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## Introduction from the Editorial Group

One of the central problems addressed by this Newsletter is to formulate methodological principles for research on the relationship between the individual and the social group as constitutive of human thought processes. In contrast with many of our colleagues, we assume that human thought is neither a purely individual process, nor entirely determined by the environment, but rather an emergent property of human interaction mediated by culture. The difficulty in bringing this abstract assumption into the research arena is that our descriptions of behavior ineluctably create boundaries between "inside" and "outside" which are always problematic. In different ways, each of the articles in this issue of the Newsletter struggle with this problem.

Middleton and Edwards take us back to the 1920's to re-examine the classic work of Frederick Bartlett, a pioneer thinker about the social nature of individual thought. Although Bartlett identified himself as a psychologist, he worked closely with scholars in anthropology, neurology, and other fields which currently identify themselves with the academic enterprise called cognitive science. He carried out some of the earliest cross-cultural research on cognition and was one of the first to attempt to specify the differences between the way that cognitive processes are organized (and observed) in standard laboratory tasks and the way they are organized in everyday settings.

Particularly influential in recent years has been the rediscovery of Bartlett's use of the concept of schema. Middleton and Edwards' offer a very different interpretation of Bartlett's concept of schema than that offered by contemporary cognitive scientists. In place of an abstract mental structure "inside the head," they argue that he believed schemas to be abstract structures describing *inter*-personal structures that regulate socially embedded behavior. This interpretation of the schema concept motivates their insistence on discourse events as the proper unit of analysis for the study of human thought processes.

The articles by Diaz and by McLane and Wertsch each focus on particular kinds of discourse that appear particularly relevant to understanding the role of social context in cognitive development.

Diaz addresses unresolved and difficult issues in conducting empirical studies on the developing relationship between thinking and speech. He points to inconsistencies in the results of studies assessing the phenomenon of egocentric speech and

proposes a number of concrete areas that need to be approached with more sophisticated research methods.

McLane and Wertsch begin the job of differentiating the process of teaching/learning according to the characteristics of the "more competent others" who act as instructors in "zones of proximal development." It is clear that children enter the task with very different presuppositions than adults. The role of the presuppositions remains an important problem for research.

Emphasis on the need to look very closely at the social context of learning and development is characteristic of the remaining contributions, although the particular research objects and levels of social analysis vary greatly. At the broadest level, Fuller reviews an important book on the social organization of literacy which brings together many research traditions of longstanding interest to Newsletter readers. Heap and Cameron are both concerned with the newest "literacy," that kind mediated by computers. Heap expands on a previous *Newsletter* contribution, suggesting ways in which micro-sociological research strategies can be combined with psychological experimentation. Cameron raises the important issue of access to this new literacy by disenfranchised parts of our society.

All of these articles return us to Middleton and Edwards' suggestion that discourse events offer a promising basis for analyses of cognition as socially constructed and culturally mediated.

Finally, some notes of gratitude at a time of transition for the Newsletter: Jacquelyn Mitchell of the University of California at Davis has been serving as an Editor of the Newsletter up until this issue. We are grateful for the help and friendship she has offered over the years; we are especially grateful for her tolerance as we have tried to discover how to work effectively with a long-distance editor. Luis Moll will be the next long-distance editor, giving us a chance to expect even more tolerance from someone who will have experienced both sides of the distance. Moll is leaving San Diego to join the faculty at the University of Arizona. While we share his excitement at this new opportunity and wish him well, we will miss his on-the-spot help and good humor a great deal. To facilitate international participation in the production of the *Newsletter*, we will expand our editorial board to include colleagues from abroad; details will be announced in the next issue. As usual, we encourage submissions to the *Newsletter* either through regular or electronic mail.

# Conversation with Bartlett

Derek Edwards

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Modern references to Bartlett's (1932) book, *Remembering*, tend to be acknowledgements made for the historical record, rather than efforts to derive substantial theoretical insights or empirical data. Indeed, readers of the contemporary literature would be forgiven for assuming that there existed two books under the same title: one on cognitive aspects of individual recall, and another on social factors influencing recall. On the one hand cognitive psychology claims the work as a pioneering version of schema theory in which certain reconstructive properties of human information processing were worked out in advance of the modern computer-modelled analogies (frames, scripts, story grammars, etc.; e.g. Anderson, 1985; Mayer, 1983). On the other hand, social psychologists, sociologists and anthropologists have emphasized the social dimension in the work. In the social psychological context it is viewed as an early seminal study of the group and individual processes that underpin rumor (Allport & Postman, 1947; Douglas, 1980) and which facilitate the transmission of symbols and concepts represented in folk traditions and mythologies.

These two traditions have, ironically, reconstructed Bartlett in their own image. The one commonality which unites them is the notion of schematic reconstruction. This is indeed a theme which permeates Bartlett's work, but it is only one of several. Three other, equally significant themes will be outlined here which together tend towards an integration of the two traditions, all of which have much to say in relation to certain modern issues in the study of human mentality. These three themes are the unity of mentality, the process of conventionalization, and the importance of conversational discourse.

**The unity of mentality.** It was essential to Bartlett's empirical and theoretical work that the subject of study was the activity of remembering rather than the faculty of memory. He conceived of remembering as a functional, affect-driven activity in which any distinction between

the processes of perception, imagination, affect, understanding, and motivation was essentially arbitrary. Feeling and affect were key features in the schematic grasp of reality which lay at the root of all psychological activity. Bartlett was concerned not simply with how our memories work, but with understanding the nature of conscious and self-conscious human activity in real social contexts. Through the study of remembering he hoped to reveal the essential unity of mentality and its functional adaptiveness to everyday existence.

**Conventionalization.** The second major continuity in Bartlett's book is his pervasive concern with what he termed "conventionalization." Indeed, as he reveals in a later work (Bartlett, 1958, chapter 8), "conventionalization" was originally intended to be the title of the book eventually published as *Remembering*. It is the name that Bartlett gives to the process by which cultural symbols and communicated materials in general take on their recognized properties. It is a process at once central to both individual schematic remembering, and to the role of culture and communication in human knowledge and understanding. The method of serial reproduction, famous as a paradigm for the study of memory, was essentially designed to capture the process of conventionalization. Remembering was for Bartlett not simply the recalling of experience, but rather, a fundamentally symbolic process both rooted in and constitutive of culture, forming and formed by symbols and meanings transmitted in texts and pictures.

**Conversational discourse.** Finally, we will argue that there is a hidden thread in Bartlett's book, that of conversational discourse. Despite his use of various formal procedures such as the methods of "description," of "repeated" and "serial reproduction," Bartlett's work is replete with reported speech, quotations from discourse with his subjects, of what they said to him and he to them. Conversational discourse with his subjects was a major basis of Bartlett's insights, though he did not examine the discourse directly, but rather took it as evidence for his subjects' underlying thought processes.

