# Microgenetic Change in the Quantity and Quality of Preschoolers' Private Speech

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Forty preschool-aged children were videotaped while carrying out paperfolding and story-sequencing tasks, during a series of three experimental sessions. During the first session, participants worked on both easy and difficult items, and in the second and third sessions they worked on familiar items (the first session difficult items, presented repeatedly) and novel items, of each task type. Participants used more private speech on difficult/novel items than on easy/familiar items, during all three sessions. Private speech production declined across sessions when participants worked on the repeated items. A greater percentage of participants' private speech preceded action when they worked on difficult/novel items, compared with easy/familiar items. On the paper-folding items, a cross-session increase occurred in the percentage of private speech that preceded action, supporting some of Vygotsky's (1934/ 1987, 1978) claims about the emergence of verbal planning in private speech. The potential of microgenetic experimental methodology for research on private speech is emphasised.

Young children often speak out loud apparently without addressing anyone else, a form of verbalisation which has come to be known as "private speech". Vygotsky (1934/1987, 1978) proposed that children's private speech constitutes an emergent system of "psychological tools" undergoing a transformational process of interiorisation. He argued that private speech originates in interpersonal communication and collaborative joint action, and that it is gradually differentiated from social speech and interiorised as a verbal form of thinking. The linguistically mediated influences that other people first exercise on the actions of the young child in interpersonal

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contexts come to be applied by the child to his/her own actions. Private speech thus develops as an instrument of thinking, problem-solving, and self-regulation. Vygotsky's theory suggests that the development of private speech facilitates children's appropriative reproduction of sociohistorically and culturally formed, distinctively human psychological functions. Interiorisation of private speech, Vygotsky argued, leads to the development of "inner speech", a central aspect of conscious, mediated psychological processes (see Vygotsky, 1934/1987, ch. 7).

Two issues inherent in Vygotsky's (1934/1987, 1978) account of children's private speech are addressed in this study. One of these concerns the relation between children's use of private speech and the difficulty of the tasks or activities in which they are engaged; the second involves the emergence of verbal planning in private speech, as evident in increases in children's self-verbalisation preceding action.

The hypothesis of increased use of private speech with increasing task difficulty has received considerable empirical support. Vygotsky (1934/1987, 1978; see also Levina, 1981) reported that when children encountered obstacles or moments of particular difficulty in experimental tasks, the proportion of their speech which was private (or "egocentric") "nearly doubled" (Vygotsky, 1934/1987, p. 69), in comparison both with baseline control data and with Piaget's (1923/1926) data. This claim (Vygotsky, 1978, p. 27) that "the relative amount of egocentric speech ... increases in relation to the difficulty of the child's task", has been investigated in contemporary research by experimentally manipulating task difficulty as a within-subjects variable. This approach has produced a substantial amount of evidence supporting Vygotsky's position (Beaudichon, 1973; Behrend, Rosengren, & Perlmutter, 1989; Kohlberg, Yaeger, & Hjertholm, 1968; Murray, 1979), corroborating the suggested involvement of private speech in problemsolving. The present experiment extends the task difficulty finding by documenting a difference in the amount of private speech produced by children when they work on novel and familiar tasks-a contrast that appears to parallel the difference between difficult and easy tasks-and provides an evaluation of the effects on private speech of practice and familiarisation with experimental tasks.

The second issue of interest in the present study is the emergence of verbal planning in children's private speech. Vygotsky (1934/1987, 1978; see also Levina, 1981) reported observations of a change in the temporal relation between private speech and action, or a shift in the relative position or location of private speech. Initially, children's private speech follows or accompanies action, serving as an evaluation or a commentary on the status or outcome of the action. A change occurs, however, in this temporal relation, with speech coming to precede action and taking on an increasingly instrumental, goal-oriented role in activity. As Vygotsky (1934/1987,

pp. 70–71) described this change, "egocentric speech initially occurs toward the middle of the action and subsequently begins to occur toward the beginning, where it assumes a planning and directing function". Vygotsky regarded this emergence of verbally mediated planning in children's private speech as central to the development of conscious, purposive self-regulation of action.

