

Age-related changes in preschool children's systematic use of private speech in a natural setting*

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ABSTRACT

This study set out to explore the contexts in which preschool children use private speech, or self-talk, in the naturalistic setting of the preschool classroom, and age-related changes in the contexts in which preschoolers talk to themselves. A total of 2752 naturalistic observations of fourteen three-year-old and fourteen four-year-old children were conducted using a time-sampling procedure in two preschool classrooms over the course of one semester. Results from logistic regression analyses revealed that both age groups were (a) more likely to use private speech during the self-selected activity classroom context as opposed to both large group and outside free play classroom contexts, and (b) most likely to talk to themselves when alone, next likely in the presence of peers, and least likely when in the presence of a teacher. Although the probability of private speech among three-year-old children did not vary as a function of the child's immediate activity, four-year-old children's private speech was more likely to occur during sustained and focused goal-directed activity as opposed to rapidly-changing and non goal-

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directed activity. The findings suggest that private speech appears systematically in young children and that, in several ways, four-year-old children use private speech more selectively than three-year-olds.

INTRODUCTION

Two of the central tenets of Vygotskian sociocultural developmental theory are that higher-order human psychological functions have social origins and that children's cognitive and social development are largely the result of the internalization or constructive appropriation of sociocultural tools and signs during joint activities with others (Vygotsky, 1930–1935/1978; Wertsch, 1985; Vygotsky & Luria, 1930/1993). Arguably the most important of the cultural tools or symbol systems available to the child for internalization is language (Luria, 1961; Nelson, 1996). Vygotsky placed great importance on the role of language in development and posited that a crucial and formative period in ontogenesis occurs in early childhood when children begin to use language not only for communication with others but also as a tool for thought and the self-regulation of behaviour (Vygotsky, 1934/1986; Berk & Winsler, 1995). With the internalization of language, cognitive processes are restructured and reorganized, the mind becomes mediated by language, and uniquely human, higher-order psychological functioning becomes possible (Vygotsky, 1930–1935/1978; 1934/1986; Diaz, Neal & Amaya-Williams, 1990).

Young children's private speech, or overt talk to the self, naturally becomes a focal point for research within this perspective as central hypotheses concerning the social origins of mental processes and the transfer from other-regulation to self-regulation can be addressed through exploration of such speech. Private speech is typically seen by researchers as reflecting an intermediate phase in the ontogenesis and microgenesis of speech internalization, wherein language moves from overt communication with others, to overt communication with the self, and finally to inner speech or covert verbal thought (Diaz *et al.*, 1990; Berk, 1992; Winsler, Diaz, & Montero, 1997). Using private speech as a methodological window for exploring the socially- and linguistically-mediated nature of cognition and behaviour, research to date has explored such important issues as (a) the role of private speech as a potential mediating link between adult–child teaching/learning interactions and children's task improvement and cognitive development (Berk & Spuhl, 1995; Winsler *et al.*, 1997), (b) relations between adult scaffolding and children's private speech and task performance (Behrend, Rosengren & Perlmutter, 1992; Berk & Spuhl, 1995), (c) the dynamic relations between private speech, task difficulty, and task performance and improvement over time (Frauenglass & Diaz, 1985; Winsler *et al.*, 1997), and (d) the role of private speech as a tool for behavioural

regulation among children with problems of self-regulation, attention deficit hyperactivity disorder, and impulsivity (Berk & Potts, 1991; Winsler, 1998). The present study explores two features of preschool children's private speech in the naturalistic setting of the preschool classroom: (1) systematic contextual variation in the occurrence of private speech, and (2) age-related changes in the contexts in which preschool children talk to themselves.

Vygotsky (1934/1986) was the first to note that children's private speech, rather than being an epiphenomenal event, appeared systematically in particular contexts. He noted that young children were especially likely to talk to themselves during moments of task difficulty in problem-solving activity. Also, he noted early on that children's private speech use was related to the presence of others, with young children being more likely to talk to themselves when others were somewhere nearby than when they were alone. Since then, other investigators have explored systematically various contextual variables associated with children's private speech, including not only the presence of others, but also the degree of behaviour regulation provided by others present, as well as the type of task, task difficulty, and classroom context. Diaz (1992), in a review of the research examining contextual variation in children's private speech usage, concluded that children's private speech is maximized under situations when there is a need for executive control and there is a relative absence of regulation provided by others. For example, children have been found to be more likely to engage in private speech (a) when children are engaged in goal-directed, academic, or problem-solving activities compared to free play or other activities (Berk & Garvin, 1984; Winsler & Diaz, 1995), (b) when children's problem-solving task is challenging but attainable as opposed to easy (Berk & Garvin, 1984; Vygotsky, 1934/1986; Behrend *et al.*, 1992), (c) when they are either alone or with peers as opposed to in the presence of an adult who is regulating the child's behaviour (Rubin, Hultsch, & Peters, 1971; Berk & Garvin, 1984; Diaz, 1992; Winsler & Diaz, 1995), and (d) when they are in collaboration with an adult who is appropriately 'scaffolding' their problem-solving activity, compared to an adult who provides high degrees of external control and direction (Goudena, 1987; Diaz, Neal & Vachio, 1991; Behrend *et al.*, 1992; Berk & Spuhl, 1995).

