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Private speech in preschool children: developmental stability and change, across-task consistency, and relations with classroom behaviour*

ADAM WINSLER
George Mason University

JESUS RENÉ DE LEÓN, BEVERLY A. WALLACE
University of Alabama

MARTHA P. CARLTON
Southern Illinois University – Edwardsville

AND

ANGELA WILLSON-QUAYLE
George Mason University

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ABSTRACT

This study examined (a) developmental stability and change in children's private speech during the preschool years, (b) across-task consistency in children's self-speech, and (c) across-setting relations between children's private speech in the laboratory and their behaviour at home and in the preschool classroom. A group of 32 normally developing three- and four-year-old children was observed twice (six month inter-observation interval) while engaging in the same individual problem-solving tasks. Measures of private speech were collected from transcribed videotapes. Naturalistic observations of children's behaviour in the preschool classroom were conducted, and teachers and parents reported on children's behaviour at home and school. Individual

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differences in preschool children's private speech use were generally stable across tasks and time and related to children's observed and reported behaviour at school and home. Children whose private speech was more partially internalized had fewer externalizing behaviour problems and better social skills as reported by parents and teachers. Children whose private speech was largely task-irrelevant engaged in less goal-directed behaviour in the classroom, expressed more negative affect in the classroom, and rated as having poorer social skills and more behaviour problems. Developmental change occurred during the preschool years in children's use and internalization of private speech during problem-solving in the form of a reduction over time in the total number of social speech utterances, a decrease in the average number of words per utterance, and an increase in the proportion of private speech that was partially internalized.

INTRODUCTION

An interesting development that takes place during the preschool years is children's use and internalization of private speech, or self-talk (Diaz & Berk, 1992). Simply put, young children often talk to themselves aloud as they go about their daily activities. From the Vygotskian sociocultural perspective, which has guided most of the research in this area, children's private speech is seen as a manifestation and intermediate step of a process of language internalization – whereby language, a cultural tool first used for communication with others, comes to be used by the child as an intrapsychological tool for regulating thought and behaviour (Vygotsky, 1934/1962, 1930–1935/1978; Berk, 1992; Berk & Winsler, 1995). According to Vygotskian theory, it is the merging of language and cognition in the form of children's early private speech that transforms children's minds and allows for the development of higher, uniquely-human, psychological functions, such as planning, executive functioning, and behavioural self-regulation. According to Vygotsky, it is through language that children become masters of their own behaviour (Vygotsky, 1934/1962, 1930–1935/1978). Thus, private speech, from this perspective, is thought to play a role in the development of children's behavioural self-control and self-regulation.

Researchers have explored a variety of different aspects of children's private speech, including its ontogenetic (Kohlberg, Yaeger & Hjertholm, 1968; Berk, 1986; Bivens & Berk, 1990; Manning & White, 1990; Winsler, Diaz, Atencio, McCarthy & Adams Chabay, 2000) and microgenetic developmental course (Berk & Spuhl, 1995; Duncan & Pratt, 1997), relations with children's task performance and on-task behaviour (Berk, 1986; Behrend, Rosengren & Perlmutter, 1989; Winsler, Diaz & Montero, 1997), social influences on self-talk (Berk & Spuhl, 1995; Lee, 1999; Winsler, Diaz,

Atencio, McCarthy & Adams Chabay, 1999), task and setting influences on such speech (Frauenglass & Diaz, 1985; Winsler & Diaz, 1995; Krafft & Berk, 1998; Lee, 1999; Winsler, Carlton & Barry, 2000), and its use among children with behaviour, learning, and/or attention problems (Berk & Potts, 1991; Berk & Landau, 1993; Winsler, 1998). In terms of the developmental course for private speech, researchers have shown an overall ontogenetic pattern of children's overt self-talk rising to a peak in the preschool years and gradually being replaced by partially internalized whispers and inaudible muttering, and silent 'inner' verbal thought, or inner speech, as children progress through early elementary school (Kohlberg *et al.*, 1968; Berk, 1986; Bivens & Berk, 1990; Manning & White, 1990; Winsler *et al.*, 2000). Researchers have also noted a similar transition from externalized to partially internalized private speech microgenetically, as children develop competence in a single task with repeated trials over time (Berk & Spuhl, 1995; Duncan & Pratt, 1997).

It is important to note in this regard, however, that our current understanding of early developmental trajectories for children's private speech is limited for a number of reasons. First, practically all of the studies exploring age trends in children's private speech to date have been cross-sectional rather than longitudinal (for notable exceptions, see Bivens & Berk, 1990; Winsler *et al.*, 2000). Second these studies have typically focused on early elementary school-aged children (Kohlberg *et al.*, 1968; Berk, 1986; Bivens & Berk, 1990; Manning & White, 1990), rather than children in the preschool period. Finally, much of the limited longitudinal work that has been conducted has focused on microgenetic changes in private speech over short periods of time during repeated trials of a task (Berk & Spuhl, 1995; Duncan & Pratt, 1997). Thus, although Vygotskian theory predicts that children's private speech should become more task-relevant, self-regulatory, and more internalized between the ages of 3;0 and 5;0, we have limited longitudinal data on this age period. Such a lack of developmental data on children's private speech during the preschool period is particularly unfortunate given that a) this is the age period in which major developments take place in the emergence of children's self-regulatory skills (Kopp, 1982; Campbell, 1997; Bronson, 2000), and b) language mediation, likely in the form of private speech, is generally thought to play an important role in the development of behavioural self-control and self-regulation (Luria, 1961; Kopp, 1982; Balamore & Wozniak, 1984; Berk & Winsler, 1995; Nelson, 1996; Campbell, 1997). Thus, a major goal of the present study was to assess short-term (6-month) developmental change in children's private speech between the ages of 3;0 and 5;0.

Researchers have found evidence for hypothesized links between children's private speech and behavioural self-regulation in a number of different ways. First, children's private speech has been observed to serve self-regulatory

or self-guiding functions for children while engaged in specific cognitive problem-solving activities (Frauenglass & Diaz, 1985; Berk, 1986; Lee, 1999). Second, children's private speech appears systematically during moments of increased task difficulty and settings with a high demand for self-regulation (Behrend *et al.*, 1989; Winsler & Diaz, 1995). Further, self-talk has been shown to be positively and dynamically related to gains in children's task performance over time (Diaz, 1992; Berk & Spuhl, 1995; Winsler *et al.*, 1997). Finally, children with problems of self-regulation and behavioural control (i.e. children either diagnosed with ADHD/LD or youngsters seen by their teachers as impulsive/hard-to-manage) appear to rely more on private speech and be delayed in speech internalization (Berk & Potts, 1991; Diaz, Winsler, Atencio & Harbers, 1992; Berk & Landau, 1993; Winsler, 1998; Winsler *et al.*, 1999) compared to children without such behaviour problems.

The work cited above, however, has only either explored speech–performance relations during specific cognitive problem-solving tasks or made global group difference contrasts in children's speech to self (i.e. ADHD/impulsive groups vs. comparison groups). Additional evidence of the role of private speech in children's behaviour regulation would come from investigation of the extent to which individual differences in children's private speech use in the laboratory setting are associated with variation in children's behaviour and behavioural control in the naturalistic setting of the preschool classroom. If private speech is indeed an important mediator for the emergence of children's behavioural control during early childhood, then one would expect to see children's use and internalization of such speech to be related to their behaviour in the school and home setting. Thus, a second goal of the present study was to explore associations between children's use of private speech in the laboratory and the quality of their behaviour in the classroom (as reported by the teachers and as independently observed in the classroom) and at home (as reported by parents) with a normative sample of preschool children.

