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**PART I:  
THEORETICAL AND  
BIOLOGICAL  
FOUNDATIONS**

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Still Talking to Ourselves after All These Years: A Review of Current Research on Private Speech

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Developmental relations between thought, language, and behavior have proved to be perennially interesting to psychologists, cognitive scientists, and philosophers (Nelson, 1996; Pinker, 1994; Vygotsky, 1934/1987). To what extent is language separate from thinking? How does language development influence cognitive development? To what extent is language development dependent upon cognitive growth? How is language used by children as a tool for guiding one’s thinking, behavior, or problem solving?

One phenomenon that falls at the intersection of many such discussions is children’s private speech – children’s overt and sometimes partially covert (whispered) self-talk while they are working on something or playing. Children’s private speech provides an empirical window for exploring many interesting questions about mind, behavior, and language, especially those having to do with language serving a role in the development of children’s executive function or self-regulation. Private speech is typically defined as overt, audible speech that is not addressed to another person (Winsler, Fernyhough, McClaren, & Way, 2004). Inner speech, on the other hand, refers to fully internal, silent verbal thought – that is, speech fully inside one’s head.

Research on children’s private speech, largely that which originated from within the Vygotskian theoretical tradition, has been summarized and reviewed before on two occasions – first, in Zivin’s (1979a) volume entitled *The Development of Self-Regulation Through Private Speech* (Zivin, 1979b), and then 13 years later in Díaz and Berk’s (1992) volume, entitled *Private Speech: From Social Interaction to Self-Regulation* (Berk, 1992). Since then, however, research on private speech and self-talk has blossomed. Indeed, at least 20 dissertations and more than 100 publications on “private speech” in children and adults have appeared during the past 15 years. A recent literature search using the PsychInfo database revealed that the majority, 110 (56%), of the 197 total publications retrieved upon searching for “private speech” have appeared in the past 15 years. Further, if “self-talk” is used instead as the search term, fully 577 (71%) of the 809 hits retrieved are from 1992 to the present. Of course, there has likely been an increase in the volume of scholarship found in

searchable databases in all areas of psychology and education over the same time period. Nevertheless, these figures still show that research on private speech is alive and well and in need of synthesis.

The present chapter will take the publication date of the review by Berk (1992) as a starting point and review developments over the past 15 years in our understanding of private speech and its role in the development of behavioral and cognitive control and self-regulation throughout the life span. First, a brief historical and theoretical overview will be offered that details the origins and trajectories of several different theoretical traditions that are currently guiding research on private speech. Then, new developments and updates in a variety of different topic areas within private speech research will be discussed. Finally, recent methodological advancements will be discussed, along with future directions that research in this area may take. Although the emphasis in this chapter will be on the research conducted within the Vygotskian, socio-cultural tradition (the largest group of studies), consistent with the goal of this volume to integrate across different research traditions, this review will also include discussion of work on self-talk from a variety of different theoretical traditions.

A BRIEF HISTORICAL AND THEORETICAL OVERVIEW

Vygotsky and Piaget

Although philosophers have certainly debated the relationship between language and thought for centuries (Cain, 2002), the history of interest in children’s private speech within the field of developmental psychology started in 1923 with the publication of Piaget’s book, *The Language and Thought of the Child* (Piaget, 1923/1962), in which Piaget described observations of children talking to themselves in classrooms and speculated as to the developmental significance (or lack thereof) of what he termed at the time “egocentric speech.” Although an oversimplification, Piaget’s position on children’s self-talk was essentially that it was simply an artifact of preschool children’s limited

cognitive abilities and general cognitive egocentrism (difficulty in taking the perspective of others). Basically, private speech was viewed by Piaget as poor social speech (in the sense of not being sufficiently well adapted), and the eventual developmental fate of such speech was for it to be replaced with fully mature and effective social speech after the child conquered egocentrism and gained increased cognitive and communicative skills.

Vygotsky took issue with Piaget's interpretation and started the first series of systematic experiments on children's private speech, which were described in his well-known book, *Thought and Language*, published in 1934 (Vygotsky, 1934/1962, alternatively translated later as *Thinking and Speech* in Vygotsky, 1934/1987). It is in this volume that Vygotsky began to flesh out his theory of children's private speech, which would later be elaborated upon, both by himself (Vygotsky, 1930–1935/1978) and with his student and colleague, Luria (1961; Vygotsky & Luria, 1930/1993). These ideas became the driving force motivating research on children's private speech for the next 70 years and would continue to be developed by neo-Vygotskian scholars (Berk & Winsler, 1995; Díaz & Berk, 1992; Díaz, Neal, & Amaya-Williams, 1990; Wertsch, 1985).