In terms of age-related changes in private speech, Vygotsky (1930–1935/1978; 1934/1986) hypothesized that children's private speech changes ontogenetically in at least three ways. First, that the frequency of children's overt private speech follows an inverted-U relation with age, peaking during the preschool years and decreasing in frequency as children enter the elementary school years. Research has generally confirmed the existence of this broad developmental pattern as decreases in children's overt private speech toward the end of the preschool years are accompanied by corresponding increases in the frequency of partially-internalized manifestations

of inner speech, such as whispers and inaudible muttering (Berk & Garvin, 1984; Bivens & Berk, 1990). However, three qualifications are in order concerning this finding: (a) this ontogenetic pattern in frequency is often observed only among certain subtypes of children's private speech rather than children's overall self-talk, (b) that age-related changes in children's private speech use in naturalistic classroom settings have been shown to be more extended and gradual than those found in laboratory studies, and (c) that similar curvilinear trends in private speech usage repeat themselves microgenetically as children of different ages master new challenging tasks (Frauenglass & Diaz, 1985; Berk, 1992; Winsler *et al.*, 1997).

A second hypothesized developmental change in private speech originating from Vygotsky's work is that over the course of the preschool years, children's self-talk makes a gradual transition from being less, to more, self-regulatory in nature. Luria's research (1961), for example, demonstrated that the speech of four-year-old children is more effective in guiding behaviour than the speech of three-year-olds. Subsequent research exploring the extent to which the various functional or semantic categories of children's private speech (i.e. word play, comments about the self, descriptions of the environment) change with age, however, has not shown large differences in the content of private speech produced by children of different ages (Rubin, 1979). Other studies that have investigated the related issue of whether the timing of children's private speech in relation to their ongoing behaviour (i.e. whether speech first follows, then accompanies, then precedes children's actions) as children get older have also provided only mixed support at best (Rubin, 1979; Pellegrini, 1981; Berk, 1992).

Finally, Vygotsky suggested that over the course of the preschool years, private speech becomes more and more differentiated from social speech as it is gradually internalized and integrated with children's covert mental activity. Research exploring the relations between social and private speech and changes in both types of speech over time with young children has generally supported this claim (Berk & Garvin, 1984; Furrow, 1992; Berk, 1992).

Several limitations and gaps in the above research literature on children's private speech are notable. First of all, although researchers have explored age-related changes in private speech and studied contextual variation in children's private speech usage, these two areas of inquiry have occurred in relative isolation. That is, age-related changes in the contexts in which children talk to themselves has not been explored. This area is worthy of study because age-related developments in children's private speech use across the preschool years are also clearly accompanied by age-related changes in the activities in which children engage, and in the immediate social and behavioural context in which children find themselves. The social affiliations, sociocognitive play behaviours, and task-related activities of

four- and five-year-old children are likely different from those of three-year-olds. Older preschoolers are more likely, for example, to sustain their task behaviour for longer periods of time, demonstrate more complex play, and interact cooperatively with others than younger preschool children (Johnson & Ershler, 1981). It is important empirically to be able to distinguish between age effects and context effects in understanding children's private speech.

A second critical limitation of the research to date in this area is that the vast majority of studies on contextual variation in children's private speech have been conducted in laboratory settings (i.e. Frauenglass & Diaz, 1985; Behrend *et al.*, 1992) or in quasi-laboratory settings such as a separate private room of a preschool (i.e. Rubin & Dyck, 1980). The few naturalistic investigations of children's private speech that do exist have typically been conducted with either toddlers age two or under in the home (Nelson, 1989; Smolucha, 1992) or with elementary school age children at school (Roberts & Tharp, 1980; Berk & Garvin, 1984; Bivens & Berk, 1990; Winsler & Diaz, 1995). Such lack of information about preschool age children's use of private speech in naturalistic settings is most unfortunate given that the preschool years are those in which much developmental change in private speech is hypothesized to occur. Given that private speech is known to be quite sensitive to the setting, and that speech use in the lab may not generalize well to natural settings (Berk & Landau, 1993), it appears crucial to collect naturalistic observational data on children's self-verbalizations in settings such as the preschool classroom. Validation of laboratory findings in natural, real-world settings is critical to progress in the discipline of applied developmental science (Fisher & Lerner, 1994).

The present study

If private speech serves important self-regulating functions for children in early childhood, then the appearance of such speech should be predictable in terms of the child's activity and the surrounding context, and this systematic variation in speech use should be observable in the early childhood classroom setting. For example, private speech should be more likely to occur during sustained, focused, goal-directed activities than during unfocused, non goal-directed activities. Similarly, if children's private speech becomes more self-guiding, more internalized, and/or more related to the child's internal goals and activities over the course of the preschool years, then four-year-old children's self-speech would be expected to occur more systematically across different natural contexts compared to the speech of three-year-olds. That is, whereas the private speech of three-year-olds might be expected to be more evenly distributed across classroom contexts and across children's activities, four-year-old private speech may be much more likely to appear systematically during certain types of activities or contexts.