The qualities of children's behaviour assessed by the classroom observations conducted in this study included children's goal-directed/on-task behaviour, sustained attention to activities, and affect expression in the classroom. The effective organization of behaviour towards the attainment of particular goals is a classic and central component of human self-regulatory and/or executive functioning (Schunk & Zimmerman, 1994; Heckhausen & Dweck, 1998; Zelazo, Astington & Olson, 1999; Bronson, 2000). Thus, the extent to which children's behaviour appeared focused on the attainment of particular, salient goals, either formulated by the teacher/classroom context (on-task) or by the child (if sanctioned by the teacher/classroom context) was taken in this study as evidence of healthy self-regulatory functioning in the classroom. Being able to maintain and control one's attention on a particular

behaviour/activity, especially in the presence of multiple distractions, is also a central feature of self-regulated behaviour (Milich & Loney, 1986; Eisenberg, Guthrie, Fabes, Shepard, Losoya, Murphy, Jones, Poulin & Reiser, 2000; Sethi, Mischel, Aber, Shoda & Rodriguez, 2000). Thus, sustained attention, or the extent to which the child remains engaged in the same activity over time, was also measured here and taken as evidence of healthy self-regulatory functioning in the classroom. Further, emotional regulation in the form of modulating one's expression of positive and negative emotions, is another component of children's effective behavioural regulation (Eisenberg, Fabes, Bernzweig, Karbon, Poulin & Hanish, 1993; Denham, 1998). Children's expressed affect in the classroom was, thus, also measured.

The present study fills another curious gap in the research literature on children's private speech in that although much has been learned about young children's self-talk, it is quite surprising that basic psychometric information about such issues as test–retest reliability/stability and across-task generalizability of private speech has never been systematically documented. Little information exists, for example, about whether individual differences in the quality and quantity of children's private speech remain stable over time, or about the extent to which patterns of children's private speech usage are consistent across multiple tasks or settings. There have been numerous investigations demonstrating that the content and frequency of children's private speech can be affected by different features of either the task or the contextual setting (Frauenglass & Diaz, 1985; Berk & Landau, 1993; Winsler & Diaz, 1995; Krafft & Berk, 1998; Lee, 1999; Winsler *et al.*, 1999), but the focus of these investigations has been on establishing task effects, rather than exploring SIMILARITIES or stable individual differences across tasks in children's quality and quantity of private speech. Part of the reason for a lack of attention to individual differences in children's private speech use is that most of the Vygotskian-inspired private speech research has appropriately come from a microgenetic, speech-in-a-particular-context perspective. However, it is certainly possible to have both stable individual differences over time and both contextual and microgenetic (trial-by-trial) variance in developmental phenomena.

Olszewski (1987) examined the stability and correlates of individual differences in one specific type of young children's self-talk, verbal fantasy play, and found high stability across occasions in the quantity of imaginative verbal play produced by children. She also found negative associations between amount of verbal fantasy play and children's social participation in preschool classrooms. Verbal fantasy play, however, represents a distinct type of children's self-talk, seen as serving different functions for children and being somewhat different from the self-guiding and self-regulatory type of private speech used by children during problem-solving activities (Berk & Winsler, 1995) that is the focus of the present investigation (and most others

studies in the area as well). Thus, among the goals of this study was to determine the across-task consistency and short term (6 months) stability of several speech measures/variables that have been used in the literature.

Overview

A group of 32 normally developing preschool children was observed twice (T1, T2 – six-month inter-observation interval) while engaging in two individual problem-solving tasks. Measures of private speech were collected from transcribed videotapes. Naturalistic observations of children's behaviour in the preschool classroom were conducted, and teachers and parents reported on children's behaviour at school and home. The goals of the present study were: (1) to assess the across-task consistency in children's private speech use in the laboratory, (2) to assess both stability of individual differences and change over time (6 months) in children's private speech, and (3) to explore relations between individual differences in children's private speech use in the laboratory and children's behavioural control at home and at school. Given that our Vygotskian theoretical framework sees private speech as not just moment-to-moment articulation of ongoing thought processes during task-specific problem-solving, but instead a coherent set of verbal self-regulatory strategies that have developed over time into an organized way of guiding one's behaviour, we expected relatively high reliability/consistency of children's private speech use across tasks even in the presence of possible task effects, and moderate six-month stability. At the same time, we expected to see significant ontogenetic change, with private speech becoming less overt and more internalized over time during the preschool years. Further, we hypothesized that individual differences in children's private speech in the laboratory would be related to their behaviour in both the school and home setting. More specifically, children whose private speech was more covert/internalized and less irrelevant were expected to demonstrate more goal-directed activity, greater sustained attention, more social competence, and fewer externalizing behaviour problems (acting out, disruptive/aggressive behaviour) than children whose speech was characterized by more overt, and task-irrelevant forms.

METHOD

Participants

Participants included 32 preschool children attending a university-affiliated child development centre in a medium-sized city in the southeastern United States. Half of the sample consisted of all 16 children enrolled in the 'three-year-old room' at the preschool (50% male). The other 16 children (44% male) comprised the 'four-year-old room' at the centre. The ages for the

'three-year-olds' at T1 data collection during the fall semester ranged from 3;1 to 4;0 ($M = 3;7;18$), and at T2 data collection in the spring semester, this group ranged in age from 3;7 to 4;7 ($M = 4;2$). The ages for the four-year-old children at T1 ranged from 4;1 to 5;0 ($M = 4;7;3$), and at T2 this group ranged in age from 4;6 to 5;5 ($M = 4;11;21$). The ethnic breakdown of the sample according to parental report on the preschool registration forms was 75% Caucasian, 11% African-American, and 14% Asian-American. A reasonable range of family socioeconomic levels was present in the sample (Hollingshead index – Range = 31–66, $M = 51{\cdot}53$, $S.D. = 10{\cdot}31$) since the preschool stratified its enrollment in the classrooms into three equal thirds: a) children of university faculty/staff, b) children of university students, and c) children of community members. The average paternal age was 36 years ($S.D. = 6$) and maternal age was 33 years ($S.D. = 5$). Fathers' years of education ranged from 13 to 21 years ($M = 17{\cdot}44$, $S.D. = 2{\cdot}72$) and mothers' education ranged from 12 to 21 years ($M = 16{\cdot}65$, $S.D. = 2{\cdot}36$). None of the demographic variables varied significantly by children's age group. The number of participants reported in the analyses below varies slightly due to occasional technical difficulties with the camera, participant refusal to participate in tasks, and participant attrition (e.g. five children were no longer at the centre at T2).

Classroom setting

The participating preschool programme was a relatively high quality, fully-accredited (by the National Association for the Education of Young Children), five-day-a-week, morning (8:00 am–12:00 pm) programme, consisting of one three-year-old class and one four-year-old class. Both classrooms were headed by one lead teacher and one graduate student assistant (all female). The two classrooms shared the same teaching philosophy and had similar daily schedules which reliably consisted of certain times each day set aside for three different types of activities: 1) self-selected activities, in which children would choose to which of several activity centres (i.e. block area, house corner, Lego® table, dress-up area …) they would go to play, 2) outside play time, and 3) large group activities, such as circle time, reading, or singing, together as a group.

Procedures

Children were videotaped as they completed tasks in a separate testing/meeting room at the preschool with a male graduate student experimenter for a total of four, 30–45-minute sessions; two sessions at T1 (September–October) and two sessions (identical to T1) at T2 (March–April). A high quality omnidirectional table microphone (Realistic PZM) was used as the

audio input to the videos in order to insure quality speech recordings. The video camera was mounted on a tripod approximately 12 feet away from the child facing the child's front as s/he was seated in front of a table with the task materials. The experimenter sat next to the child at the table during the instruction/collaborative parts of the tasks and moved his chair over to the side end of the table and looked away during the individual parts of the tasks. The average time interval between the two sessions for children within T1 and T2 data collection phases was one week. During each session, children completed one problem-solving task in a fixed order with the first session consisting of the Selective Attention (SA) task and the second session consisted of the Lego® Construction (LC) task. Finally, naturalistic observations of the children in the classroom were conducted over the course of the spring semester, and parent- and teacher-ratings of child social skills and behaviour problems were collected towards the end of the school year.