These three neglected themes are basic to the discussion which follows. However, rather than simply taking each in turn and re-examining

Bartlett's book, these themes are drawn upon to define a set of important issues for the modern psychology of remembering. These are:

- (1) The role of "feeling" and "attitude" in remembering. This is essential to the issue of the unity of mentality.
- (2) The nature of cross-modal "symbolic remembering," where what is to be remembered was experienced in a different form from that in which it is recalled (e.g., a narrative account of witnessed events, or a written account of spoken conversation). Particularly important is the relation between experience and language, and the importance of conventional symbols in everyday human mentality.
- (3) Remembering as a function of conversational discourse, where remembering occurs in the context of communicative purposes that often override simple notions of reproductive accuracy, and where the social dimension of symbolic remembering is most accessible to examination.

### Feeling and Attitude

Within modern cognitive psychology acknowledgements to Bartlett (1932) frequently cite the studies of serial reproduction of stories and pictures, together with the theory of organized mental schemata (e.g., Anderson, 1985; Mayer, 1983; Weisberg, 1980). The modern laboratory-based study of the role of cognitive schemata, mental models, plausible inferences, etc. in the recall of prose passages owes a great deal to the legacy of Bartlett's work. He discovered that people tend to "rationalize" what they recall, imposing conventional meaning and order. But in Bartlett's own account, this rationalization was "only partially—it might be said only lazily—an intellectual process ... the end state is primarily affective, (1932, p. 85). Indeed, the affective basis of remembering was well established in pre-war experimental psychology and psychopathology (Freud, 1960; Rappaport, 1961), and in the "New Look" psychology of the 1950s (e.g., Bruner, 1957). Its relative neglect until recently (Bower, Monteiro, & Gilligan, 1978; Forgas, 1981) has owed much to experimental psychology's preoccupations with cognitive information processing. The affective and contextual aspects of schemata

are emphasized here because their cognitive character is already familiar in the literature. Furthermore, an emphasis on these other aspects of schemata clearly highlights the necessity to approach mental functioning as a unitary process.

Bartlett himself was critical of the notion of mental "schemata," a term he borrowed from Head's (1920) work on the neural representation of motor skills. He disliked Head's notion of the cortex as "the storehouse of past impressions" (Bartlett, 1932, p. 200), and preferred instead the notion of schemata as "organized settings." For Bartlett, schemata were not static knowledge structures stored in the brains or minds of individuals for the interpretation of experience, but rather, functional properties of adaptation between persons and their physical and social environments. Their essential properties therefore were social, affective and purposive, the basis of actions and reactions in the contexts of living one's life. It is ironic that Bartlett's use of Head's term "schema" has been assimilated into a cognitive psychology, which, while acknowledging Bartlett's use of the term, distorts its meaning in a manner that Bartlett's work has made familiar.

Amongst the terms used by Bartlett, "schema" is a little misleading to modern psychologists who are familiar with the uses of the term by theorists of cognitive development (Piaget in particular), and of adult cognition (e.g., Rumelhart, 1975). More indicative of Bartlett's psychology was his more frequent use of the terms "attitude," "feeling" and "organized setting," all of which he evidently preferred to "schema." *Attitude* in particular conveyed the notion of mental processes in which cognition, affect and purpose were indistinguishable, where a person's general psychological stance towards things was what mattered. Zangwill (1972) notes that "Bartlett's use of the term *attitude* owes much to Betz's term *Einstellung*, which broadly signifies mental posture or set" (p. 126). Materials made sense to people in terms of their functional significance and the reactions they evoked. The term *feeling* had been explored in an earlier paper (Bartlett, 1925), and similarly included both affect and judgement, as it does in colloquial English ("How do you feel about the arms race?"). *Organized setting*, as we have pointed out, evokes the notions of context and relationship; mental processes are functional in relation to a person's activities and purposes.

These notions of attitude, feeling and organized setting, despite their different meanings, are all terms which Bartlett used in an effort to capture the essential integration of individual mentality and culture, of cognition, affect, and cultural symbols. They combine to undermine any neat division of mental processes. It is seldom acknowledged that the studies of serial reproduction occupy only 2 of the 19 chapters of Bartlett's book *Remembering*. The earlier parts of the book are concerned largely with perception, imagination and description. It was clear to Bartlett that the same underlying psychological principles were at work throughout -- "in order to understand what we remember, we must set in relation to this how and what we perceive" (Bartlett, 1932, p. 15). Memory, perception and imagination were bound together in the same everyday processes of mentality. It is only the experimental psychologist who, in the service of controlled empirical study, has needed to separate them temporarily. The closest that modern theorists come to capturing this essential cognitive unity is in Neisser's (1976) notion of the "perceptual cycle," and in Schank's (1982) fusion of perception and memory. However, these modes are still basically cognitive rather than "attitudinal," while approaches that do stress the importance of affect (e.g., Bower, et al., 1978; D'Andrade, 1981; Forgas, 1981; Zajonc, 1980) are typically restricted to mood and emotion, often in the pursuit of connections with brain function. Indeed, Forgas (1981), whose work emphasizes the importance of affect in memory, cites Bartlett as an early schema theorist with no reference to what he had to say on the role of affect in remembering.

The importance of "attitude" (involving a fusion of personal and social significance, affect and cognition) was evident in a study of conversational joint recall (Edwards & Middleton, in press). Participants in a group discussion were required to recall together as much as they could of a feature film that they had each recently seen (Steven Spielberg's *E. T.*). Personal evaluations and emotional reactions were the basis of many particular recollections. Moreover, a marked transition was noted when, after completing the required narrative reconstruction, the discussants relaxed into a free exchange of non-sequential recollections--favorite scenes and moments from the film, particularly poignant events, and such.

The preferred basis of recall was evidently one of affective and evaluative significance (e.g., "I cried most when...;" "Tell you what got me, the bit when..."), rather than systematic reproduction, and it was also obvious that the sharing, comparing, agreeing and disagreeing of these feelings with those of other people was the important business. The participants were at pains to establish their own rememberings and evaluations in relation to those of other people in the group. The importance of affect in the context of remembering is not simply a matter of the involvement of emotional states and moods. It is that affect is a prime marker of significance, of why things matter to people, of what makes them memorable or worth talking about (cf. Schank, et al., 1982).

The sort of remembering that Bartlett studied was one dictated by affect, attitude and social context. But the issue remains, are these things essential aspects of remembering per se, or else merely influences on remembering, interferences that experimental studies of memory do well to remove? Several psychologists, in the pursuit of some notion of pure memory traces, have argued that much of Bartlettian schematic remembering is not really "memory" at all (see, for example, Gauld & Stephenson, 1967; Zangwill, 1972). The alternative stated here is that the social, functional and discursive bases of remembering are inherent properties of human mentality. The pursuit of metaphor to do with storage and retrieval, and of the neural basis of these isolated individual processes, is founded on a fragmentary and decontextualized view of human mentality which is largely responsible for the poor match that we find between the findings and theories of experimental psychology and the practices of everyday life (cf. Cole, Hood, & McDermott, 1978; Neisser, 1976; Rogoff & Lave, 1984). One of the major keys to the relationship between individual mentality and social context is, of course, language. The study of remembering must unavoidably deal with the relationship between language and thought. Furthermore, a study of everyday discourse (to be distinguished from the familiar use of semantic systems as models of memory structure) offers a natural bridge between the individual and the social, one indeed in which the functional and affective significance of things finds direct expression.