This study contributes to the literature in several ways. First, it provides much needed naturalistic data on preschool children's use of private speech in the preschool classroom. Second, it examines a new dimension of developmental change in children's private speech, namely, age-related changes in the contexts in which children talk to themselves. Third, the present study introduces two advantageous methodological features to the private speech literature: a) the use of dichotomous coding of time-sampled observations on the basis of whether or not private speech occurred (as opposed to counting number of private speech utterances) which eliminates the problem, common in the private speech literature (Diaz, 1992), of large individual differences in children's quantity of speech, and b) the use of multiple logistic regression with partial parameter estimates, which examines the unique and combined influences of several contextual variables on private speech simultaneously, including variables which are likely to change with age, such as the type and duration of children's activity, and children's immediate social context. This study, therefore, has at least four major goals: (1) to examine the degree to which preschool children spontaneously use private speech in the naturalistic context of the early childhood classroom, (2) to explore the extent to which private speech use in preschool classrooms varies as a function of contextual variables, (3) to see the degree to which findings from earlier naturalistic studies with older children (i.e. Winsler & Diaz, 1995) replicate and generalize to younger children, and (4) to investigate age-related shifts from age three to four in the systematicity of children's private speech usage.

A total of 2752 naturalistic observations were conducted of 14 three-year-old children and 14 four-year-old children in two preschool classrooms. Measures included (a) the classroom context in which the observation took place (i.e. large group activity period, self-selected activity period, or outside time on the playground), (b) children's social context (alone, with peer(s), teacher present), (c) the goal-directed nature of children's activity, and (d) whether or not children's activity was sustained over time. If private speech is a tool used systematically by young children for behavioural self-regulation, and if developmental change takes place between the ages of three and four in the self-regulatory function of private speech, then the following predictions can be offered based on the previous literature: (1) Private speech will be more likely to occur during self-selected activity periods as opposed to outside on the playground or large group activities, (2) Children will be more likely to use private speech while alone, next likely while with peers, and least likely in the presence of an adult, (3) Private speech will more likely appear when children are engaged in goal-directed activities as opposed to non goal-directed activities, and (4) Children will be more likely to use private speech in the context of sustained activity rather than rapidly-changing activities, and this effect will be stronger when the child's activity

is goal-directed rather than not. Finally, it was hypothesized (5) that each of the above effects would be stronger among the four-year-old children than among the three-year-old children.

METHOD

Participants

Participants included 28 preschool children attending a university-affiliated laboratory preschool in a medium-sized city in the Southeastern United States. Half of the sample ($N = 14$, 53% male) consisted of the 14 children enrolled in the 'three-year-old room' at the preschool. The ages in this group ranged from 3;3 to 4;3 ($M = 45.4$ mos., $s.d. = 4.5$) at the beginning of the spring semester when data collection began. The remainder of the sample ($N = 14$, 47% male) included 14 children who were enrolled in the 'four-year-old room,' with ages in this group ranging from 4;4 to 5;3 ($M = 57.1$ mos., $s.d. = 3.5$). The ethnic breakdown of the sample according to parental report on the preschool application/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, $M = 53.30$, $s.d. = 9.98$) as 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. Paternal age ranged from 25 to 52 years ($M = 36.03$, $s.d. = 6.04$) and maternal age ranged from 24 to 44 years ($M = 33.04$, $s.d. = 5.29$). Fathers' years of education ranged from 13 to 21 ($M = 17.44$, $s.d. = 2.72$) and mothers' education ranged from 12 to 21 years ($M = 16.65$, $s.d. = 2.36$). None of these demographic variables varied significantly by children's age group.

Setting. The preschool program attended by the children was a NAECP-accredited, five day a week, morning (8:00am-12:00pm) program, consisting of one three-year-old class and one four-year-old class, with each class typically including 14-16 children. Both classrooms were headed by one lead teacher and one graduate student assistant (all female). Due to the centre's responsibilities as a training and observation site for human development students, the classrooms also typically included one to five other adult students who would periodically observe or assist in the classroom. The two classrooms shared the same teaching philosophy and had similar daily schedules which, other than the occasional special activity (such as a walk to a park or a field trip), reliably consisted of certain times each day set aside for three different types of activities: 1) self-selected activities, in which children would choose which of several activity centers (i.e. block area, house corner, Lego® table, dress-up area...) they would go to to play, 2) outside play time,

and 3) large group activities, such as reading or singing together as a group. Written literature from the center, impressions from the observations, and interviews with the teachers and the director indicated that the preschool program holds a 'child-centred' or constructivist early childhood education philosophy. Within this perspective, children are allowed and encouraged to independently explore their environment and design their own learning and play activities within the boundaries of the set of developmentally-appropriate materials that have been set out by the teacher. The role of the teacher from this perspective was described by the teachers as 'facilitator' – one who chooses the learning materials made available to the children each day, lets children play and solve problems independently as much as possible, and one who generally does not get directly involved with the children's activities, intervening only when absolutely necessary.

Procedure

Observations. Naturalistic observations were carried out in the two classrooms 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 using a time-sampling method. 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 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 center's laboratory responsibilities. By design, observations took place during the three regularly-scheduled daily activity periods (discussed above) in the two classrooms: large group (LG), self-selected activity time (SSA), and outside during recess (OUT). Each child was observed an average of 98 times yielding a total of 2752 observations. The resulting distribution of observations by classroom context was 1100 observations during SSA (40% of the observations), 882 during OUT (32%), and 770 during LG (28%). This distribution of observations represents well the relative proportion of time children in these classrooms spend each day in each context.