Tasks/measures

Problem-solving tasks. Children were asked to complete two problem-solving tasks twice (T1 and T2) for the primary purpose of eliciting children's private speech. The first was a selective attention (SA) task which has been used extensively in the private speech literature (Diaz *et al*., 1992; Winsler *et al*., 1997; Winsler, 1998) and has been found to be interesting and appropriately challenging for preschoolers and because it is effective in eliciting children's private speech. In this task, children first determine which dimension (either form or colour) is shared by two pictures on a card and then they attach with Velcro a third picture that represents the dimension shared by the other two. For example, a card might have a picture of a green flower and one of a red flower. Here, the correct response would be for the child to select and attach the card that is the colourless flower. The correct dimension (colour or form) varies randomly across the 12 items with three forms (car, flower, dog) and three colours (blue, yellow, orange) possible. Included in the answer box are 18 cards each representing one of six possible answers. The experimenter introduced the task, assisted the child with two example items, asked the child to try to finish the remaining 12 items individually, and increased the seating distance between the experimenter and child for the remainder of the items.

The second problem-solving activity was a lego-construction (LC) task in which children attempted to reproduce a Lego structure according to an accessible three-dimensional model. Variants of this task have been used successfully in previous private speech research with young children (Berk & Spuhl, 1995; Winsler *et al*., 1999). Children first completed the 27-piece model of a robot together with the assistance of the experimenter

and then the child was asked to construct the robot individually, with the experimenter moving to the other end of the room. The tasks were the same at T2.

Parent- and teacher-report of children's behaviour. Parents and teachers completed the Preschool and Kindergarten Behaviour Scales (PKBS; Merrell, 1994). Overall scale scores for children's externalizing behaviour problems and social skills were used.

Classroom observations. A total of 2752 time-sampled naturalistic observations of children's on-task behaviour, sustained activity, and affect in the preschool classrooms were conducted. Observations were carried out over a 10-week period during the spring semester of the academic year. Two female research assistants (one per classroom) observed children according to a predetermined random order. Observations began after a three-week introductory period during which time children grew accustomed to the presence of the observers in the classroom, observers were trained, the observational checklist instrument was pilot tested, and the reliability of the final observational checklist instrument was established. Observer influence effects were minimized in this study by both the presence of the three-week, rapport-building period and by the fact that children in these classrooms were generally quite accustomed to the presence of observers in the classroom given the centre's laboratory responsibilities. Observations took place throughout the entire preschool morning which typically included all three types of classroom activity settings (discussed above). Each child was observed an average of 98 times yielding a total of 2752 observations.

Observers, unaware of the research hypotheses, used a behavioural observation checklist instrument to record their observations. Also, to assist in adhering to the time-sampling observation schedule, observers listened to pre-recorded time signals which projected via headphones to one ear from an audiocassette recorder attached to her belt. Target children were observed for approximately ten, 10-minute periods, with each period consisting of ten, 10-second direct observation intervals separated by 50-second recording intervals. Thus, an observer would observe a target child for 10 seconds, at which time the audio signal would sound and she would then record her observations for that 10-second period on the checklist instrument for the remainder of the minute. Then the audio signal would sound again indicating that it was time to observe the child again for the second, ten-second observation. This pattern would continue for ten observations at which time the observer would go on to conduct a series of ten observations on the next child on the list. Predominant activity sampling (PAS; Hutt & Hutt, 1970) was used for the social context and activity variables, meaning that if more than one type of behavioural class occurred within a 10-second observation interval, observers coded the occurrence of only the predominant behaviour

that was present for the larger time period during the observation. The following variables were coded on the observational checklist instrument. The variables used in the analyses below were the overall proportion of the child's observations over the entire semester that the particular behaviour or code was present.

First, children's ACTIVITY was coded as being either explicitly goal-directed or non goal-directed. Goal-directed activity was defined as behaviour by the child which appeared focused, organized, and had a tangible goal or end point to the activity. The goal being pursued by the child could either be self-formulated or teacher-provided. Examples of goal-directed activity included building a structure out of Legos or some other assembly/construction materials, doing a puzzle, playing a game with rules, or engaging in an organized make-believe episode of 'house'. Not explicitly goal-directed behaviour included, for example, aimless wandering around the classroom and/or repeatedly spinning a puzzle piece around one's finger for the apparent 'fun of it'. Children's SUSTAINED ACTIVITY was coded by assessing the relationship between the child's activity during the current ten-second observation interval and the child's activity during the previous observation period, one minute ago. For the second through tenth observation in each series of 10 observations on target children, the observer coded whether or not the activity the target child was engaged in during the current observation was the same (in terms of goal, materials, and behaviour) as that in which the child was engaged during the previous observation one minute ago.

Children's AFFECT (positive, negative, neutral) was also coded during the observations. Positive affect was coded if children exhibited any overt smiles or laughter during the observation. Negative affect was coded if frowning, crying, yelling, pouting or explicit facial expressions of anger were present. Neutral affect was coded if the child's affect during the 10 seconds was neither positive nor negative.

Laboratory private speech. Children's private speech during the laboratory tasks (SA and LC) was transcribed from the videotapes by research assistants naive to study hypotheses, and transcripts were later independently verified/corrected by another person. As is typical in private speech research, the unit of analysis was the utterance, defined as either a complete sentence, a sentence fragment or clause with intentional markers of termination, a conversational turn, or any string of speech which is temporally separated from another by at least three seconds (Winsler, 1998). Child speech utterances were classified as either social or private, with private speech being defined as any verbalization by the child which was not explicitly addressed to another person, as indicated by either a pronoun reference, a gaze to another person, or other signals of social intent, such as physical contact, argumentation, repetition, loudness/intonation, or conversational turn-taking (Winsler,

1998). Because we would be providing fundamental psychometric information about across-task consistency and test–retest reliability, we decided to code each utterance for several different aspects of children's private speech in order to be reflective of the types of self speech variables and metrics that are used in the literature.

Private speech utterances during problem-solving were classified according to Laura Berk's (1986) coding system which categorizes children's private speech utterances on the basis of overtness (volume) and task-relevance and consists of three broad categories. Level I, task-irrelevant private speech, includes word play, affect expressions, comments to imaginary others, and other utterances which appear unrelated to the task at hand. Level II, overt (regular volume) task-relevant private speech, includes statements about the task or the child's ongoing or future task-related activity. Level III, partially internalized private speech, includes inaudible muttering, whispers, and silent, verbal lip movements. To control for differences in the amount of time children took to complete the task, number of utterances per minute was calculated for each of the private speech categories and total private speech. Overall number of social speech utterances per minute was also calculated. In addition to raw number of utterances in each level, utterances per minute, and the proportion of the child's total private speech that was made up from each level, was calculated.

