tended to produce more private speech than children given less effective adult support.

Goudena (1987) found that four-year-old children produced more private speech while working alone on a puzzle, immediately following an interactive session with a collaborative adult experimenter (during which the dyad worked together on tasks of several kinds), than following a similar session with an experimenter who was noncollaborative. No notable differences, however, were evident between the collaborative and noncollaborative conditions in terms of the five-dimensional profiles used by Goudena to describe the private utterances produced by his subjects.

To summarize, correlational research (Furrow, 1984; Berk & Garvin, 1984) has demonstrated functional differences between speech in social and nonsocial contexts. Results of experimental research have been mixed: whereas Rubin et al. (1971) observed higher coefficients of egocentrism in nonsocial than social situations, Behrend et al.

(1989a) found no such difference. Behrend et al. (1989b) did, however, find an association between parental scaffolding and private speech. This collection of results fails to resolve the ambiguity inherent in Vygotsky's (1934/1987; 1978) work, regarding the relative amount of private speech produced under social and nonsocial circumstances.

MA and Other Variables

Correlations between MA and private speech production have been assessed in several studies; several researchers have estimated MA using the Peabody Picture Vocabulary Test (Deutsch & Stein, 1972; Frauenglass & Diaz, 1985; Goodman, 1981). Since Vygotsky's theory leads to the expectation that a child's private speech production should be more closely related to his or her mental development than to chronological age, examination of this relationship seems a reasonable research strategy. Kohlberg et al. (1968, Study 2) found that in their sample of 4- to 10-year-olds, "bright" (that is, high IQ) subjects' coefficients of egocentrism peaked around the age of four years, and that this peak occurred at the same MA level as the peak occurring among "average" subjects between the ages five and seven years. Deutsch and Stein (1972) found that as MA increased, the developmental level of private speech, in terms of the Kohlbergian sequential categories, tended to increase as well. Frauenglass and Diaz (1985) report that across a series of four MA levels (between four years, four months and seven years, seven months) cross-sectional comparisons revealed that as MA increased, 'Self-regulatory' speech decreased and 'Muttering' increased. As well as providing a degree of support for the proposed sequentiality of the Kohlbergian model, these results accord with Vygotsky's account of the relation between private speech and mental development.

Other variables whose relation to private speech has been examined include gender and cultural group. Kohlberg et al. (1968, Study 4) failed to find either gender differences or cultural differences in private speech production, comparing Norwegian and American children. Berk and Garvin (1984), working with a sample of schoolchildren in the

culturally-distinctive Appalachian region of the United States, found that boys produced the quantitative equivalent of girls' private speech, but that boys' private speech tended to be categorized as less developmentally advanced (according to their nine-category Kohlbergian-based classification system). They attribute this gender difference to culturally-specific patterns of socialization. In Appalachian society, Berk and Garvin relate, adult men tend not to speak much; boys are discouraged from speaking beginning at an early age, leading to general delays in their language development - delays reflected in their private speech. Goudena (1987) found no gender difference in private speech production, among four-year-old children.

In summary, several studies (Kohlberg et al., 1968, Study 2; Deutsch & Stein, 1972; Frauenglass & Diaz, 1985) have found relationships between private speech production and MA which are consistent with Vygotskian ideas.

Task Types

In the experimental literature on private speech, children have been observed while carrying out a number of different tasks. These include working on jigsaw puzzles (Kohlberg et al., 1968, Study 4; Deutsch & Stein, 1972; Goodman, 1981, 1984; Frauenglass & Diaz, 1985; Goudena, 1987; Behrend et al., 1989a, 1989b), stringing beads (Kohlberg et al., 1968, Study 4), building either a freely chosen construction or a copy of a model, with toy blocks (Kohlberg et al., 1968, Study 4, and Frauenglass & Diaz, 1985, respectively), arranging sets of picture-cards in sequential order (Beaudichon, 1973; Frauenglass & Diaz, 1985), classification of sets of picture-cards into categories (Frauenglass & Diaz, 1985), free play (Rubin et al., 1971), and a board game (Feigenbaum, in press). The most common procedure is to have children work on jigsaw puzzles. Goodman (1981) - who reported an overall coefficient of egocentrism of 71 % - recommended puzzle-solving as a highly suitable task activity, "in that it is inherently interesting to young children, it permitted a description of the child's moment-to-moment

puzzle-solving activity, and children spontaneously verbalized when doing the task" (p. 287).

This recommendation is difficult to reconcile with findings reported by Frauenglass and Diaz (1985). These researchers pointed out that the observed rates of private speech in most contemporary studies are surprisingly low: most investigators "report occurrences of private speech for only half of the children in their samples" (p. 357), and coefficients of egocentrism are typically quite small (and only infrequently reported). Frauenglass and Diaz suggested that children tend to assume that unnecessary talking is discouraged in the company of unfamiliar adults, and thus might be inhibited in their private speech production; using a 2 X 2 mixed design, they compared children instructed to talk while working with a group not so instructed. The second variable in this study was task type. Frauenglass and Diaz suggested that perceptually-based tasks of the kind generally employed in private speech studies (tasks such as puzzles, blocks, and beads) elicit low levels of private verbalization because they are not directly based on linguistically-related processes. They compared two kinds of 'perceptual' tasks (puzzles and blocks) with two kinds of 'semantic' tasks (picture-sequencing and picture classification), having each child in their sample of preschoolers carry out all four tasks.

Frauenglass and Diaz (1985) found that whereas the between-subjects instructional manipulation produced no effect, within-subjects differences between perceptual and semantic tasks were as predicted: children produced more private speech when working on the semantic tasks than on the perceptual tasks. This result would seem to suggest - contrary to expectations based, for instance, on Goodman's (1981) work - that puzzles may not be optimal tasks for many research questions concerning children's private speech. This discrepancy may be related to characteristics of particular puzzles (that is, some puzzles elicit more private speech than others), or to specific features of different task situations.

Overall, findings concerning different kinds of tasks are rather contradictory. Jigsaw puzzles have been used by a number of researchers, and have been strongly endorsed by Goodman (1981) as a task well suited for use in private speech studies, but have actually been shown in comparative empirical work to be rather unsuited for this purpose (Frauenglass & Diaz, 1985).

Task Difficulty

Vygotsky's assertion that children's private speech increases at points of difficulty during an activity has been examined in two ways: (1) through manipulation of the difficulty of experimental tasks, and (2) by way of assessing statistical associations between private speech and task performance.

Kohlberg et al. (1968, Study 4) found support for Vygotsky's theory through comparison of the private speech of children while they worked on four different tasks, presumed to be of varying difficulty. Children carried out a bead-stringing task, a building-blocks task, and an easy and a difficult jigsaw puzzle. If the former two tasks are classified as easy and the latter two as more difficult (an a priori classification which gained some validation from a comparison of the frequencies of children's requests for help on the four tasks), then Vygotsky's theory was supported by the finding that children produced more private speech while working on the difficult puzzle than on the easy puzzle, and more on the easy puzzle than on the other two tasks. There is, however, some uncertainty as to the relative difficulty levels of the tasks employed in this study. Differences in task difficulty between the puzzles and the building-blocks and bead-stringing tasks are confounded with possible differential effects on private speech of the different types of task, independent of difficulty. This qualification is probably not applicable to the observed difference between the two puzzles, since these tasks presumably were quite similar, apart from their levels of difficulty.

This problem of confounding of task type and difficulty was overcome by the design

of an experiment reported by Beaudichon (1973). who presented five-year-old and seven-year-old children with four card-sequencing tasks, two of which were relatively easy, and two more difficult. The difficult items were quite similar in principle to the easy items. Beaudichon found that while five-year-olds produced much more private speech while working on the difficult items than on the easy ones, no such difference was apparent for seven-year-olds. This can be taken to suggest that the older children, having more fully interiorized their speech-for-oneself, are less reliant on overt verbalization in the face of increasing task difficulty.

The effect of a task difficulty manipulation on private speech production has also been investigated by Behrend et al. (1989a), who presented children with two sets of three progressively more difficult puzzles. Each child worked on one set with his or her mother, and one set alone. Results of this experiment showed that when working on the tasks with maternal assistance, children produced more private speech on the difficult puzzle than on the moderately difficult or easy ones. When working alone on the task, though, children had the highest private speech production on the puzzle of moderate difficulty. One possible interpretation of this pattern is that when working with the support of a parent, children had less difficulty with the moderate puzzle, and were challenged by the difficult one; when working alone, however, children found the moderate puzzle quite difficult and so produced appreciable private speech while occupied with it, but were somewhat overwhelmed by the difficult one, and less engaged in the task, tending therefore to produce less private speech.

In summary, Vygotsky's observation of an increase in children's private speech production when they encounter difficulties in a task has been replicated in contemporary experimental research, for instance by Kohlberg et al. (1968). In addition to repeating this basic observation, Beaudichon (1973) and Behrend et al. (1989a) have provided evidence that this relation is quite complex, varying with factors such as social context and age.

In a rather different vein, both Deutsch and Stein (1972) and Goodman (1981)

attempted to manipulate preschoolers' perceptions of the difficulty of jigsaw puzzles by

interrupting subjects on some items before they could finish, telling them "Time is up,"

with the implication that the subjects had been working too slowly. This "induced task

failure" (Goodman, 1981, p. 288) brought about an increase in private speech production

on subsequent puzzles, as predicted, in the Deutsch and Stein (1972) study, but not in

Goodman's (1981) study.

Early North American studies of private speech (Beaudichon, 1973; several

unpublished doctoral dissertations: see Fuson, 1979, p. 157) showed with few exceptions

that private speech production and proficiency of task performance were uncorrelated.

Beaudichon (1973) found no relationships between private speech and performance except

for the category, 'Describing task materials,' which showed a positive association with

performance. More recently, Goudena (1987) reported no relationships between private

speech and task performance. Frauenglass and Diaz (1985) have argued that Vygotsky's

theory does not actually lead to the expectation of a positive correlation between private

speech and performance; rather, "private speech is most likely to co-occur with failure in

cognitive tasks because both private speech and the likelihood of failure increase with task

difficulty" (p. 358). This suggestion was supported by their data. Recent work by

Behrend et al. (1989a, 1989b), however, is contrary to this finding. These researchers

reported positive correlations between private speech and puzzle completion, on items of

moderate and high difficulty (Behrend et al., 1989a, p. 316). Further analyses of a portion

of this data set indicated that private speech and task performance within the same

experimental session were unrelated when the children worked on puzzles alone but

positively correlated when they were given maternal assistance. Furthermore, private

speech production during the first session (in terms of both number of private utterances

and coefficient of egocentrism) was positively correlated with subsequent task performance

while children worked independently during a second experimental session, one week later (Behrend et al., 1989b).

Bivens and Berk (1990) found that in their longitudinal data, private speech production and arithmetic marks were largely uncorrelated within each grade However, both Level 2 and Level 3 private speech during grade 1 were positively correlated with arithmetic marks during grade 2, and Level 3 private speech during grade 2 was positively related to arithmetic marks in grade 3. Such a pattern suggests that the relationship between private speech and performance may be a relatively long-term one, necessitating the use of a longitudinal approach in order to fully apprehend it.

Fragmentation of Private Speech

Fragmentation or abbreviation of the syntactic structure of children's private speech has recently been investigated by Feigenbaum (in press). In this study, four-, six-, and eight-year-old children were videotaped while they played alone with a specially-devised board game. The game involved linking curved and straight pieces of wooden track in order to form as many routes as possible between two points on a board. It proved quite a difficult task, particularly for the younger children in the study. The coefficient of egocentrism was 54 %. The children's utterances were categorized as either 'complete' or 'fragmented.' In order to be classified as complete, an utterance had to be grammatically intact; otherwise, the utterance was classified as fragmented. This distinction does not directly correspond to Vygotsky's (1934/1987) concept of psychological predication: fragmentation is clearly a much broader category than predication. At best, it might provide an approximate assessment of predication in private speech. This approach does, however, avoid potentially serious problems (including low inter-observer reliability and other difficulties, discussed below) inherent in identification of psychological predicates as well as abbreviation.

Feigenbaum (in press) found that private speech was more likely to be fragmented

than social speech. No increases were evident in the amount of fragmentation from age four to eight years. However, 65 % of all scorable private utterances were classified as fragmented, representing a substantial level of abbreviation. This suggests, as Feigenbaum points out, that increases in fragmentation of the syntactic structure of private speech may occur in children younger than four years.

Summary and Conclusions of Review

The results of contemporary research on children's private speech are, on the whole,

in basic agreement with Vygotsky's account. The largely supportive outcomes produced

by researchers employing quite diverse empirical methodological approaches provide a

variety of evidence in favour of his theory. Vygotsky's observations of increases in private

speech production when task difficulty is augmented have been replicated in interesting and

theoretically-consistent ways in contemporary work (Kohlberg et al., 1968; Beaudichon,

1973; Behrend et al., 1989a). Investigations of differences in the frequencies of various

functional forms of private speech - both using classification systems related to the

Kohlbergian model (Kohlberg et al., 1968, Study 3; Deutsch & Stein, 1972; Rubin et al.,

1971; Berk & Garvin, 1984; Berk, 1986; Bivens & Berk, 1990; Frauenglass & Diaz,

1985), and using other kinds of categorization schemes (Beaudichon, 1973; Rubin &

Dyck, 1980; Furrow, 1984) - have also produced evidence in support of Vygotskian ideas.

The problem of the relation between social context and children's private speech

production is in need of further investigation, particularly in light of Vygotsky's own

ambiguity on this matter, in his reports of experimental findings (Vygotsky, 1934/1987;

1978). The effect of differing social contexts (that is, task situations with or without other

people present) has been assessed experimentally (as discussed above) by Rubin et al.

(1971) in a free play setting in which private speech production was higher when subjects

were alone than when they were in the company of either a child or an adult, and by

Behrend et al. (1989a), who found no difference between children working on puzzles

alone and with a parent. Goudena (1987) found that preschoolers produced more private

speech after working on tasks with a collaborative experimenter than after working with a

noncollaborative experimenter. Correlational-observational research has indicated that

children tend to produce a higher proportion of private speech in the absence of adults than

in the presence of adults (Berk & Garvin, 1984), and that the functional differentiation of

private and social speech has its origin at a very young age (Furrow, 1984). These findings fall short of providing a comprehensive empirical account of the effect of social context on private speech production.

Overall coefficients of egocentrism are available in 11 of the 16 papers reviewed above; these values were explicitly reported in 5 papers, and could be recovered with some hand calculation in the remaining 6. The majority of these coefficients are less than 40 %, but they vary widely, even across studies employing similar tasks. During puzzle-solving, for instance, coefficients of egocentrism range from 22 % (Deutsch & Stein, 1972; recovered from Table 1, p. 317) and 26 % (Behrend et al., 1989a; recovered from Table 2, p. 313) to 60 % (Goudena, 1987; recovered from p. 199) and 71 % (Goodman, 1981, p. 283). Feigenbaum (in press) reported a coefficient of egocentrism of 54 %, based on observations of children playing a challenging board game. Using puzzles along with other experimental tasks, Frauenglass and Diaz (1985) observed an overall coefficient of egocentrism of 87 % (recovered from Figure 2, p. 362). It seems likely that values as high as 87 % and 71 % were produced (perhaps somewhat artifactually) either by specific characteristics of classification criteria or by quite strict experimental control over the task context.