Vygotsky proposed that private speech, rather than originating from within the child's mind and becoming more social over time as envisioned by Piaget, originates from the social world of the child in children's interactions with others. Social speech from parents and caregivers to the child, which functions in part to guide and regulate children's behavior and attention ("other-regulation"), gradually becomes internalized during the toddler and preschool years as the child begins to talk to the self out loud to guide his or her own thinking, behavior, and problem solving. Thus, the social/cultural tool or symbol system of language, first used for interpersonal communication, is used by the child overtly not for communication with others but for intrapersonal communication and self-guidance. During this process of internalization or the appropriation of language for the self, a fundamental transformation of the child's cognitive processes takes place when preintellectual language and prelinguistic cognition fuse to create verbally mediated thought. A new level of functional organization of the brain and mind is thus created that allows children to engage in uniquely human, higher-order cognitive processes, such as self-reflection and self-regulation of behavior. That is, with the help of private speech, young children are able to distance themselves from the immediate environment and stimuli (Müller, Jacques, Brocki, & Zelazo, Chapter 3 of this volume) and have their behavior and attention guided by their own internal (verbal) plans; thus, they can reflect better on their own thinking and behavior and reach greater levels of control and mastery over their own behavior. Within this framework, private speech is seen in the preschool and early elementary years as an intermediate and overt step in the eventual formation of inner speech or inner verbal thought (talking to oneself silently in one's head).

## Behaviorism

Behaviorists also took an interest early on in this peculiar form of "verbal behavior" evidenced by children and adults. Watson (1930) and later Skinner (1957), although not attributing any real functional or developmental significance to such speech, and seeing such speech as existing purely under the control of external reinforcement contingencies, conceded that talking out loud to oneself could facilitate the appearance or disappearance of certain other desirable or undesirable behaviors. The behavioral perspective on private speech would later become important within the context of self-instructional, cognitive-behavioral interventions attempted for children with behavior problems (Camp, Blom, Herbert, & van Doorninck, 1977; Díaz & Berk, 1995; Kendall, 1977; Meichenbaum & Goodman, 1971) that became popular in the late 1970s and 1980s. More recently, behavioral applications and interventions based on self-talk have become quite popular with adolescents and adults within sports psychology (Johnson, Hrycaiko, Johnson, & Halas, 2004; Landin & Hebert, 1999; Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000) and industrial-organizational psychology (Brown, 2003; Millman & Latham, 2001), and they continue to be influential within clinical psychology (Alfano, Beidel, & Turner, 2006; Calvete, Estévez, & Landín, 2005; Wang, Brennen, & Holte, 2006). These areas of research on self-talk will be discussed in more detail later in this chapter.

## Strategies and information processing

One important moment in the history of private speech research was the publication, in 1966, of John Flavell's early works (Flavell, 1966; Flavell, Beach, & Chinsky, 1966), in which he coined the term "private speech" that is now widely used and almost universally preferred to "egocentric speech." Flavell observed that children would often use private speech in the form of spontaneous verbal rehearsal of to-be-remembered information in the context of memory experiments. Flavell found that such verbal mediation or rehearsal was an effective strategy for children to use to maximize performance in memory tasks. In these works, Flavell and his colleagues stimulated two new lines of inquiry related to children's self-talk – verbal strategy development studies within an information-processing tradition and Vygotskian-inspired research on children's spontaneous private speech.

Decades of research by numerous investigators would soon follow, exploring the variety of verbal and non-verbal strategies that children use during memory and problem-solving tasks (Bjorklund & Douglas, 1997; Bjorklund, Miller, Coyle, & Slawinski, 1997; Harnishfeger & Bjorklund, 1990; Kuhn, Garcia-Mila, Zohar, & Anderson, 1995; Miller, 1994) and the extent to which children are metacognitively aware of such strategies (Justice, 1986; Justice, Baker-Ward, Gupta, & Jannings, 1997). This group of strategy development researchers was primarily

guided by information-processing theory, and their work progressed almost completely independently from the Vygotskian-inspired work on private speech that also ensued shortly after Flavell's early studies (Díaz & Berk, 1992; Zivin, 1979a).

The focus of the strategy development researchers has been on the cognitive processes and problems themselves (i.e., memory, categorization) and the speech that is directly part of the cognitive process itself (i.e., labeling, verbal rehearsal) and not so much on the metacognitive or overarching executive or self-regulatory function of the speech for guiding the child's problem solving in general (i.e., "Now, let's see, where should I start?") or the properties of the speech itself (full volume versus whispered speech), completeness or length of utterance which have been the focus of the Vygotskian private speech researchers. Similarly, strategy development researchers often study older children and instruct or train them in the use of particular verbal strategies, or specifically ask children to talk aloud while working on a particular task and analyze such verbal protocols for information specifically about what is going on cognitively (Ericsson & Simon, 1993). The emphasis on training children to use particular speech strategies, seen to some extent in the work of the strategy development researchers as well as that of the behaviorists who studied self-instructional training discussed earlier, originated from Western readers of Vygotsky's works, who rather quickly equated children's spontaneous private speech (what Vygotsky was writing about) with trained or instructed verbal strategies. However, these types of speech are seen as different (Díaz & Berk, 1995; Wozniak, 1972). Private speech researchers from the Vygotskian tradition, on the other hand, have typically studied younger children's spontaneous (unprompted) speech during a wider variety of problem-solving tasks (puzzles, sequencing tasks, building/construction tasks, math problems). In a sense, private speech researchers have studied all aspects of self-speech (motivational functions, affect expression, metacognitive reflection, volume, internalization) and have focused on the speech itself as a general regulatory tool during any activities, whereas the strategy development researchers have examined only the task- and strategy-relevant content of the speech specific to the task at hand that yields information about children's cognition.