A second category system based on the SEMANTIC CONTENT/FUNCTION of the private speech was also used (adapted from Diaz *et al.*, 1992; Winsler, 1998). Each private speech utterance by the child was placed into one of the following 10 mutually exclusive and exhaustive categories, based on speech content: (1) *Exclamations* – typically one word expressions of affect or expletives (e.g. 'Oh!' 'Oops!', (2) *Nonwords* – sound effects, wordplay, humming (e.g. 'Hmmm', 'Vroom' – explosion noises), (3) *Descriptions of the self* – statements about the child's state or behaviour (e.g. 'I'm looking for blue', 'I found a fish', 'I'm hungry'), (4) *Descriptions of the environment/task* – statements about the child's surroundings or the task (e.g. 'They're the same colour', 'A blue one', 'It's hot in here'), (5) *Evaluative or motivational statements* – statements about the child's ability, performance, or motivation; self-reinforcement or deprecation; evaluation of the task (e.g. 'I did it!', 'I'm good at this', 'Good', 'This is easy'), (6) *Plans/hypothetical reasoning* – planning or future-oriented statements; if-then constructions (e.g. 'I need a purple one', 'I'll do this first', 'If I put this here …'), (7) *Commands to the self* – explicit instructions to the self with imperative verb (e.g. 'Pick them up!', 'Don't put that one', 'Get one more'), (8) *Questions/answers* – questions addressed to the self or clear answers to one's own questions (e.g. 'Which one should I put next?', 'This one', 'Where's the blue?', 'Is that right?', 'Yes'), (9) *Transitional statements* – reflective utterances which had to do with ending one activity and starting another

(e.g. 'So', 'Then', 'Next', 'OK'), and (10) *Other* – any utterance which could not be placed in one of the above categories. To reduce the total number of dependent variables explored, only the raw number of each of these types of private speech utterances was calculated and used in the analyses.

Further coding of children's private speech explored selected linguistic and syntactic features of the speech (Feigenbaum, 1992). Each private speech utterance was categorized as being either complete or fragmented. An utterance was defined as complete if it were grammatically intact in that it contained both a subject (explicit or implied, as in the imperative) and a predicate. Complete utterances also included one word questions, answers, and imperatives to the self. Examples of utterances coded as complete include 'This goes here', 'Where does this go?', 'I need a three', 'How?' and 'I see'. Grammatically incorrect or incomplete utterances were coded as fragmented, such as 'This one', 'Over here', 'Blue', 'Where is the ...?', 'But', 'Six more' and 'The red one on top of the yellow'. From this, the percentage of the child's private speech utterances that was fragmented was calculated. Finally, also calculated were (a) the mean length of each private speech utterance – the mean number of words per utterance, (b) the total raw number of private speech utterances emitted, (c) the total number of private speech utterances per minute, and (d) the proportion of all children's speech that was private.

Reliability. Inter-rater reliability for the classroom observations was determined during the last phases of observer training, at which time two observers independently rated the same children for 257 10-second observations. Reliability was acceptable to good for all category systems. Percentage agreement across observers was 88% for children's activity (Kappa = 0·75), 96% for sustained activity (Kappa = 0·90), and 87% for affect (Kappa = 0·71). Inter-rater reliability for the private speech coding systems was estimated by having two naive research assistants independently code a randomly-selected subset of the transcripts. Percentage agreement for the distinction between social and private speech (on a subsample of 17% of the transcripts) was 94% (Kappa = 0·87), for the fragmented vs. complete distinction 85% (Kappa = 0·70), for the ten content category speech coding system (on a 20% subsample) 89% (Kappa = 0·83), and for the three Level (I, II, III) system, 95% (Kappa = 0·88).

RESULTS

Speech samples

To give the reader a sense of the qualitative nature of the child private speech data, we first present two excerpts from the transcripts of two four-year-olds,

one engaged in the selective attention task and one in the Lego task. The first child, age 4;1, is seated individually at the table doing the 4th item/card of the SA task:

CHILD: (Humming)	(As he is putting away item #3)
CHILD: Dog and dog.	(Referring to the two pictures on the card)
CHILD: Guess I have to get another dog.	
CHILD: They have any more dogs … in there?	(While searching the box for the correct 'dog' answer)
CHILD: There.	(While putting the answer card on the item)
CHILD: Whisper (?) (?) (?)	(Three words whispered to himself too quietly to make out)

The second child, boy, age 4;5, is seated individually at the table working on the Lego robot:

CHILD: OK.	(Just finished putting on a piece, thinking about next move)
CHILD: Red right … here.	(While placing a red lego piece in the correct location)
CHILD: Now.	(Looking at the model)
CHILD: It's not hard at all	(Smiles)
CHILD: (Mutt).	(Inaudible muttering – verbal lip movements)
CHILD: (Mutt).	(Inaudible muttering – verbal lip movements)
CHILD: Now two blacks.	(Reaching for black legos from the box)
CHILD: Mmhm.	(Meaning 'yes')
CHILD: Now where's …?	(Look for a piece)
CHILD: (Mutt).	(Inaudible muttering – verbal lip movements)

Across-task consistency of private speech

To determine whether children use private speech in similar ways across the two different problem-solving tasks, Spearman correlations were calculated on all of the private speech variables across the two tasks at T1. Table 1 provides these correlations as well as means (and standard deviations) for all of the speech variables, and flags indicating in which cases repeated measures ANOVAs revealed mean differences in children's private speech by task. As seen in the table, for practically every private speech variable, correlations across the two tasks are strong, positive, and statistically significant (r's from

TABLE 1. *Means (and standard deviations) for the private speech variables and across-task consistency (Spearman* r*'s across tasks), at T1*

	SA Task		LC Task		
PRIVATE SPEECH VARIABLE	*Mean*	(*S.D.*)	*Mean*	(*S.D.*)	*r*
Content/function (# utterances)					
Exclamations	1·33	(3·76)	1·63	(2·06)	0·53*
Word play/noises	0·83	(1·40)	1·67	(3·40)	0·41*
Descriptions of own activity	2·54	(4·94)	2·04	(4·73)	0·73*
Descriptions of the task	9·04	(18·34)	2·00	(4·45)	0·45*
Motivational/evaluative statements	0·46	(1·10)	0·46	(0·93)	0·62*
Plans	1·58	(3·01)	1·04	(2·90)	0·47*
Commands to the self[a]	1·13	(2·38)	0·25	(0·74)	0·40*
Questions to the self[a]	2·25	(3·21)	0·83	(2·31)	0·46*
Transitional statements	4·75	(13·10)	2·13	(4·89)	0·11
Other	6·75	(22·60)	3·13	(5·88)	0·39*
Level/relevance					
Level I – Irrelevant					
– Raw # of utterances	5·79	(22·04)	2·13	(3·98)	0·52*
– Utterances per minute	0·45	(1·09)	0·43	(0·78)	0·47*
– Proportion of private speech[a]	0·09	(0·12)	0·27	(0·31)	0·02
Level II – Task-Relevant Overt					
– Raw # of utterances	21·38	(41·59)	9·29	(15·56)	0·53*
– Utterances per minute	2·25	(3·42)	1·06	(1·96)	0·57*
– Proportion of private speech	0·51	(0·35)	0·35	(0·34)	0·33
Level III – Partially internalized					
– Raw # of utterances	5·71	(8·31)	4·00	(4·99)	0·43*
– Utterances per minute[a]	0·96	(1·49)	0·35	(0·48)	0·48*
– Proportion of private speech	0·40	(0·35)	0·38	(0·38)	0·62*
Syntactic abbreviation					
% of fragmented utterances	0·78	(0·27)	0·85	(0·17)	0·56*
Mean # of words per utterance	1·62	(1·33)	1·52	(1·41)	0·67*
Other					
Total private speech (raw)	32·88	(64·83)	16·92	(24·87)	0·54*
Total private speech (per minute)[a]	3·65	(4·64)	1·84	(2·77)	0·70*
Proportion private of total speech	0·67	(0·33)	0·58	(0·27)	0·33
Social speech (raw)	13·67	(19·62)	9·67	(14·04)	0·50*
Social speech (per minute)	1·66	(2·14)	1·35	(2·50)	0·60*

* $p < 0·05$.
[a] Significant task effect in ANOVA ($p < 0·05$).