Observers, who were 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 their belt. Target children were observed according to a predetermined random order

for approximately 10, 10-minute periods, with each period consisting of 10, 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.

Measures. Four variables were coded on the observational checklist instrument. First, children's speech during each 10-second observation was coded as either containing social speech, private speech, or no speech. Social speech was defined as any verbalization intended for communication to another individual as indicated by the presence of either a) a name or pronoun reference, b) a gaze at another person during or within one second of the utterance, c) an intentional physical touch of another person, or d) a conversation or verbal turn-taking episode. Any verbalization by the child which did not contain one of these social markers, including inaudible muttering and silent verbal lip movements, was taken as evidence of private speech. A dichotomous variable was later constructed which represented simply whether or not private speech was present during each observation.

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 an identifiable 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 in the context of self-selected activity periods (SSA) included, for example, 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 in this context included, for example, aimless wandering around the classroom, looking on into another group's activity, repeatedly spinning a puzzle piece around one's finger for the apparent 'fun of it,' and making a transition between one activity and another.

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.

Finally, children's immediate social context was also coded. Observers noted, for each 10 second interval, whether the child was alone, with one or more peers, with a combination of one or more peers and a teacher, or one-on-one with a teacher. Children were coded as being alone if no other person doing the same general activity was within three feet of the target child and there were no social interchanges with another person during the observation. Children were coded as being with a peer if there were one or more other children present who were either doing the same activity in parallel with the target child within three feet or who were physically or verbally interacting with the target child. Children were coded as being with both peer(s) and a teacher if any adult was included as one of the members of a group, using the same criteria as those used above for 'peer.' Children were classified as being exclusively with a teacher if they were interacting one-on-one with a teacher with no other children present within three feet of the target child. Because no instances of one-on-one direct interaction with a teacher occurred during the 1301 observations which took place in the four-year-old classroom, the last two categories were combined for the analyses to make one category indicating teacher presence, broadly defined.

Reliability. Inter-rater reliability for the above coding systems 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 ($\kappa = 0.90$), 78% for speech ($\kappa = 0.66$), and 89% for social context ($\kappa = 0.83$).

RESULTS

The analysis strategy chosen for addressing the hypotheses was to fit two appropriate and manageable logistic regression models to the data – each with private speech (yes/no) as the dependent variable, subject nested within class ($df = 26$) as a repeated measures effect entered first into the model, and the relevant contextual variables and interaction terms entered as predictors. The first model tested hypotheses one and two concerning the influence of the global contextual variables (classroom context and social context) on the probability of private speech occurring. The second model tested hypotheses three and four exploring the influence of specific activity variables (activity and sustained activity) on the probability of private speech. Significant effects from these models were interpreted by examining and calculating

odds ratios from the relevant two- or three-way contingency tables (Hosmer & Lemeshow, 1989).

One advantage of using logistic regression is it can control for the effects of other variables within the model and provide partial parameter estimates for each variable of interest, much like ordinary least squares multiple regression with continuous predictors of a continuous outcome variable. Obtaining partial parameter estimates is especially crucial for this type of naturalistic research as the researcher does not have control over many of the variables, and indeed many of the predictor variables are not independent from one another. For example, in this study, age and social context are related in that the three-year-old children spent more time interacting directly with their teachers than did four-year-olds. Similarly, classroom context is not unrelated to social context. Children were understandably more likely to be in the presence of a teacher during large group activities than during outside recess time. The logistic regression analyses reported below are able to tease out the individual and combined contributions of each relevant variable to the outcome variable of interest, namely private speech.

Classroom context and social context. The first model, which predicted the log likelihood of private speech on the basis of subject (nested within class), age (3/4), classroom context (LG/SSA/OUT), social context (Alone/Peer/Teacher Present), and the interaction terms for age-by-classroom context and age-by-social context, was significant [$\chi^2(35, 2696) = 332.8, p < 0.0001$]. Likelihood ratio effect tests indicated that each of the variables in the model contributed significantly to the prediction of private speech [subject within class $\chi^2(26) = 63.62, p < 0.0001$, class $\chi^2(1) = 67.96, p < 0.0001$, classroom context $\chi^2(2) = 59.90, p < 0.0001$, social context $\chi^2(2) = 67.37, p < 0.0001$, age-by-classroom context $\chi^2(2) = 27.25, p < 0.0001$, and age-by-social context $\chi^2(2) = 27.57, p < 0.0001$]. The significant subject effect indicates that children vary considerably in their base rate frequency of private speech usage. Other significant effects while the subject variable is present in the model indicate that the effect is still significant after controlling for the subject variance.