Contemporary research has produced only limited evidence supporting Vygotsky's (1934/1987, 1978) description of this developmental shift. Kohlberg et al. (1968) found evidence of an ontogenetic decline in the relative amount of private speech in the category "describing own activity" (a category approximately equivalent to Vygotsky's description of speech following or accompanying action) in a cross-sectional study comparing 5-, 6-, 8-, and 9-year-olds. However, no systematic pattern of age differences was evident in the category "self-guiding speech" (approximately equivalent to Vygotsky's description of verbal planning preceding action). Feigenbaum (1992) observed 4-, 6-, and 8-year-old children playing a board game, and found that percentages of speech (both private and social) classified as indicative of planning increased with age across these three groups.

In another study, Azmitia (1992) classified 6- and 8-year-olds as either "experts" or "novices" on a Lego block construction task, based on pre-test performance. During subsequent sessions, experts and novices did not differ in terms of their use of single-step planning statements, but experts made more statements planning longer sequences of steps and more evaluative statements than novices. No cross-sectional differences in terms of planning were evident in this study. Several other cross-sectional studies, using both the Kohlberg et al. (1968) classification system (Rubin, 1979) and other systems (Beaudichon, 1973; Pellegrini, 1981; Rubin & Dyck, 1980), have found no evidence of age differences in terms of planning in children's private speech.

A few studies have incorporated multiple observational sessions with each participant, creating the potential for investigating short-term, microgenetic changes in private speech, rather than—or in addition to—the longer-term ontogenetic patterns investigated using cross-sectional methodology. Such an approach corresponds to what Vygotsky (1978, p. 61) referred to as the "experimental-developmental" method. Multiple-session experiments have been reported by Rubin and Dyck (1980), who found no differences in private speech between two free play sessions, and by Azmitia (1992), who found no changes in terms of planning in private speech across a series of four block-building sessions. (Behrend et al., 1989 also used a two-session design but analysed only quantities, not quality, of private speech.)

The methodology of the present experiment differs in certain respects from that of most previous studies of private speech. One of these concerns the criteria used in classifying private utterances as planning or nonplanning. With a single exception (Pellegrini, 1981, discussed later), the coding systems used in previous research have involved classifying private speech as planning or nonplanning primarily on the basis of semantic content. Although the temporal relation between action and private speech has not been completely ignored, as a coding criterion it has generally played a role secondary to that of semantic characteristics. However, Vygotsky's (1934/1987, 1978) account of the emergence of verbal planning in private speech deals with this problem of the positioning of speech in relation to action, as well as with semantic content.

The widely used Kohlberg et al. (1968) classification system, for instance, may not be particularly well suited for investigating Vygotsky's (1934/1987, 1978) "shift hypothesis", in that it does not categorise all private utterances in a given data set in a manner directly relevant to this specific research question (cf. Diaz, 1992). For example, utterances classified in the "whispering or muttering" and "self-answered questions" categories are thereby excluded from classification based on whether they might serve some planning or self-guiding function. Furthermore, using semantic coding criteria, an utterance that is whispered or muttered obviously cannot be classified with regard to the shift hypothesis, because its semantic content cannot be determined. Although such an utterance may not appear meaningful to an observer, it may nonetheless have considerable meaning, in terms of description or planning of action, to the child producing it. In studies using the Kohlberg et al. (1968) classification system or derivatives of it, then, data may not be fully utilised and Vygotsky's (1934/1987, 1978) hypothesis may, indeed, go essentially untested.

The present study makes use of a coding system that focuses on temporal relations between private speech and action. Somewhat similar classification criteria were used in a study by Pellegrini (1981) comparing the private speech of 3-, 4-, and 5-year-olds. Private utterances in Pellegrini's study were classified as (1) preceding, (2) accompanying, or (3) following action; as has already been mentioned, no cross-sectional differences were evident. The classification system introduced in the present study is based on a distinction between: (1) private speech preceding action, or "planning speech"; and (2) "constituting speech" (borrowing a term from Levina, 1981), or private speech either accompanying or following action.