0·39 to 0·73), indicating that children who used a lot of one particular type of private speech category during one task (relative to the other children in the sample) tended to do the same on the other task as well. Although the proportion of children's private speech that was made up of the partially internalized type (whispers and muttering) was reliable across the two tasks, the other two proportional private speech variables and the overall proportion of private speech to total speech measures were not as consistent across tasks

(r's from 0·02 to 0·33). Thus, the proportion of children's private speech that is either task-relevant or irrelevant appears to vary somewhat by task, as also indicated by the repeated-measures ANOVAs. Children's private speech was proportionately more task-irrelevant during the Lego construction (LC) task than during the selective attention (SA) task, $F(1, 19) = 5{\cdot}28$, $p < 0{\cdot}05$, d (Cohen's effect size) $= 0{\cdot}84$. Children's private speech during the SA task was more common in terms of overall utterances per minute ($F(1, 23) = 5{\cdot}35$, $p < 0{\cdot}05$, $d = 0{\cdot}49$), contained more commands ($F(1, 23) = 4{\cdot}37$, $p < 0{\cdot}05$, $d = 0{\cdot}56$), more questions to the self ($F(1, 23) = 5{\cdot}23$, $p < 0{\cdot}05$, $d = 0{\cdot}51$), and more partially internalized forms of speech ($F(1, 23) = 5{\cdot}56$, $p < 0{\cdot}05$, $d = 0{\cdot}62$) than speech during the LC task.

Thus, although certain tasks appear to be more likely to elicit particular types of private speech in general, children overall tend to maintain their relative ranks in terms of (a) the frequency with which they use different types of private speech across tasks, (b) the extent to which the speech is syntactically abbreviated, and (c) the proportion of children's private speech which is partially internalized. Individual differences in children's use of private speech are large (as indicated by the size of the standard deviations) yet fairly stable across tasks. Given such consistency across the two tasks in children's private speech usage, aggregate private speech measures, averaging across the two tasks, were calculated and used in all subsequent analyses.

Stability of private speech over time

To assess six-month stability in different components of children's private speech over the six-month period, Spearman correlations were calculated using the aggregate (across-task) private speech variables from T1 and T2 for all children combined. Table 2 presents these correlations, and the T1 and T2 means (and standard deviations) for these variables. Stability of private speech, in terms of children maintaining their relative ranks in the distributions from T1 to T2, was fairly strong (r's from 0·34 to 0·73) for most of the private speech variables. The exceptions to this rule included partially internalized private speech, the proportion of private speech irrelevant to the task, the overall private speech to total speech proportion, and three of the specific content categories (self descriptions, plans, and other), for which little stability was demonstrated. Thus, individual quantitative and qualitative differences in most indices of children's private speech appear to be not only consistent across tasks settings, but also stable over a six-month period for preschoolers age 3;0 to 5;0. The relative proportion of children's speech that is self-directed, and partially internalized private speech in the form of whispers and inaudible muttering, show greater interindividual variability in their patterns of intraindividual change over time during the preschool

TABLE 2. *Six-month stability* (*T1–T2 Spearman* r*'s*) *and means* (*and standard deviations*) *for the aggregated* (*across-task*) *private speech variables, for all children combined*

	T1		T2		
PRIVATE SPEECH VARIABLE	*Mean*	(*S.D.*)	*Mean*	(*S.D.*)	*r*
Content/function (# utterances)					
Exclamations	1·54	(2·62)	1·50	(2·24)	0·69*
Word Play/noises	1·28	(2·02)	1·26	(2·59)	0·62*
Descriptions of own activity	2·37	(4·70)	3·20	(5·19)	0·24
Descriptions of the task	6·09	(9·88)	5·33	(6·15)	0·58*
Motivational/evaluative statements	0·46	(0·98)	0·52	(0·92)	0·54*
Plans	1·37	(2·62)	0·37	(0·74)	0·08
Commands to the self	0·72	(1·46)	0·57	(1·03)	0·52*
Questions to the self	1·52	(2·36)	1·24	(1·76)	0·34*
Transitional statements	3·70	(7·82)	3·76	(4·74)	0·37*
Other	5·22	(12·82)	2·15	(1·93)	0·28
Level/relevance					
Level I – Irrelevant					
– Raw # of utterances	4·83	(12·11)	1·89	(2·65)	0·47*
– Utterances per minute	0·44	(0·70)	0·19	(0·26)	0·49*
– Proportion of private speech	0·16	(0·16)	0·08	(0·11)	0·07
Level II – Task-relevant overt					
– Raw # of utterances	16·30	(26·53)	13·24	(13·89)	0·73*
– Utterances per minute	1·80	(2·40)	1·42	(1·75)	0·73*
– Proportion of private speech	0·51	(0·33)	0·42	(0·25)	0·39*
Level III – Partially internalized					
– Raw # of utterances	4·98	(6·27)	9·78	(7·73)	0·18
– Utterances per minute	0·69	(0·93)	1·52	(1·41)	0·01
– Proportion of private speech	0·33	(0·33)	0·49	(0·26)	0·28
Syntactic abbreviation					
% of fragmented utterances	0·85	(0·18)	0·78	(0·22)	0·40*
Mean # of words per utterance	1·77	(1·20)	1·22	(0·84)	0·59*
Other					
Total private speech (raw)	26·11	(41·12)	24·91	(20·03)	0·58*
Total private speech (per minute)	2·94	(3·32)	3·12	(2·52)	0·35*
Proportion private of total speech	0·61	(0·24)	0·70	(0·22)	0·12
Social speech (raw)	12·04	(12·61)	11·85	(11·42)	0·60*
Social speech (per minute)	1·53	(1·77)	1·17	(1·16)	0·61*

* $p < 0{\cdot}05$.

period. These findings are likely related to the amount of ontogenetic change over the same time period in private speech, a topic to which we turn next.

Ontogenetic change in private speech

A series of (2) age = 3, 4 × (2) time = T1, T2 – repeated-measure mixed ANOVAs was conducted with each of a subset of the most relevant private speech variables included in turn as the dependent variable. Table 3 shows

TABLE 3. *Change in private speech from T1 to T2 for three- and four-year-olds*

	Three-year-olds		*Four-year-olds*	
	T1	*T2*	*T1*	*T2*
Level/relevance				
Level I – Irrelevant				
– Utterances per minute[b]				
Mean	0·72	0·24	0·19	0·13
(*S.D.*)	(0·91)	(0·33)	(0·32)	(0·16)
– Proportion of private speech				
Mean	0·21	0·08	0·10	0·09
(*S.D.*)	(0·17)	(0·07)	(0·13)	(0·15)
Level II – Task-relevant overt				
– Utterances per Minute[c]				
Mean	2·89	1·57	0·81	1·28
(*S.D.*)	(2·92)	(1·82)	(1·25)	(1·75)
– Proportion of private speech[a]				
Mean	0·69	0·51	0·31	0·32
(*S.D.*)	(0·24)	(0·20)	(0·30)	(0·28)
Level III – Partially internalized				
– Utterances per minute[b]				
Mean	0·56	1·85	0·81	1·22
(*S.D.*)	(1·11)	(1·87)	(0·77)	(0·77)
– Proportion of private speech[a,b,c]				
Mean	0·10	0·41	0·58	0·59
(*S.D.*)	(0·11)	(0·22)	(0·31)	(0·27)
Syntactic abbreviation				
% of fragmented utterances				
Mean	0·79	0·77	0·90	0·79
(*S.D.*)	(0·20)	(0·18)	(0·15)	(0·25)
Mean # of words per utterance[a,b,c]				
Mean	2·55	1·61	1·06	0·86
(*S.D.*)	(1·09)	(0·81)	(0·82)	(0·73)
Other				
Total private speech (per minute)				
Mean	4·16	3·66	1·82	2·63
(*S.D.*)	(4·08)	(2·70)	(2·01)	(2·35)
Proportion private of total speech				
Mean	0·54	0·72	0·69	0·69
(*S.D.*)	(0·27)	(0·11)	(0·20)	(0·30)
Social speech (per minute)[c]				
Mean	2·30	1·34	0·83	1·02
(*S.D.*)	(2·12)	(1·16)	(1·04)	(1·19)