## Cross-Modal Remembering: Thought and Language

The terms "mode" and "cross-modal" are used here to refer not to the sense organs but to the forms of symbolization or representation in which any material is experienced and later remembered. In this sense, most modern studies of memory and remembering, including Bartlett's reproduction studies, are methodologically single-modal. Input is in the same mode as output--stories recounted as stories, sentences recognized as sentences, pictures recognized as such or reproduced as drawings. There is an excellent methodological reason for this; it affords a direct comparison between input and output, and therefore concrete evidence of any intervening mental operations. In addition, a great many studies of memory involve memory for verbal materials. The nature of language permeates our understanding of memory, both long-term and short-term. Indeed, "semantic memory" is a term used to denote general knowledge structures (Tulving, 1972). However, it can be argued that much of everyday remembering is cross-modal, and even that it is the essential function of language to be cross-modal. This has important implications for the study of remembering.

To substantiate the cross-modal nature of much of everyday remembering it is necessary to distinguish two sorts of remembering, which may be called *sensory* and *symbolic*. These are distinguished by modality and the involvement of language rather than by duration. Typologies of memory are usually based either on stage or depth of information processing (Atkinson & Shiffrin, 1968; Craik & Lockhart, 1972), or else distinguish "actual memories" (Schank, 1982) from general knowledge structures (cf. Tulving, 1972). The aim here is not to offer a competing theory of the nature of individual memory, but simply a useful distinction in terms of which to discuss the role of language in remembering. The distinction between sensory and symbolic remembering has more affinity with Bruner's (1964) notion of "modes of representation" than with current conceptions of memory.

*Sensory remembering* is the sort where past experiences are recalled or recognized in a form based directly on that in which they were experienced. It includes the sort of conscious remembering involved in Schank's (1982) "reminders," and

also, at a more basic level, the essential continuity between past and present experience embodied in Niesser's (1976) "perceptual cycle." It is inherently single-modal. *Symbolic remembering* involves putting things into words, into conventional and communicable symbols. This includes such matters as long-term memory for text, and recounting eye-witnessed events. It is inherently cross-modal, and is closely bound up with the conventions which link thought and symbol.

Bartlett's studies of remembering were concerned with symbolic remembering. However, his major concern was not strictly with memory or remembering at all, but with the process of "conventionalization." By studying a certain sort of remembering, Bartlett hoped to shed light on a major issue that had engaged his attention since his early experiences amongst the Swazi of East Africa (Bartlett, 1923, 1932), and continued to do so throughout his life (Bartlett, 1958). This was the process of cultural symbolic formation--of how cultural forms and meanings originate and are shaped through transmission, and of how they shape and are shaped by human mentality. The method of serial reproduction was adopted as a means of examining at the social-psychological level the cultural process of conventionalization of symbolic materials. The various transformations of these materials (rationalizations, reductions, omissions, etc.) were microcosms of general symbol formation in the wider culture. It is not surprising in this context that Bartlett could not reconcile his notion of remembering with the prevailing notion of experiential memory traces. The important point to realize here, though, is that his pervading interest in conventionalization imposed certain constraints on Bartlett's methods and materials, constraints which become serious distortions when his studies are taken to be studies simply of memory or remembering. These distortions arise from two features of his methods which were dictated by the issue of conventionalization: the use of serial individual reproductions, and the use of a single-modal methodology.

Bartlett's concern with conventionalization led naturally to the study of how textual and pictorial materials are reproduced from memory, and this has in turn influenced a great many subsequent studies of memory for textual materials. However, if we ignore conventionalization for a moment and consider the essential nature of text, of discourse generally and of relations between

experiencing and remembering, it is immediately clear that the serial reproduction studies are unlike much of everyday remembering. This observation rests on two points. First, it is the very nature and function of written text that it provides a permanent record which can be repeatedly consulted and copied verbatim (Olson, 1977). Reliance on memory is more naturally involved in oral discourse. Second, it is the essence of oral language that it is a two-way means of communication through which knowledge and experience can be conceptualized and exchanged between people. It is clearly not the essence of discourse that people engage in one-way chains of messages in which the task is to convey someone else's text from memory accurately. People generally recall and recount things that interest them and that they assume might interest the people they talk to, and people talk back, react, interpret, prompt, remind each other of things, misunderstand, disagree, and so on. These everyday conversational events are the stuff of symbolic remembering.

Symbolic remembering is all about relations between thought and language. It is a commonplace of cognitive psychology that long-term memory involves "re-coding," that memory for nonlinguistic materials may undergo language-determined transformations (Carmichael, Hogan & Walter, 1932), and conversely that memory for text involves nonlinguistic processes, plausible inferences, mental models and the like (Bransford, 1979; Johnson-Laird, 1984). When the experimental task is to recall or recognize textual materials, these processes appear as interesting discoveries about our mentality--our memories are inferential, not literal as might be expected. But only a simple associationist or a mental faculty theorist would expect such a thing. What is happening in these studies is that psychologists are forcing naturally cross-modal materials into a single-modal methodology, invariably finding that cross-modal material effects leak through the experimental design; subjects image words, label perceptions, make inferences and evoke models of reality to interpret the text. People unavoidably deal with language cross-modally; that is, arguably, language's principal function.

It is a legacy of S-R associationism that memory is still defined, despite whatever complexities, as retention. It is the measurable discrepancy between input and output. By impli-

cation, without a measure of input there is no measure of memory. Furthermore, input and output have to be in the same modality for discrepancies to be measurable. It is unfortunate that Bartlett's forgotten concern with conventionalization served to reinforce the adoption of this input-output methodology as the one to adopt for studying memory in general. Indeed, the method has become the theory. What has been lost is an understanding of the essential nature of everyday remembering (cf. Neisser, 1982). We have to find ways of studying cross-modal remembering; the search takes us back to Bartlett.

Bartlett's (1932) experimental studies of remembering did not actually begin with reproductions, but with descriptions. In chapter 4 of *Remembering* he presents the findings of some "preliminary" studies in which people were asked to recall, via verbal description, a set of five drawings of military men's heads, with appropriate hats identifying rank, depicted on picture postcards of the era (the First World War). These studies are of particular interest because they represent a cross-modal methodology which Bartlett later abandoned in favor of repeated and serial reproduction. The findings anticipated many of those of the later studies. The faces were recalled and described largely in terms of "affective attitudes" influenced by "conventional notions about soldiers of a given rank. These were the more effective because a great war was in progress; but complications of exactly the same kind noticeably affect our reactions to faces and to facial expressions at all times" (ibid, p. 53). Bartlett goes on to note a variety of reconstructive descriptions based on conventional and attitudinal schemata.