A second important methodological feature of the present study involves experimental design. Most previous studies which might have been expected to find evidence of the hypothesised emergence of planning in private speech have been strictly cross-sectional (e.g. Beaudichon, 1973; Feigenbaum, 1992; Kohlberg et al., 1968; Pellegrini, 1981; Rubin, 1979). The cross-sectional approach is based on the reasoning that the shift in the temporal relation between private speech and action occurs on an ontogenetic time scale. Although this may be the case, Vygotsky also suggested that changes in private speech can be observed within a much shorter, microgenetic time frame. He reported, for instance, that the speech-action "relation can shift even during an experiment" (Vygotsky, 1978, p. 27), changing as a function of learning and experience.

The present study explores this suggestion. This experiment is an investigation of short-term, microgenetic change in preschoolers' private speech, across a series of three observational sessions (1–10 days between sessions, M = 2.75 days). During each of these sessions participants carried out tasks of two kinds. Short-term changes in private speech were expected across the three sessions, with increasing experience, familiarity, and proficiency with the experimental tasks. During the first session, participants carried out easy and difficult items of each task type. During the second and third sessions, they worked on familiar items (the first-session difficult items, presented repeatedly) and novel items of each task type. The design of this experiment, then, was a  $2 \times 2 \times 3$  (difficulty/novelty × task type × session) repeated-measures factorial.

A number of hypotheses were tested in this study. A main effect of task difficulty on percentage of private speech was predicted: It was expected that participants would use more private speech while working on the firstsession difficult items than on the easy items. The manipulations of task novelty/familiarity during the second and third sessions were expected to produce effects analogous to that of difficulty: More private speech was expected on novel items than on familiar items. A decline in percentage of private speech was predicted across sessions on the repeated items (that is, the first-session difficult and second- and third-session familiar items), as these items became progressively easier with practice; no such pattern was expected on the novel items.

Levina (1981, pp. 281–282) wrote that "through his analysis of egocentric speech under conditions in which the difficulty of the task was increased, Vygotsky noted that its frequency increased just before a child's action"; on this basis, a difficulty/novelty effect in terms of the percentage of private speech preceding action ("planning speech") was predicted. An increase in planning speech was also expected across sessions, as participants gained practice and familiarity with the experimental tasks. No specific hypotheses were advanced regarding differences between the two kinds of experimental tasks (paper-folding and story-sequencing) used in this study.

## METHOD

### Participants

In this experiment were forty 5-year-old children (22 girls and 18 boys), ranging in age from 4 years, 9 months to 6 years, 0 months (mean age, 5 years,

5 months), in attendance at day-care centres, preschools, and kindergartens in Kitchener-Waterloo, Ontario, Canada.

#### Materials

*Tasks*. The tasks used in this study were of two general types: paperfolding tasks (resembling simple origami tasks), and story-sequencing tasks. Eleven items of each task type were employed; three were used as practice items, and eight as experimental items.

The paper-folding tasks were based on examples found in books on crafts for children. Before the experimental sessions, sheets of plain white paper were cut to the appropriate size and shape for making each particular object. Completed models of each item, and sequences of partially completed models, showing the series of folds involved in producing the particular object, were provided for participants to consult. Selection of the two easy paper-folding items as less difficult than the others was based on rankings of difficulty of all eight paper-folding items, made by three adult judges.

The story-sequencing tasks used in this study were adapted from the Picture Arrangement test of the Wechsler Intelligence Scale for Children, Revised (WISC-R: Wechsler, 1974). The easy tasks were items 2 and 3; selection of these story-sequence tasks as less difficult than the others was based on the ordinal arrangement of the items by difficulty on the WISC-R. The first-session difficult and second- and third-session familiar tasks were items 6 and 7. The second-session novel tasks were items 5 and 8, and the third-session novel tasks were items 4 and 9.