These two research traditions, the strategy development researchers and the private speech researchers, rarely talked to or cross-referenced one another over the years. It has been only recently that there have been attempts to integrate the two traditions (Winsler & Naglieri, 2003; Winsler, Naglieri, & Manfra, 2006;) in showing that private speech can be usefully seen as a strategy that children sometimes use to guide their problem-solving activities. One of the multiple meanings of the title of this chapter, "Still Talking to Ourselves after All These Years," is that researchers from different theoretical traditions have been exploring the role of language in guiding behavior in different ways and have not really been talking to one another

much. The time is ripe for cross fertilization across traditions in private speech research to occur. Toward that end, I turn now to some of the lessons that have been learned within strategy development research that may be useful for private speech researchers to bear in mind.

One lesson learned from the strategy development literature is that children typically use multiple strategies, verbal or not, to do their problem solving and that strategy use is quite variable even within the same individuals over time (Bjorklund & Rosenblum, 2001; Siegler, 1996; Siegler & Stern, 1998). So, private speech is not the only means that children and adults might use to get their problem solving done. Also clear from this literature is that strategy use is rather variable and inconsistent across situations and time and that even the same child engaging in the same task upon multiple trials will show inconsistent use of strategies (Bjorklund & Douglas, 1997; Crowley & Siegler, 1999; Schneider & Weinert, 1990; Siegler, 1996; Siegler & Stern, 1998). As discussed later in this chapter, private speech researchers have been concerned in the past when either task effects or inconsistent within-child time effects are observed in children's private speech, as if the researchers were expecting self-talk to always be there and to be the same across all situations. The strategy literature suggests that we should not be so perplexed when this is observed in children's private speech.

A second lesson to be learned from the strategy development work is that it is very common for strategies, including verbal strategies, to be used but not necessarily be related to performance (Bjorklund & Douglas, 1997; Miller, 1994; Schneider & Weinert, 1990). In fact, concepts such as production deficiency (when a child is capable of engaging in an effective strategy but doesn't do so spontaneously), and utilization deficiency (whereby a child engages in the strategy but it doesn't seem to help them) (Miller, 1994) and findings of remarkable persistence in the continued use of ineffective strategies over time (Siegler & Stern, 1998) need to make their way into the Vygotskian camps of researchers who have struggled for decades with similar issues of speech-performance relations (Berk, 1986; Fernyhough & Fradley, 2005; Winsler, Díaz, & Montero, 1997) without the benefit of these ideas. Finally, the utility of the use of the intensive, microgenetic, trial-by-trial method of examining children's problem solving and strategy use over time (Siegler, 1996; Siegler & Stern, 1998) is another lesson that can be taken up more fully by private speech researchers.

### Cognitive development and executive control

A final group of researchers, coming from yet different traditions, that has recently taken up an interest in private speech and self-talk in guiding behavior is an eclectic collection of cognitive developmentalists and cognitive psychologists with domain-specific theories on the development of executive functioning, working memory, perseveration, inhibition, cognitive flexibility and control, and/or rule use (Baddeley, 1986; Carlson & Moses, 2001;

Diamond, Kirkham, & Amso, 2002; Jacques & Zelazo, 2005; Kirkham, Cruess, & Diamond, 2003; Müller, Zelazo, Hood, Leone, & Rohrer, 2004; Russell, Jarrold, & Hood, 1999; Zelazo, Müller, Frye, & Marcovitch, 2003). Those who study the development of working memory, for example, find that language is important in that thinking about things verbally either quietly inside one's head or out loud, via the phonological loop, is an important mechanism through which individuals process and represent information and get/keep material in their working memory (Baddeley, 1986; Gathercole & Baddeley, 1993). Baddeley and Hitch's classic model of working memory, however, limits inner speech to playing only a representational role and does not posit that the speech itself can have an executive or guiding function. Some investigators are now starting to integrate Baddeley and Hitch's model with the Vygotskian work on private speech (which does posit an executive control role for speech) and show associations between children's overt private speech usage and their phonological recoding during memory and math tasks (Al-Namlah, Fernyhough, & Meins, 2006; Ostad & Sorensen, 2007).

Other new research developments have forced cognitive psychologists to broaden their models and give speech a larger, more executive role in guiding mental activity. Switching back and forth from one cognitive operation or task to another is an executive skill, because it requires conscious and flexible control over one's mental operations (Monsell & Driver, 2000). Switching between one task and another is difficult, and it takes extra time to complete both tasks compared to the amount of time it takes to complete each task consecutively. The difference between these two reaction times (doing the tasks consecutively, and doing them together at the same time while switching back and forth) is called the task-switching cost, and this is a measure of the executive processing involved in switching between tasks. A number of experiments have now been conducted that show that adults appear to use inner speech to help them switch from one task to the other, and that if one prevents individuals from engaging in inner speech (by giving them another secondary, simple verbal task that they have to do at the same time as the main task, a process known as articulatory suppression), the task-switching cost is greatly increased (Baddeley, Chincotta, & Adlam, 2001; Emerson & Miyake, 2003; Goschke, 2000; Miyake, Emerson, Padilla, & Ahn, 2004). These findings suggest that inner speech plays an important role in retrieving and activating one's task-related goals and guiding one's goal-directed behavior and activities. The same is likely true for children's overt private speech, but studies directly testing this have not yet been conducted and are certainly needed.