Despite the fruitfulness of the method of description, Bartlett eventually abandoned it in pursuit of other processes of conventionalization, in favor of the methods of repeated and serial reproduction. But if we are interested more generally in the nature of everyday symbolic remembering, the method of description has two great advantages. It affords a study of cross-modal remembering, and it puts the relationship between language and experience at the heart of the study, where on the present argument it belongs. The necessary abandonment of the ability to monitor closely input-output discrepancies is a considerable price, but there are some compensations. Bartlett himself managed to derive from

the method essentially the same general principles that are usually attributed to his later studies using serial reproduction. Indeed, as with Bartlett's pictures and with other cultural products such as feature films, there is considerable scope for close examination of "input." Moreover, we avoid the tendency for the input-output method to dictate theory, making it possible to pursue an understanding of everyday remembering without reducing it to an ultimately neural model of information processing. Furthermore, our understanding of the nature and functions of oral discourse and written text (e.g. Brown & Yule, 1983; Chafe, 1980; Freedle, 1979; Tannen, 1982), together with the availability of audio and video recording equipment, render possible today the study of things which were virtually impossible for Bartlett. It is now a feasible enterprise to study the mnemonic potential of everyday discourse.

### Discursive Remembering and Metacognition

As soon as we begin to examine how people remember things in the context of everyday activities and conversations, the importance of input-output matching quickly diminishes. The psychologist's concern with precise measures of input-output discrepancies does not reflect what, in many cases, people are trying to achieve in recalling or recounting things. Objectivity would often be a more appropriate criterion than accuracy, but there are plenty of other criteria. Remembering often serves functions which place a low premium on accuracy, as for example in recounting an interesting tale. Discursive remembering is subject to social and discursive norms such as the avoidance of being boring, the pursuit of humor and entertainment, and the more basic conversational rules which include strictures against including too much detail, however accurate, for the listener's needs (Grice, 1975). Bartlett was well aware of the nature of everyday remembering:

The actions and reproductions of everyday life come largely by the way, and are incidental to our main preoccupations. We discuss with other people what we have seen, in order that we may value or criticize, or compare our impressions with theirs. There is ordinarily no directed and laborious effort to secure accuracy. We mingle interpretation with description, inter-

polate things not originally present, transform without effort and without knowledge (Bartlett, 1932, p. 96).

It is clear from this statement that Bartlett's conception of everyday remembering was one that frequently involved conversational discourse and social comparison. In everyday life, "literal recall is extraordinarily unimportant" (*ibid.*, p. 204). Indeed, everyday remembering is, on Bartlett's account, something rather different from the chained reproductions through which he sought to capture the processes of conventionalization.

### Bartlett's Conversations

Although Bartlett undertook no formal study of conversational remembering, it is a remarkable fact, already noted, that the book *Remembering* is full of examples of it. Throughout the book, Bartlett quotes what his subjects said to him, and uses this reported speech as evidence of the schematic psychological processes at work in perception and remembering. Obviously, reported speech was the formal basis of the "Method of Description" discussed in section 3. But Bartlett also draws on comments that people made *about* the pictures, and about their own perceptions, images and memories. For example, he reports what his subjects said about the clarity of particular remembered visual images of faces:

The colonel, because of his moustache.  
The colonel is the clearest because of his marked facial characteristics.  
...The captain, because I prefer the naval type (Bartlett, 1932, p. 56).

It is this sort of task-oriented dialogue with his subjects about their mental processes, rather than simply the formal data, that was the major basis of Bartlett's insights and arguments. It was in the course of this metacognitive dialogue that his subjects offered to Bartlett direct evidence of the sorts of reflective, schematic and attitudinal mental processes that could only be inferred indirectly from the serial reproduction data. "Because I prefer the naval type" is a direct expression of the role of interest and attitude in visual memory. These uses of "because" are notably similar to those discussed in Edwards & Middleton (*in press*); in conversational remembering, people routinely offer metacognitive justifications and arguments for the comparative validity of their mental



processes. It is clear that Bartlett's subjects were not simply reporting their mental processes, but doing so in the context of a dialogue with Bartlett in which they were answering questions, explicating and explaining things to an investigative psychologist.

Most of Bartlett's theorizing about the role of schemata, of affect, attitude and conventionalization, was worked out long before he used the method of serial reproduction. Some of his earliest studies (reported in *Remembering*, Chapter 2) concerned the imaginative imagery evoked in people by inkblots, before Rorschach (1921) devised his well known psychodynamic use of them. Bartlett's subjects used their imaginations on request--i.e., in dialogue with Bartlett:

The instructions were: 'Here are a number of ink-blots. They represent nothing in particular, but might recall almost anything. See what you can make of them, as you sometimes find shapes for clouds, or see faces in a fire' (Bartlett, 1932, p. 34).

Bartlett presents an analysis of his subjects' responses, of the variety of imagery, and the importance of affect and personal interest. But again, important insights and even his theoretical constructs were derived not merely from the data proper, but from dialogue *about* the task:

The subjects themselves ... frequently called attention to this fact. 'You ought to be able to tell a lot about a man's interests and character from this sort of thing,' several of them said (ibid., p. 38).

This subject said he had distinct visual imagery throughout, but never of himself. He came to his scenes through having what he called the 'feel' of an experience. That is to say, a predominantly affective attitude was set up ... (ibid, p. 41).

Ask the observer to characterize this general impression psychologically, and the word that is always cropping up is 'attitude' (ibid., p. 206).

This use of experimenter-subject dialogue continued throughout the studies of remembering. Bartlett quotes a subject who attempted to recall the story "The War of the Ghosts" after a period of 6 1/2 years: "Was it on a pilgrimage that they met a hostile party and one brother was slain?" (ibid., p. 77). Bartlett notes:

The story as he constructed it is full of rationalizations and explanations, and most of the running comments of the subject concerned the interconnexion of the various events and were directed to making the whole narration as coherent as possible (ibid., p. 78).

It is arguable that, in spite of Bartlett's use of formal experimental procedures involving comparisons of input data with recalled output, the more important basis of data and theory was in fact his dialogues with his subjects. Indeed, Bartlett also describes how he derived much theoretical and methodological insight from discourse with his colleagues (as, of course, we all do). In *Thinking* (1958), he provides an account of how the notion of using repeated stimuli was formulated in conversation with Ward, the concept of schemata in conversation with Henry Head, and of how the notion of serial reproduction was suggested to him by Norbert Wiener.

### Discourse and Metacognition

One of the central issues that Bartlett raised was that of self consciousness, what might now be termed "metacognition." This was purportedly the key to any organism's ability to transcend the temporal order of events:

...to go to that portion of the organized setting of past responses which is most relevant to the needs of the moment ... An organism has somehow to acquire the capacity to turn around upon its own 'schemata' and to construct them afresh. This is a crucial step in organic development. It is where consciousness comes in; it is what gives consciousness its most prominent function. I wish I knew exactly how this is done (ibid., p. 206).