Table 1 provides the odds ratios for each of the pairwise contrasts within classroom context and social context, separately by age group and for all children combined. The odds ratios describe how much more likely private speech is to occur in one condition compared to another. For example, the 7.52 figure given in Table 1 referring to the comparison of SSA over LG for four-year-olds indicates that four-year-old children were seven and a half times more likely to talk to themselves during self-selected activity periods than during large group activities. Overall, three-year-olds were 1.75 times more likely to talk to themselves than four-year-olds, but as indicated by the significant age-by-classroom context interaction, this was not true across all classroom contexts. Four-year-olds were just as likely to talk to themselves

TABLE 1. *Raw odds ratios (pairwise increase in likelihood that private speech will occur) for classroom context and social context, combined and by age*

	Three-year-olds	Four-year-olds	Combined
Classroom context			
SSA over OUT	1.22	4.46	1.81
SSA over LG	2.22	7.52	3.61
OUT over LG	1.82	1.69	1.99
Social context			
Alone over Peers(s)	4.86	2.57	3.75
Alone over Teacher presence	11.70	2.88	5.93
Peer(s) over Teacher presence	2.41	1.12	1.58

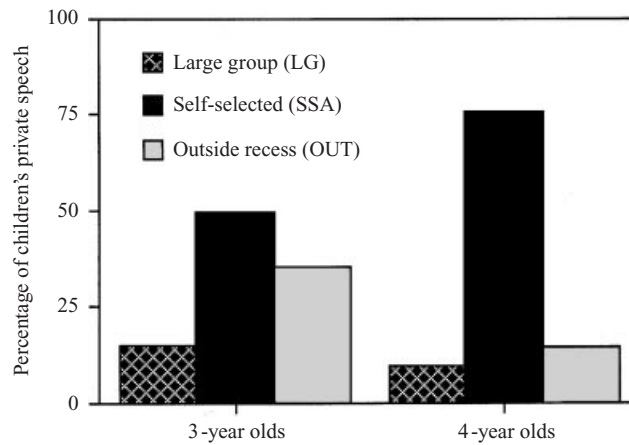


Fig. 1. Distribution of children's private speech across each of the three contexts (SSA, LG, OUT), by age group.

as three-year-olds during the self-selected activity context but less likely to use private speech outside or during large group activities. Figure 1 visually displays the age-by-classroom context interaction in terms of the overall proportion of children's private speech which occurred in each of the three classroom contexts. Hypotheses 1 and 5 (as they pertain to classroom context) were, therefore, strongly supported by the data. Children's private speech use appears systematically across different classroom contexts and older preschoolers are more systematic in their spontaneous use of self-talk than are younger preschoolers.

PRIVATE SPEECH

Regarding social context, children overall were most likely to talk to themselves if they were alone, next likely in the presence of their peers, and least likely to use private speech in the presence of an adult. However, this social context effect also interacted with child age as shown in Figure 2,

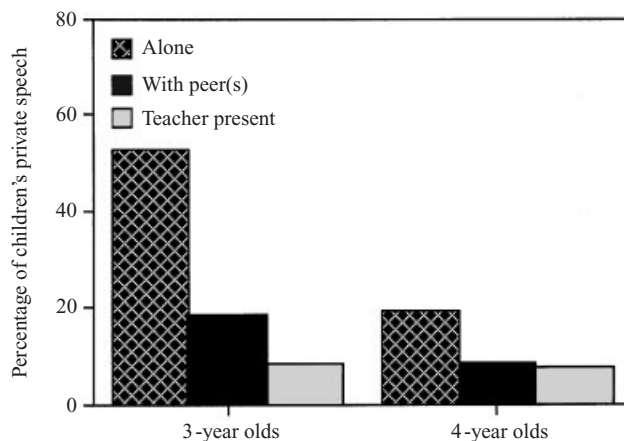


Fig. 2. Percentage of observations in which children used private speech in each of the three social contexts (alone, with peer(s), teacher present), by age group.

which plots the percentage of observations in each of the three social contexts where children were using private speech, by age group. Interestingly, however, the direction of the interaction is opposite to that which was originally hypothesized. Three-year-old children's private speech use was much more associated with their immediate social context than was the private speech of four-year-olds. Thus, although hypothesis 2 was clearly supported by the data, the social context component of hypothesis 5, which predicted that the social context effect would be stronger for four-year-olds, was not supported.

Children's activity and sustained activity. The second logistic regression model exploring the relationship between children's activity and private speech was limited to only those observations which took place during the SSA classroom context. This decision was justified given that (a) the majority (58%) of children's private speech occurred in the self-selected activity (SSA) classroom context, (b) the largest number of observations ($N = 1100$, 40%) took place during SSA, (c) children's goal-directed behaviour and private speech likely have different interpretations in the three different classroom contexts, (d) the SSA classroom context is the setting with the most theoretical and pedagogical relevance, and (e) the desire to control for

other variables to aid in the interpretability of the regression models. This overall model, which included private speech (yes/no) as the dependent variable, subject (nested within class), age (3/4), activity (goal-directed/not), sustained activity (yes/no), the two-way interaction terms for age-by-activity, age-by-sustained activity, and activity-by-sustained activity, and the three-way, age-by-activity-by-sustained activity interaction, was significant [$\chi^2(32, 95) = 78.1, p < 0.0001$]. Likelihood ratio effect tests indicated that the following were significant predictors: subject [$\chi^2(26) = 56.30, p < 0.001$], sustained activity [$\chi^2(1) = 5.39, p < 0.05$], age-by-sustained activity [$\chi^2(1) = 6.97, p < 0.01$] and the three-way interaction [$\chi^2(1) = 8.06, p < 0.01$]. Table 2 provides the raw odds ratios for these two variables,

TABLE 2. *Raw odds ratios (pairwise increase in likelihood that private speech will occur) for activity and sustained activity, combined and by age*

	Three-year-olds	Four-year-olds	Combined
Activity			
On-task over	1.30	3.11	1.72
Off-task			
Sustained activity			
Sustained task	1.15	2.57	1.59
over New task			

separately by age and as a combined group. Figure 3 shows the percentage of private speech occurrences which took place during goal-directed activity as opposed to unfocused behaviour. Figure 4 displays the distribution of children's private speech as a function of whether or not the child was engaged in a sustained or a new activity.