[a] Significant age effect in ANOVA ($p < 0·05$).
[b] Significant time effect in ANOVA ($p < 0·05$).
[c] Significant age-by-time interaction effect in ANOVA ($p < 0·05$).

the means (and standard deviations) by age group for each of these components of private speech at T1 and T2. Overall, about 70% of preschoolers' speech was directed to the self. Although the proportion of private to total speech was somewhat smaller (0·54) for the youngest age group at T1 (3;7), no significant age effects, time effects, nor age-by-time interactions emerged from the ANOVA. Social speech to the experimenter during the task was found to vary systematically by age and time (age-by-time interaction $F(1, 21) = 4{\cdot}70$, $p < 0{\cdot}05$), with the three-year-olds significantly reducing their amount of social speech from T1 to T2 ($d = 0{\cdot}54$) appearing at the end to be more like the four-year olds at T1 and T2, whose social speech utterances per minute were lower and more stable. A similar age-by-time interaction was found for the average number of words per private speech utterance used by the children during the problem-solving tasks, $F(1, 21) = 4{\cdot}20$, $p < 0{\cdot}05$. Thus, although the elaborateness of both age groups' private speech decreased from T1 to T2 (significant time $F(1, 21) = 3{\cdot}77$, $p < 0{\cdot}01$, $d = 0{\cdot}72$), and three-year-olds' private speech utterances were generally longer than those of four-year-olds (significant age $F(1, 21) = 12{\cdot}73$, $p < 0{\cdot}01$, $d = 1{\cdot}3$), significantly greater decreases in the elaborateness of children's private speech utterances occurred among the three-year-olds. Overall, approximately 80–90% of children's private speech utterances were syntactically fragmented (not containing both a subject and predicate) and this proportion did not vary significantly by age group or time.

Interesting developmental changes were observed in the topography of children's private speech in terms of its task relevance and partial internalization. Figure 1 shows how the proportion of children's private speech that was made up of task-irrelevant (Level I), task-relevant (Level II), and partially internalized (Level III) speech changes over time differentially for the three- and four-year olds. Dashed lines between the ages of 4;2 and 4;7 are used in the figure to remind the reader that two different groups of children (three- and four-year-olds) were followed over two points in time rather than one group over four time points. As seen in the figure, the majority (69%) of the youngest (3;7) group's private speech was of the overt, task-relevant type with the remaining 10 and 21% of their private speech being made up of the partially internalized and task-irrelevant forms, respectively. However, significant changes occur between the ages of 3;7 and 4;7 in the composition of children's private speech, as the four-year-old group's private speech at both 4;7 and 5;0 comprised approximately 60% partially internalized whispers and muttering; 30% overt, task-relevant speech; and 10% overt speech irrelevant to the task. These patterns are confirmed by a significant age-by-time interaction effect, $F(1, 19) = 5{\cdot}79$, $p < 0{\cdot}01$, and age effect, $F(1, 21) = 16{\cdot}08$, $p < 0{\cdot}001$, $d = 1{\cdot}4$, for the proportion of children's level III to total private speech, and by a significant age effect, $F(1, 19) = 10{\cdot}46$, $p < 0{\cdot}01$, $d = 1{\cdot}1$, for the proportion of children's level II to total private

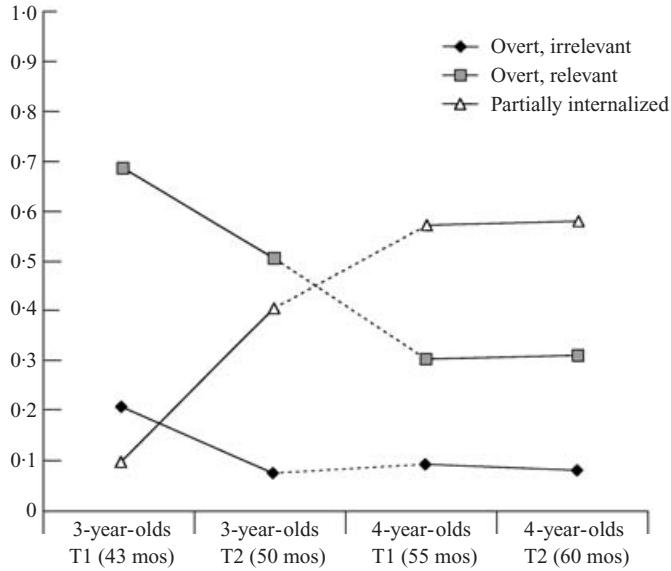

Fig. 1. Changes over time (6 months) in three-year-old and four-year-old children's private speech.

speech. Thus, children's private speech becomes increasingly internalized, both in terms of shifts from overt to partially-covert speech and shifts to more predicated and abbreviated forms of speech, from the age of 3;0 to 5;5. The biggest changes in children's private speech appear to occur for the three-year-olds between the ages of 3;7 (T1) and 4;2 (T2).

Relations between children's private speech and behaviour at home and school

A correlational analysis strategy was chosen to assess associations between children's private speech in the laboratory and their behaviour at home and school. However, given the age-related changes found above for children's private speech and suspected age-related changes in children's behaviour in the classroom and adult reports (see below), partial correlations (controlling for age) were conducted. Indeed, age was positively associated with children's goal-directed activity in the classroom ($r = 0{\cdot}42$, $p < 0{\cdot}05$). Also, teachers reported improved social skills ($r = 0{\cdot}64$, $p < 0{\cdot}05$) and fewer externalizing behaviour problems ($r = -0{\cdot}42$, $p < 0{\cdot}05$) for the older children relative to younger children. Table 4 shows partial Pearson correlations (controlling for age) between children's private speech use in the lab (overall, averaged across tasks and time) and parent-reported problems at home and both their observed and teacher-rated behaviour in the classroom. Given the exploratory nature of this work and a desire not to ignore a substantial

TABLE 4. *Partial correlations (controlling for age) between the laboratory private speech and children's observed behaviour in the classroom and parent- and teacher-reported behaviour problems*

Classroom observations	*Proportion irrelevant PS*	*Proportion relevant PS*	*Proportion partially internalized PS*	*Total PS per minute*	*Proportion private of total speech*
Activity					
Goal-directed	−0·49*	−0·06	0·32	−0·12	0·33
Sustained	−0·20	−0·23	0·33	−0·15	0·50*
Affect					
Positive	−0·49*	0·53*	−0·27	0·40†	−0·16
Neutral	0·44*	−0·55*	0·31	−0·43†	0·17
Negative	0·50*	−0·15	−0·12	−0·02	0·03
Teacher-report					
Social skills	−0·49*	−0·12	0·37†	−0·21	−0·07
Externalizing problems	0·59*	0·12	−0·43†	0·34	−0·04
Parent-report					
Social skills	−0·41†	−0·46*	0·55*	−0·15	0·27
Externalizing problems	0·34	0·14	−0·16	0·16	−0·16

* $p < 0{\cdot}05$; † $p < 0{\cdot}10$.

effect size because of small sample sizes minimizing chances of statistical significance, an alpha value of 0·10 was chosen for these analyses.