Observations of young children engaged in free play have produced coefficients of 51 % (Rubin et al., 1971; recovered from Table 2, p. 45) and 36 % (Furrow, 1984, p. 359). The lowest coefficient was observed by Kohlberg et al. (1968, Study 2, p. 717), who classified 18 % of children's speech while working on sticker designs as 'private.' This low proportion may be attributable to the comparatively low cognitive demands inherent in a task like making sticker designs. Observations of children during various school activities have yielded coefficients of egocentrism of 32 % (Kohlberg et al., 1968, Study 1, p. 714) and 24 % (Berk & Garvin, 1984; recovered from p. 278). Berk (1986) reported the rather higher value of 61 % (recovered from Figure 1, p. 675) for children in grades 1

and 2 while they worked on arithmetic assignments in their classrooms. Arithmetic intuitively seems like an activity well suited for eliciting private speech in children; it is highly abstract and closely dependent on linguistic and significative processes, and is mediated to a high degree by psychological tools. Bivens and Berk (1990) observed private speech by all 33 participants in their longitudinal study, again using classroom arithmetic as the task context.

It would be a worthwhile improvement in the efficiency of communication of research results in th s area if writers made a more regular practice of specifying overall coefficients of egocentrism for their data sets. The overall coefficient of egocentrism for a study constitutes a rather useful metric for rough collation with the results of other studies, facilitating comparative evaluation of the various observational contexts, experimental tasks, and procedural features utilized by different researchers.

Investigators do not typically report proportions of subjects who produced private speech; in the studies in which it is communicated, this proportion is often in the area of half the children in the sample (see Fuson, 1979; Frauenglass & Diaz, 1985). This pattern suggests the existence of considerable individual differences in private speech production between children, and begs the question of the cross-temporal consistency of these differences: do some children simply not produce private speech at all, at least while being observed? Clearly, within a single observational session, many children do not produce any private speech; it is possible, though, that if observed during two or more sessions, many more subjects would use at least some. Analyses of this kind, assessing cross-session persistence of individual differences in private speech production, have not been reported to date.

In fact, the potential of repeated measures designs for examination of changes in children's private speech production has been greatly underutilized in general. The strategy of illuminating microgenetic changes in private speech between sessions is, of course,

closely in keeping with Vygotsky's emphasis on developmental, processual analysis. Evaluations of cross-lagged correlations (similar to analyses reported by Behrend et al.,1989b), between several potentially interesting variables, are likely to prove a fruitful avenue of investigation of the development of private speech; with a design featuring three or more sessions, quite complex relationships between variables could be assessed. In a study employing such a multi-session design, changes across sessions in the frequencies of private speech in various functional categories would also be of interest. Of particular significance for Vygotskian theory would be changes occurring in the frequencies of children's descriptions of their own activity, or constituting speech, and their self-guiding or planning speech. Patterns of change in these two forms could potentially provide the Vygotskian account with very substantial empirical support. Predictions regarding cross-session changes in the frequencies of other categories could be made on the basis of the Kohlbergian classification model. One might expect, for instance, that the frequencies of the categories 'Word play' and 'Comments to nonhuman objects' would decrease across sessions, while the frequency of 'Muttering' would increase.

Another form of change across sessions which could be assessed using such a repeated-measures approach is variation in the quantity and quality of predication in private speech. On a microanalytic level, complex changes might be expected in aspects of the situation or the task that constitute 'given' and 'new' information, over repeated sessions working on similar tasks under similar circumstances. No analyses of this kind have been reported in the literature on private speech. One strategy which could prove especially productive for examining changes in the character of private speech is repeated presentation to children of the same task items during several successive sessions. Given such a design, Vygotskian theory would predict an increase in the degree of predication across sessions, based on the assumption that with practice on the same type of task and particularly, one would think, on the same repeated items, private speech should become

progressively more like inner speech in its structure.

The design of the pilot research discussed below incorporates microgenetic methodological features related to some of the questions that have been discussed. (For more specific details of the procedure and results of the following pilot study, see Duncan, 1991.)

Preschoolers' Private Speech During Story-Sequencing Tasks:

A Pilot Experiment

Thirty-two four- and five-year-old children (16 girls and 16 boys, ranging in age from 4 years, 1 month to 5 years, 11 months; mean age 4 years, 11 months) were videotaped while working on story-sequencing tasks, during two sessions about one week apart. The tasks were adapted from the Picture Arrangement test of the Wechsler Intelligence Scale for Children, Revised (WISC-R; Wechsler, 1974); the subjects' task was to arrange each set of picture-cards to form a coherent story. Tasks of this general nature have been employed before in private speech research by Beaudichon (1973) and by Frauenglass and Diaz (1985).

The use of WISC-R items facilitated a clear manipulation of task difficulty, free of ambiguities of the kind inherent in the manipulation employed by Kohlberg et al. (1968). (Recall that in their fourth study, these researchers compared children's private speech production while they worked on different kinds of tasks, which were assumed to be of varying difficulty.) In this pilot study, a set of standardized test items, ordered in terms of increasing difficulty, were simply dichotomized into 'easy' and 'difficult' items. During the first session, subjects worked on one block of four easy items and one block of four difficult items, counterbalanced across subjects for order. Results showed that children produced more private utterances while working on the difficult than on the easy items.

During this first session, half of the children were scaffolded on the tasks by the experimenter, and half worked independently. Scaffolded participants produced no private speech during the first session; all tests of first-session data are based on participants in the independent condition only. It was hypothesized that children in the scaffolded condition would produce more private speech during the second session than children in the independent condition, having been provided by the experimenter during the earlier session with verbal regulative strategies specific to the story-sequencing tasks. No overall

quantitative difference was evident. However, the private speech produced by scaffolded condition subjects tended to be classified to a greater extent in the developmentally more advanced than in the less advanced categories (in terms of the sequence proposed by Kohlberg et al., 1968), compared with independent condition participants' private speech.

During the second session, children worked on four story-sequencing items, two of which were familiar to them as difficult items from the first session, and two of which were novel difficult items. It was predicted that subjects would produce more private speech in general while working on the novel items than on the familiar items, since familiar items would be easier on the second presentation than items that were not familiar. This hypothesized difference was not found. A tendency was observed for participants to produce more speech in the functional category, 'Self-guiding utterances,' while working on the novel items than on the familiar items. One possible reason for the absence of an overall difference lies in the character of the task materials. Since the WISC-R is designed for use with individuals in the age range 6 to 16 years, many of the items were very difficult for the preschoolers in this sample; it seems likely that the two difficult items presented again as familiar items during the second session were not appreciably easier the second time than the first time, and were in fact equivalent in difficulty to the novel items. This underscores the importance of using tasks of appropriate difficulty for the ages of children in the sample.

The private speech classification system used in this study was based on the Kohlberg et al. (1968) system, with two changes: the category 'Comments to nonhuman objects' was dropped (due to nonoccurrence), and the category 'Nonlinguistic utterances' was added. This category included utterances which, though not actually language in a formal sense, can nonetheless be regarded as private speech, from a functional perspective (utterances such as "Hmm" and "Umm"). (There is no theoretical reason to expect this additional category to fall within any developmental sequence inherent in the other five.)

The experimenter classified the utterances in all 64 experimental sessions; a second observer classified the speech in 4 randomly chosen sessions. For both the initial classification of utterances as private or social, and the classification of private speech into functional categories, 100 % inter-observer agreement was obtained. Thus, reliability problems of the kind encountered by some previous researchers (for example, Berk & Garvin, 1984; Rubin et al., 1971) appeared to be negligible in this study.

Four categories of private speech had quite low frequencies and showed little change across the two sessions (see Figure 1). (The category 'Self-answered questions' was not included in Figure 1 because of its very low frequency. Utterances in this category comprised 1.6 % of participants' private speech during the first session, and 0.0 % during the second session.) Two categories - 'Describing own activity' and 'Self-guiding utterances' - changed in a manner supporting Vygotsky's (1934/1986, 1978) and Levina's (1981) descriptions of the dynamic relation between the child's speech and action. 'Describing own activity' went from 54 % of total private utterances during the first session to 21 % during the second session, whereas 'Self-guiding utterances' went from 22 % to 51 % (see Figure 1).

Insert Figure 1 about here

This shift, occurring with increasing familiarity with the story-sequencing tasks, corresponds to the shift from constituting speech to planning speech, as reported by Soviet investigators.

The overall coefficient of egocentrism in this study was 26 % (the same value reported by Behrend et al., 1989a). During each session, 56 % of the children used private speech. Of the 16 independent condition participants, 7 produced private speech during both sessions, and 5 during neither; 4 subjects produced private speech during one session

but not the other. This outcome can be regarded as a binary distribution, with 12 participants classified alike during the two sessions and 4 classified differently. Application of the binomial test supported the claim that subjects were more likely than not to be classified the same in both sessions, suggesting a degree of cross-temporal consistency as to whether individual preschoolers produce private speech in an observational situation.

Following the reasoning that private speech production and task performance should be inversely related due to the occurrence of high levels of private speech when children work on difficult tasks, on which they are more likely to fail (see Frauenglass & Diaz, 1985), it was hypothesized that private speech and task performance within each of the two sessions would be negatively correlated or uncorrelated. Results showed that both correlations were nonsignificant; this was the case for within-session relationships between performance and both the number of private utterances and the coefficient of egocentrism. It was also expected, based on findings reported by Behrend et al. (1989b), that first-session private speech would be positively related to second-session task performance. Such a cross-session relationship would support Vygotsky's view of private speech as an instrument of thinking undergoing a process of interiorization. This correlation was, however, found to be nonsignificant.

Some interesting correlational results did emerge from this pilot work. Overall coefficient of egocentrism (for both sessions combined) was found to be negatively correlated with overall task performance, in agreement with suggestions made by Frauenglass and Diaz (1985). Overall coefficient of egocentrism was also found to be positively correlated with age. A relationship like this is to be expected with a sample of children in this age range, based on the curvilinearity (or cubic trend) inherent in the developmental pattern suggested by the Vygotskian model. Four- and five-year-olds are likely to be in the first (positive slope) phase of the inverted U curve. Analysis also

revealed that boys were more likely than girls to produce private speech during the second session. A gender difference of this kind is apparently a novel finding. Among independent condition participants during the first session, however, no such difference was evident.

In summary, the pilot study replicated the effect of task difficulty on private speech production, but failed to find a similar difference between familiar and novel items. The scaffolding manipulation used in this study had little effect on subsequent private speech production. However, interesting and theoretically-consistent cross-session changes in the frequencies of different functional forms of private speech were apparent in the data, but were not statistically evaluated due to the small size of the data set.

An Experimental Study of Microgenetic Change

in Preschoolers' Private Speech

The experiment reported herein consisted of three sessions, during which preschool-aged children were videotaped while working on tasks of two kinds - story-sequencing and paper-folding. Examination of data from three sessions facilitated analysis of microgenetic changes in quantitative and qualitative characteristics of children's private speech, both across sessions and within sessions. The design of this experiment can be seen as an application of Vygotsky's microgenetic approach to experimentation. This cross-session technique is loosely analogous to the method of artificially generating or provoking a developmental process - "telescoping" the course of this development, concentrating or condensing it in order to optimize the conditions for its observation. By providing participants with experience with the two kinds of tasks during a series of three experimental sessions, the approach used in this study initiates or provokes, to some degree, short-term developmental processes, and renders these processes observable. The similarity between this method and the Vygotskian experimental-developmental approach is, however, a somewhat limited one, since it is questionable whether much actual telescoping or condensation of developmental processes occurred in the present experiment.

During the first session, children were observed while working on easy and more difficult items of each task type, with the objective of replicating the task difficulty effect observed in the pilot study, as well as by other researchers (Kohlberg et al., 1968, Study 4; Beaudichon, 1973; Behrend et al., 1989a). Repeated presentation, during all three sessions, of the difficult items of each type, along with novel items, facilitated comparisons of two kinds. Firstly, quantities of private speech while children worked on these repeated items were compared across the three sessions. It was expected that private speech production would decline on these increasingly familiar (and therefore presumably easier)

items. Secondly, comparisons were made of private speech production on familiar and novel items, during the second session and during the third session. It was predicted that children would use more private speech while working on the novel items than on the familiar (easier) items.

This design also allowed assessment of changes across the three sessions in terms of functional categories of private speech. Private utterances were coded into categories in accordance with two different classification systems. First, speech-for-oneself was classified as 'Constituting speech,' 'Planning speech,' or 'Other private speech.' This facilitated examination of changes in the location of verbalization relative to action, as observed by Vygotsky (1934/1986, 1978) and Levina (1981). A shift was expected, across the three experimental sessions, from constituting speech toward planning speech. This shift was expected to be especially salient in the private speech children produced while they worked on the familiar items.

In addition to this tripartite categorization, children's private utterances were also classified using the seven-category variant of the Kohlberg et al. (1968) system employed in pilot research. Based on the results of pilot research, a shift was predicted across the three sessions in the frequencies of the two categories, 'Describing own activity' and 'Self-guiding utterances.' It was expected that initially, the former category would be predominant, but that across sessions the frequency of this form would diminish, whereas the latter category would increase.

Support for the sequentiality of the Kohlbergian categories might be claimed if early categories such as 'Word play' decreased across sessions while more advanced categories such as 'Muttering' increased. It is not clear, though, that much change is to be expected over these three experimental sessions within a relatively short period of time, since Kohlberg et al. (1968) apparently regarded their categories more as MA-related developmental stages than as microgenetically-dynamic functional forms.

Predictions were advanced regarding structural, as well as functional, changes across the three experimental sessions. All private utterances during each session were classified as either predicative or not predicative, and the proportions of utterances showing predication during the three sessions were compared. It was expected that across sessions, children's private speech would become increasingly predicative, with the children demonstrating an increasing tendency to fail to mention 'given information.'

The design of this experiment also facilitated evaluation of the cross-session consistency of individual differences in private speech production, in that it was possible to observe whether participants tended consistently either to produce private speech or not to produce private speech in all three experimental sessions. Vygotsky's theory leads to the expectation that all children produce private speech (although one might suppose that the unavoidable artificiality of the experimental situation could preclude some from doing so while being videotaped). Support for this claim would be obtained if no children failed to produce private speech in at least one of the three sessions.

Numerous correlations, representing both within-session and cross-session relationships, were of potential interest in this study. It was expected that within each experimental session, private speech production would not be positively correlated with a measure of task performance. The expansion of the method used in the pilot study to include a third session provided an opportunity to assess multiple cross-session relationships between private speech and performance on the two tasks. Behrend et al. (1989b) took the approach of correlating initial private speech with subsequent task performance. This analysis seemingly takes account of some aspect of the microgenetic process of interiorization of private speech, from one session to another. It seemed likely, though - partly based on pilot research - that some children could have high task performance during all sessions while producing little or no private speech (suggesting that these children found the tasks relatively easy). Cases of this kind reduce the magnitude of

the cross-session relationship as reflected in the correlation, in a way which is basically artifactual. The variable to which private speech should be expected to be correlated across sessions is not performance as such, but a measure of cross-session change in performance - the difference between earlier session performance and later session performance. A significant positive correlation between these variables would indicate that children who used a lot of private speech in the earlier session tended to improve more on the task, across sessions, than children who produced little or no private speech. This relationship would appear to reflect the facilitative nature of private speech, as proposed by Vygotsky (1934/1987, 1978), more accurately than does the straightforward cross-session correlation with performance.

One further methodological innovation tested in this experiment follows from the suggestion by Fuson (1979. p. 157-158) that task performance should be related to self-regulating or planning speech, rather than to overall private speech. Fuson makes this suggestion in reference to the within-session correlation, but her reasoning is readily applied also to cross-session relationships.

The hypotheses tested in this experiment can be summarized as follows:

(1) Based on findings reported by Frauenglass and Diaz (1985), a prediction was made regarding amounts of private speech production while participants were working on story-sequencing tasks compared with paper-folding tasks. These researchers observed more private speech while subjects worked on tasks of a semantic nature than on tasks which were more perceptually-based. Frauenglass and Diaz classified story-sequencing tasks as semantic; paper-folding tasks - which seem less directly related to semantic or semiotic processes - can be classified as perceptual tasks. It was predicted that participants would produce more private speech while working on story-sequencing tasks than on paper-folding tasks, although both types of task were expected to engender substantial quantities of private speech.