This apparently rather ineffable process of becoming aware of one's own schemata, couched by Bartlett in terms of individual "organisms" and their development, could well have a basis in discourse itself. Despite his heavy use of discourse in the construction of his ideas about mentality, Bartlett appears to have looked through rather than at discourse. His subjects were formulating and communicating conceptions of their own mentality in conversation, as Bartlett himself was doing. For Bartlett, introspection was simply a device for revealing things about mentality, and language was a means of expressing them. The possibility arises, however, that introspection and metacognitive discourse are in fact interesting self-cognitive processes in their own right, and amenable to study via an analysis of discourse itself. The importance of language in the transcendence of the serial chain of behavior has been well established since Bartlett's time (e.g., Bruner, 1964; Lashley, 1951), though the importance of conversational discourse in this process remains to be worked out. It is important not simply that language offers displaced reference, but that people avail themselves of this device and communicate, compare and argue their various perspectives with each other. This is indeed the social basis of what we have called "symbolic remembering," the use of language to construct joint understandings which are accessible and communicable via a common code (i.e., conventional symbols, grammatical rules and rules of interpretation). The role of language in memory derives from this more basic role of language in the establishment of commonality and differences of perspectives through discourse (cf. Freyd, 1983).

In his book *Remembering*, Bartlett made heavy use of conversational discourse without studying it directly, or explicitly considering its importance. By the time he wrote *Thinking* (1958), he had become aware of its importance as a fundamental process, which he termed "everyday thinking:"

Everyday thinking can also be termed 'immediate communication thinking.' It can find expression in speech, or in some kind of miming, or it can be written (Bartlett, 1958, p. 164).

Though still not looking directly at language itself, Bartlett clearly had come to the opinion that an understanding of everyday cognition and its social basis would have to be rooted in everyday conversation. This is a point of considerable contemporary significance; the royal road to an understanding of ordinary mentality is surely via the study of everyday discourse.

### Varieties of Discourse

Discourse has been discussed here largely as if it were a unitary phenomenon. Of course, it is no such thing. In symbolic remembering, the nature and content of what is remembered will be heavily determined by the sort of discourse through which it is done. In many respects, the current understanding of the workings of memory is a function of the very limited communicative contexts in which psychologists have asked subjects to perform for them. These have been invariably, as they were for Bartlett, efforts in which subjects were asked to be as accurate, as literal or as complete as possible, for no purpose other than cooperation with the investigator's requirements. In ordinary life, people remember things for their own reasons, and seldom is accurate or complete recall either necessary or even the principal object of the exercise. Outside of the experimental laboratory, people remember things incidentally and by accident (Salaman, 1970; Schank, 1982), and also deliberately for a variety of purposes such as telling funny stories, persuading people of a point of view, arguing for or against a given version of events, where a concern for accuracy may even be hindrance.

Bartlett's subjects' story reproductions had an important characteristic which Bartlett did not discuss. They were constrained by a literary style which is the more obvious the further we are from the time, place and cultural milieu in which the studies were done (Cambridge University in the 1920's). Even within such a closely constrained paradigm as a psychological experiment on story recall, variations are found of a sort which are essentially textual rather than, in the simple sense, mnemonic. Modern replications of Bartlett's procedures, frequently a part of undergraduate practical work, regularly produce reproductions with a literary quality which contrasts markedly with those reported in *Remembering*. Evidence that reworkings of reproduced material may have at least as much to do with the conventions of text

as with the nature of "memory," if indeed these can be separated, can be found in Bartlett's study. Here is a brief section of the story "The War of the Ghosts," followed by the second of several serial reproductions reported by Bartlett (1932, pp. 65 and 121).

### **The Original**

One of the young men said: "I have no arrows."

"Arrows are in the canoe," they said.

"I will not go along. I might be killed. My relatives do not know where I have gone. But you," he said, turning to the other, "may go with them."

So one of the young men went, but the other returned home.

### **Reproduction 2**

"No," they replied, "we cannot fight, for we have no arrows."

"There are arrows in the canoe, so come and tarry not."

"Nay," replied one of the Indians, "I shall not come, for if I am killed, my people who have need of me, will be sore grieved."

Then, turning to his companion, he went on: "You go. You have no friends, and if aught befall you will not be missed."

"Aye, go I will," answered his friend, and bidding him adieu, he joined the men in the canoe; and the other went back home.

The reproduced version has clearly acquired certain embellishments of the sort that post-Bartlett cognitive psychology has highlighted: inferential links that aid narrative coherence, such as that the Indian who accompanied the others actually got into the canoe, and said goodbye to his companion. But much of the transformation is essentially literary, with the stylistic conventions of English folk song and tale (bidding adieu, trying not, being sore grieved, saying "Nay," etc.). This subject is obviously not simply remembering a story, but re-writing it. The role of discourse form in remembering is social psychological; it is a

cultural form of mentality. Its importance in individual acts of remembering derives from the fact that individual mentality is socialized by language. Its importance is compounded as soon as one person's remembering becomes another person's experience; joint versions of events are negotiated in discourse, and are subject therefore to the dictates of whatever sort of discourse it is.

### **Conclusions**

The very familiarity of Bartlett's theory and methods is probably responsible, ironically, for the scant attention generally paid to the original work. But this modern familiarity is a distorted one, based largely on the theory of schemata and the method of serial reproduction, and the assimilation of these into post-Neisser (1967) cognitive psychology. In re-examining some of the original work an attempt has been made to highlight important aspects of it which merit more detailed attention by modern psychology (the importance of affect, "attitude" and the cultural basis of symbols) and also some aspects of it which have misled subsequent work (the substitution of conventionalization for everyday remembering, and the hidden importance of conversational discourse). The intention in emphasizing the importance of discourse in remembering is to argue that discourse provides the most natural basis for studying social cognition in general. The study of discourse in the functional contexts of everyday life offers the bridge between the individual and the social that Bartlett sought throughout his work, and attempted to capture through the conventionalization of successively remembered symbolic materials. It is unfortunate that the major tradition of psychological investigation that cites his work has turned its attention to processes that go on inside the individual, where the method of comparing input with output has become reified as a model of mentality itself--of information processing.

Bartlett was truly concerned with social-cognitive issues. He was concerned not with the ways in which social factors affect individual cognition (e.g., Stephenson, et al., 1983), where two heads are seen to be more effective than one, but rather with the inherently social basis of mentality itself. It made no sense to Bartlett to isolate the components of mentality as consisting in the Platonic divisions of cognition, affect and conation. Mentality was driven by the criteria of functional

adaptiveness to the social conditions and contexts of everyday existence. The full force of Bartlett's critique of the theory of mental faculties has been lost in a tradition which, while citing him as an antecedent, takes as its subject matter individual mentality, defines for investigation a cognitive component, and proceeds to divide this methodologically invented entity into its component stages, levels and processes. It is not Bartlett's legacy that cognitive social psychology (e.g., Eiser, 1980) and the study of individual memory (e.g., Baddeley, 1976) have become so widely separated.