Other scholars, studying the emergence of cognitive control and how young children become able to resist mental distractions and flexibly modify cognitive strategies, find that language and the use of verbal rules are critical. Zelazo and his colleagues have developed and revised their theory

of Cognitive Complexity and Control (CCC-r) (Zelazo & Frye, 1998; Zelazo & Jacques, 1996; Zelazo et al., 2003) and their Levels of Consciousness (LOC) model (Zelazo, 2004), which together posit that language plays a key role in executive functioning, both by increasing psychological distance between the self and the world, and thus helping children become more aware or conscious of their own activity, and by being a primary vehicle or tool children use to exercise executive control over their thoughts and actions (Müller et al., Chapter 3 of this volume). Although these investigators have not explored children's spontaneous private speech directly, they have examined the effects of asking children to verbally label relevant task dimensions or stimuli while completing various executive functioning tasks. Such studies find that executive functioning performance is generally enhanced when children use task-directed speech, especially for younger 3-year-old children who may not spontaneously use this verbal strategy but do so readily and effectively when asked (Diamond et al., 2002; Jacques & Zelazo, 2005; Kirkham et al., 2003; Müller et al., 2004 – but for more detail, see Müller et al., Chapter 3 of this volume).

Finally, another important component of executive functioning is inhibitory control, being able to suppress prepotent responses or highly salient information and call up and execute another, less salient strategy or response set (Davidson, Amso, & Anderson, 2006; Russell et al., 1999). Although inhibitory control is more typically studied as a cognitive (Wilson, Kipp, & Daniels, 2003) or behavioral (Riggs, Blair, & Greenberg, 2003) phenomenon, inhibition is also involved in other areas such as social understanding and theory of mind (children have to inhibit their own knowledge/belief/desire and take the perspective of the other less-salient person involved) and pretense (children have to inhibit the salient representation of what an object actually is, and pretend that it is something else). Some investigators have started to extend work on links between language and executive function to other realms of children's functioning that can be seen as involving some form of inhibition, including the role of language and symbols in children's social understanding (Carpendale & Lewis, 2004; Carpendale, Lewis, Susswein, & Lunn, Chapter 5 of this volume), pretense (Carlson & Beck, Chapter 12 of this volume), and theory of mind (Carlson & Moses, 2001; Fernyhough & Meins, Chapter 6 of this volume). Readers are encouraged to consult these other chapters in this volume for additional information about these interesting new directions for an even broader role of language in guiding a diversity of human activity.

Thus, over the past 75 years, scholars from a wide variety of different theoretical traditions have been exploring different aspects of the role of language in guiding behavior and problem solving. However, as yet, there has not been much cross-fertilization and communication across traditions and paradigms. What is new – and is the hope of this chapter and volume – is that these disparate theoretical traditions and different ways of examining the role

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of language in self-regulation and executive control start to talk to each other rather than to themselves. The rest of this chapter will review research on private speech that has appeared within the past 15 years. Most but not all of this work emanates from the Vygotskian tradition, which has mostly focused on early childhood and children's spontaneous (rather than elicited or instructed) private speech during tasks and has answered questions about developmental trajectories and links between private speech and (a) children's behavioral control and task performance, (b) the child's social world, (c) adult-child interactions, and (d) the types of classroom contexts that foster or constrain such speech.

## DEVELOPMENTAL TRAJECTORIES IN PRIVATE SPEECH

One of the early questions that has guided research over the years is whether there is a particular developmental trajectory for the appearance of private speech; that is, at what ages is private speech likely to be observed, and how does such speech change in frequency, type, and/or function as children get older? Vygotsky's original observations and hypotheses regarding private speech were that frequency of private speech showed a curvilinear, inverted-U-shaped relationship with age with overt self-talk increasing in frequency and peaking during the preschool years and then becoming less common during the early elementary school years, when it is gradually replaced with whispers, inaudible muttering, and silent inner verbal thought. There has been qualified support over the years for this general developmental pattern. There is clear support for the notion that private speech moves from more externalized forms of speech to more partially internalized forms as children get older, but less support is present for the simplistic idea of there being particular ages at which private speech appears and disappears (Berk, 1992).

Researchers have now addressed such questions in three different ways: cross-sectionally, by observing the speech use of children of different ages while engaging in the same task or in different tasks (Matuga, 2003; Winsler & Naglieri, 2003); longitudinally, by examining changes in the same children's use of private speech over time (Montero, de Dios, & Huertas, 2001; Winsler, de León, Wallace, Carlton, & Willson-Quayle, 2003); and micro-genetically, by examining changes in private speech use within children over very short intervals of time, such as across multiple discrete trials with one task administration or across several relatively close-in-time repeated administrations of the same task (Berk & Spuhl, 1995; Duncan & Pratt, 1997; Winsler et al., 1997).