As is clear from the graphs, three-year-old private speech is almost equally likely to appear during goal-directed and non goal-directed behaviour whereas four-year-old private speech is much more likely to appear when children are engaged in an explicitly goal-directed activity. Similarly, while private speech is almost equally likely to appear during sustained or rapidly-changing activities for the three-year-olds, four-year-old self-talk is much more likely to occur during sustained activities. The three-way interaction consisted of the following. Children were more likely to talk to themselves during sustained activities than during rapidly-changing activities, but this was only the case when children's sustained activity was goal-directed in nature and not true when children's behaviour was unfocused. The above pattern was stronger for the four-year-old children than for the three-year-olds. Thus, hypotheses three, four, and the part of hypothesis five concerning the relationship between children's private speech and their sustained and focused behaviour, were supported by the data.

PRIVATE SPEECH

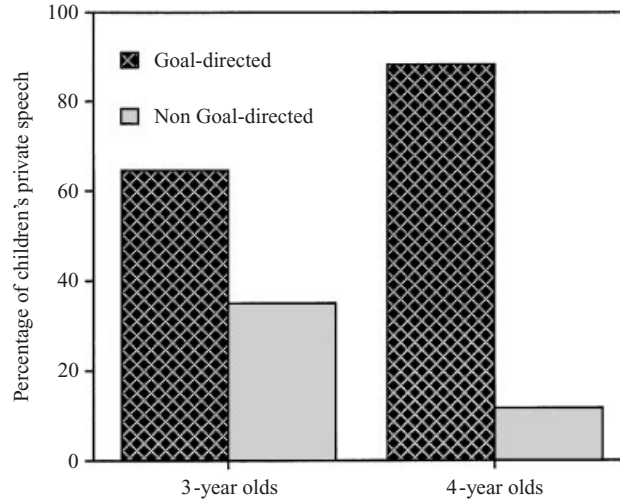


Fig. 3. Distribution of children's private speech across the two types of children's activity (goal-directed, non goal-directed), by age group.

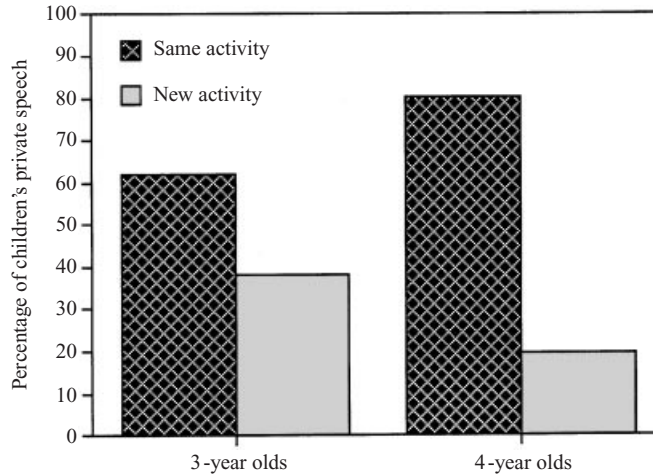


Fig. 4. Distribution of children's private speech across the two temporal dimensions (same activity, new activity), by age group.

DISCUSSION

This investigation set out to explore, in the natural setting of the preschool classroom, contextual variation in children's use of private speech and age-related changes in children's systematic use of self-talk. The results of this study provide support for neo-Vygotskian developmental theory regarding

private speech and the development of self-regulation in the preschool years by showing that private speech, rather than being epiphenomenal, is used systematically by young children depending on their activity, immediate social context, and classroom context. Overall, 13 percent of the classroom observations contained private speech. This percentage is consistent with, if not slightly higher than, what has been observed with older, kindergarten-age children in classrooms (Winsler & Diaz, 1995), and demonstrates that three to four-year-old children do spontaneously use self-directed language in the naturalistic context of the preschool classroom.

Several of the findings of this study suggest that an important transition may occur between the ages of three and four in the way in which preschool children spontaneously use private speech, with four-year-old children's private speech occurring more systematically (but still spontaneously) as a function of the classroom context and the type and duration of their activity, than the self speech of three-year-olds. Most four-year-old children's private speech occurred during the tacitly structured, self-selected activity classroom setting, whereas three-year-old children's self-talk was more evenly distributed across the three classroom contexts. Most four-year-old private speech occurred during focused, goal-directed activity whereas three-year-old private speech was more equally likely to appear during either goal-directed or unfocused activities. The majority of four-year-old children's private speech occurred in the context of sustained activity, whereas three-year-old private speech was more equally likely to occur during either sustained or rapidly-changing activities.