Records were kept during all three sessions of participants' task performance on the experimental items. For each paper-folding item, participants were assigned 0, 1, or 2 points according to whether their finished copy bore no resemblance, some resemblance, or close resemblance to the model. For each story-sequencing item, participants were assigned 1 point if they correctly ordered all the cards in the set, and 0 if they did not. Performance on the experimental tasks was summarised across participants in order: (a) to determine whether designation of the easy items for the two task types as less difficult than the other items was borne out by the data; and (b) to obtain documentation supporting the assumption that the items presented repeatedly in all three sessions became progressively easier with practice.

*Counterbalancing.* Four experimental items of each of the two task types were used during each session. These consisted of two pairs of items—an easy pair and a difficult pair during the first session, and familiar and novel pairs during the second and third sessions. The items in each of these pairs were presented contiguously, one after the other. For each session, four different orderings of the eight experimental items were used.

These four sequences were counterbalanced for order of (a) the two task types, (b) the easy and difficult or familiar and novel pairs, and (c) the individual items within the pairs. Participants were randomly assigned to one of the four orderings, independently for each of the three sessions.

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

#### Procedure

The experiment included three 20- to 30-minute sessions with each participant, conducted in a convenient room adjacent to the day-care, preschool, or kindergarten facilities. All sessions were conducted by a male experimenter.

During each session, participants worked collaboratively with the experimenter on four to six practice items (two or three of each task type), and independently on eight experimental items (four of each type). The experimenter and the participant carried out the practice items of one task type together, then the participant worked independently on the experimental items of that type; this was followed by the joint practice items and independent experimental items of the other task type. During the collaborative phases, the experimenter mentioned salient features of the tasks (for instance, the strategies of consulting the models for the paperfolding tasks, and of discerning a story-line for the story-sequencing tasks), but participants were not specifically asked to verbalise.

The screen was situated 20 or 30 feet from the participant's table and chair. While participants worked on the experimental items, the experimenter sat out of sight on a chair behind the screen. Participants were instructed to try to do the experimental items on their own, and to call the experimenter when they finished each item, so he could bring the next item. Participants were permitted to take the paper objects with them at the end of each session.

*First session*. The first session included the 3 assisted practice items of each task type, and 4 independent experimental items of each type (a total of 14 items, during this session). Half the experimental items of each type were easy, and half were more difficult.

Second session. Each participant worked on 2 practice items of each task type with the experimenter, and independently on 4 experimental items of each type (a total of 12 items during the session). For each task type, 2 independent items were familiar to the participant from the first session (when they were presented as the difficult items), and the other 2 were novel.

Third session. During the third session, each participant again worked

with the experimenter's assistance on 2 practice items of each type, and independently on 4 items of each type (a total of 12 items during the session). For each task type, 2 experimental items again were familiar to the participant from the earlier sessions (the first-session difficult items), and the other 2 were novel.

*Classification of Participants' Speech.* All utterances made by participants while working on the experimental items were classified as private or social utterances. If private, they were subdivided according to whether they preceded action, or they accompanied or followed action. Using the videotapes, one observer classified participants' speech while on task during all the experimental sessions. An independent observer made classifications of the utterances in a randomly chosen 5% of the sessions.

An utterance unit was identified by at least one of three criteria. A verbalisation was considered a discrete utterance if: (1) the subject did not speak for at least two seconds before and after a verbalisation (after Furrow, 1984); (2) the verbalisation was not temporally isolated from other verbalisations by at least two seconds, but was distinctly associated with a single relatively discrete act; or (3) the verbalisation was a turn in conversation with the experimenter.

Classification of an utterance as private or social was based on whether the particular utterance was associated with either eye contact or social interaction with the experimenter; if one of these conditions obtained, an utterance was considered social (Furrow, 1984). (Utterances associated with eye contact were infrequent due to the positioning of the experimenter behind the screen, but occasionally participants produced on-task speech before the experimenter was in position, and eye contact occurred.) If the utterance involved neither eye contact nor social interaction, it was classified as private. Intonational characteristics were often useful in determining whether a given utterance was intended as communication with the experimenter; social speech is usually louder and somewhat more clearly articulated than private speech. For classification of participants' utterances as private or social, Cohen's kappa = 0.98 (inter-judge coefficient of agreement = 98.8%).