## Cross-sectional studies

At the time of the previous review (Berk, 1992), practically all of the studies that were available were cross-sectional in nature. The difficulty with summarizing the cross-sectional work on private speech to answer develop-

mental trajectory questions is that the investigations (a) have rather small and nonrepresentative sample sizes (no doubt due to the labor-intensive work of recording, transcribing, and coding children's private speech!), (b) have each included different age groups and age ranges of children, and (c) have typically had children engage in different tasks and in different settings, both across studies and even within individual studies across age groups. This is unfortunate but understandable, given that children at different ages require different and age-appropriate tasks of moderate difficulty to elicit private speech. Given that frequency of private speech is known to vary considerably as a function of task and setting variables (Behrend, Rosengren, & Perlmutter, 1989; Berk, 1992; Frauenglass & Díaz, 1985; Krafft & Berk, 1998; Winsler, Carlton, & Barry, 2000), this has made the assessment of any ontogenetic developmental patterns that may be present in private speech very difficult to ascertain. Also, when studies include only two age groups, it is difficult to tell which side of the hypothesized developmental curve (upswing or downswing) the children are in in terms of quantity of private speech.

Winsler and Naglieri's (2003) cross-sectional study helped overcome many of these limitations by observing a large, diverse ( $N = 2,156$ ), nationally representative, multi-site sample of children and adolescents across a wide age range (5 to 17 years) engaging in the same, standardized, planning task. Children's observed overt and partially covert (whispers, muttering) self-speech during the task was recorded, as was children's self-reported use of inner speech (in terms of the percentage of children who used/reported the verbal strategies at least once during the task). Overt private speech declined linearly with age, with 43% of the 5-year-olds talking out loud to themselves, decreasing to 10% for 17-year-olds. The self-reported use of silent, inner speech started at 4% for the youngest age group and rose to around 30% for the oldest groups. Interestingly, partially covert whispers and mutterings showed the inverted-U pattern, starting at 13% for the 5-year-olds, peaking for the 9-year-olds at 28%, and then decreasing again to around 11% for the teenagers. It is important to note that the overall percentage of children (60%) who used verbal mediation of some kind (overt, partially covert, covert) remained constant across all ages – it was the *type* of speech that varied by age. This study confirmed findings from earlier smaller-scale studies (Berk & Garvin, 1984) showing that use and internalization of speech extends farther into middle childhood than was originally hypothesized by Vygotsky. Indeed, as will be discussed further, a considerable minority of even late adolescents in this study continued to use either overt or partially overt private speech during the planning task.

## Longitudinal studies

A handful of longitudinal studies have emerged over the past 15 years that have examined children's use of private

speech over time (Montero et al., 2001; Winsler, Díaz, Atencio, McCarthy, & Adams Chabay, 2000; Winsler et al., 2003). Winsler and colleagues (2003) twice assessed a group of 3.5-year-old and a group of 4.5-year-old children's private speech during a Lego construction and a selective attention task, with a 6-month interval between observations. Significant shifts in the proportional topography of children's private speech occurred between around 43 and 55 months of age. Speech became proportionally more task-relevant and more partially internalized between these age periods. By 55 months, children's private speech was about 60% partially internalized, 30% overt and task-relevant, and 10% irrelevant to the tasks at hand, and there was no change in these figures between 55 and 60 months. Children's private speech utterances were also found in this study to decrease over time in the average number of words per utterance, which is consistent with another of Vygotsky's (1934/1986) hypotheses about how private speech becomes internalized: namely, that overt speech should become abbreviated, more cryptic, and more predicated (a reliance on only new content or ideas rather already "given" or stated information) over time during the preschool years (Berk, 1992; Wertsch, 1979).

Importantly, in addition to the developmental changes just described, Winsler et al.'s (2003) longitudinal study showed developmental stability across tasks and over a 6-month period in terms of certain patterns of interindividual differences in young children's private speech. Individual differences in private speech were fairly stable across the two different problem-solving tasks used in the study and over time. Children who use a lot of one (or more) particular types of self-talk during one task or at one time point were likely to use similar amounts of such verbal self-regulatory strategies on the other task and at the other time point. In addition, even though certain tasks appear to be more likely to elicit particular types of private speech, children tend to maintain their relative ranks in terms of the frequency with which they use different types of private speech across tasks, the extent to which the speech is syntactically abbreviated, and the proportion of children's private speech that is partially internalized (Winsler et al., 2003).

The fact that the content and frequency of children's private speech can be influenced by different features of either the task or the contextual setting (as has been found in studies that were specifically looking for such effects, such as Berk & Landau, 1993; Frauenglass & Díaz, 1985; Krafft & Berk, 1998; Lee, 1999; Winsler, Carlton, & Barry, 2000; Winsler & Díaz, 1995) thus does not rule out the possibility that stable individual differences in children's private speech across tasks, time, and settings are also present. This finding of stability and reliability of individual differences in children's private speech across tasks and time is important for future research exploring the developmental significance of such speech and the role it may play in self-regulation. It confirms that, in addition, to microanalytical questions about the functions of

such speech and particular speech-performance relations during specific individual problem-solving activities, interesting larger-scale ontogenetic questions about change over time in children's private speech, and interindividual differences in such intraindividual change, can also be profitably addressed. For example, Winsler et al. (2003) found that individual differences across children in certain features of their private speech usage in the laboratory (i.e., the total amount of private speech, the proportion of speech relevant and irrelevant to the task, and the proportion that was partially internalized) were related to independent observations of children's on-task behavior and affect in the preschool classroom, and to parent and teacher reports of child social skills and behavior problems. This is consistent with a Vygotskian theoretical framework that sees private speech as not just moment-to-moment articulation of ongoing thought processes during task-specific problem solving, but instead as a coherent set of verbal self-regulatory strategies that have developed over time into an organized way of guiding one's behavior.