(2) It was expected that during the first session. participants would (a) have lower coefficients of egocentrism and (b) produce fewer private utterances while working on easy forms of the two tasks compared with more difficult forms.

Task type and task difficulty comparisons were also examined in terms of differences in relative frequencies of functional categories of private speech, (1) according to the three-category classification system based on Levina's (1981) distinction between constituting speech and planning speech (and including the third category, 'Other private speech'), and (2) for the Kohlbergian categories, 'Self-guiding utterances' and 'Describing own activity.'

(3) It was predicted that during the second and third sessions, subjects would produce more private speech while working on the novel items than on the familiar items.

(4) It was expected that subjects would produce more private speech while working on the repeated items during the first session (as the difficult items) than while working on these same items again (as the familiar items) during the second session, and more in turn during the second session than in the third session.

(5) Across the three sessions, progressively more 'Planning speech' (in terms of percentage of total private speech) was expected. Participants' speech while they worked repeatedly on the familiar items was analyzed separately, as well as being included in the overall analysis. Across the three sessions, the Kohlbergian categories 'Self-guiding utterances' and 'Describing own activity' were expected to undergo a shift paralleling the change in constituting and planning speech; that is, it was predicted that participants would produce progressively more 'Self-guiding utterances' and progressively less 'Describing own activity,' across sessions.

Changes across sessions in the frequencies of the remaining four Kohlbergian categories were also of potential interest. To the extent that these categories change in ways consistent with the Kohlbergian model, the suggested developmental sequentiality of this

system would receive a form of support. Specifically, it was thought that the frequencies of the first and second categories ('Word play' and 'Comments to nonhuman objects') might decline along with the third ('Describing own activity'), and the higher categories ('Self-answered questions,' 'Self-guiding utterances,' and 'Whispering') might increase. However, as discussed above, it was not entirely clear that such a pattern of short-term change follows from the reasoning of Kohlberg et al. (1968).

(6) Across the three sessions, subjects' private speech should become increasingly predicative; that is, it was expected that subjects would exhibit an increasing tendency to mention only new information, omitting given information. Across sessions, then, a progressively greater proportion of private utterances should be classified as predicative, and a smaller proportion as not predicative.

(7) Within each of the three sessions, private speech production and task performance were expected to be negatively correlated or uncorrelated. The three within-session relationships between task performance and the percentage of private speech classified as planning speech were examined as well; these correlations were also expected to be nonpositive. It was predicted that, in general, private speech production during the first and second sessions would be positively correlated with task performance during subsequent sessions. Three kinds of private speech variables - overall private speech in terms of both (a) number of utterances and (b) coefficient of egocentrism, and percentage classified as planning speech - were examined in relation to two different kinds of performance variables - percentage correct, and the difference between this (later session) percentage and the percentage correct during the earlier session. It was expected that the highest of these cross-session correlations would occur between planning speech and the performance difference score.

Method

<u>Subjects</u>

Participants in this experiment were 40 five-year-old children (22 girls and 18 boys,

ranging in age from 4 years, 9 months to 6 years, 0 months; mean age, 5 years, 5 months)

in attendance at daycare centres, preschools, and kindergartens in Kitchener-Waterloo,

Ontario, Canada. Written consent for participation was obtained from the children's

parents or guardians.

<u>Materials</u>

<u>Tasks.</u> The tasks used in this study were of two general types: paper-folding tasks

(resembling simple origami tasks), and story-sequencing tasks. Eleven items of each task

type were employed; three were used as practice items, and eight as experimental items.

Plain white paper was used for the paper-folding tasks. Before the experimental

sessions, the paper for each item was cut to the appropriate size and shape for the particular

object. Completed models of each item and, where appropriate, sequences of

partially-completed models showing the series of folds involved in producing the particular

object, were provided for participants to consult. Sheets of newspaper were used for

making "pirates' hats" at the end of the second session. Nine of the 11 paper-folding tasks

were based on examples found in books on art activities for children (Temko & Simon,

1968; Van Breda, 1963; Lewis & Oppenheimer, 1963), and 2 items ('triangle' and 'stop

sign') were devised specifically for this study.

The paper-folding tasks used as practice items were 'fish,' 'triangle,' and 'square.'

The easy paper-folding items (used during the first session) were 'tent' and 'cupboard;'

selection of these two items as less difficult than the others was based on rankings of

difficulty of all eight paper-folding items, made independently by three adult judges. The

tasks presented as difficult items during the first session, and again in the second and third

sessions as familiar items, were 'ice cream cone' and 'flag.' The second-session novel

items were 'fan' and 'bird,' and the third-session novel items were 'house' and 'stop sign.'

The story-sequence tasks used in this study were items from the Picture Arrangement test of the Wechsler Intelligence Scale for Children, Revised (Wechsler, 1974), as in the pilot study. Each item consists of three to five black-and-white cartoon drawings of people doing various things, on small cards. Each set depicts a brief story if the cards are arranged in a particular order.

The WISC-R Picture Arrangement items used as practice tasks were the sample item ('Scale'), item 10 ('Gardener'), and item 12 ('Rain'). The easy items were items 2 ('Picnic') and 3 ('Fire'); selection of these story-sequence tasks as less difficult than the others was based on the ordinal arrangement of the items on the WISC-R. The first-session difficult and second- and third-session familiar items were items 6 ('Sleeper') and 7 ('Artist'). The second-session novel tasks were items 5 ('Burglar') and 8 ('Lasso'), and the third-session novel tasks were items 4 ('Plank') and 9 ('Boat').

The Peabody Picture Vocabulary Test, Revised (PPVT-R; Dunn & Dunn, 1981), Form L, was used as an estimate of vocabulary development.

Counterbalancing. Four experimental items of each of the two task types were used during each session. These consisted of two pairs of items - an easy pair and a difficult pair during the first session, and familiar and novel pairs during the second and third sessions. The items in each of these pairs were presented contiguously, one after the other. For each session, four different orderings of the eight experimental items were used. These four sequences were counterbalanced for order of (1) the two task types, (2) the easy and difficult or novel and familiar pairs, and (3) the individual items within the pairs. In two of the four orderings used during each session, the paper-folding items were presented first, and in the other two the story-sequencing items were first. In two orderings for each session, the easy or familiar pairs were first, while in the others the difficult or novel pairs were first. In two orderings, the items within each pair were presented in one order, and in

the other two the order within each pair was reversed. (The four orderings for each session are presented in Appendix A.) Participants were randomly assigned to one of the four orderings, independently for each of the three sessions.

Equipment. A free-standing lightweight collapsible screen was used, for the experimenter to sit behind while participants worked on experimental items. A VHS videocassette tapedeck, camera, tripod, and remote "shotgun" microphone were used to record the sessions.

Procedure

The experiment included three sessions with each participant, from 1 to 10 days apart. Each session was 20 to 30 minutes in duration, and audiovisual records of the sessions were made.

Sessions were conducted in a convenient room adjacent to the daycare, preschool or kindergarten facilities. During each session, participants worked collaboratively with the experimenter on four to six practice items (two or three of each type), and independently on eight experimental items (four of each type). The experimenter and the participant carried out the practice items of one task type together, then the participant worked independently on the experimental items of that type; this was followed by the joint practice items and independent experimental items of the other task type.

The screen was situated 20 or 30 feet from the participant's table and chair. While participants worked on the experimental items, the experimenter sat out of sight on a chair behind the screen. After each set of practice items, the experimenter explained that he had some work to do on the other side of the screen, and asked if the participant would like to do some more tasks of this kind alone, while the experimenter worked. Participants were instructed to call the experimenter when they had finished each item; the experimenter then presented the next item and went back behind the screen. The experimenter was minimally responsive to communications from subjects while they worked on the experimental items.

For instance, the usual strategy used by the experimenter when responding to persistent questions and requests for help from subjects while they worked on independent paper-folding items was to remind them to consult the models on the table in front of them.

First session. At the beginning of the first session, the experimenter read the participant a short children's story, in an effort to put him or her at ease in the experimental situation; this activity lasted about five minutes. The first session included all 3 assisted practice items of each task type, and 4 independent experimental items of each type (a total of 14 items, during this session). Two of the 4 experimental items of each type presented during the first session were relatively easy to carry out, and the other 2 were more difficult. (The practice items were used again in subsequent sessions.)

Second session. At the beginning of the second session, the PPVT-R was administered. Each subject worked on 2 practice items of each task type with the experimenter, and independently on 4 experimental items of each type (a total of 12 items during the session). For each task type, 2 independent items were familiar to the participant from the first session (when they were presented as the difficult items), while the other 2 were novel. At the end of the second session, the experimenter and the participant made a "pirate's hat" together. The time lag between the first and second sessions varied from 1 to 8 days (M = 3.33).

Third session. At the beginning of the third session, as in the first, the experimenter read the participant a short children's story. During the third session, each participant again worked with the experimenter's assistance on 2 practice items of each type, and independently on 4 items of each type (a total of 12 items during the session). For each task type, 2 experimental items were familiar to the participant from the first and second sessions, while the other 2 were novel. The time lag between the second and third sessions ranged from 1 to 10 days (M = 2.18).

Records were kept during all three sessions of participants' task performance on the

independent items. For each paper-folding item, participants were assigned 0, 1, or 2 points according to whether their finished copy bore no resemblance, some resemblance, or close resemblance to the model. For each story-sequencing item, participants were assigned 1 point if they correctly ordered all the cards in the set, and 0 if they did not. Performance scores were converted to percentages for use in correlational analyses.

Classification of private speech. All utterances made by participants while working on the experimental items (but not the practice items) were (1) classified as private or social utterances and (2) if private, then classified (a) according to the seven-category Kohlbergian-based system, (b) according to the three-category system based on the distinction between constituting and planning speech, and (c) as to whether their structural characteristics showed evidence of psychological predication. One observer classified the speech in all 120 experimental sessions. For the purpose of obtaining reliability estimates, an independent observer classified the speech in 6 randomly chosen sessions.

The 'utterance' unit was defined in three ways. A verbalization was considered a discrete utterance if (1) the subject did not speak for at least two seconds before and after a verbalization; (2) the verbalization was not temporally isolated from other verbalizations by at least two seconds but was distinctly an accompaniment to a single relatively discrete act (that is, the verbalization began and ended more or less simultaneously with the act); or (3) the verbalization was a turn in conversation with the experimenter.

Classification of an utterance as private or social was based on whether the particular utterance was associated with either eye contact (see Furrow, 1984) or social interaction with the experimenter; if one of these conditions obtained, an utterance was considered social. If the utterance involved neither eye contact nor social interaction, it was classified as private. Intonational characteristics were often useful in determining whether a given utterance was intended as communication with the experimenter; social speech is usually louder and somewhat more clearly articulated than private speech. On classification of

utterances as private or social, 98.82 % inter-observer agreement was obtained (168 out of 170 utterances).

The seven-category extension of the Kohlberg et al. (1968) private speech classification system used in this study was as follows:

Category 1: Word play and repetition (including singing,

rhyming, and nonsense words);

Category 2: Comments to nonhuman objects;

Category 3: Describing own activity (speech which describes

the speaker's activity but is not clearly and directly

goal-related; usually concurrent with or following

action);

Category 4: Self-answered questions;

Category 5: Self-guiding utterances (speech which mediates

analysis of features of the task or planning of

task-related action; often preceding action);

Category 6: Whispering, muttering, or mumbling (utterances

which cannot be understood because they are not clearly

articulated);

Category 7: Nonlinguistic utterances (for example, "Oh,"

"Um," "Uh," or "Hm").

On classification of private speech using this system, 92.59 % inter-observer agreement was obtained (75 out of 81 utterances).

Categorization of private speech as planning or constituting speech was based on the temporal relation of utterances to relatively discrete task-related actions. In applying the Kohlbergian describing and self-guiding classifications, semantic and functional characteristics of utterances were considered as well as their location; planning and

constituting speech, however, were distinguished solely on the basis of utterance location. This permitted classification of utterances which could not be understood (that is. whispering and nonlinguistic utterances, under the Kohlbergian system). Utterances which began prior to the beginning of an identifiable task-related act were classified as planning speech, and utterances which were concomitant with or following an act were classified as constituting speech. Utterances which were clearly not related to the experimental task were assigned to the "other" category. On classification of private speech as planning, constituting, or other, 85.19 % inter-observer agreement was obtained (69 out of 81 utterances).

Classification of private utterances as psychologically predicative or not psychologically predicative was based on the distinction between new information and given information, as discussed above (see also Wertsch, 1985). If an utterance was judged to include only new information (taking into account the specific situation of the utterance, within the context of the particular experimental task), it was categorized as predicative. If, on the other hand, an utterance included either new and given information or only given information, it was classified as not predicative. For example, on story-sequencing tasks, an utterance consisting of the single word, "There," would probably be categorized as not predicative, because in the context of this task, the place ("There") is given information. The utterance, "This one," would likely be considered predicative, since on the story-sequencing task it is the next picture-card which generally comprises the new information, or the information which must be sought in order to carry out the task.

The many utterances for which there were insufficient bases to make judgements regarding psychological predication were categorized as "uncodable." This category included nonlinguistic and whispered or muttered utterances, utterances such as singing or counting of task materials, and utterances which were too brief and simple to classify. On

classification of private speech as predicative, not predicative, or uncodable, 93.83 %

inter-observer agreement was obtained (76 out of 81 utterances).

Results

Results of analyses addressing six general sets of hypotheses are reported in the following section. These hypotheses concern task types, task difficulty, task novelty, cross-session changes both in quantities of private speech and in private speech forms, and correlational questions. Overall mean coefficients of egocentrism in this experiment were 46.59 % (s. d. = 23.59) while participants worked on paper-folding tasks, and 36.22 % (s. d. = 26.96) while they worked on story-sequencing tasks. Thirty-six of the 40 participants (90.00 %) produced private speech on the paper-folding tasks, and 33 (82.50 %) on story-sequencing. Within the first session, numbers of participants producing private speech were substantially lower and not unlike those typical of studies with single-session designs: 26 (65.00 %) on paper-folding, and 22 (55.00%) on story-sequencing. Overall, however, 37 participants (92.50 %) produced private speech at some time during the present three-session experiment.

Distributions for virtually the entire data set were substantially nonnormal (frequently skewed, and occasionally somewhat bimodal). Some of the tests reported below are based on reduced sample sizes, because data of the form required by the test were not obtained for some subjects (for example, cases with no private speech cannot be included in a test based on the percentage of total private speech classified in a particular category). Also, there is some degree of doubt as to whether the utterance unit employed in this study constitutes an interval scale of measurement. It is thus for several reasons that results of distribution-free randomization tests for ordinal data are reported below, along with parametric analyses of variance. The programme for this randomization test (May, 1989) randomly samples 2,000 cases from the null distribution of all possible permutations of the ranks for the data, and compares the observed permutation to this sample. In light of the various distributional and other properties of the data, the result of the randomization test can in many cases be regarded as more stable than the result of the corresponding t-test or

F-test. Also due to the properties of these data, only univariate within-subjects tests (no multivariate or factorial procedures) were carried out. For economy of presentation, no nonsignificant test statistics are reported (using $\alpha = .05$).

Statistical tests based on two private speech metrics - coefficient of egocentrism and number of private utterances - are reported below. Correlations between the two metrics were high: evaluations based on overall private speech (that is, all three sessions combined) indicated that for the paper-folding data, r_S ($N = 40$) = .846, $p<.001$, and for the story-sequencing data, r_S ($N = 40$) = .907, $p<.001$. As would be expected, then, analyses based on coefficient of egocentrism and number of private utterances were largely redundant, leading in most cases to the same statistical decision.