Overall, stable individual differences in children's private speech use were associated with children's behaviour at home and at school. Children whose private speech during the problem-solving tasks was proportionately more internalized (e.g. contained a higher proportion of whispers and inaudible muttering) were rated by parents and teachers as having better social skills and rated by their teacher as having fewer externalizing behaviour problems than children whose private speech was less internalized. Correspondingly, children whose private speech consisted mostly of overt, full-volume task-relevant speech were seen by parents as having poorer social skills. Also, high proportions of overt relevant private speech were associated with increased positive affect and decreased neutral affect displayed by the children in the classroom.

Irrelevant, off-task private speech by children during problem-solving in the lab was predictive of poor behaviour at home and school. Children whose private speech was largely and proportionately more irrelevant to the problem-solving task at hand a) spent significantly less time engaged in goal-directed activities and exhibited more negative affect in the classroom, b) were rated by their teachers and parents as having poorer social skills, and c) rated by teachers as exhibiting greater behaviour problems than children whose speech was more relevant and/or internalized.

In terms of the overall quantity of private speech emitted in the lab (utterances per minute), children who talked to themselves a lot during the problem-solving tasks exhibited more positive and less neutral affect in the classroom, and were more likely to be perceived by their teachers as having behaviour problems. Finally, children whose total speech during the problem-solving tasks was proportionately more private (as compared to social) were observed to sustain their attention longer during activities in the classroom.[1]

DISCUSSION

Research on children's private speech has examined many different aspects of children's self-talk (e.g. the semantic content and/or function of the speech, its task-relevance, its degree of internalization [overt vs. partially internalized], syntactic abbreviation or fragmentation), using a variety of different metrics (raw utterance counts, utterances per minute, proportion of total speech or total private speech, ratio of social to private speech). One of the aims of this study was to provide fundamental psychometric information on the reliability or consistency of individual differences in children's private speech use across tasks and time for a number of different speech variables and metrics – information that is currently lacking in the literature. Overall, 70% of children's utterances during the problem-solving task in the lab were directed to the self, and 93% of the children were observed to engage in at least some private speech at T1, indicating that private speech is indeed frequently observed during the preschool years. Individual quantitative differences in children's private speech use in the laboratory were large yet fairly stable across the two different problem-solving tasks used in this study. That is, children who use a lot of one (or more) particular types of self-talk during one task are likely to use similar amounts (relative to the rest of the sample) of such verbal self-regulatory strategies on another task. Although some 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 which is partially internalized. It is important to note, however, that overall proportion of children's speech that was self-directed as opposed to other-directed (the 'coefficient of egocentricity' as some have historically called it) did not show stability across task or time.

[1] Associations between the private speech measures and child task performance on the LG and SA tasks in the lab were not explored here both because speech and concurrent task performance associations were not among the goals of the study, and because getting around the third-variable confound of task difficulty for such analyses requires special microanalytical coding techniques (see Winsler *et al.*, 1997) that were not a feature of the study.

This particular early measure, originally used by Vygotsky and Piaget and indeed rarely used by contemporary researchers because the focus has appropriately shifted from how 'egocentric' the child is to what functions private speech serves for children, appears to be of limited usefulness.

Further, although there is ontogenetic change in children's private speech between the ages of 3;6 and 5;6, a fair degree of stability over time (6 months) is also present in terms of children maintaining quantitative and qualitative individual differences on most private speech variables from T1 to T2. Less stability over time was observed for children's partially internalized private speech (whispers and inaudible muttering) than for other dimensions of children's self-talk and this is related to significant developmental change and interindividual differences in change in this type of speech over this age period (as discussed below). The 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. This is because it confirms that, in addition, to microgenetic/microanalytical questions about the functions of such speech and particular speech–performance relations during individual problem-solving, interesting larger-scale ontogenetic questions about change over time in children's private speech, and inter-individual differences in such intraindividual change, can also be profitably addressed.

This study contributed sorely needed longitudinal data that reveal important developmental changes in children's private speech that occur during the preschool period. The proportional topography of children's private speech changes between the ages of 3;0 and 5;0. Three-year-old private speech is more characterized by overt, task-relevant (Level II) forms, whereas four-year-old self-talk consists of more partially internalized (Level III – whispers/muttering) forms. Further, a number of changes in children's speech during problem-solving appear to take place between the ages of 3;6 and 4;0. These include a reduction in the total number of social speech utterances, a decrease in the average number of words per private speech utterance, and an increase in the proportion of private speech which is partially internalized. Such developments in children's private speech during the preschool years are consistent with our hypotheses and with Vygotskian predictions about the gradual internalization and abbreviation of private speech during early childhood. Although other investigators have found similar developmental trends in private speech among older children (Bivens & Berk, 1990), these findings suggest that ontogenetic changes in children's self-talk are evident earlier, between ages 3;0 and 5;0.

Clear associations were found in this study between children's private speech use in the laboratory setting and their behaviour in the classroom and at home. Children whose private speech during problem-solving in the lab

was more partially internalized had fewer externalizing behaviour problems reported by the teacher, and better social skills reported by both parent and teacher. Children whose private speech in the lab was largely task-irrelevant engaged in less goal-directed behaviour in the classroom, expressed more negative and less positive affect in the classroom, and had poorer social skills and more externalizing behaviour problems as reported by the teacher. Such findings are consistent with Vygotskian predictions of greater behavioural self-regulation accompanying increasing internalization of speech, and are quite notable since associations between children's private speech in one setting and their behaviour in another setting have proved difficult to document in previous studies with slightly older children (Berk & Landau, 1993). Thus, the present study provides evidence that individual differences in children's private speech are associated with differences in children's observed self-regulatory behaviour in the classroom. Future work will have to determine whether private speech plays an important causal or mediating role in the development of self-regulation or whether it is simply an artifact correlated with other things, such as behavioural control or more general verbal ability.

The present study has a number methodological limitations that should be addressed in future research. One limitation is clearly the relatively small sample size of the present study combined with a relatively large number of variables/analyses. Replication of the current findings with a larger sample is needed. The number and strength of the results found in the present study even in the presence of a small sample attest to the robust size of the effects under investigation and suggest that future study is warranted. A second limitation of the present study is the relatively short-term longitudinal window (6 months) explored and the fact that only two points in time were assessed. Better information about intraindividual ontogenetic change in private speech and interindividual differences in such change would be obtained with a larger scale longitudinal study with three or more time periods. Third, fairly global child behavioural variables (i.e. behaviour problems reported by adults) were used in the present work. Another potentially fruitful avenue for future research in order to advance our understanding of the role of private speech in children's self-regulation would be to examine links between children's private speech use and their performance on standardized laboratory batteries tapping particular aspects of children's emerging behavioural control, such as inhibitory/effortful control, internalization, or compliance (Kochanska, Murray & Harlan, 2000).

Research on the normative developmental patterns of children's self-regulation and private speech can inform efforts to predict and modify maladaptive developmental pathways that may eventually lead to impulse control and disruptive behaviour disorders. The present investigation has contributed new data showing that individual differences in preschool

children's private speech use are fairly stable across tasks and time, developmental change occurs during the preschool years in children's use and internalization of private speech, and children's private speech use in the laboratory is related to their behaviour and social skills in the home and preschool setting. Future research should explore the extent to which the internalization of children's private speech contributes independently to, or mediates developments within children's emerging self-regulation.

REFERENCES

Balamore, U. & Wozniak, R. H. (1984). Speech–action coordination in young children. *Developmental Psychology* **20**, 850–8.

Behrend, D. A., Rosengren, K. S. & Perlmutter, M. (1989). A new look at children's private speech: the effects of age, task difficulty, and parent presence. *International Journal of Behavioral Development* **12**, 305–20.