A distinction has been drawn between "sensory" and "symbolic" remembering, defined qualitatively in terms of either a single-modal or a cross-modal relationship between experience and remembering. In symbolic remembering, experience is coded and transformed for communication. Two main points have been emphasized about symbolic remembering: First, its basis not merely in the thought-language relationship, but in discourse, in relations between people; and second, its functionality. Discursive remembering is functional in two ways. It is part of the essential human activity of constructing shared mentality, and it is functional also at the level of the pragmatics of conversational content--people talk about what is significant and interesting to them, and have to make calculations regarding what is interesting and significant to others. Memory is coded for communication and significance, rather than for accurate representations of experience. It is not so much that people are not very good at remembering, as that they are very good at making the past serve the present: "To be mistaken about details is not the result of a bad memory, but of the normal functioning of human memory" (Loftus & Ketcham, 1983). The argument presented here is that we need to seek the basis of symbolic remembering in terms of functions in everyday discourse before looking for its explanation in individual mentality and biology.

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Once call the brain an intellectual stomach and one's ingenious conception of the classics and geometry as ploughs and harrows seems to settle nothing. But then it is open to someone else to follow great authorities and call the mind a sheet of white paper or a mirror, in which case one's knowledge of the digestive process becomes quite irrelevant. It was doubtless an ingenious idea to call the camel the ship of the desert, but it would hardly lead one far in training that useful beast.

George Eliot

# The Union of Thought and Language in Childrens' Private Speech

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One of the most detailed and fascinating accounts of the relation between thought and language development has been given to us by Lev Semenovich Vygotsky. According to Vygotsky (1962), human infants, as well as many other species, are endowed with two distinct and functionally separate systems of communication (language) and practical intelligence (thought). At one point in human development, unlike in other species, the two systems of language and thought interact and merge to form a new and qualitatively distinct type of cognition, that is, the development of our species-specific verbal thinking. The first evidence of this unique interaction between thought and language is preschool children's frequent use of speech to guide and direct their activities. The use of such speech, usually termed private speech, transforms the child's system of practical intelligence.

In Vygotsky's view, private speech develops or "branches off" from social speech. That is, at some point in development, children begin to use language not only for communication but also as a tool to pace, organize and direct their activities. It is the same language of social interaction that the children bring to their problem-solving activities. At first, children talk to others and to themselves almost interchangeably. Later, private speech becomes less bound to the conventions of human communication and more personalized. Vygotsky observed that private speech is emitted first as an afterthought following a given action. With increasing age, the timing of private speech changes, first accompanying and later preceding the children's actions. By preceding children's actions, private speech gradually develops the orienting, planning and guiding functions characteristic of human verbal thought.

In sum, Vygotsky saw private speech as the transition point between vocal and inner language, the moment in development when language and thought unite to constitute verbal thinking. He proposed that private speech diminished and disappeared with age not because it becomes

socialized (as Piaget, 1926, had previously suggested) but rather because it "goes underground" to constitute inner speech or verbal thought.

## Empirical Support

The 1962 translation and publication of Vygotsky's *Thought and Language* inspired many researchers in the fields of cognitive and language development. Vygotsky had offered a substantial theory of development but only anecdotal or marginally empirical data to support his contentions. For example, Vygotsky argued that children's spontaneous speech has the power to change the course of their actions. But in support to his argument, only the anecdotal description of one child's behavior was given. A child in Vygotsky's laboratory was drawing a car and his pencil broke in the middle of the drawing session. The child uttered: "It broke!" and getting another pencil proceeded to draw a broken car. For Vygotsky, this observation provided a convincing argument that speech, beyond communication and interpersonal functions, had some effects on a person's actions.

Needless to say, Vygotsky's conceptually rich developmental theory and its lack of systematic supportive observations proved to be fertile ground for American and European researchers. In addition, Vygotsky's challenge to the increasingly prevalent Piagetian views invited many developmentalists to the empirical task. As a result, by 1979 (see a detailed review of the empirical literature in Fuson, 1979) more than twenty empirical studies of children's spontaneous private speech had been published. The results of these studies can be organized and presented as supporting the following hypotheses or predictions derived from Vygotsky's theory:

- (1) The amount of spontaneous private speech produced by children shows a curvilinear relationship to age, increasing steadily between the ages of three and five, and gradually decreasing until it disappears about the age of seven or eight (Berner, 1971; Dickie, 1973). At early stages, the use of spontaneous private speech is significantly correlated with mental age (Deutsch & Stein, 1972), while small negative correlations are found for children aged five to eight (Dickie, 1973).

- (2) Prior to its eventual disappearance, private speech is replaced by some kind of whispers or "inaudible mutterings," supporting Vygotsky's contention that private speech goes underground to constitute inner speech rather than just being transformed into social or more communicable speech.
- (3) Private speech does not occur at random, rather, it clusters meaningfully around problem-solving activities. For example, preschoolers' private speech increases with tasks of increasing difficulty (Beaudichon, 1973; Kohlberg, Yeager & Hjertholm, 1968). More specifically, the amount of self-regulatory private speech increases after failed or nearly failed tasks (Deutsch & Stein, 1972; Goodman, 1981). The findings suggest that young children use private speech in order to cope more efficiently with the increasing cognitive demands of their problem-solving activities.
- (4) The use of private speech is related to actual success in problem solving. Klein (1964) found that good young problem solvers tend to use more private speech than children who failed to complete the experimental tasks. More recently, in a study of preschoolers' spontaneous private speech, Goodman (1981) found that puzzle solutions accompanied by a higher rate of verbalization were judged as more proficient and were completed in a shorter period of time. These findings indicate that private speech is indeed an effective tool for more successful cognitive functioning.
- (5) The self-regulatory functions of private speech extend beyond cognitive problem-solving (Zivin, 1979). The quantity and quality of private speech appears to be a central variable in differentiating reflective from impulsive children. Reflective children rely more often on the semantic aspects of their verbalizations in order to control their motor behavior. By the same token, studies of hyperactive and impulsive children and aggressive boys show a high frequency of immature and irrelevant private speech (Camp, 1977; Copeland, 1979). Training hyperactive and impulsive children to talk to themselves has proved effective as a means

of developing self-control (Meichenbaum & Goodman, 1971, 1979; Pelkes, Stewart & Kahana, 1968).

## Two Empirical Challenges

It is clear from the above mentioned findings that Vygotsky's theory has received substantial support in the empirical literature. The pattern of findings, however, is not entirely consistent with Vygotsky's theorizing. In fact, Vygotsky's theory has been seriously challenged on two different fronts. First of all, with very few exceptions, empirical studies have not revealed a positive effect of children's spontaneous speech on task performance. Second, the frequency of private speech utterances produced by children is typically so low, that it is difficult to ascertain their relevance to their cognitive development. Let us now discuss and document these challenges to Vygotsky's theory in greater detail.