One interpretation of such age-related differences in the systematicity with which preschool children use private speech is that such speech plays an increasingly self-regulatory role as children move from three to four years of age. That is, four-year-old children, more than three-year-olds, may be using private speech in situations in which it fruitfully serves self-regulatory functions. Although increased predictability in the occurrence of private speech clearly does not necessarily imply that such speech is changing developmentally in its function or regulatory significance, it is certainly one indication consistent with such an hypothesis. Change in the breadth of situations for which children employ particular problem-solving strategies (either in terms of generalization or increased selectivity) is one of several important change dimensions in developmental inquiry (Siegler, 1996). The data reported here suggest only that four-year-olds spontaneously use private speech more selectively than three-year-olds – not that such children do so in a conscious, deliberate manner. It is not at all clear (and indeed unlikely) that four-year-old children are actively choosing to use their self-speech in these ways. An important area for future study, in fact, would be to determine the extent to which such variation in children's verbal self-regulatory strategy use in the classroom represents conscious choices on the part of the child.

What roles do the child's conscious awareness and understanding of private speech play in their private speech usage and in this movement toward increased systematicity? Is children's increased systematicity of private speech dependent upon increased awareness of the potentially self-guiding nature of private speech, or does children's unwitting use of private speech eventually lead to greater metacognitive awareness? Goldin-Meadow (1997) has demonstrated that young children's use of gesture during cognitive activity appears without children's awareness, and that such subconscious gesture use predicts later changes in children's thinking and strategy use. A similar pattern might be found to be the case for private speech. Flavell, Green, Flavell & Grossman (1997) concluded that four-year-olds show relatively little understanding or recognition of inner speech, or covert verbal thought, as a possible mental activity existing within themselves or within the minds of others. However, no empirical information exists at present about young children's awareness and understanding of overt private speech.

The theory of mind literature may also provide some insight into understanding the observed age-related changes in the situations in which children talk to themselves. Among the most well-documented developments known to take place during the preschool years is that four-year-olds, compared to three-year-olds, have notably increased understanding and awareness of their own thinking and the thinking of others (Astington, 1993). By the age of four, children demonstrate a clear understanding of their self and others as intentional agents and they can be said to possess a representational theory of the mind (Perner, 1991; Flavell & Miller, 1998). Changes in the contexts in which children talk to themselves regularly may be related to these developments in social cognition and theory of mind which are also known to take place between the ages of three and four.

Children's language development and private speech appear to be intricately involved with children's theory of mind development from at least two perspectives. The first perspective sees children's theory of mind development as having social origins, emerging as a result of the child's social history interacting with caregivers and from the caregiver and child's use of mental state language during joint dialogue (Dunn, Brown, Slomkowski, Tesla & Youngblade, 1991; Astington, 1996; Nelson, 1996). Parents who enjoy secure attachment relations with their children, who treat the child as an independent mental being with their own perspective, who provide rich language input, and who use much mental state language tend to have children who are more advanced in their theory of mind or mentalizing abilities (Jenkins & Astington, 1996; Meins & Fernyhough, 1997). From this perspective, language is seen as the main mediating tool children use to internalize their understanding of themselves and others as mental agents. Private speech has recently been implicated as playing a role in assisting young children with understanding the self and distinguishing the self from

others as a personal, active, mental agent (Fernyhough & Russell, 1997). Also, increased use of self-regulatory private speech appears to be positively associated with more advanced mentalizing abilities (Fernyhough, 1997). Thus, private speech might be intimately related, if not formative, in the development of children's theory of mind.

A complementary perspective is that of Tomasello, Kruger & Ratner (1993), who argue that a representational understanding of the self and other as separate intentional agents is an important social-cognitive prerequisite which needs to be in place before children are able to fully internalize social dialogue (i.e. use private speech) and benefit from cultural learning experiences. Implicit in this formulation is the suggestion that certain properties of children's private speech may be expected to change after a representational theory of mind is established. Qualitative changes in young children's understanding of social cognition and mind may lead to changes in the way in which private speech is used by four-year-old children. For example, it is possible (although sheer speculation as the research has not yet been conducted) that increased understanding of the self as an active intentional agent and increased understanding of mental states such as beliefs, thoughts, and desires, lead children to be more aware of their own speech and/or use more intentional, planful, and self-guiding forms of self-talk. One important question for future research, therefore, concerns the timing of these developments in ontogenesis – do changes in children's private speech precede, accompany, or follow changes in mentalizing abilities?

Another finding of this study was that the probability of children's private speech was found to vary as a function of children's immediate social context. As hypothesized, both age groups were most likely to talk to themselves when alone, next likely to use such speech in the presence of peers, and least likely when in the presence of a teacher. Although the presence of an adult does not always imply reduced private speech among children (it depends on the extent to which the adult is regulating the child's behaviour [Behrend *et al.*, 1992]), it did in the present study. This is likely due to the fact that teacher presence in these particular classrooms mostly covaried with teacher intervention or regulation of child behaviour. The social context effect was observed to be significantly stronger for the younger as opposed to the older age group, which is contrary to the original age-by-social context hypothesis which predicted that the social context effect would be stronger for the four-year-olds. The original rationale for this hypothesis was the same as that for the other interaction with age predictions, namely, that four-year-old speech across the board will be more systematically related to contextual variables than the speech of three-year-olds. It appears from this investigation, however, that the emergence of preschool children's self-speech does become more selective with age, but only in relation to the child's own activities and

goals. Whereas three-year-old children's private speech is more predictable on the basis of the child's social context, four-year-old self-speech is more predictable on the basis of the child's own activities, goals, and the affordances of the classroom context. Such findings, upon further examination, are not inconsistent with neo-Vygotskian notions of the ontogenetic pathway for private speech, as the theory sees children's private speech as originally branching off from social speech and gradually becoming more and more integrated with the child's own cognitive activity and goals (Berk & Winsler, 1995). The finding here that social context becomes less important a predictor of children's private speech usage with age during the early childhood years is not only theoretically interesting but it also helps explain some of the mixed results of previous studies that have explored the influence of the immediate social context on children's private speech use (for a review, see Berk, 1992). For example, Winsler & Diaz (1995), who used a similar methodology and observed five-year-old kindergarten children's private speech in classroom situations, did not find the probability of children's private speech use to be significantly related to the presence of others.