Winsler and colleagues conducted another longitudinal study (Winsler, Díaz et al., 2000) in which both typically developing preschool children and matched children with behavior problems were followed over 3 years with four waves of data collection. The normative pattern for changes in children's private speech over time between the ages of 3 and 6 (and the pattern that was associated with successful performance on tasks and parent and teacher behavioral reports) was a reduction in overall amount of private speech over time, increased probability of completing task items correctly with silence over time, a reduction in irrelevant speech over time, and an increase over time in the proportion of private speech that was partially internalized (whispered or muttered). Finally, another longitudinal study was carried out by Montero and colleagues in Spain (Montero et al., 2001). The main focus of this investigation was to explore the motivational and attributional (to what children attribute their successes and failures) content of speech rather than tracking developmental stability and trajectories over time in other aspects of children's private speech use. These investigators found little change over the course of four observations throughout the school year in the motivational content of 4-year-old and 6-year-old children's private speech while completing math problems.

### Microgenetic studies

The third way that investigators have explored questions about developmental trajectories, albeit on a smaller, microgenetic rather than ontogenetic time scale, is through microgenetic studies. These studies involve repeated observations of the same children engaging in (a) the same task upon multiple presentations in relatively rapid succession (Berk & Spuhl, 1995; Duncan & Cheyne, 2001); (b) multiple trials within the same task administered once (Winsler et al., 1997); or (c) both – multiple

trials within one task and multiple task occasions (Duncan & Pratt, 1997). In these studies, the focus has been not only on determining the frequency and fate of private speech during the course of the tasks, but also on exploring relations between speech and performance over time. Only findings related to the former will be discussed here, with relations between speech and performance considered further later.

Berk and Spuhl (1995) showed, with a sample of 4- to 5-year-olds completing tasks multiple times, that as children's competence with the task increased over the multiple sessions, their private speech followed the same sort of Vygotskian-predicted course of progressive internalization, with fewer overt utterances and more partially covert speech and silence. Similar findings have emerged from other studies that have documented internalization of preschool children's private speech use over the administration of multiple trials of tasks (Duncan & Pratt, 1997). Interestingly, this microgenetic pattern of progressive internalization and reduction in overt private speech over repeated task trials is also found in microgenetic research examining private speech use among adults (i.e., Duncan & Cheyne, 2001), a topic to which I turn next.

### Private speech use among adults

It is clear that if one averages across many children, many different settings, and many different tasks, one finds that preschool-age children are more likely to exhibit spontaneous, overt private speech than older individuals. However, it is also clear that private speech is not something that is just for young children. Older children (e.g., Winsler & Naglieri, 2003), adolescents (e.g., Kronk, 1994), and even adults (e.g., Duncan & Cheyne, 2001) use overt self-talk while engaging in problem-solving and other activities. In Winsler and Naglieri's study, up to 30% of adolescents were observed to use overt, obvious self-talk during a planning task. In other investigations designed more specifically to tap individual's self-speech using videotape recordings, 98% to 100% of adolescents and adults were found to use private speech during paper-folding, exam-taking, and computer data-entering activities (Duncan & Cheyne, 2001; Duncan & Tarulli, Chapter 13 of this volume; Kronk, 1994).

Interestingly, about one half to two thirds of the adult samples in Duncan and colleagues' studies deny having spoken to themselves when asked afterwards (Duncan & Tarulli, Chapter 13 of this volume), suggesting either that adults are inhibited about admitting their self-talk or that they are not particularly aware of their overt verbalizations. In support for the inhibition hypothesis is the fact that adolescents are more likely to talk to themselves while in the remote presence of a confederate who is also periodically saying things to himself while working, as compared to being fully alone (Kronk, 1994). In support of the "lack of awareness" hypothesis, however, is the fact that when adults are asked in general about their use

of private speech, either through questionnaires (Duncan & Cheyne, 1999) or interviews (Winsler, Feder, Way, & Manfra, 2006), most (96% in the case of Winsler, Feder, et al., 2006) report using overt private speech with some frequency (Duncan & Cheyne, 1999).

Researchers examining self-talk among adults also find similar microgenetic patterns of progressive internalization over repeated trials and similar patterns of increased usage of private speech during more difficult tasks or during certain types of tasks over others (Duncan & Cheyne, 2001; Duncan & Tarulli, Chapter 13 of this volume; Sánchez Medina, Alarcón Rubio, & De la Mata Benítez, Chapter 14 of this volume). These observations, that adults use private speech and that similar relations are found between speech and performance/task difficulty in adults and in children, have led some to question what such findings mean for Vygotsky's theoretical notions of the developmental trajectory and special role of private speech in early childhood (see Duncan & Tarulli, Chapter 13 of this volume; Sánchez Medina et al., Chapter 14 of this volume).