Berk, L. E. (1986). Relationship of elementary school children's private speech to behavioral accompaniment to task, attention, and task performance. *Developmental Psychology* **22**, 671–80.

Berk, L. E. (1992). Children's private speech: an overview of theory and the status of research. In R. M. Diaz & L. E. Berk (eds), *Private speech: from social interaction to self-regulation*. Hillsdale, NJ: Erlbaum.

Berk, L. E. & Landau, S. (1993). Private speech of learning disabled and normally achieving children in classroom academic and laboratory contexts. *Child Development* **64**, 556–71.

Berk, L. E. & Potts, M. K. (1991). Development and functional significance of private speech among attention-deficit hyperactivity disordered and normal boys. *Journal of Abnormal Child Psychology* **19**, 357–77.

Berk, L. E. & Spuhl, S. T. (1995). Maternal interaction, private speech, and task performance in preschool children. *Early Childhood Research Quarterly* **10**, 145–69.

Berk, L. E. & Winsler, A. (1995). *Scaffolding children's learning: Vygotsky and early childhood education*. Washington, DC: NAEYC.

Bivens, J. A. & Berk, L. E. (1990). A longitudinal study of the development of elementary school children's private speech. *Merrill-Palmer Quarterly* **36**, 443–63.

Bronson, M. B. (2000). *Self-regulation in early childhood: nature and nurture*. New York: Guilford.

Campbell, S. B. (1997). Behavior problems in preschool children: developmental and family issues. *Advances in Clinical Child Psychology* **19**, 1–26.

Denham, S. (1998). *Emotional development in young children*. New York: Guilford.

Diaz, R. M. (1992). Methodological concerns in the study of private speech. In R. M. Diaz & L. E. Berk (eds), *Private speech: from social interaction to self regulation*. Hillsdale, NJ: Erlbaum.

Diaz, R. M. & Berk, L. E. (1992). *Private speech: from social interaction to self-regulation*. Hillsdale, NJ: Erlbaum.

Diaz, R. M., Winsler, A., Atencio, D. J. & Harbers, K. (1992). Mediation of self-regulation through the use of private speech. *International Journal of Cognitive Education and Mediated Learning* **2**, 1–13.

Duncan, R. M. & Pratt, M. W. (1997). Microgenetic change in the quantity and quality of preschoolers' private speech. *International Journal of Behavioral Development* **20**, 367–83.

Eisenberg, N., Fabes, R. A., Bernzweig, J., Karbon, M., Poulin, R. & Hanish, L. (1993). The relations of emotionality and regulation to preschoolers' social skills and sociometric status. *Child Development* **64**, 1418–38.

Eisenberg, N., Guthrie, I. K., Fabes, R. A., Shepard, S., Losoya, S., Murphy, B. C., Jones, S., Poulin, R. & Reiser, M. (2000). Prediction of elementary school children's externalizing

problem behaviors from attention and behavioral regulation and negative emotionality. *Child Development* **71**, 1367–82.
Feigenbaum, P. (1992). Development of the syntactic and discourse structures of private speech. In R. M. Diaz & L. E. Berk (eds), *Private speech : from social interaction to self regulation*. Hillsdale, NJ : Erlbaum.
Frauenglass, M. H. & Diaz, R. M. (1985). Self-regulatory functions of children's private speech : a critical analysis of recent challenges to Vygotsky's theory. *Developmental Psychology* **21**, 357–64.
Heckhausen, J. & Dweck, C. S. (eds) (1998). *Motivation and self-regulation across the life-span*. New York : Cambridge.
Hutt, S. J. & Hutt, C. (1970). *Direct observation and measurement of behavior*. Springfield, IL : Charles C. Thomas.
Kochanska, G., Murray, K. T. & Harlan, E. T. (2000). Effortful control in early childhood : continuity and change, antecedents, and implications for social development. *Developmental Psychology* **36**, 220–32.
Kohlberg, L., Yaeger, J. & Hjertholm, E. (1968). Private speech : four studies and a review of theories. *Child Development* **39**, 691–736.
Kopp, C. B. (1982). Antecedents of self-regulation : a developmental perspective. *Developmental Psychology* **18**, 199–214.
Krafft, K. C. & Berk, L. E. (1998). Private speech in two preschools : significance of open-ended activities and make-believe play for verbal self-regulation. *Early Childhood Research Quarterly* **13**, 637–58.
Lee, J. (1999). The effects of five-year-old preschoolers' use of private speech on performance and attention for two kinds of problem-solving tasks. *Dissertation Abstracts International*, A (Humanities and Social Sciences), 60(6-A), 1999.
Luria, A. R. (1961). *The role of speech in the regulation of normal and abnormal behavior* (J. Tizard, ed.). New York : Liveright.
Manning, B. H. & White, C. S. (1990). Task-relevant private speech as a function of age and sociability. *Psychology in the Schools* **27**, 365–72.
Merrell, K. W. (1994). *Preschool and Kindergarten Behavior Rating Scales*. Austin, TX : Pro-Ed.
Milich, R. & Loney, J. (1986). Playroom observations of activity level and sustained attention : two-year stability. *Journal of Consulting & Clinical Psychology* **54**, 272–4.
Nelson, K. (1996). *Language in cognitive development : the emergence of the mediated mind*. New York : Cambridge University Press.
Olszewski, P. (1987). Individual differences in preschool children's production of verbal fantasy play. *Merrill-Palmer Quarterly* **33**, 69–86.
Schunk, D. H. & Zimmerman, B. J. (eds) (1994). *Self-regulation of learning and performance : issues and educational applications*. Hillsdale, NJ : Erlbaum.
Sethi, A., Mischel, W., Aber, J. L., Shoda, Y. & Rodriguez, M. L. (2000). The role of strategic attention deployment in development of self-regulation : predicting preschoolers' delay of gratification from mother-toddler interactions. *Developmental Psychology* **36**, 767–77.
Vygotsky, L. S. (1962). *Thought and language* (E. Hanfmann & G. Vakar, eds & trans). Cambridge, MA : MIT Press. (Original work published 1934).
Vygotsky, L. S. (1978). *Mind in society : the development of higher mental processes* (M. Cole, V. John-Steiner, S. Scribner & E. Souberman, eds). Cambridge, MA : Harvard University Press. (Original work published 1930, 1933, 1935).
Winsler, A. (1998). Parent–child interaction and private speech in boys with ADHD. *Applied Developmental Science* **2**, 17–39.
Winsler, A., Carlton, M. P. & Barry, M. J. (2000). Age-related changes in preschool children's systematic use of private speech in a natural setting. *Journal of Child Language* **27**, 665–87.
Winsler, A. & Diaz, R. M. (1995). Private speech in the classroom : the effects of activity type, presence of others, classroom context, and mixed-age grouping. *International Journal of Behavioral Development* **18**, 463–88.

Winsler, A., Diaz, R. M., Atencio, D. J., McCarthy, E. M. & Adams Chabay, L. (2000). Verbal self-regulation over time in preschool children at-risk for attention and behavior problems. *Journal of Child Psychology and Psychiatry and Allied Disciplines* **41**, 875–86.

Winsler, A., Diaz, R. M., McCarthy, E. M., Atencio, D. & Adams Chabay, L. (1999). Mother–child interaction, private speech, and task performance in preschool children with behavior problems. *Journal of Child Psychology and Psychiatry* **40**, 891–904.

Winsler, A., Diaz, R. M. & Montero, I. (1997). The role of private speech in the transition from collaborative to independent task performance in young children. *Early Childhood Research Quarterly* **12**, 59–79.

Zelazo, P. D., Astington, J. W. & Olson, D. R. (eds) (1999). *Developing theories of intention : social understanding and self-control*. Mahwah, NJ : Erlbaum.