The numerous limitations of this study are worthy of discussion and they suggest that replication and extension of these findings would be desirable. First, this study's cross-sectional design does not allow for claims to be made about developmental change in children's private speech over time. Clearly, a desirable next step would be a short term longitudinal study addressing similar questions. Second, the actual content of children's self-verbalizations was not measured in the present study. There are certainly multiple forms of children's private speech with some types of speech (e.g. noises, fantasy speech, task-irrelevant statements, crib talk) appearing to be less 'self-regulatory' than others. Such functionally different subcategories of children's private speech may follow different ontogenetic pathways (Berk, 1992), with each worthy of individual naturalistic examination. The assumption which remains untested in the present study is that most of the private speech used by the preschoolers was self-regulatory in nature. This assumption may be reasonable on at least two accounts. First, research has shown that the majority of preschool children's private speech is task-relevant and appears to have self-regulatory functions (Berk & Garvin, 1984; Frauenglass & Diaz, 1985; Winsler *et al.*, 1997). Second, there is some debate as to whether other types of private speech utterances should be considered non-regulatory (see Diaz, 1992). For example, self-stimulating word play and noises, task-irrelevant affect expressions, and fantasy dialogues can serve important regulatory functions as well, such as regulating emotions, maintaining motivation, and processing/consolidating gender roles. Nevertheless, future investigations along these lines should attempt to use a finer-grained speech coding system. Obtaining private speech data of sufficient quality to allow coding of utterances into various functional subcategories while the

child is in the natural context of the preschool classroom, however, poses formidable methodological challenges. Real-time coding of utterances by an observer in the classroom is likely precluded given that the proximity of the observer to the child that would be required for hearing and classifying utterances is likely to be too intrusive for the child. Using audio recordings of children's speech in the classroom may be a viable option but obtaining high quality audio recordings of individual children's private speech utterances within the context of a loud preschool classroom is certainly not without its challenges.

Third, although the time-sampling procedure used in this study avoids at least one classic methodological problem often found in the private speech literature, namely, large individual differences among children in the amount of private speech uttered at any given time, time sampling itself has not escaped criticism. Mann, Ten Have, Plunkett & Meisels (1991), for example, have demonstrated that many time sampling procedures produce relatively poor estimates of the duration and frequency of specific behaviours, at least when applied to rich, dyadic social interaction data. Several characteristics of the time-sampling procedures employed in this study, however, suggest that many of Mann *et al.*'s concerns over time sampling either don't apply or are significantly reduced in this situation. First, the reliability of time-sampling increases as the observation interval gets shorter, and the interval used in this study (10 seconds) was relatively short. Second, predominant activity sampling, a procedure believed to increase the reliability of time sampling observations (Mann *et al.*, 1991), was used for the coding of children's social context and activity. Third, duration of behaviour, the parameter most poorly estimated by time-sampling, was not of particular theoretical or practical interest here. Finally, the events measured and studied here were not as dynamic and complex as the moment to moment, (state and event), mother-infant interaction data on which the Mann *et al.* critique was based.

In terms of implications of this work for practice in the early childhood classroom, it is clear that increased awareness and understanding of young children's private speech use in the classroom is potentially useful for early childhood educators because such speech may serve as an assessment tool in at least three senses. First, children's private speech provides an effective window through which teachers can observe young children's thought processes, emotions, motivational processes, problem-solving strategies, and their emerging metacognitive skills. Second, given that children are most likely to talk to themselves when they are in their zone of proximal development working on challenging but attainable goals, some have suggested that children's overt private speech use can serve as a measure of the extent to which either a child's goals/activities or the classroom's curricular activities are at an appropriately challenging level (Berk & Winsler, 1995; Winsler & Diaz, 1995). Third, recent data have demonstrated that

young children's private speech may serve an important mediating link between teacher-child interaction/instruction and children's subsequent cognitive growth (Berk & Spuhl, 1995; Winsler *et al.*, 1997). That is, children may profit more from scaffolded instruction when they engage in private speech either during or shortly after the teaching episode, and such private speech use in the context of a teaching interaction may be a better predictor of children's later task improvement than the teaching activities themselves. Thus, teachers can look toward the self-speech of their children as an indicator of the extent to which their instructional efforts have been appropriated or internalized by children.

One of the central goals of developmental psychological science is the prediction of behaviour. The present study contributed new data on when, and in which contexts, young children use private speech in the setting of the early childhood classroom, and how the predictability of such speech changes with age. The field has now come to a fairly good understanding of when children talk to themselves. Such knowledge, together with the information gained from continuing studies exploring the functional and developmental significance of children's private speech, will lead us to a better understanding of this important phenomena of early childhood.

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