Categorisation of private utterances as either planning or constituting speech was based on the temporal relation of utterances to relatively discrete task-related actions. Semantic contents of utterances were used only in assigning utterances to a third miscellaneous category of private speech unrelated to the experimental task, and not in classifying utterances as planning or constituting. Private utterances that began prior to the beginning of an identifiable task-related act were classified as planning speech (private speech preceding action), and private utterances that began simultaneously with or following the beginning of an act were classified as constituting speech. Utterances which were clearly not related to the experimental task were assigned to the third miscellaneous category. The denominator for all three ratios (percentages of planning speech, constituting speech, and not task-related) was the total number of private utterances. For classification of private speech as planning, constituting, or not task-related,  $\kappa = .62$  (inter-judge coefficient of agreement = 85.2%). Percentages of constituting speech were almost perfect mirror images of percentages of planning speech; overall, only 1.4% of private utterances were classified in the third miscellaneous category, and percentages in the planning and constituting categories were highly correlated, r(35) = -.995. On this basis, it was considered appropriate to analyse only the percentage of planning speech.

#### RESULTS

Task performance data are summarised in Table 1. A  $2 \times 3$  (difficulty  $\times$ session) analysis of variance was carried out for each task type. For the paper-folding data, there was a significant difficulty × session interaction [F(2,78) = 5.07, P < .01]; a significant effect of difficulty [F(1,39) = 59.11,P < .001]; and a significant effect of session [F(2,78) = 19.27, P < .001]. Newman-Keuls tests ( $\alpha = .01$ ) detected improvement in performance on the repeated paper-folding items from the first session to both the second and third sessions, but not from the second to third sessions. For the storysequencing data, there was a significant interaction [F(2,78) = 13.13], P < .001]; a significant effect of difficulty [F(1,39) = 6.52, P < .05]; and no significant effect of session. No significant improvement was evident across sessions in terms of performance on the repeated story-sequencing items, although the means were ordered in the expected direction (see Table 1). For both tasks, Newman-Keuls tests ( $\alpha = .01$ ) supported the designation of the easy items as less difficult than the others (the first-session difficult items and the second- and third-session novel items).

Percentage of Private Speech. Descriptive statistics for percentage of private speech are summarised in Table 2. Percentage of participants' "private" was analysed classified as using  $2 \times 2 \times 3$ speech а  $(difficulty \times task \times session)$  repeated-measures analysis of variance. (Following Goudena, 1987, a square root transformation was applied to these data; analyses of transformed data revealed the same significant effects as analyses of untransformed data. Descriptive statistics and analyses of untransformed data are therefore reported.)

The three-way analysis of variance indicated a main effect of difficulty [F(1,39) = 69.07, P < .001], and a main effect of task type [F(1,39) = 16.08, P < .001]. Private speech production was greater on difficult/novel items

	Sess	Session 1		Session 2		Session 3	
_	Easy	Difficult	Familiar	Novel	Familiar	Novel	
Paper-folding	72.50	43.13	58.13	30.63	65.00	54.38	
	(21.78)	(21.92)	(22.21)	(27.44)	(19.45)	(24.60)	
Story-sequencing	65.00	31.25	37.50	45.00	42.50	42.50	
	(37.89)	(33.37)	(35.36)	(37.21)	(38.48)	(40.11)	

 TABLE 1

 Mean Percentages Correct for Task Performance, by Task, Session, and Difficulty

Note: Standard deviations are in parentheses.

than on easy/familiar items, and greater on paper-folding tasks than one story-sequencing tasks. There were no other significant effects.