Many studies have failed to show a functional relationship between private speech and success in problem-solving activities. In fact, only in the two studies mentioned in #4 above (Klein, 1964; Goodman, 1981) have some positive relations between private speech and children's task performance been found. Other studies that have reported correlations or effects of speech on cognitive and/or social behaviors are mostly studies where the investigators taught children some given verbalizations rather than studies that measured spontaneous private speech.

Correlations between task success and amount of private speech produced during the tasks are generally small and nonsignificant (Beaudichon, 1973; Dickie, 1973). In some cases, the findings seem to contradict Vygotsky's intuitions. For example, Zivin (1972) reported that four-year-olds who did not talk while doing finger mazes were faster and more accurate than children who produced some kind of private speech. Zivin also reported that about 75% of the utterances were "task irrelevant or inarticulate, reflecting an emotional reaction to errors rather than self-regulating speech" (as cited in Fuson, 1979, p. 142). Even in studies where some association between private speech and problem-solving style has been found, task relevant verbalizations do not invariably lead to more successful task performance (Goodman, 1981).

The second, and by far the most serious, criticism to Vygotsky's theory stems from the fact that the majority of studies in the field report occurrences of private speech for only half of the children in their samples (see Fuson, 1979). Furthermore, those children who actually talk while working on the tasks emit so few utterances that the possible relevance of such speech to the problem-solving process is seriously questioned. Needless to say, these findings question the validity of Vygotsky's theory of private speech as a universal stage of development where language and thought unite.

### Addressing the Challenges

#### The low frequency of private speech.

I propose that the observed scarcity of spontaneous private speech is most likely an artifact of the typical paradigm used in current research. Most studies have used nonverbal tasks such as puzzles, finger mazes or block designs that could be easily solved by children without the use of language, using visual-spatial strategies. Also, many studies have not given instructions allowing or permitting children to talk aloud. Most likely, young children associate the experimental situation with classroom or formal preschool activities where they usually must remain silent. Such paradigms, using perceptual tasks with no instructions or permission to talk aloud might (not surprisingly) minimize and underestimate children's use of language in problem-solving activities.

In order to investigate this possibility, we conducted a study with 32 preschoolers where the type of task and instructions were systematically manipulated (this study is reported in greater detail in Frauenglass & Diaz, in press). Specifically, we hypothesized that semantic tasks (such as classification and story-sequencing) and instructions to talk aloud would maximize the production of children's private speech, while the least production of private speech would occur during perceptual tasks where no instructions to talk aloud are given. Figure 1a displays a visual representation of this hypothesis while Figure 1b shows its empirical verification.

It is clear from Figure 1b that both types of task and instructions to talk aloud have a substantial effect on children's production of private speech utterances. From these data it can be concluded that the experimental situation most frequently used in private speech research (percep-

tual tasks with no instructions to talk aloud) indeed minimizes children's production of private speech utterances.

**Private speech-performance correlations.** I believe that the lack of a positive correlation between task success and amount of private speech does not necessarily contradict Vygotsky's theoretical assertions. Two empirical facts must be considered to clarify this statement. First, the amount of private speech invariably increases with tasks of increasing difficulty. Second, children are more likely to fail in more difficult tasks. If both the production of private speech and likelihood of failure are functions of task difficulty, private speech will more often co-occur with failed tasks than with successful performance. The negative correlations between private speech and performance are the product of the familiar "third variable confound" to which correlational analyses are vulnerable. In the present case the third variable is task difficulty. Figure 2 portrays a visual representation of the confound. Table 1 shows the expected confounded results where lower performance scores are found in those children who emit most private speech. These data were obtained from the same 32 preschoolers mentioned above (see Frauenglass & Diaz, in press).

Such similar confounded negative correlations have been reported by researchers studying the relationship between child-directed speech or "Motherese" and measures of children's cognitive and language development. A typical finding is that mothers' simplification of language while teaching a given task to her child is negatively correlated with the child's performance. As Bates, Bretherton, Beeghley-Smith & McNew (1982) clearly state, it would be absurd to see mothers' helpful attempts as causing children's poor performance. The most plausible explanation is that mothers' attempts at helping their children increase when children have greater difficulties with the tasks.

What should be clear from the above discussion is that the observed negative correlation between private speech and performance does not contradict the assertion that such speech might be a tool used by children to deal with the increasing difficulty of a task and, therefore, improve their likelihood of success. The transformation of preverbal problem-solving skills into verbal thinking with the use of private speech that Vygotsky pos-



|              |                 | TYPE OF TASK |            |
|--------------|-----------------|--------------|------------|
|              |                 | Semantic     | Perceptual |
| INSTRUCTIONS | To talk aloud   | ++           |            |
|              | No instructions |              | --         |

**Figure 1a. Hypothesized effects of type of task and instructions to talk aloud on the production of private speech.**

|              |                 | TYPE OF TASK     |                  |
|--------------|-----------------|------------------|------------------|
|              |                 | Semantic         | Perceptual       |
| INSTRUCTIONS | To talk aloud   | 40.5<br>(24.47)  | 28.63<br>(25.13) |
|              | No instructions | 31.44<br>(36.59) | 25.31<br>(26.24) |

**Figure 1b. Means (and standard deviations) of private speech utterances by type of task by instructions conditions.**

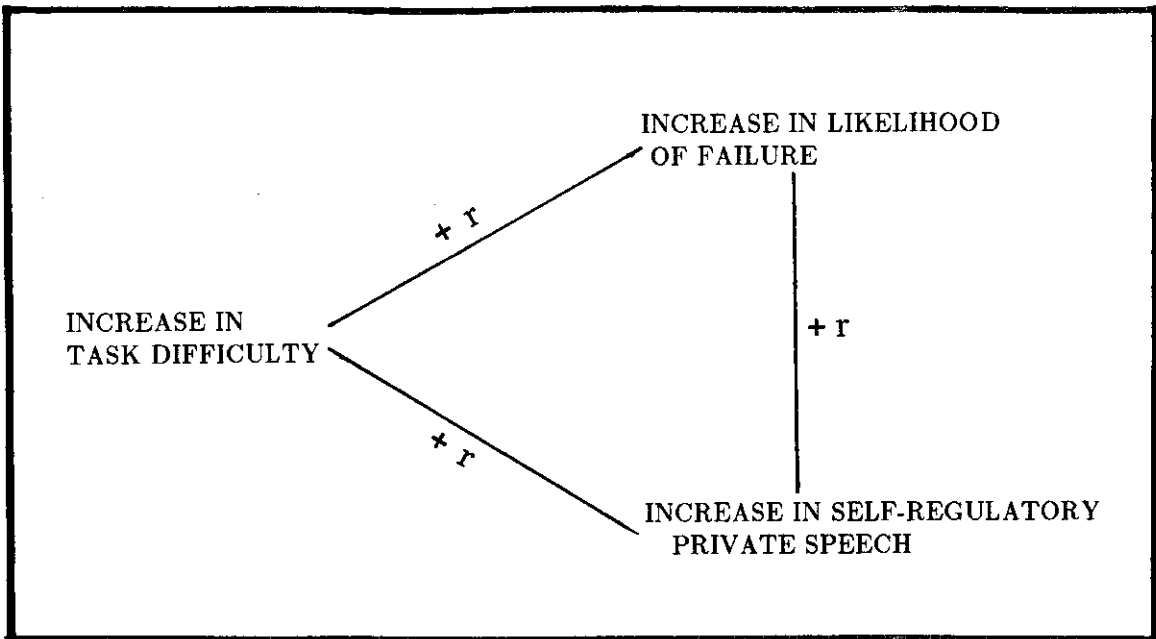


Figure 2. Third Variable Confound in the Correlation between Private Speech and Failure.