Comparison of task types

Analyses revealed that, contrary to expectations, participants produced more private speech while working on paper-folding tasks (for coefficient of egocentrism, $M = 46.59$, $s. d. = 23.59$; for number of private utterances, $M = 19.28$, $s. d. = 14.51$) than on story-sequencing tasks (for coefficient of egocentrism, $M = 36.22$, $s. d. = 26.96$; for number of private utterances, $M = 10.65$, $s. d. = 11.87$). This difference was significant for coefficient of egocentrism, $t (39) = 3.39$, $p<.01$; randomization test ($N = 40$), $p<.001$ (see Figure 2). The test based on number of private utterances was also significant, $t (39) = 4.53$, $p<.0001$; randomization test ($N = 40$), $p<.001$.

Insert Figure 2 about here

Comparisons of the two task types in terms of percentage of private speech classified as planning speech, percentages assigned to the Kohlbergian describing and self-guiding categories, and amount of psychological predication revealed no differences. This suggests

that although there was an overall quantitative difference in private speech production on paper-folding and story-sequencing, there were no qualitative differences, in terms of the private speech forms assessed by these three classification systems.[1]

Task difficulty

Performance on the individual task items was summarized across subjects in order to determine whether choices of easy items for the two task types were borne out by the data. In the case of both paper-folding and story-sequencing, participants had higher performance scores on the two easy items than on the other six items. (For difficulty rankings of the individual task items, see Appendix C.) The adequacy of the task difficulty manipulation becomes even clearer when the items are considered in the pairs in which they were presented during the experiment: for both types of task, performance on the pair of easy items exceeded performance on the highest of the other pairs by approximately 18 %. For the paper-folding tasks, overall performance on the pair of easy items was 72.50 %, whereas performance levels on the other pairs were 54.38 % (on the third-session novel items), 43.13 % (repeated items), and 30.63 % (second-session novel items). For story-sequencing, performance on the easy pair was 65.00 %, compared with 47.25 % (second-session novel items), 43.75 % (third-session novel items), and 31.25 % (repeated items).

Participants produced more private speech during the first session while working on the difficult items than on the easy items, for both task types, as predicted. On paper-folding tasks, coefficients of egocentrism were higher on difficult items ($\underline{M}$ =

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[1] These comparisons were made only in terms of two of the Kohlbergian categories, 'Describing own activity' and 'Self-guiding utterances' and not the other four because, as discussed above, these two are the most theoretically interesting categories from a Vygotskian perspective, and the most likely to manifest interpretable differences.

41.74, s. d. = 35.12) than on easy items (M = 16.56, s. d. = 26.82), t (39) = 5.25, p<.0001; randomization test (N = 40), p<.001 (see Figure 3). This difference was also significant for number of private utterances (on difficult items, M = 4.10, s. d. = 4.71; on easy items, M = 1.28, s. d. = 2.48), t (39) = 3.77, p<.001; randomization test (N = 40), p<.01.

Coefficients of egocentrism on story-sequencing were higher on difficult items (M = 34.60, s. d. = 35.97) than on easy items (M = 16.73, s. d. = 26.20), t (39) = 4.31, p<.001; randomization test (N = 40), p<.05 (see Figure 3). The difference was also clear for number of private utterances (on difficult items, M = 2.40, s. d. = 3.43; on easy items, M = 1.10, s. d. = 2.33), t (39) = 3.03, p<.01; randomization test (N = 40), p<.05.

Insert Figure 3 about here

No effects of task difficulty were evident on percentages of private speech classified as planning speech, as describing or self-guiding speech, or as predicative. Thus, despite the quantitative difference in private speech production on easy and difficult items, no qualitative difference was apparent, in terms of the three classification systems.

Comparisons of novel and familiar items

Participants produced more private speech while working on novel items than on familiar items, as predicted (see Figures 4 and 5). This effect was consistent across task types, experimental sessions, and private speech metrics. For story-sequencing, the effect of task novelty increased somewhat from the second to the third session, as evident in the results of the randomization tests.

Second session. Coefficients of egocentrism for paper-folding tasks were higher on novel items (M = 45.26, s. d. = 33.96) than on familiar items (M = 25.26, s. d. = 27.88), t (39) = 3.31, p<.01; randomization test (N = 40), p<.01 (see Figure 4). The difference

was also significant for number of private utterances (on novel items, $M = 5.00$, s. d. = 5.78; on familiar items, $M = 1.35$, s. d. = 1.96), t (39) = 4.62, p<.0001; randomization test ($N = 40$), p<.001.

A similar pattern was evident in the story-sequencing data: for coefficient of egocentrism (on novel items, $M = 34.22$, s. d. = 33.18; on familiar items, $M = 21.63$, s. d. = 29.14), t (39) = 2.81, p<.01; randomization test ($N = 40$), p<.05 (see Figure 4). This difference was also apparent for number of private utterances (on novel items, $M = 2.50$, s. d. = 2.98; on familiar items, $M = 1.43$, s. d. = 2.41), t (39) = 2.88, p<.01; randomization test ($N = 40$), p<.08.

Insert Figure 4 about here

Third session. Coefficients of egocentrism were higher on novel ($M = 46.42$, s. d. = 32.26) compared with familiar ($M = 27.43$, s. d. = 30.72) paper-folding items, t (39) = 4.07, p<.001; randomization test ($N = 40$), p<.001 (see Figure 5). The pattern for number of private utterances was similar (on novel items, $M = 5.53$, s. d. = 5.46; on familiar items, $M = 1.60$, s. d. = 2.32), t (39) = 4.72, p<.0001; randomization test ($N = 40$), p<.001.

For story-sequencing data, also, coefficients of egocentrism were higher on novel items ($M = 37.88$, s. d. = 34.04) than on familiar items ($M = 10.42$, s. d. = 19.86), t (39) = 5.64, p<.0001; randomization test ($N = 40$), p<.001 (see Figure 5). The difference was clear for number of private utterances, as well (on novel items, $M = 2.68$, s. d. = 2.96; on familiar items, $M = 0.55$, s. d. = 1.45), t (39) = 5.41, p<.0001; randomization test ($N = 40$), p<.01.

Insert Figure 5 about here

Changes in quantity of private speech

Quantities of private speech were compared across the three sessions, separately for each task type, in three ways: (1) comparing private speech on all items; (2) comparing private speech on the difficult items during the first session and the novel items during the second and third sessions (that is, the 'novel' items in each session); and (3) comparing private speech on the repeated items (the first-session difficult and second- and third-session familiar items). Tests of changes on all items and on novel items showed no differences, for either task type or either private speech metric. Descriptive statistics are presented in Table 1.

Insert Table 1 about here

Tests of changes in private speech across sessions on the repeated items detected the predicted pattern of reduction across sessions. The omnibus test for coefficient of egocentrism on paper-folding tasks was significant, F (2, 78) = 4.18, $p<.05$; randomization test (N = 40), $p<.05$ (see Figure 6; for descriptive statistics, see Table 1).

Scheffe tests ($\propto$ = .05) revealed no significant differences between the first and second sessions or the first and third. Randomization tests for these two comparisons, however, indicated $ps<.01$ for each comparison, and the pattern of means parallels the stronger pattern evident in the data for number of private utterances (reported below). In this light, it is reasonable to regard these as substantive differences.

The overall test for number of private utterances on paper-folding was significant, F (2, 78) = 10.52, $p<.0001$; randomization test (N = 40), $p<.01$ (see Table 1). Scheffe tests

($\propto = .05$) for these data found differences between the first and second sessions, $F (1, 39)$ = 15.17, and between the first and third sessions, $F (1, 39)$ = 10.46, but not between the second and third sessions.

For the story-sequencing data, the patterns of reduction in the means were clearer, for both private speech metrics. A monotonic decline was observed for coefficient of egocentrism, $F (2, 78)$ = 9.46, $p<.001$; randomization test (N = 40), $p<.01$ (see Figure 6; see also Table 1). Scheffe tests ($\propto = .05$) indicated that coefficient of egocentrism was lower in the third session than either the first session, $F (1, 39)$ = 17.18, or the second session, $F (1, 39)$ = 6.63, but that first and second session means were equivalent. For number of private utterances, a similar monotonic reduction was evident, $F (2, 78)$ = 6.92, $p<.01$; randomization test (N = 40), $p<.001$ (see Table 1). Scheffe tests ($\propto = .05$) detected the same pattern of differences for number of private utterances as for coefficient of egocentrism: fewer private utterances were observed during the third session than during the first session, $F (1, 39)$ = 12.00, or the second, $F (1, 39)$ = 6.55, but means in the first and second sessions were equivalent.

Insert Figure 6 about here

Changes in private speech forms

Planning speech. Percentages of constituting speech were almost a mirror image of percentages of planning speech (although not precisely, due to the classification of 1.50 % of private utterances on paper-folding tasks and 1.17 % on story-sequencing tasks in the "Other" category). Correlations between planning speech and constituting speech were high: for the paper-folding data, r_s (N = 36) = -.899, $p<.001$, and for the story-sequencing

data, r_s (N = 33) = -.988, p<.001. For this reason, it was deemed appropriate to analyze changes in percentages of planning speech only.

Changes in planning speech were examined across the three sessions on (1) the repeated items, (2) all items, and (3) the novel items, separately for each task type. Tests of these hypotheses were conducted with reduced sample sizes; analyses included only data for those participants who produced private speech while working on the particular items in question, during all three sessions.

No changes were evident in the percentage of planning speech on the repeated items, for either paper-folding (N =11; M_1 = 23.36, $s. d.$ = 17.37; M_2 = 38.21, $s. d.$ = 41.63; M_3 = 23.74, $s. d.$ = 26.43) or story-sequencing (N = 6; M_1 = 39.58, $s. d.$ = 37.25; M_2 = 24.07, $s. d.$ = 26.44; M_3 = 35.42, $s. d.$ = 50.26).

The predicted increase across sessions was evident in the test of planning speech on all paper-folding items (M_1 = 21.78, $s. d.$ = 14.19; M_2 = 37.28, $s. d.$ = 27.76; M_3 = 39.38, $s. d.$ = 18.86), F (2, 42) = 4.81, p<.05; randomization test (N = 22), p<.01 (see Figure 7). Scheffe tests ($\propto$ = .05) detected a difference between the first and third sessions, F (1, 21) = 10.63, but no differences between the first and second or the second and third sessions. On all story-sequencing items, a statistically significant but theoretically ambiguous pattern of differences was observed (M_1 = 41.52, $s. d.$ = 33.53; M_2 = 16.56, $s. d.$ = 20.31; M_3 = 55.40, $s. d.$ = 36.13), F (2, 26) = 6.59, p<.01; randomization test (N = 14), p<.05 (see Figure 7). Scheffe tests ($\propto$ = .05) indicated that whereas second- and third-session means differed significantly, F (1, 13) = 11.63, first-session planning speech was equivalent to percentages during both the second and third sessions.

Insert Figure 7 about here

Cross-session changes in percentages of planning speech while participants worked on the novel items followed patterns similar to those found in the analyses based on all items. The analysis for paper-folding tasks (M_1 = 21.05, s. d. = 19.01; M_2 = 38.99, s. d. = 27.67; M_3 = 44.90, s. d. = 16.77) was significant, F (2, 40) = 6.52, p<.01; randomization test (N = 21), p<.05. As in the analysis based on data for all paper-folding items, Scheffe tests ($\propto$ = .05) detected a difference between the first session and the third, F (1, 20) = 17.12, but not between the first and second or second and third sessions. The omnibus test for story-sequencing (M_1 = 49.45, s. d. = 40.16; M_2 = 27.25, s. d. = 33.10; M_3 = 52.52, s. d. = 35.19) also suggested differences, F (2, 24) = 2.93, p<.08; randomization test (N = 13), p<.05. As in the analysis based on data for all story-sequencing items, Scheffe tests ($\propto$ = .05) indicated that second- and third-session planning speech differed for this task, F (1, 12) = 7.68, but that planning speech during the first session did not differ from either the second or the third session.

Kohlbergian-based categories. Tests of cross-session change in the percentage of private speech classified as 'Describing own activity' showed no differences between sessions on paper-folding tasks, for either the repeated items (N = 11; M_1 = 15.19, s. d. = 16.19; M_2 = 6.82, s. d. = 16.17; M_3 = 22.43, s. d. = 39.14) or all items (N = 22; M_1 = 16.63, s. d. = 20.93; M_2 = 11.31, s. d. = 20.35; M_3 = 14.03, s. d. = 18.79).

The three-session analysis for the describing category on repeated story-sequencing items (N = 5; M_1 = 8.44, s. d. = 11.58; M_2 = 30.00, s. d. = 28.28; M_3 = 10.00, s. d. =

22.36) was also nonsignificant. However, a comparison of the describing category on the repeated items during the second and third sessions, which afforded a slightly larger sample size ($N = 8$; $M_2 = 26.79$, s. d. $= 25.81$; $M_3 = 13.75$, s. d. $= 25.60$), was significant according to the randomization test, $p<.05$, but not the t-test, $t (7) = 1.74$, $p<.13$. This suggests some degree of decline in the describing category during the latter part of the experimental procedure. Clearer evidence of such a decline was found in the three-session analysis of this category on all story-sequencing items ($M_1 = 20.71$, s. d. $=$ 25.30; $M_2 = 29.72$, s. d. $= 31.10$; $M_3 = 3.35$, s. d. $= 7.37$), $F (2, 28) = 5.24$, $p<.05$; randomization test ($N = 15$), $p<.05$ (see Figure 8). Scheffe tests ($\propto = .05$) indicated that while first- and third-session means differed, $F (1, 14) = 7.12$, first- and second-session means were equivalent.

Insert Figure 8 about here

Tests of change in the percentage of private speech classified as 'Self-guiding utterances' showed no differences across sessions, for repeated paper-folding items ($N = $ 11; $M_1 = 7.60$, s. d. $= 15.60$; $M_2 = 19.48$, s. d. $= 31.27$; $M_3 = 7.87$, s. d. $= 13.91$), all paper-folding items ($N = 22$; $M_1 = 8.06$, s. d. $= 13.82$; $M_2 = 13.21$, s. d. $= 17.37$; $M_3 = $ 7.54, s. d. $= 9.95$), repeated story-sequencing items ($N = 5$; $M_1 = 22.34$, s. d. $= 27.29$; $M_2 = 8.00$, s. d. $= 17.89$; $M_3 = 10.00$, s. d. $= 22.36$) or all story-sequencing items ($N = $ 15; $M_1 = 15.52$, s. d. $= 20.70$; $M_2 = 16.14$, s. d. $= 25.58$; $M_3 = 14.60$, s. d. $= 20.28$).

Cross-session patterns of change in percentages of five of the seven Kohlbergian-based categories are represented in Figure 8 for all story-sequencing items.

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Insert Figure 9 about here

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The categories 'Comments to nonhuman objects' and 'Self-answered questions' were not included in these figures due to their very low frequencies. On story-sequencing, these categories comprised 0.00 % and 0.20 % of private utterances, respectively; on paper-folding, they accounted for 0.67 % and 0.40 %.

'Whispering, muttering, and mumbling' was the predominant category by a wide margin. On story-sequencing tasks, this category accounted for 44.50 % of overall private speech (see Figure 8), and on paper-folding, 52.21 % (see Figure 9). 'Describing own activity' and 'Self-guiding utterances' - the most theoretically interesting categories - comprised 21.31 % and 15.69 % of private utterances, respectively, in the story-sequencing data, and 14.36 % and 9.80 % on paper-folding.

The decline in the describing category on story-sequencing from the second session to the third session can clearly be seen in Figure 8. Also in Figure 8, the percentage of private utterances classified in the whispering category appears to increase from the second session (38.36 % of all private utterances) to the third session (57.36 %). In a repeated-measures analysis based on data for those participants who produced private speech on the story-sequencing tasks during both the second (M = 40.59, $s. d.$ = 37.72) and third (M = 58.58, $s. d.$ = 33.78) sessions, this increase was significant by the randomization test (N = 18), $p<.05$, but not the t-test, t (17) = 1.63, $p<.13$. Beyond that, no systematic or theoretically interesting change is evident in either Figure 8 or Figure 9.