Consistent with our hypothesis, Newman-Keuls tests ( $\alpha = .05$ ) showed significant differences between difficult/novel items and easy/familiar items during every session, on both tasks (see Table 2). Also as hypothesised, Newman-Keuls tests indicated that on paper-folding, the mean for firstsession difficult items was greater than second- or third-session means for familiar items; in other words, a cross-session decline occurred on the repeated items. However, the difference between second- and third-session means on these repeated items was not significant. In the story-sequencing data, the mean for first-session difficult items was significantly greater than second- and third-session means for familiar items; furthermore, the difference between second- and third-session means for familiar storysequencing items approached significance (P < .06). No cross-session differences were evident in comparisons involving novel items for either task (see Table 2).

Mean Percentages of Private Speech, by Task, Session, and Difficulty $(N = 40)$						
	Session 1	Session 2	Session 3	Overall Task Means		
Paper-folding						
Easy/Familiar	M = 16.56	M = 25.26	M = 27.43			
	(26.82)	(27.88)	(30.72)			
				<i>M</i> = 33.99		
Difficult/Novel	42.99	45.26	46.42	(20.75)		
	(35.40)	(33.96)	(32.26)			
Story-sequencing						
Easy/Familiar	16.73	21.63	10.42			
	(26.20)	(29.14)	(19.86)			
				M = 26.33		
Difficult/Novel	34.60	36.72	37.88	(22.12)		
	(35.97)	(34.28)	(34.04)			

TABLE 2

Note: Standard deviations are in parentheses.

Percentage of Planning Speech. Descriptive statistics for percentage of planning speech (private speech preceding action) are presented in Table 3. Percentage of participants' private speech classified as planning speech was analysed using a  $2 \times 2 \times 3$  (difficulty  $\times$  task  $\times$  session) repeated-measures analysis of variance, similar to the analysis of percentage of private speech. Three cases were omitted from the analysis of planning speech because these participants produced no private speech during the experiment; thus, the analysis was carried out using data for the remaining 37 cases. (Analysis of square-root transformed data indicated effects equivalent to those for the untransformed data. Statistics for untransformed data are therefore reported.)

The three-way analysis of variance indicated two significant effects: (1) a task × session interaction; and (2) a main effect of difficulty. For the task × session interaction, F(2,72) = 4.75, P < .05. Simple effects analyses indicated a significant increase in planning speech across sessions for the paper-folding data F(2,72) = 7.70, P < .001, but not for the story-sequencing data. Newman-Keuls tests ( $\alpha = .05$ ) indicated significant differences in the paper-folding data between first- (M = 10.14%, collapsed across difficulty/novelty) and second-session (M = 25.87%) means, first- and third-session (M = 27.69%) means, and second- and third-session means.

For the main effect of difficulty, F(1,36) = 19.38, P < .0001, with higher percentages of private speech preceding action on difficult/novel items, as predicted. Newman-Keuls tests ( $\alpha = .05$ ) indicated significant differences between means for familiar and novel items during the third session for paper-folding items, and during both the second and third sessions for story-sequencing (see Table 3). Though not statistically significant, other

	<b>a</b>		<i>a</i>	Overall
	Session I	Session 2	Session 3	Task Means
Paper-folding				
Easy/Familiar	M = 6.76	M = 26.67	<i>M</i> = 18.51	
	(15.96)	(38.83)	(29.39)	
				M = 21.23
Difficult/Novel	13.51	25.07	36.87	(12.52)
	(17.51)	(27.92)	(26.35)	
Story-sequencing				
Easy/Familiar	16.40	7.28	10.70	
	(32.36)	(20.84)	(26.10)	
				<i>M</i> = 19.95
Difficult/Novel	25.11	25.62	34.61	(15.77)
	(33.54)	(26.10)	(38.32)	

TABLE 3 Mean Percentages of Planning Speech, by Task, Session, and Difficulty (N - 37)

Note: Standard deviations are in parentheses.

within-session differences were also in the predicted direction, with the exception of second-session paper-folding data.

## DISCUSSION

The results of this study provided several new kinds of experimental evidence supporting Vygotsky's (1934/1987, 1978) account of children's private speech. Previous findings of increased private speech production with increased task difficulty were extended, with analyses revealing the expected analogous effects of task novelty/familiarity, in terms of both percentage of private speech, and percentage of private speech preceding action (or "planning speech"). Cross-session microgenetic changes were evident with both these measures: Quantities of private speech declined across sessions when participants worked on the repeated items for both task types, whereas planning speech increased across sessions on the paperfolding items.