The Vygotskian notion is that during early childhood, the initial emergence and internalization of private speech is transformative – that the appropriation or interiorization of language is a critical development leading to a reorganization of mental activity and new functional links between language, cognition, and behavior that allow for uniquely human, higher-order psychological functions and self-regulation. Research findings on private speech among young children are certainly consistent with this hypothesis. However, new data show that older children and adults also sometimes use overt private speech under certain task and situational contexts. The simple fact that older individuals talk to themselves as well is not necessarily a challenge to the Vygotskian position on what is going on during early childhood if one sees the existence of overt self-talk in older individuals as simply the continued and periodic use of a strategy that was found to be important earlier in development. The strategy development literature is clear that people use varied and multiple tools and strategies throughout development during cognitive problem-solving activities, with some strategies or task behaviors appearing more frequently than others during certain periods of ontogenetic development (Siegler, 1996). Further, a decline in the relative frequency of the use of a strategy that might occur for one task across time does not mean that that particular strategy or behavior cannot appear again later on different tasks or even the same task within individuals (Bjorklund & Douglas, 1997; Siegler, 1996; Siegler & Stern, 1998). Fernyhough (2004) characterizes this phenomenon as "re-externalization" of private speech among adults as needed, depending on contextual or personal stresses or cognitive challenges.

### Summary – developmental trajectories

In sum, there appear to be multiple developmental trajectories at different levels for private speech. At the

ontogenetic level, if one averages across many studies and across many tasks, settings, individual differences in children, and social contexts (each of which is known to affect the probability of seeing children's private speech), there does appear to be an overall, global pattern of overt private speech being common and peaking during the preschool years and becoming more internalized in nature and less frequent on average around age 5 and 6. After that, older children and adults have the option of using overt self-talk during various tasks and activities as needed, and they do so when cognitively challenged. However, there is another, smaller-scale, microgenetic developmental trajectory that takes place within individuals, at any age, as they engage with and eventually master a new, moderately challenging, complex, problem-solving task – namely, that overt private speech appears to peak during moments of initial task difficulty and then gradually decrease in frequency as the individual masters the task over time or over repeated trials (Berk & Spuhl, 1995; Duncan & Pratt, 1997; Sánchez & Alarcón, 2005; Winsler et al., 1997).

It is thus important for researchers to move away from the simple notion that private speech should only be used by children at a particular age and should not be seen at another age. Because the appearance of private speech is intimately linked with the individual's task-specific competence, and because that competence changes over time with repeated task experience (not to mention that certain tasks are more likely to elicit private speech than others – Winsler, Fernyhough et al., 2004), one can't conclude where a child is at in terms of a simple, domain-general ontogenetic pathway by examining the child's self-talk at one point in time on one task. Multiple observations are needed over time in the context of longitudinal or microgenetic studies to understand developmental shifts in private speech that occur for a specific task.

It is important to point out here that there is perhaps yet another developmental level at which private speech trajectories can be observed – namely, the cultural-historical level. Sánchez Medina and colleagues have conducted a series of investigations involving middle-aged adults attending an adult education center who vary in their degree of formal education received and in their literacy – some who cannot read, some who are in the middle of learning to read, and others who are more literate (Sánchez Medina et al., Chapter 14 of this volume). By giving such groups of adults classification tasks of varying difficulty and recording the social and private speech used by the adults during task completion, these experimenters have been able to provide additional evidence not only that adults do talk to themselves, but also that relations between social and private speech and between private speech use and task difficulty are similar for adults and for children. Relevant to the present discussion, however, is the fact that they show that adults who are more literate and have more formal education are more internalized in their private speech use (less private speech overall, less overt private speech, and more partially

internalized speech) than adults with lower levels of education and literacy (Alarcón, Sánchez, & Winsler, 2007; Azevedo, Sánchez, Alarcón, & De la Mata, 2002; Sánchez Medina et al., Chapter 14 of this volume). This finding is intriguing because it suggests that it could be experience with formal education and symbolic systems such as literacy (i.e., cultural development) in addition to, or even rather than, age that matters in terms of predicting individuals' use of language as a tool for self-regulation. Such notions are certainly consistent with the Vygotskian tradition and its emphasis on development itself being the acquisition of cultural historical tools and symbol systems (Vygotsky, 1930–1935/1978; Vygotsky & Luria, 1930/1993).

### EARLY PRECURSORS OF PRIVATE SPEECH

One of the very exciting new directions for research on private speech and self-regulation is exploration into the early developmental precursors of self-regulatory speech. Vygotsky's (1930–1935/1978) general genetic law of development states that all psychological and mental functions are first shared between the child and others socially, and then they are internalized to become part of the internal worlds of the child. Although most have studied children's overt, full-blown language in the form of private speech, Vygotsky's original ideas were broader than just verbal language, indicating that signs and symbol systems more generally (of which language is a part) are first used socially and then turned inward to guide one's own thinking privately. Before children have language at their disposal, they use a variety of gestures and point early on to things to indicate meaning and share information with others. Recent research has discovered that infants and preschoolers engage in private gestures and pointing (Delgado, Gómez, & Sarriá, Chapter 11 of this volume; Rodríguez & Palacios, 2007).