Psychological predication in private speech. Approximately three-quarters of private utterances were considered uncodable for psychological predication (79.04 % on paper-folding tasks, and 70.39 % on story-sequencing). Overall, 9.21 % of private

· ~ 1 ~·d on naper-folding tasks were classified as predicative, and 11.75 % as

not predicative. On story-sequencing tasks, 9.10 % of private utterances were classified as predicative, and 20.51 % as not predicative. Mean numbers of utterances for the complete sample are presented in Table 2.

Insert Table 2 about here

Tests of differences between the three sessions in amount of predication (mean percentages of codable utterances classified as predicative) were conducted for all items of each task type. For these tests, data were used from the small numbers of participants who produced codable speech during all three sessions: for paper-folding, $N = 7$ ($M_1 = 43.57$, $s. d. = 38.16$; $M_2 = 37.10$, $s. d. = 36.11$; $M_3 = 52.37$, $s. d. = 34.69$), and for story-sequencing, $N = 4$ ($M_1 = 3.58$, $s. d. = 7.15$; $M_2 = 37.50$, $s. d. = 47.87$; $M_3 = 5.78$, $s. d. = 11.55$). Neither test suggested any differences between sessions. Analyses of predication on repeated items were not carried out, due to insufficient data.

Comparisons were made, for each task type, between the first and second sessions, and between the second and third sessions, using data for the slightly larger numbers of subjects available for these narrower analyses, as follows: for paper-folding, $N = 10$ for first and second sessions ($M_1 = 35.50$, $s. d. = 36.40$; $M_2 = 30.97$, $s. d. = 33.94$), and $N = 9$ for second and third sessions ($M_2 = 41.20$, $s. d. = 39.22$; $M_3 = 40.73$, $s. d. = 37.89$); for story-sequencing, $N = 7$ for first and second sessions ($M_1 = 20.30$, $s. d. = 31.29$; $M_2 = 52.86$, $s. d. = 47.16$), and $N = 6$ for second and third sessions ($M_2 = 27.08$, $s. d. = 40.63$; $M_3 = 7.18$, $s. d. = 11.17$). The only one of these four tests which detected a difference was the comparison between the first and second sessions for story-sequencing. As hypothesized, predication was greater, in terms of percentage of codable utterances,

during the second session ($\underline{M}$ = 52.86, $\underline{s}$. $\underline{d}$. = 47.16) than during the first session ($\underline{M}$ = 20.30, $\underline{s}$. $\underline{d}$. = 31.29), $\underline{t}$ (6) = 2.48, $\underline{p}$<.05; randomization test ($\underline{N}$ = 7), $\underline{p}$<.05.

<u>Correlational analyses</u>

Tests of correlational hypotheses in this study are, for the most part, reported in terms of $\underline{r_s}$, providing a distribution-free index which is more conservative than the standard Pearson $\underline{r}$. Overall correlations were examined between three private speech variables (coefficient of egocentrism, number of private utterances, and percentage of private speech classified as planning speech), on the one hand, and task performance, raw score on the PPVT-R (Dunn & Dunn, 1981), chronological age, and gender, on the other (see Table 3). Two of these correlations were significant. Age was negatively correlated with coefficient of egocentrism on paper-folding tasks, $\underline{r_s}$ ($\underline{N}$ = 40) = -.354, $\underline{p}$<.05 (2-tailed). (The two-tailed probability was used because the direction of this relationship was opposite to that found in the pilot study.) Age was also negatively correlated with number of private utterances on paper-folding, $\underline{r_s}$ ($\underline{N}$ = 40) = -.325, $\underline{p}$<.05 (2-tailed). No relationships between age and private speech were evident in the data for story-sequencing. PPVT-R raw score was positively correlated with age, $\underline{r}$ (38) = .482, $\underline{p}$<.001, but was uncorrelated with the three private speech variables (see Table 3).

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Insert Table 3 about here

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Correlations were also examined between quantities of private speech (both coefficient of egocentrism and number of private utterances) and a number of task performance variables (first-session performance, second-session performance, third-session performance, and differences between performance in the three sessions). The 72 correlation coefficients computed in these analyses are reported in Appendix D,

Sections 1 to 4. No statistically significant correlations were found in the paper-folding

data (for all items or repeated items) between these private speech and performance

variables (see Appendix D, Sections 1 and 2). No significant correlations were found in

the data for all story-sequencing items (Section 4).

Analyses of data for repeated story-sequencing items found two correlations which

were significant, but opposite in direction to predicted relationships (see Appendix D,

Section 3). Second-session coefficient of egocentrism was inversely related to the

difference between second-session performance and third-session performance, r_S ($\underline{N}$ =

40) = -.401, $\underline{p}$<.05 (2-tailed). Second-session number of private utterances was also

negatively correlated with this second- to third-session difference score, r_S ($\underline{N}$ = 40) =

-.377, $\underline{p}$<.05 (2-tailed).

Correlations between task performance variables and the percentage of private speech

classified as planning speech were also examined (see Appendix D, Sections 5 to 8). Two

of these correlations were significant. A positive correlation was found between

second-session planning speech and second-session performance, on all paper-folding

items, r_S ($\underline{N}$ = 31) = .336, $\underline{p}$<.05 (1-tailed; see Appendix D, Section 6). On the repeated

paper-folding items, first-session planning speech was negatively correlated with

second-session performance, r_S ($\underline{N}$ = 26) = -.516, $\underline{p}$<.01 (2-tailed; see Appendix D,

Section 5). No significant correlations were found in the story-sequencing data (Sections 7

and 8).

Discussion

This experiment provides evidence in support of several aspects of the Vygotskian account of children's private speech. A number of outcomes have direct implications for issues arising from previous research motivated by Vygotsky's theory, supporting or extending previous findings. This study also demonstrates the value of a microgenetic experimental approach, for research on private speech. Outcomes related to each of the six sets of hypotheses in this study have either substantive or methodological implications for future research, warranting at least brief discussion of a number of points. Each set of hypotheses is reviewed in turn below.

The finding that 37 of the 40 children in this study produced private speech in what was essentially a field laboratory setting, with a relatively unfamiliar adult, provides support for the assumption implicit in Vygotsky's (1934/1987, 1978) theory that private speech is a universal developmental phenomenon. It seems likely that the three participants who produced no private utterances were simply inhibited by aspects of the situation such as the videocamera and the large microphone, or the presence of an adult stranger. Results of a number of previous studies (for example, Duncan, 1991; see also Fuson, 1979; Frauenglass & Diaz, 1985), in which a large percentage of subjects produced no private speech at all, appeared to question the universality of the phenomenon. However, studies of private speech under naturalistic conditions (for instance, Berk, 1986; Bi ens & Berk, 1990) have provided confirmation of this universality. The present study demonstrates that even under rather contrived experimental conditions, it is possible to record some private speech by almost every child in a group of 40 five-year-olds. In light of these findings, variation in private speech production seems more likely to be contingent on situational features than to be based on some stable personality characteristic on which individual children differ markedly.

The critical design feature facilitating observation of private speech by such a large

percentage of participants in this study was, of course, the multi-session approach. Had

the experiment ended with the first session, the number of children producing private

speech - 29 out of 40, or 72.50 % - would not have been especially atypical. Clearly,

when one observes a child several times, one is more likely to hear private speech than

within any single observational session.

The direction of the task type difference in this study seems rather anomalous at first,

when considered in conjunction with findings reported by Frauenglass and Diaz (1985).

Recall that these researchers found that children produced more private speech while they

worked on tasks of a semantic character than on tasks of a more perceptual nature. This led

to the prediction that more private speech would be elicited in the present study by

story-sequencing tasks (considered by Frauenglass & Diaz to be semantic in character) than

by paper-folding (presumably a more perceptual kind of task). Instead, a clear pattern in

the opposite direction emerged: children produced much more private speech on

paper-folding than on story-sequencing.

A parsimonious explanation for the direction of this difference can be found in the

difference in the meanings of these two tasks for the children, and the difference in

motivation which follows from this difference in meaning. Most children in this

experiment were very enthusiastic about the paper-folding tasks. Many asked early in the

first session whether they could take the paper objects with them when they finished, and

they were permitted to do so. A number of participants related, during the later sessions,

that they had coloured or drawn on the paper objects from previous sessions at home.

Several mentioned having given them to family members or teachers. These extraneous

task characteristics, along with the general enthusiasm of the children for making the paper

objects, led to an enhancement of interest and motivation not possible with the

story-sequencing items used in this study. This motivational difference between the two

tasks, in turn, might account for the difference in private speech production.

As a result, the comparison of task types in this experiment cannot be considered a clear test of findings reported by Frauenglass and Diaz (1985). This study does, however, provide potentially useful information about the kinds of task properties that can affect children's production of private speech. Paper-folding appears to be a task which is particularly well-suited for use in private speech research, both because children produce large quantities of private speech while working on tasks of this kind and because children find these tasks enjoyable. It would appear, based on this study, that although story-sequencing can also serve to elicit substantial quantities of private verbalization and is thus not unsuited for the purpose, tasks of this kind are less productive for eliciting private speech in preschoolers than the more appealing and engaging paper-folding tasks.

Findings of this experiment replicate Vygotsky's (1934/1987, 1978) observations of escalation in children's use of private speech when they encounter difficulty while carrying out a task. Vygotsky (1978) reported that, on a variety of experimental tasks, the coefficient of egocentrism "almost doubled" (p. 30) when obstacles or complications arose for the children. In the present study, results were even more convincing than those related by Vygotsky: on both paper-folding and story-sequencing tasks, mean coefficients of egocentrism (see Figure 3) and mean numbers of private utterances on the difficult items were more than double the values on the easy items.

The manipulations of task difficulty used in this study were clearly more internally valid than the manipulation reported by Kohlberg et al. (1968), which (among other problems) was confounded with task type. In the present study, allocation of specific paper-folding items as easy or difficult was based on careful consideration of difficulty rankings made by three judges, and was subsequently confirmed with an analysis of task performance data. Allocation of story-sequencing items was based on their organization as standardized test materials, and was also subjected to post hoc verification. Efforts such as these were absent in the manipulation reported by Kohlberg et al.

Findings of the present study are compatible with results reported by Beaudichon (1973), who found the task difficulty effect among five-year-old participants, but not among seven-year-olds. The present experiment does not touch on the matter, explored by Behrend et al. (1989a), of possible curvilinearity in the relationship between private speech and task difficulty, such that private speech production is lower on tasks of extreme or excessive difficulty than on tasks of moderate difficulty. In any case, there are very few straightforward replications of the relationship between task difficulty and private speech in previous research, and the present study makes a valuable contribution on this point.

The finding that children used more private speech on novel task items than on items which were familiar from previous sessions is without precedent in the existing literature. This finding seems closely analogous to the effect observed for task difficulty: with repeated presentation, participants encountered less difficulty with the familiar items and thus produced less private speech, whereas the novel items presented fresh challenges, leading to greater use of private speech. In view of these results and findings of other research, the basic task difficulty effect should probably be regarded as a complex phenomenon which is nonlinear (Behrend et al, 1989a) and age-related (Beaudichon, 1973), and which reflects a more extensive pattern that also includes task novelty.

The decline in private speech with repetition of the same task items can be interpreted as evidence of the occurrence of a process of interiorization, over the course of the experiment. With practice on and increasing familiarity with the repeated items, participants made less use of highly explicit, overt forms of linguistic mediation of their actions. Instead, mediation of problem-solving processes on the repeated items - but not the novel items - was presumably carried out more by covert, internally-realized means. The use of a microgenetic experimental approach facilitated detection of these cross-session changes. Other interpretations of this pattern of cross-session reduction are also possible: for instance, one might suggest that verbal regulation in general - both overt and covert -

declined across sessions, or even simply that the children verbalized less because they were becoming bored with the repeated tasks. However, these essentially atheoretical interpretations lack the more general explanatory power of the Vygotskian account.

Analyses of cross-session changes in the percentages of private speech classified as planning speech support the Vygotskian claim that private speech undergoes a developmental shift in position, from verbalization following or simultaneous with action, to verbalization preceding action. Apart from the appealing but quite tentative cross-session pattern found in the pilot study using the Kohlbergian describing and self-guiding categories (see Figure 1), this constitutes the only evidence of such a pattern in the contemporary literature, to date. The strength of this evidence is, of course, qualified somewhat by the failure of the story-sequencing data to conform to a monotonic pattern like that observed for the paper-folding data (see Figure 7). In view of this discrepancy, these findings should be regarded as somewhat tentative, and in need of replication using tasks of various kinds.

Percentages of planning speech differed between sessions while children worked on novel items, and these differences were also found using data from all items. On repeated items, though, no change across sessions was evident. Thus, different kinds of cross-session change were found in this experiment with analyses based on different sets of task items: changes in planning speech were evident overall and on novel items only, but not on repeated items, whereas changes in simple quantities of private speech were found on repeated items, but were not evident overall or on novel items. An integrative interpretation of these seemingly discrepant patterns is possible, based on a distinction between two different kinds of familiarization effects. As well as becoming increasingly familiar with the specific items presented repeatedly in each session, participants in this study also became more familiar with the generic requirements of these two kinds of tasks. This line of reasoning leads to a distinction between item familiarity - which increased on

the repeated items - and task familiarity - which increased across all items, for each task type. It would seem, then, that reduction in amount of private speech tends to occur with growing item familiarity, whereas functional change in private speech - specifically, heightened use of planning speech - tends to be associated instead with growing task familiarity. Perhaps the increased use of planning speech across sessions is a reflection of the development of a general strategic orientation to the task, during which process planning speech, as a system of increasingly effective psychological tools, comes to mediate participants' task-related actions.

Analyses of microgenetic shifts in the Kohlbergian describing and self-guiding categories were less revealing. A decline in the describing category was observed, from the second to the third session, on story-sequencing (see Figure 8) - interestingly, the same kind of task on which the more complete pattern of predicted cross-session change was apparent in the pilot study (see Figure 1). However, there was no further evidence in the present study of the expected shift from private speech in the describing category to self-guiding speech.

Clearly, issues surrounding systems for classification of private utterances are of critical importance for research in this area. The choice of a classification system for use in a particular study influences both the researcher's own findings, and the ease with which these findings can be compared with results of other research. While the system originating with Kohlberg et al. (1968) is well known and variants of it have been employed by numerous researchers, it is not ideal for assessing all aspects of the Vygotskian account of private speech. The alternative system based on Levina's (1981) distinction between constituting speech and planning speech, utilized in the present study, is specifically designed to assess shifts in the positioning of private speech, and it provides a more direct, straightforward means of investigating such changes than does the Kohlbergian approach. The adaptation of the distinction between constituting and planning

speech applied in this study relied almost exclusively on the positioning or placement of private utterances in relation to participants' actions, with virtually no attention to the actual content or function of the utterances. This reliance on utterance location permitted classification of almost every utterance with respect to Vygotsky's (1934/1987, 1978) original claims. With the Kohlbergian system, on the other hand, many utterances were classified as whispering because they could not be understood, and only a relatively small portion of the data set was classified in a way relevant to this issue.

'Whispering, muttering, and mumbling' was by far the most frequent of the Kohlbergian-based categories in this study, on both experimental tasks (44.50 % on story-sequencing, overall, and 52.21 % on paper-folding; see Figures 8 & 9). This is in marked contrast to the small percentage classified in this category in the pilot study (6.19 %, overall; see Figure 1). This difference can likely be accounted for by the different microphones used in the two studies: in the pilot study, a small microphone attached to the top of the videocamera was used, whereas the present study made use of a remote "shotgun" microphone, situated near the participant. This larger microphone recorded sounds much lower in volume than the pickup used in the pilot study (a feature which was sometimes helpful during transcription and coding of the data, and sometimes not). It is also possible that the greater relative frequency of whispering in this study than in the pilot study is related to differences in the ages of participants. Participants in the present study were somewhat older, on the whole, than those in the pilot study (as will be discussed below in more detail). An expectation based on the logic of the Kohlbergian developmental scheme, in which whispering is the most advanced category, would be that children in the older group should produce a greater proportion of whispering than children in the younger group. This, of course, is the pattern emerging from comparison of the two studies. In any case, the large amounts of barely audible speech in this study confirm beyond any lingering doubt that preschool-aged children produce considerable quantities of

verbalization that is clearly intended for no one but themselves.