The basic relationship between task difficulty and the quantity of children's private speech has been replicated in a number of contemporary studies (Beaudichon, 1973; Behrend et al., 1989; Berk & Garvin, 1984; Kohlberg et al., 1968; Murray, 1979; Roberts, 1979). Data from the first session of the present study provided further affirmation of this basic task difficulty effect, using well-validated manipulations of difficulty, with data for two different kinds of experimental tasks. Some research has suggested that, instead of reflecting a simple and narrowly circumscribed phenomenon, the task difficulty effect is rather complex, and may be part of a broader, more general pattern [e.g. Behrend et al., 1989; Deutsch & Stein, 1972; see also, for instance, Vygotsky's (1934/1987, p. 70) discussion of Claparede's idea of the "law of conscious reflection"]. Thus, the task difficulty effect warrants further exploration. The present study makes a contribution in this direction, by experimentally demonstrating greater quantities of private speech on novel tasks than on familiar tasks, a difference analogous to the effect of task difficulty.

Another way to consider the influence of the novelty or familiarity of these experimental tasks on private speech production is to compare quantities of self-verbalisation across sessions on those items that were carried out repeatedly—that is, the first-session difficult items and the second- and third-session familiar items. As predicted, a pattern of cross-session decline was evident in the amount of private speech while participants worked on the repeated items of each task type. Presumably, as participants became more familiar with the repeated items and these items became somewhat easier for them (as reflected in the task performance data), less problem-solving was required, and therefore less private speech was used. In addition to this task difficulty interpretation, however, it should be pointed out that this pattern of reduction of private speech across sessions could also be interpreted in terms of interiorisation: When children are presented with identical tasks several times, the psychological processes necessary for carrying out these particular tasks gradually become automated, as it were, and may be carried out internally, with less need for overt verbalisation. At any rate, it is clear that on this as well as other points, microgenetic methodology intended to assess short-term change holds considerable potential for research on private speech.

As noted, the predicted task novelty effect was evident for the planning speech measure as well as for the basic quantity of private speech. This effect was evident during both the second and third sessions for the storysequencing data, and during the third session for paper-folding. This finding corroborates Vygotsky's observations of increased self-verbalisation preceding action, as task difficulty increases (Levina, 1981). It appears that by the later sessions of this study, participants had developed verbal planning strategies for the tasks, strategies which they tended to generate more readily when faced with the novel, more challenging items, compared with the easier familiar items. This finding again underscores the value of a multiple-session research design for studying private speech, because a difference that emerges clearly only after practice and familiarisation with the experimental tasks is unlikely to be observed in a single-session study.

This study found evidence of the emergence of verbal planning in children's self-verbalisations (see also Feigenbaum, 1992). The percentage of planning speech increased across sessions in this study when participants worked on paper-folding items, supporting Vygotsky's (1934/1987, 1978) claims about a change from verbalisation accompanying or following action to verbalisation preceding action.

Two methodological features of the study facilitated this finding. One is the microgenetic component of the experimental design, which oriented the investigation toward observation of short-term changes occurring as participants became increasingly familiar with the experimental tasks. Perhaps changes of the kind described by Vygotsky (1934/1987, 1978) are more readily observed within a short-term, microgenetic time frame than across an ontogenetic time frame, as examined using cross-sectional methodology. Cross-sectional differences in patterns of short-term change might prove a more productive kind of question for future research on children's private speech than cross-sectional differences in planning or self-guiding speech *per se*.