Rodríguez and Palacios (2007) have recently suggested that infants between 12–18 months may be capable of using two different types of gestures for self-regulatory purposes: pointing gestures and ostensive gestures (own hand movements with an object that are attended to by the self and appear to be done for the purpose of practice, reflection, or studying of an action). These authors present a longitudinal case study of an infant with Down syndrome without language from 12 to 18 months and another case of a typically developing, preverbal, 13-month-old child. Each of these children was playing with a toy that involves rings fitting on top of posts/towers or shapes fitting inside of holes/spaces, after the infants had played together with their parents with the toys in which the conventional placement of the objects was shown to them naturally and repeatedly. The infants, in both cases, pointed to the location where the object was supposed to go while they were playing with the materials themselves, without gazing up at the adults in the room, and seemed to be purposefully watching themselves repeatedly rotate or change

the orientation of the object in their hand to get it right (because the piece will only go into its respective location if it is oriented the right way). Rodríguez and Palacios suggest that, similar to what has been found with private speech among older children, these infants learned the gestures and actions from their social world, then used the gestures themselves when they were having a hard time (after repeated failures to get the object in its conventional location), and that the gestures had a self-reflective and self-regulatory purpose. Delgado et al. (Chapter 11 of this volume) concern themselves specifically with pointing by young children and show that infants and older children do use nonsocial pointing and that, at least for preschool-age children, use of pointing increases with task difficulty and is associated with task performance in a way similar to what has been found with private speech.

Other research on gestures in older children suggests that gestures are often done for the self rather than for communicating information to others socially. This is indicated by the fact that congenitally blind persons gesture in ways similar to those used by sighted people when explaining or reflecting on things (Iverson, 1998), and by the fact that children seem to externalize and encode information in their gestures when trying to solve problems by themselves and that such private gestures are facilitative of task performance (Goldin-Meadow, 1999; Goldin-Meadow, Nusbaum, Kelly, & Wagner, 2001).

The finding that infants as young 12 months use private gestures has potentially wide-reaching implications as it is typically assumed that self-reflective consciousness does not emerge until language is in place (Rodríguez & Palacios, 2007). So these findings show that self-regulation and the use of signs for one's own purposes appear, at least in some forms, preverbally, earlier than previously thought. Clearly, this is an area of research that will likely blossom in the years to come.

### SOCIAL ORIGINS OF PRIVATE SPEECH

There has been some research over the past 15 years examining one of Vygotsky's (1934/1987; 1930–1935/1978) central tenets about private speech – namely, that such speech emerges from the child's social interactions with caregivers. Such a position suggests a number of ideas and testable hypotheses, each of which has been explored to some extent. First is that private speech, if it is internalized from the child's history of social interactions, should share the dialogic features of social speech. This idea has been developed and demonstrated theoretically (Bertau, 1999; Fernyhough, 1996, and Chapter 2 of this volume) and tested empirically (Mang, 1998). Mang (1998) analyzed the social speech used by a small sample of mothers and their preschool-age children while working together on a construction task and the private speech used by the children individually while working on the same task later. Mang found similar dialogic features (i.e., conversational turn taking) of children's private speech as in the social

speech shared by mother and child earlier, and child private speech use was related to the previous dyadic interactions. Thus, it would appear that the content and structure of private speech is similar to that of social speech.

Other evidence of the social origins of private speech, or at least social influences on private speech, comes from studies showing that adults can increase or decrease the amount of private speech that children use during tasks either by actively encouraging or discouraging its use (Lee, 1999) or by varying the degree of adult control or regulation provided during joint scaffolding interactions (Winsler, 1995; Winsler, Díaz, McCarthy, Atencio, & Adams Chabay, 1999). As discussed later in the section on children with behavior problems or attention deficit hyperactivity disorder (ADHD), Winsler (1995) found that 6- to 8-year-old children with ADHD used considerably more private speech during a joint problem-solving session when they were working with an adult who was deliberately trying to scaffold the joint activity by contingently reducing adult control over the activity, compared to when they were working together with their parent. Interestingly, significant and expected relations between children's private speech usage and task performance and attention during a subsequent individual problem-solving session (positive associations with performance for partially internalized speech and negative associations for task-irrelevant speech) were found after the therapeutic scaffolding session but were not present after the same ADHD child had collaborated with their parent. In Winsler et al. (1999), maternal withdrawal of adult control during a collaborative problem-solving session with a magnet board construction task was predictive of typical 3-year-old children's subsequent frequent and effective use of partially internalized private speech (whispers and inaudible muttering) in an individual problem-solving session. Finally, broader sociocultural influences on private speech are likely present as well, as evidenced by Al-Namlah et al.'s (2006) work demonstrating differences in patterns of private speech usage among boys and girls in Saudi Arabia and in Britain that are hypothesized to be due to cultural differences in the way boys and girls are allowed to participate in discussions with adults in the two countries. Thus, children's use of private speech for self-regulation appears to be sensitive to fairly subtle changes in their social context.

Other investigators who have implemented intervention programs involving the modification of children's private speech provide additional evidence of the social origins of self-talk. In one case (White & Manning, 1994), the intervention involved rather direct training and instruction to normally developing 5-year-olds on how to guide oneself through both a geometric shapes reasoning task and mundane organizational school tasks by talking out loud to oneself. In the other intervention study (Díaz, Winsler, Atencio, & Harbers, 1992), impulsive preschoolers were not taught explicitly how to talk to themselves but instead participated in a series of carefully