Regarding evidence of systematic cross-session change in the Kohlbergian categories generally, it is possible only to point out the theoretically-consistent increase in the whispering category (the sixth and most advanced category in the Kohlbergian sequence) and decrease in the describing category (category 3 in the Kohlbergian sequence), from the second to the third session, on story-sequencing (see Figure 8). It may be appropriate to conclude that the category system introduced by Kohlberg et al. (1968) does not constitute a set of microgenetically-dynamic private speech forms, of a kind likely to exhibit substantial change in a short-term experiment such as this. This conclusion does not, however, have any necessary bearing on the system's status as a longitudinally-oriented developmental sequence.

The present study also provides little evidence of microgenetic increases in degree of psychological predication in preschoolers' private speech. One increase was detected, from the first to the second session on story-sequencing, but this test was based on data from only seven participants. A major problem was created for analyses involving predication by the large number of utterances which could not be classified in terms of this variable. Obviously, not much evidence is likely to be gained from a data set in which only about one in four utterances can be coded. In his cross-sectional investigation of fragmentation in private speech, Feigenbaum (in press) eliminated approximately 10 % of the utterances in his data set as generally unscorable, as a first step in categorization of speech. All the remaining speech was scored for fragmentation, but no age-related differences were found. At any rate, Feigenbaum's approach does not provide a clear test of Vygotsky's (1934/1987) ideas about the development of psychological predication in private speech either, since fragmentation is a much broader category than predication. Development of an appropriate and productive empirical methodology for investigating Vygotsky's claims about predication in private speech remains a problem for future research.

Correlational analyses in this study were quite inconclusive. Examination of correlations between planning speech and task performance found no evidence of predicted cross-session relationships, and no interpretable patterns were apparent in these data. Predicted cross-session correlations between quantities of private speech and task performance variables were, by and large, not observed. In fact, the total number of correleation coefficients significant at the .05 level in all these analyses (6 out of 132, or 4.55 %) did not exceed chance levels. There are, however, some aspects of the correlational findings in this study which warrant brief discussion.

One point of particular interest arises from a comparison of the relationships between chronological age and coefficient of egocentrism, in the present study and the pilot study. In the present study, a moderate inverse relationship was found between age and overall coefficient of egocentrism on paper-folding tasks. In the pilot study, this correlation was of approximately the same magnitude but in the opposite direction (in the pilot study, r_s = .367; in the present study, r_s = -.354). It must be pointed out that these two correlations are based on data from different tasks: story-sequencing in the pilot study, and paper-folding in the present study. The age correlation for story-sequencing in this study was also negative, but nonsignificant (see Table 3).

At any rate, this apparent discrepancy across studies in the direction of the correlation may be accounted for by particulars of the age composition of the groups of children participating in the two studies. Furthermore, this account is fully consistent with the claim - based on Vygotsky's (1934/1987, 1978) theory - that the developmental course of private speech corresponds to an inverted U-shaped function. In the present study, only 10.00 % of the participants were under 5 years, 0 months of age; in the pilot study, however, 53.13 % of the subjects were below this age. In the present study, 50.00 % of the participants were 5 years, 6 months or older, whereas only 18.75 % were in the pilot study. Thus, it
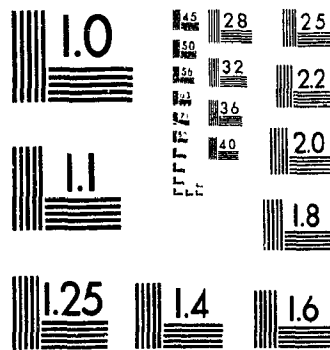
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No 2)

can be argued that the sample of participants in the pilot study was drawn from a rather younger population than the sample for the present study, and that this difference explains the directional difference between the correlations in the two studies. Specifically, the positive correlation in the pilot data reflects the large number of subjects in the sample who were in the early, positive-slope phase of the inverted-U curve, whereas the negative correlation in the present study reflects the large number in the later, negative-slope phase.

The absence of correlations between private speech and PPVT-R (Dunn & Dunn, 1981) raw score is rather surprising. One possible explanation for this is that the range of PPVT-R scores (35 to 94) was not wide enough for a statistical relationship to be apparent. Another possibility is that the linguistic processes involved in carrying out the PPVT-R do not correspond to the processes involved in private speech production. There is no particularly compelling reason to suppose that the use of speech-for-oneself by preschoolers should be closely related to their level of vocabulary development. Whereas measurement of private speech is based on subjects' spontaneous verbalizations, the PPVT-R is a test of receptive vocabulary, and its administration does not require the subject to speak. It appears plausible that dissimilarities in the kinds of language-related psychological processes inherent in private speech production and in carrying out the PPVT-R could account for their lack of correlation in this study.

Strictly speaking, correlations between quantities of private speech and task performance showed none of the expected cross-session relationships. The directions of the two statistically significant correlations that were found are contradictory to predictions based on an hypothesized cross-lagged facilitative effect of private speech (see Behrend et al., 1989b). The number of significant correlations in these analyses (2 out of 72, or 2.78 %) is less than the number expected by chance alone, using $\alpha = .05$. This leads to the conclusion that there were no actual correlations, and the two significant r_s values were

products of chance, reflecting nothing of interest. Another, decidedly tentative,

interpretation of these correlations can, however, be ventured. This alternative

interpretation suggests some potentially interesting research questions for further enquiry.

Research concerned with between-session correlations among private speech and task

performance (Behrend et al., 1989b; Duncan, 1991) has not, to date, investigated

relationships beyond a second session. Private speech during a first session and private

speech during a second session may have different kinds of relationships with task

performance in subsequent sessions. A certain amount of evidence supporting this

suggestion - albeit tentative and admittedly rather weak - can be gleaned from Appendix D

(Sections 1 to 4).

Upon reexamination of these correlations using a relaxed $\propto$ level of .10 (with $\underline{N}$ =

40, critical 1-tailed $\underline{r_S}$ = .207), something of a probative pattern becomes apparent. Even

with this liberal significance level, only one within-session correlation between private

speech and task performance is significant - a negative correlation, in the third session (see

Appendix D, Section1). Six positive correlations exceeding or closely approaching the

critical value can be found between first-session private speech, and performance during

subsequent sessions (see Appendix D, Sections 1, 3, and 4). (With 6 out of 32

correlations, or 18.75 %, at or near the critical value, it is again conceivable that this is a

chance pattern.) Eight negative correlations between second-session private speech and the

two variables involving subsequent performance can be found which either exceed or

approach the critical value (including the two reported in the Results section, above; see

Appendix D, Sections 1 to 4). At 50.00 % of the 16 correlations, this seems unlikely to be

a chance pattern. This liberal but tentative interpretation using $\propto$ = .10 identifies 15

correlations, altogether, which are of at least some interest; this constitutes 20.83 % of the

total number of 72 correlations evaluated in this set of analyses. However, it must be

pointed out that some of the correlations identified in this speculative discussion are based on nonindependent indices.

These small correlations hint at the following tentative pattern: first-session private speech is a weak positive predictor of task performance during subsequent sessions, whereas second-session private speech is a weak negative predictor of third-session performance, and of improvement in performance from the second to the third session. A straightforward interpretation of such a pattern would be that while first-session private speech tends to reflect task-related learning, private speech during the second and third sessions tends to reflect continuing difficulty with the task items. At any rate, the pattern which has been suggested cannot be regarded as anything more than a potential direction for further research on cross-temporal facilitative effects of private speech. It may be that cross-lagged correlations involving private speech are better suited to longitudinal analysis (see, for example, Bivens & Berk, 1990) than to short-term microgenetic experimentation.

Results of this study suggest several potentially interesting problems for further research on children's private speech. One methodological consideration following from the pattern of findings in this study is that the two private speech metrics, coefficient of egocentrism and number of private utterances, are essentially redundant. The two were highly intercorrelated, and usually led to the same statistical decisions. The coefficient of egocentrism is probably the metric of choice, both because it has been more commonly used in previous research than the other metric, and because it incorporates a component of control for individual children's level of general talkativeness, which the other metric does not.

Findings of this study create a need for replication and further exploration of the effects on private speech of both task novelty and task difficulty. Patterns of cross-session changes in both quantity and positioning or function of private speech need to be examined further. A possible conceptual basis for such research is provided by the distinction

between item familiarity and task familiarity, as discussed above. The private speech classification system involving constituting speech and planning speech, as used in the present study, provides an appropriate means for exploring the developmental shift in the location of private speech, discussed by Vygotsky (1934/1987, 1978).

The finding by Behrend et al. (1989a) that private speech production was lower on very difficult jigsaw puzzles than on puzzles of moderate difficulty is also in need of replication. Both task types employed in this study - story-sequencing and, especially, paper-folding - would be quite appropriate for use in such an experiment.

The suggested relationship between motivation and private speech production, discussed above, presents another potential problem for future enquiry. Motivational effects could readily be tested using the paper-folding tasks employed in the present study, in an experiment incorporating a between-subjects manipulation of whether the participants were permitted to take the paper objects with them, at the end of each session. An extension of the basic two-condition design might include a third condition in which participants are given additional rewards for proficient performance on the tasks. Fundamental issues of this kind have not been specifically addressed in previous research on private speech.

Examination of correlations between private speech production and chronological age appears to provide a means of testing certain aspects of Vygotskian theory, and certainly warrants further attention. Correlational hypotheses involving task performance and private speech, on the other hand, seem less likely to prove informative in the microgenetic experimental context. Although hypotheses of this kind do not warrant prominent treatment in future research, such correlations should nonetheless be evaluated, when the necessary information is available.

It is possible that improvements in procedures for scoring task performance might help to produce more informative correlational analyses. Performance on many of the

paper-folding tasks, for instance, could be scored in a more detailed manner, based on the number of correctly-executed folds on a particular item, rather than on general, somewhat subjective impressions on the part of the experimenter. Another alternative would be to utilize some other kind of task which allowed more precise, more discriminating scoring of performance, although the effort may not be warranted merely for the sake of testing microgenetic correlations. Future research is likely to find that cross-temporal correlations are better suited to longitudinal analysis than to microgenetic analysis.

In view of its importance in Vygotsky's (1934/1987, 1978) account of private speech, structural change involving heightened psychological predication is clearly in need of attention in future research. However, development of an adequate means of coding private speech data for predication is an obviously primary problem which has not been resolved at the present time.

An essential aspect of Vygotsky's (1934/1987, 1978) theory of private speech which was not touched on in the present study is the social origin of this speech form. Conclusive data relevant to this matter would be of considerable value, both because of a relative scarcity of existing evidence, and because of Vygotsky's own lack of clarity regarding effects of experimental manipulations of social context. Future research on children's private speech will need to address this issue in some detail.

On the whole, results of the present experiment provide considerable support for Vygotsky's (1934/1987, 1978) account of the development of children's private speech, on a number of points. A strong replication of the task difficulty effect was ascertained, and a similar effect was found in connection with task novelty. Evidence was found of interiorization of private speech across sessions, when participants worked repeatedly on the same task items. The comparison of paper-folding and story-sequencing in this experiment demonstrated that the relations between the kind of task used in a study and the amount of private speech produced by children are complex; these relations can involve

other characteristics of the task, apart from the type of cognitive processes apparently invoked in carrying it out. Evidence was also found in support of Vygotsky's claim that private speech undergoes a shift over time, from occurrence following action or simultaneous with action, to occurrence preceding action.

As well as contributing several substantive findings to the research literature on children's private speech, the present study also provides an example of an application of Vygotskian experimental methods to a contemporary psychological research problem. This study convincingly demonstrates that Vygotsky's (1934/1987, 1978) ideas about "experimental-developmental" or microgenetic empirical methodology can be effectively and productively applied to the problem of private speech. Results of this study indicate that it is possible to experimentally elicit systematic, theoretically-consistent short-term changes in the private speech of preschool-aged children, in a study implementing an appropriate multi-session, repeated-measures design. It seems likely that considerable gains would follow from increased inclusion of microgenetic experimental methodology in studies concerned with developmental problems of other kinds, as well as in research in other areas of psychology.

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Appendix A. Counterbalanced Orderings of Task Items

Session 1.

Order 1: Picnic, Fire, Artist, Sleeper / Tent, Cupboard, Flag, Ice Cream Cone.

Order 2: Sleeper, Artist, Fire, Picnic / Ice Cream Cone, Flag, Cupboard, Tent.

Order 3: Cupboard, Tent, Ice Cream Cone, Flag / Fire, Picnic, Sleeper, Artist.

Order 4: Flag, Ice Cream Cone, Tent, Cupboard / Artist, Sleeper, Picnic, Fire.

Session 2.

Order 1: Artist, Sleeper, Lasso, Burglar / Flag, Ice Cream Cone, Bird, Fan.

Order 2: Burglar, Lasso, Sleeper, Artist / Fan, Bird, Ice Cream Cone, Flag.

Order 3: Ice Cream Cone, Flag, Fan, Bird / Sleeper, Artist, Burglar, Lasso.

Order 4: Bird, Fan, Flag, Ice Cream Cone / Lasso, Burglar, Artist, Sleeper.

Session 3.

Order 1: Artist, Sleeper, Plank, Boat / Flag, Ice Cream Cone, Stop Sign, House.

Order 2: Boat, Plank, Sleeper, Artist / House, Stop Sign, Ice Cream Cone, Flag.

Order 3: Ice Cream Cone, Flag, House, Stop Sign / Sleeper, Artist, Boat, Plank.

Order 4: Stop Sign, House, Flag, Ice Cream Cone / Plank, Boat, Artist, Sleeper.

Appendix B. Example Transcript of An Experimental Session

Classifications follow each utterance by the subject, for (1) social / private, (2) planning /

constituting, (3) Kohlbergian-based categories, and (4) predication categories.

Session 3, Order 4.

Exp'ter: Just take your time with it.

Subject: Okay. {social}

E: So there you go.

S: Oh. Mmm. I forgot which one is first. {social}

E: It doesn't matter - whichever you like.

S: Hey ... mm. {private; constituting; describing; uncodable}

[whispering] {private; constituting; whispering; uncodable}

Mmm. {private; planning; nonlinguistic; uncodable}

Ah. {private; planning; nonlinguistic; uncodable}

[whispering] {private; constituting; whispering; uncodable}

[whispering] {private; constituting; whispering; uncodable}

[indecipherable] {private; constituting; whispering; uncodable}

Oh. Oh. [whispering] {private; planning; whispering; uncodable}

Oh. Ooh. {private; planning; nonlinguistic; uncodable}

How do you make the bottom? {social}

E: The bottom part?

S: Yeah. {social}

E: Just like that tent ... remember?

S: Mm-hm. {social}

Mm. Mm. {private; constituting; whispering; uncodable}

Oh. {private; constituting; nonlinguistic; uncodable}

Oh. {private; constituting; nonlinguistic; uncodable}

Won't stay together. {social}

E: Take your time.

S: Okay. {social}

E: They can help you quite a bit if you use them.

S: Ah. {social}

[whispering] {private; constituting; whispering; uncodable}

[whispering] {private; planning; whispering; uncodable}

Umm. {private; constituting; nonlinguistic; uncodable}

[indecipherable] {private; planning; whispering; uncodable}

Okay. {social}

E: Remember - no hurry.

S: Okay. {social}

E: There.