Second, the finding of increased planning speech was also facilitated by the nature of the classification system used in this study. With this system, private utterances were coded according to their position or location relative to action, with minimal inferences concerning their semantic characteristics. Such an approach allows classification, in a manner relevant to Vygotsky's (1934/1987, 1978) "shift hypothesis", of utterances that cannot be understood because they are whispered or muttered. Whispered utterances which cannot be classified using semantic criteria may none the less be richly meaningful to children producing them, and should not be excluded from the hypothesis test. A classification method that does not rely on semantic content brings more of the available data to bear on the research question. This approach also avoids certain problems associated with dividing the data into multiple categories. Problems of this kind are possible, for instance, with the Kohlberg et al. (1968) system, in which the relevant "self-guiding" and "describing" classifications are only two among a total of six categories, the remainder of which have no relation to this particular research question. This research supports the view that private speech classification systems should be specifically designed to investigate the hypotheses tested in particular studies (cf. Diaz, 1992).

A number of findings of this study demonstrate the value for research on children's private speech of microgenetic experimentation, based on incorporation of multiple sessions in the experimental design and on an orientation toward observing short-term change. For instance, the observed effect of task difficulty/novelty on children's planning speech, which was not clear until the later sessions, would not have occurred in a single-session experiment. The microgenetic pattern of short-term decline in percentage of private speech when participants worked on the repeated items during the second and third sessions would not have been accessible to observation without a study oriented toward analysis of short-term change. Similarly, a microgenetic approach was also necessary for observation of the pattern of cross-session increase in planning speech on the paper-folding items. These last two findings, in particular, demonstrate the value of a microgenetic approach for private speech research, showing that it is possible to elicit systematic, theoretically consistent short-term changes in preschoolers' private speech experimentally, in a study implementing an appropriate multiple-session, repeated-measures design.

A further point related to the incorporation of multiple sessions in this study is that only 3 of the 40 children in this sample did not produce any private speech during the experiment. Over the course of the three sessions, 92.5% of the participants used at least some private speech, a proportion comparing very favourably with the rather problematic rates of 50–60% that are typical of single-session laboratory studies (see Berk, 1992; Diaz, 1992; Frauenglass & Diaz, 1985; Fuson, 1979). During each of the three sessions separately, on the other hand, proportions of participants using private speech were considerably lower (72.5%, 80.0%, and 75.0%, in the first, second, and third sessions), and perhaps not especially atypical for laboratory research. By observing each child during several experimental sessions, then, it was possible to record some private speech production by

almost every child in this sample of 5-year-olds, even in a rather contrived setting.

The finding in this study that private speech production was greater on paper-folding tasks than on story-sequencing tasks suggests that what might be termed "the task effect" is, like the difficulty effect, also a complex phenomenon. Frauenglass and Diaz (1985) observed preschoolers working on perceptual tasks (jigsaw puzzles and blocks) and semantic tasks (picture classification and picture sequencing); private speech production was greater on semantic tasks than on perceptual tasks, presumably because the semantic tasks invoked cognitive processes more closely related to speech than those involved in carrying out the perceptual tasks. Applying this line of reasoning to the present study, a seemingly obvious prediction would specify greater quantities of private speech while children worked on the storysequencing tasks than on the paper-folding tasks. Instead, the opposite pattern was observed: participants used more private speech on paperfolding than on story-sequencing.

It seems likely this somewhat incongruous task difference is related to rather subtle motivational differences between the two kinds of tasks. Most participants in this experiment were very enthusiastic about the paperfolding tasks. They were permitted to take their paper objects with them at the end of each session, and several children mentioned having given them to family members or teachers. These extraneous characteristics of the paper-folding tasks led to an enhancement of interest and motivation not possible with the story-sequencing items used in this study. It is thus likely that although it does suggest complex subtleties in the relationship between private speech production and experimental task type, this study does not provide a valid test of an hypothesis based on findings reported by Frauenglass and Diaz (1985). Motivational differences of this kind may also account for the occurrence of a cross-session increase in the percentage of private speech preceding action on the paper-folding tasks but not on the story-sequencing tasks, in that tasks of the former type were more engaging for participants than those of the latter type, and tended to elicit more verbal planning. Obviously, further research using a similar paradigm is needed to relations between properties of experimental tasks, clarify and characteristics of children's private speech.

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