S: Ooh. {private; planning; nonlinguistic; uncodable}

Oo-kay. {private; planning; self-guiding; uncodable}

This one. {private; constituting; describing; predicative}

This one. {private; constituting; describing; predicative}

And this one. {private; constituting; describing; predicative}

This one. {private; constituting; describing; predicative}

All right. {social}

_____

E: Yeah. That's right.

S: Tah. {private; planning; nonlinguistic; uncodable}

Mm-mm. {private; planning; whispering; uncodable}

Mmh. {private; constituting; whispering; uncodable}

All right. {social}

_____

E: Remember, no hurry.

S: I know that. {private; other; describing; not predicative}

All right. {social}

Appendix C. Difficulty Rankings of Individual Task Items

Difficulty rankings for individual items (from easiest to most difficult), based on the analysis of task performance data.

Paper-folding items: 'tent,' 'cupboard,' 'flag,' 'stop sign,' 'house,' 'fan,' 'bird,' 'ice cream cone.'

For comparison, averages of the ratings by the three judges (as discussed in the Method section, above) yielded the following rankings: 'tent,' 'cupboard,' 'stop sign,' 'flag,' 'bird' (equal in average estimated difficulty to the previous item), 'ice cream cone,' 'fan,' 'house.'

Story-sequencing items: 'Picnic' (item 2 on the WISC-R Picture Arrangement test), 'Fire' (item 3; equal in difficulty to the previous item), 'Boat' (item 9), 'Lasso' (item 8), 'Burglar' (item 5; tied with the previous item), 'Artist' (item 7), 'Plank' (item 4; tied with the previous item), 'Sleeper' (item 6).

Appendix D. Spearman Rank Correlations
Between Private Speech and Task Performance

% Coefficient of Egocentrism
# Number of Private Utterances

Section 1. Quantities of Private Speech and Task Performance:
Repeated Paper-folding Items

		Perf. Ses. 1	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 1-2	Diff. Ses. 1-3
Session 1	%	0.075	0.204*	-0.026	0.172	0.022
	#	0.066	0.08	0.053	-0.049	0.052

*p<.12 (1-tailed)

		Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 2-3
Session 2	%	-0.011	-0.207*	-0.203*
	#	0.04	-0.166	-0.199

*p<.12 (1-tailed)

		Perf. Ses. 3
Session 3	%	-0.113
	#	-0.209*

*p<.10 (1-tailed)

Section 2. Quantities of Private Speech and Task Performance:
All Paper-folding Items

		Perf. Ses. 1	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 1-2	Diff. Ses. 1-3
Session 1	%	-0.146	-0.063	-0.081	0.131	0.173
	#	-0.089	-0.115	-0.063	0.042	0.144

		Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 2-3
Session 2	%	0.091	-0.047	-0.206*
	#	-0.104	-0.149	-0.091

*p<.12 (1-tailed)

		Perf. Ses. 3
Session 3	%	-0.063
	#	-0.08

Section 3. Quantities of Private Speech and Task Performance:
Repeated Story-sequencing Items

		Perf. Ses. 1	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 1-2	Diff. Ses. 1-3
Session 1	%	0.091	0.196	0.15	0.133	0.068
	#	0.113	0.213*	0.192	0.121	0.102

*p<.10 (1-tailed)

		Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 2-3
Session 2	%	0.018	-0.263*	-0.401**
	#	0.012	-0.252*	-.377**

*p<.10 (1-tailed)
**p<.05 (2-tailed)

		Perf. Ses. 3
Session 3	%	0.02
	#	0.017

Section 4. Quantities of Private Speech and Task Performance:
All Story-sequencing Items

Session 1		Perf. Ses. 1	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 1-2	Diff. Ses. 1-3
	%	0.135	0.162	0.228*	0.056	0.245*
	#	0.116	0.124	0.218*	0.048	0.229*

*p<.10 (1-tailed)

Session 2		Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 2-3
	%	0.15	-0.026	-0.185
	#	0.143	-0.047	-.222*

*p<.10 (1-tailed)

Session 3		Perf. Ses. 3
	%	0.17
	#	0.173

Section 5. Planning Speech and Task Performance:
Repeated Paper-folding Items

Ses.1 Planning Speech (N=26)	Perf. Ses. 1	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 1-2	Diff. Ses. 1-3
	-0.102	-.516*	-0.16	-0.369	0.023

*p<.01 (2-tailed)

Ses.2 Planning Speech (N=22)	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 2-3
	-0.222	-0.177	0.004

Ses.3 Planning Speech (N=21)	Perf. Ses. 3
	-0.031

Section 6. Planning Speech and Task Performance:
All Paper-folding Items

Ses.1 Planning Speech (N=26)	Perf. Ses. 1	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 1-2	Diff. Ses. 1-3
	-0.146	-0.245	0.015	-0.16	0.042

Ses.2 Planning Speech (N=31)	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 2-3
	0.336*	0.253	-0.231

*p<.05 (1-tailed)

Ses.3 Planning Speech (N=26)	Perf. Ses. 3
	0.122

Section 7. Planning Speech and Task Performance:
Repeated Story-sequencing Items

Ses.1 Planning Speech (N=22)	Perf. Ses. 1	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 1-2	Diff. Ses. 1-3
	0.042	-0.035	-0.018	-0.137	-0.177

Ses.2 Planning Speech (N=16)	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 2-3
	-0.094	-0.078	-0.024

Ses.3 Planning Speech (N=11)	Perf. Ses. 3
	-0.045

Section 8. Planning Speech and Task Performance:
All Story-sequencing Items

Ses.1 Planning Speech (N=22)	Perf. Ses. 1	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 1-2	Diff. Ses. 1-3
	0.154	0.035	0.065	-0.133	-0.097

Ses.2 Planning Speech (N=25)	Perf. Ses. 2	Perf. Ses. 3	Diff. Ses. 2-3
	-0.183	-0.036	0.294

Ses.3 Planning Speech (N=23)	Perf. Ses. 3
	-0.355

Appendix E: Parental Consent Letter and Form

Robert Duncan

Dr. Michael Pratt

April, 1991

To: Parents of children attending the daycare programme at the

Dear parents,

I am a graduate student in psychology at Wilfrid Laurier University, Waterloo. I am

hoping to carry out a study involving the participation of some children in attendance at this

daycare centre. This research is part of a Master of Arts degree programme in psychology,

and is being supervised by Dr. Michael Pratt of the Department of Psychology, Wilfrid

Laurier University.

In this study, children will be asked to carry out story-sequencing tasks and

paper-folding tasks. For the story-sequencing tasks, children will be shown several sets of

cards with pictures on them, and asked to arrange each set of cards in a particular order, so

the pictures form a brief story. For the paper-folding tasks, children will be asked to make

things by folding sheets of paper. On three different days (about one week apart),

participants will spend about twenty minutes working on these tasks, while being

videotaped. During one of the sessions, children will also carry out a measure of

vocabulary development. This will involve seeing sets of four pictures, and indicating the

picture in each set which matches a specific word. These sessions will be scheduled to take

place in the daycare centre in April or May, 1991.

Young children talk to themselves while they play and while they carry out tasks of

various kinds. The purpose of this study is to examine connections between (1) children's

actions while working on story-sequencing and paper-folding tasks, and (2) things the

children say while working on these tasks. The videotapes will be viewed by Dr. Pratt and

I as part of an investigation of the relationship between children's comments and their

behaviour while working on tasks by themselves. The videotapes will be erased as soon as the examination of all the sessions has been completed. Knowledge of speech of this kind is valuable both for approaches to child care and for the development of early educational methods. It could, for instance, be of great value in teaching children to read, or in understanding the development of self-control.

Only children whose parents or guardians give their consent will take part in this study, since participation is entirely voluntary. All children for whom this consent is given will be asked at the time of the sessions if they wish to participate, and will, of course, be able to withdraw from participation in the study at any point before or during the procedure. Results of all individual participants will be kept strictly confidential - in this study, only group results are of interest. A summary of these group results will be mailed to all households expressing an interest in receiving this feedback, in July, 1991. If you would like clarification of any aspect of the study, or have questions of any kind, please do not hesitate to call me at 747-4951, or Dr. Pratt at 884-1970, ext. 2824. If you are interested in having your child participate in this study, please sign the attached consent form and return it to daycare staff.

Thank you

_____

Robert Duncan

_____

Dr. Michael Pratt

I consent to my child's participation in the study of children's speech while they work on story-sequence tasks and paper-folding tasks, carried out by Robert Duncan and Dr. Michael Pratt, as described above.

Child's name: _____

Child's age: ___ years, ___ months

Parent's name: _____

Parent's signature: _____

_ _

I am interested in receiving a summary of the group results of this study.

Yes ___ No ___

(If 'yes,' please print your address in the space below.)

Address: _____

_____

_____

Appendix F: Feedback Letter to Parents of Participants

July 10, 1991

To parents of children who participated in recent research on preschoolers' private speech.

Dear parent(s),

At some time over the last few months, your child participated in a study of the use of "private speech" by preschool-aged children, carried out at daycare centres, preschools, and schools in Kitchener-Waterloo. We are grateful for your cooperation and your child's cooperation. This research led to a number of interesting findings, and we would like to take this opportunity to tell you about them.

The objective of the study was to assess patterns of speech by the children while they worked on paper-folding tasks nd story-sequencing tasks. Of particular interest to us were the ways in which the children talked out loud to themselves, and used speech to guide and regulate their actions. This form of language is known as "private speech" (or "speech for oneself").

The study included three sessions with each child, during which children were videotaped while carrying out the paper-folding and story-sequencing tasks. The videotapes were later viewed in order to document the children's use of private speech.

The results of the study showed that the children used more private speech when they carried out the paper-folding tasks than when they worked on the story-sequencing tasks. During the first of the three sessions in the study, children worked on some easy tasks and some difficult tasks, both paper-folding and story-sequencing. As we had expected, children used more private speech while working on the difficult tasks than on the easy tasks. This suggests that private speech, which is frequently considered to be "thinking out loud" in young children, is particularly important for children when they are carrying out tasks they find challenging.

During the second and third sessions, children carried out the difficult tasks from the

first session again. They also carried out novel tasks (both paper-folding and story-sequencing), which they had not worked on before during the study. Comparisons of the novel tasks and the familiar tasks, in terms of the private speech produced by the children, indicated that the children used private speech more on the novel tasks than on the familiar tasks, during both the second session and the third session. Like the difference in private speech on the easy tasks and the difficult tasks described above, this difference between familiar and novel tasks again suggests that children use more private speech when their problem-solving skills are challenged.

As was already mentioned, the paper-folding and story-sequencing tasks which were presented as the difficult items during the first session were also presented during both the second and third sessions. Comparisons of private speech during the three sessions while children worked on these increasingly-familiar problems showed a decline in the amount of private speech produced by the children, over the course of the study. This indicates that as children became more familiar with these particular tasks, they used less private speech while carrying them out. This finding fits well with other findings regarding the effects of both task difficulty and task novelty on children's private speech use.

We also found that early in the study, children's private speech tended either to follow or accompany their actions. As the study progressed, though, their private speech tended more to precede their actions, suggesting that it came to be used by the children as a means of planning their actions, before actually acting.

Children who participated in this study also carried out a measure of vocabulary development. Contrary to our expectations, children's performance on this vocabulary measure was not statistically related to their use of private speech.

This study has provided new knowledge about preschoolers' private speech. We hope that this research will contribute toward our understanding of the development of children's speech and thinking. We would like to thank both you and your child for your

help with this study.

Sincerely,

_____

Robert Duncan

_____

Dr Michael Pratt

Table 1. Mean Quantities of Private Speech Across Sessions

Paper-folding

		Session 1	Session 2	Session 3
All Items	Coefficient of Egocentrism	34.87 s.d.=30.50	40.34 s.d.=30.51	40.47 s.d.=30.29
	Number of Private Utterances	5.38 s.d.=5.85	6.43 s.d.=7.07	7.08 s.d.=6.54
Novel Items	Coefficient of Egocentrism	41.74 s.d.=35.12	45.26 s.d.=33.96	45.14 s.d.=31.21
	Number of Private Utterances	4.1 s.d.=4.71	5 s.d.=5.78	5.48 s.d.=5.51
Repeated Items	Coefficient of Egocentrism	41.74 s.d.=35.12	25.26 s.d.=27.88	27.43 s.d.=30.72
	Number of Private Utterances	4.1 s.d.=4.71	1.35 s.d.=1.96	1.6 s.d.=2.32

Story-sequencing

		Session 1	Session 2	Session 3
All Items	Coefficient of Egocentrism	28.03 s.d.=30.17	31.93 s.d.=29.34	30.01 s.d.=28.10
	Number of Private Utterances	3.5 s.d.=5.20	3.93 s.d.=4.88	3.23 s.d.=3.94
Novel Items	Coefficient of Egocentrism	34.6 s.d.=35.97	34.22 s.d.=33.18	37.88 s.d.=34.04
	Number of Private Utterances	2.4 s.d.=3.43	2.5 s.d.=2.98	2.68 s.d.=2.96
Repeated Items	Coefficient of Egocentrism	34.6 s.d.=35.97	21.63 s.d.=29.14	10.42 s.d.=19.86
	Number of Private Utterances	2.4 s.d.=3.43	1.43 s.d.=2.41	0.55 s.d.=1.45

Table 2. Mean Numbers of Private Utterances in Predication Categories, Across Sessions (N=40)

Paper-folding

	Predicative	Not Predicat.	Uncodable
Session 1	0.38 s.d.=0.93	0.55 s.d.=1.11	4.4 s.d.=4.99
Session 2	0.55 s.d.=1.39	0.85 s.d.=1.89	4.88 s.d.=5.24
Session 3	0.8 s.d.=1.91	0.8 s.d.=1.84	5.53 s.d.=5.11

Story-sequencing

	Predicative	Not Predicat.	Uncodable
Session 1	0.38 s.d.=1.19	1.03 s.d.=2.89	2.13 s.d.=3.06
Session 2	0.38 s.d.=1.15	0.73 s.d.=2.52	2.88 s.d.=3.37
Session 3	0.23 s.d.=0.8	0.45 s.d.=1.69	2.55 s.d.=2.52

Table 3. Correlations With Overall Private Speech

(Table entries are Spearman rank correlations, except correlations involving gender, which are point-biserial correlations.)

Paper-folding

	Overall Coefficient of Egocentrism	Overall Number of Private Utterances	Overall % Classified as Planning Speech
Overall Performance	-0.144	-0.202	0.06
PPVT-R Raw Score	-0.109	-0.051	0.062
Chronological Age	-0.354*	-0.325*	0.048
Gender	0.158	0.112	-0.132

*p<.05, 2-tailed

Story-sequencing

	Overall Coefficient of Egocentrism	Overall Number of Private Utterances	Overall % Classified as Planning Speech
Overall Performance	0.093	0.065	-0.207
PPVT-R Raw Score	0.006	0.077	0.179
Chronological Age	-0.137	-0.184	0.156
Gender	0.275	0.246	-0.042

Figure 1. Kohlbergian-Based Categories Across Sessions: Pilot Data
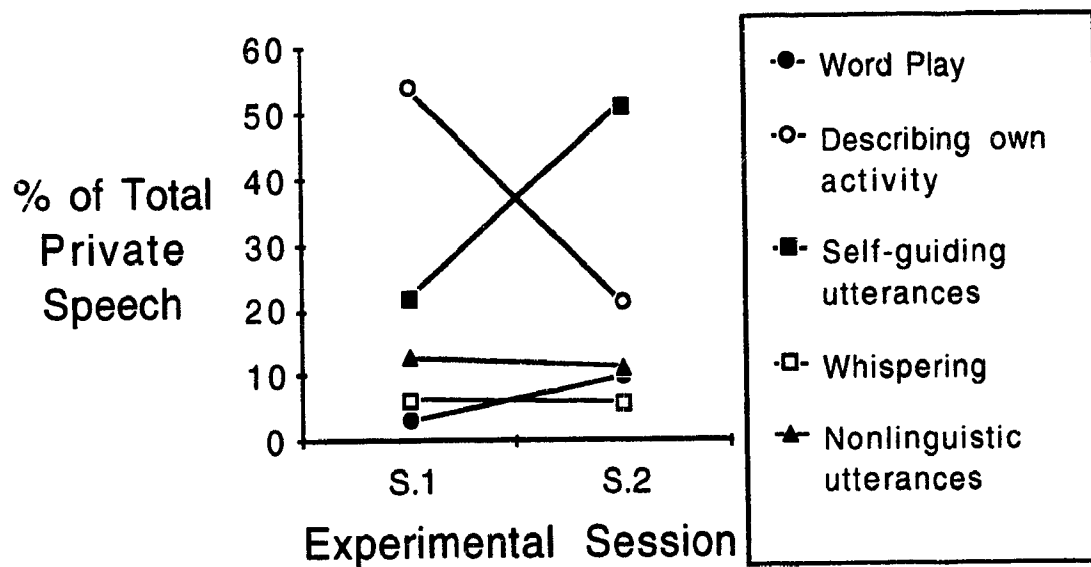
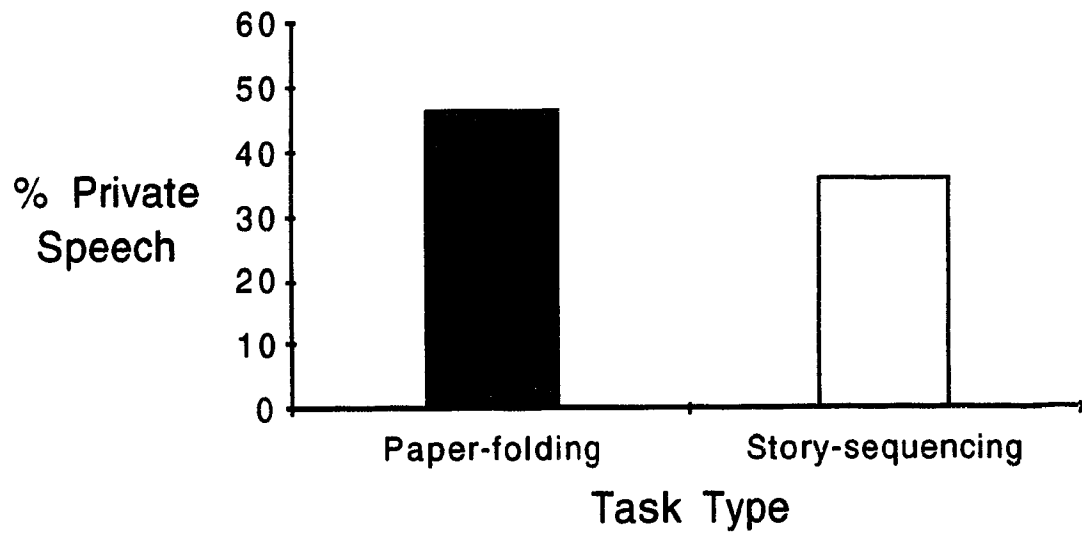Figure 2.   Coefficient of Egocentrism
Across Task Type

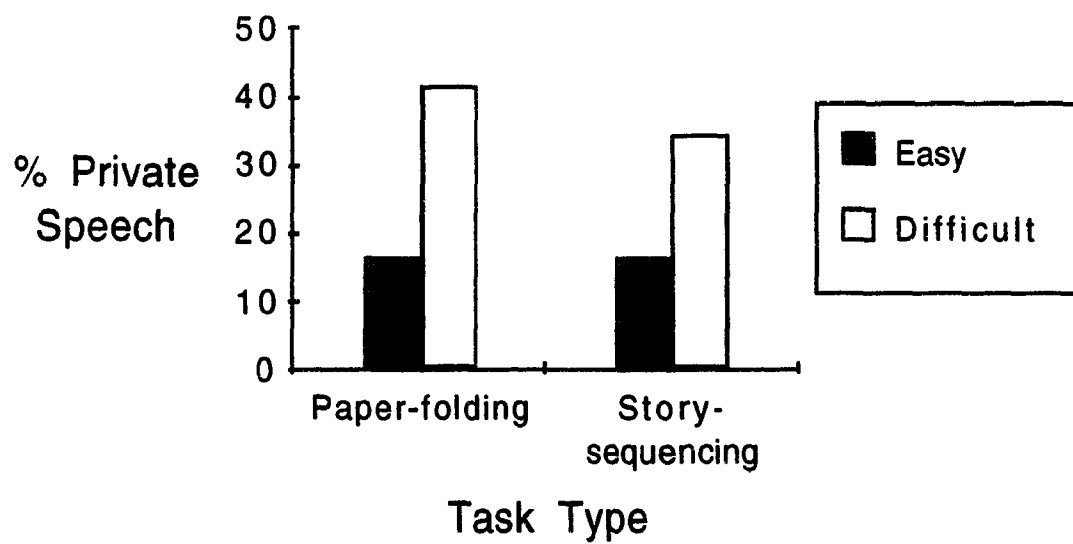Figure 3.   Coefficient of Egocentrism
Across Task Difficulty

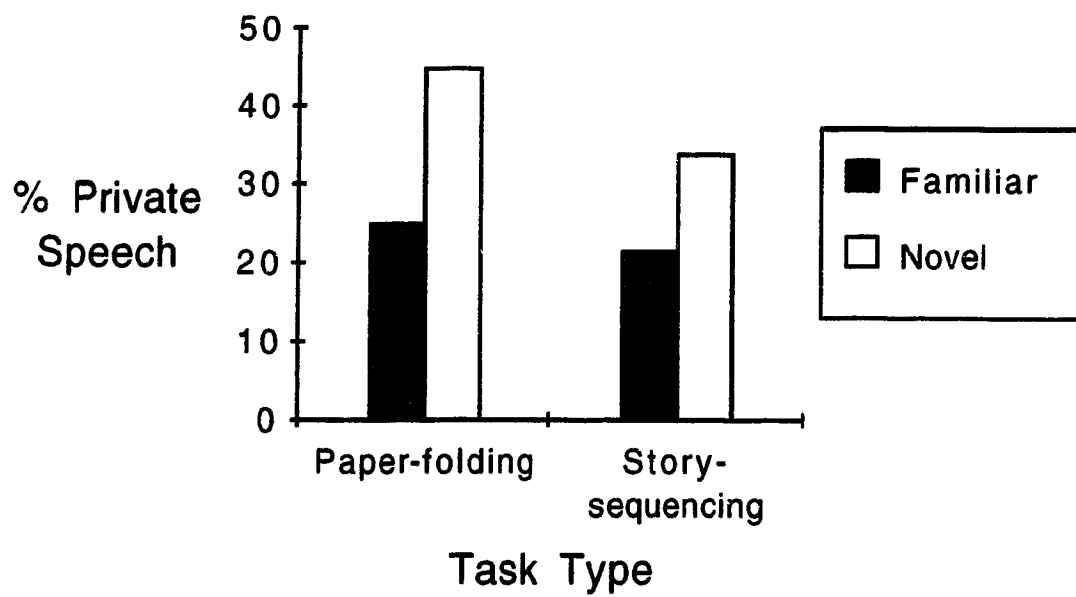# Figure 4. Task Novelty, Session 2

Bar chart showing % Private Speech by Task Type. X-axis: Task Type (Paper-folding, Story-sequencing). Y-axis: % Private Speech (0 to 50). Legend: Familiar (black), Novel (white). Paper-folding: Familiar ≈25, Novel ≈45. Story-sequencing: Familiar ≈22, Novel ≈34.

Figure 5. Task Novelty, Session 3
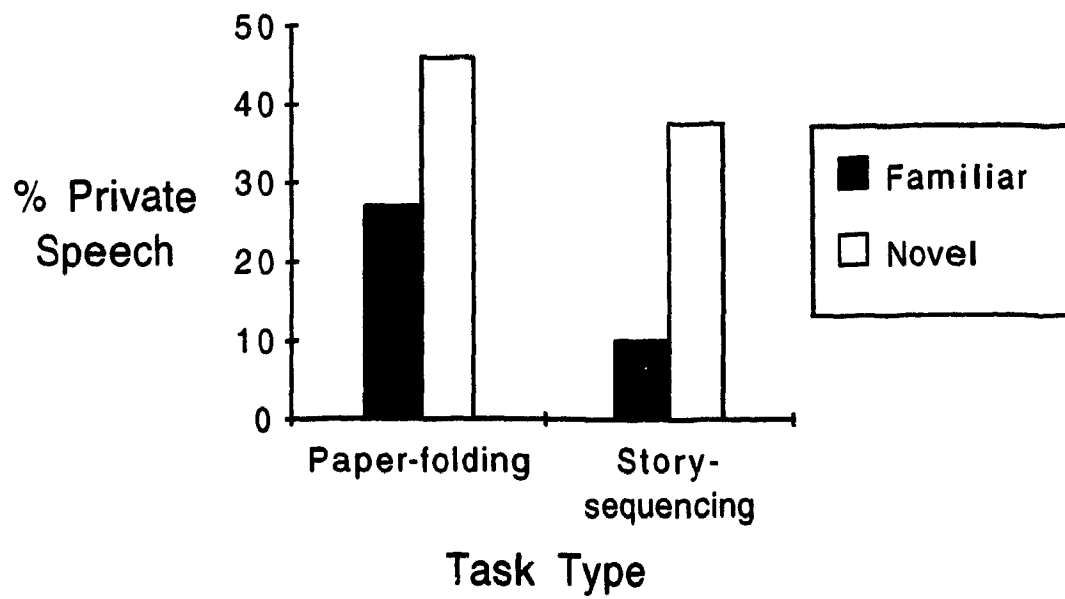
Figure 6. Coefficient of Egocentrism
Across Sessions, On Repeated Items
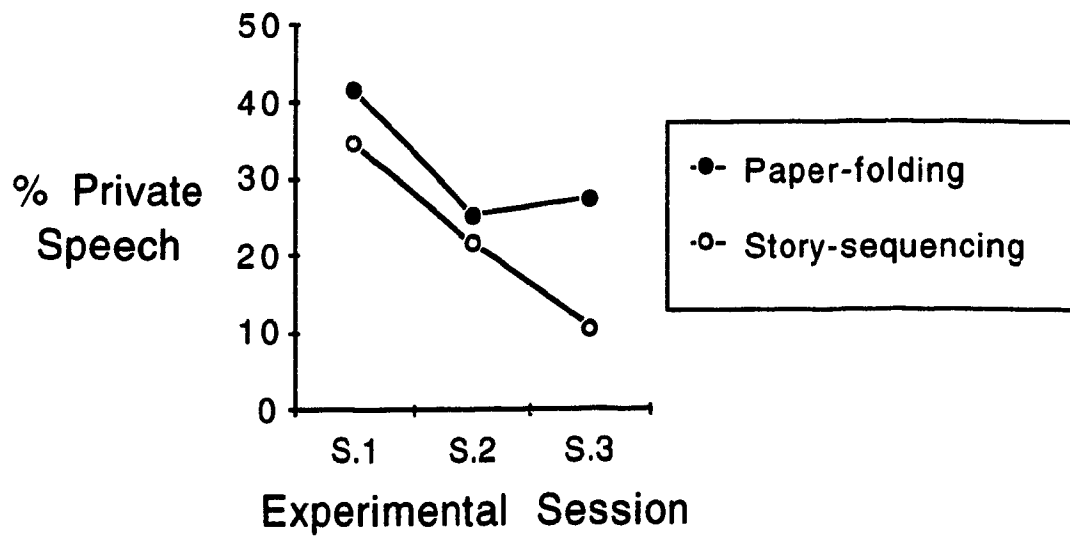
Figure 7. Planning Speech
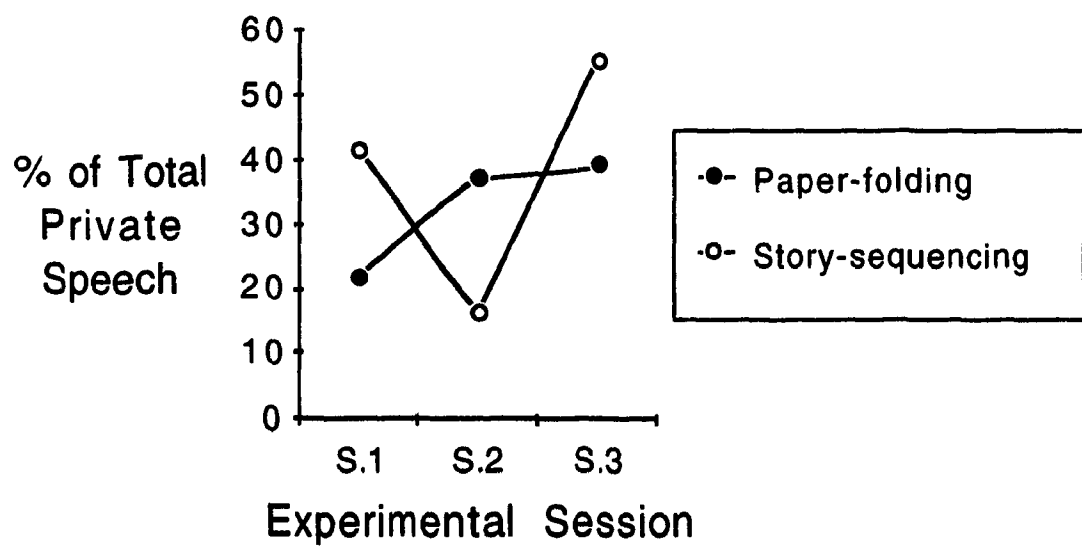## Across Sessions, On All Items

Figure 8. Kohlbergian-Based
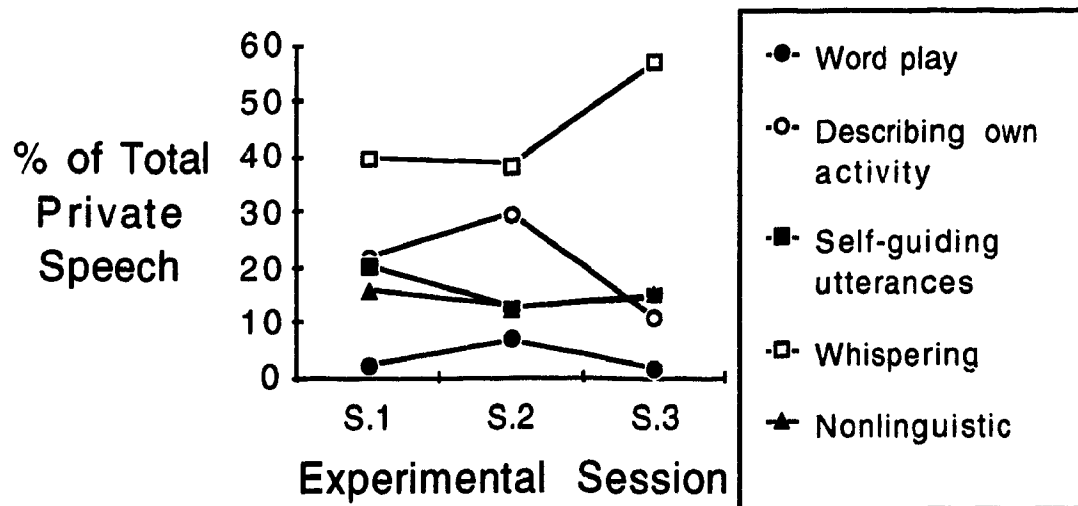Categories Across Sessions,
On Story-Sequencing

Figure 9. Kohlbergian-Based
Categories Across Sessions,
On Paper-Folding