**Table 1**

**Amount of Private Speech Emitted**

|                          | Low Talk Group                  | High Talk Group                |
|--------------------------|---------------------------------|--------------------------------|
| Puzzles                  | 23.19<br>(6.65)                 | 22.60<br>(5.82)                |
| Block Designs            | 37.75<br>(15.48)                | 32.47<br>(7.90)                |
| Classification           | 18.44<br>(8.53)                 | 15.73<br>(8.84)                |
| Story-Sequencing         | 24.69<br>(7.43)                 | 18.60<br>(7.25)                |
| <b>Total Performance</b> | <b>104.06</b><br><b>(33.14)</b> | <b>89.40</b><br><b>(23.57)</b> |

Note: Means (and standard deviations) of task performance scores for children with low and high production of private speech, showing the typical relation between high production of private speech and low performance.

tulated is probably a gradual and slow process. The effects of using private speech on cognitive development, therefore, might not be evident at the time that such speech is being used.

Even though the bulk of the available empirical evidence gives support to a Vygotskian conceptualization of cognitive development, the two challenges mentioned above have discouraged empirical efforts in the area. The number of published empirical studies on children's spontaneous private speech has seriously declined in the 1980's as compared to the late 1960's and 1970's. In what follows I would like to outline two questions derived from Vygotsky's theory that need further empirical work and clarification. In addition, I will mention current efforts by myself and my students aimed at answering these important questions. It is my hope that the following exposition will rekindle the seemingly lost enthusiasm for empirical work on children's private speech.

### **I. How does the use of private speech transform a child's problem-solving skills?**

The question is crucial but possible answers, unfortunately, are practically nonexistent. In our laboratory, the first attempt to answer this question has been to identify the different functions that children's private speech seems to perform in a task situation. Studying the speech protocols of close to one hundred preschoolers, we have found the following self-regulatory functions.

**1. Labeling and describing.** Children frequently use verbal labels to describe and identify different elements of a given task. In doing so, they strengthen with verbal encodings their mental representations of the task. For example, a child might look at a block design and say "A red one," while changing his or her gaze from the model to the box where the blocks are located. Such utterances help children remember what they are looking for; the utterance becomes a true aid for memory.

**2. Focusing attention.** Through private speech children keep their attention focused on the task. Different verbal strategies are used in order to maintain a certain level of engagement and involvement in the task. One interesting example is the use of questions and answers to solve the problem or complete the task: "Where does this go?...it goes here." The dialogue form, a quite familiar mode of interacting with the world, is

brought to the task through private speech in a self-regulatory fashion.

**3. Regulation of motor activity.** Children use language to pace, guide and direct motor activity. Frequently children alter the duration, volume and pitch of utterances controlling the pace and shape of movements with the speed and contour of their utterances. For example, a child said "Ooooooover heeree" while sliding a card to a corner of the table; the utterance began, continued and stopped simultaneously with the hand-sliding movement.

**4. Facilitating transitions.** Perhaps the most difficult task for a young child working alone is finishing one item and going to the next without adult assistance. Private speech is an important tool to facilitate such transitions between items or steps. Children often emit transitional statements such as "done!...ok, let's see now", marking the end of one item and the beginning of the next one.

**5. Ending uncertainty while facilitating perseverance.** Children often use private speech to end uncertainty and persevere. For example, in a classifying task, a child might be uncertain where a given card might go. The child is paralyzed with uncertainty and moves the card back and forth between the two possible piles. The utterance "this is food and this goes out" might end the uncertainty, helping the child assert a given course of action.

**6. Abstraction of distinctive features.** Objects have integrated properties of color, size, shape, etc. Children often use language to bring out the relevant feature of a given object for completing a task. That is, children use language to abstract the distinctive properties and features of objects, breaking the perceptual gestalt in response to task demands. For example, a child might say "This big one" referring to a big, red, smooth triangle, if the task really demands a big piece regardless of color, shape or texture.

**7. Praise and self-reinforcement.** Children often praise and reinforce themselves and their work with utterances like "Oh, this is easy" or "I can do more than that," creating a climate of encouragement and reassurance that facilitates task performance.

**8. Whispers.** Children often emit whispers or inaudible utterances while performing a given task. Such whispered utterances have provided

strong evidence (see Frauenglass & Diaz, in press) for Vygotsky's suggestion that private speech gradually becomes subvocal to constitute inner speech or verbal thinking.

**9. Play and relaxation.** Lastly, but not least important, children use language for play and relaxation. Children play with words or even sing familiar tunes and jingles while working on different tasks. Such use of language has been found to facilitate task performance. For example, Tinsley (1982) found that children instructed to talk out loud about "things you like to do" spent more time than a control group of children on a monotonous, boring task.

The above functions of children's private speech should be more appropriately considered as hypotheses to be confirmed by further research. Even though we have observed these functions, we have not systematically explored the relation between those kinds of utterances and independent measures of performance. For example, we have not examined the correlations between the number of statements coded under the "Facilitating Transitions" and an independent (i.e. non-speech) measure of children's ability to move from one item to the next. Once again, as mentioned above, we are convinced that speech-performance correlations are confounded by task difficulty and will yield no valuable information on how private speech transforms children's problem-solving abilities. At present we are investigating how private speech during a given task might affect the performance on a similar task given at a later point in time. That is, we have moved to investigate speech-improvement correlations rather than speech-performance correlations. Unfortunately it is now too early to assess the fruitfulness of such an approach.

Our second question follows naturally from the identification of the private speech functions outlined above:

## **II. How do these Verbal Self-Regulatory Functions Develop?**

Guided by both Vygotsky's and Luria's formulations, we have searched for the origins of private speech functions in the immediate social interactions between children and their caregivers. We have hypothesized that the observed functions in children's private speech represent an internalization of maternal verbal teaching stra-

tegies. Furthermore, if self-regulation indeed emerges by children's internalization of maternal verbal behavior, then some structural similarities should exist between children's private speech and their mothers' verbal teaching behaviors. Such similarities, however, have never been documented in the empirical literature.

In order to begin testing this internalization hypothesis, we conducted the following pilot study: Four mother-child dyads were videotaped while building a three-dimensional puzzle. The task involved constructing a three-dimensional farm over a two-dimensional representation containing drawings of all the elements in the farm. Mothers were instructed to teach their children so that they could subsequently do the task by themselves. Mothers' speech during the teaching sessions was transcribed and studied in a way similar to the analysis of preschoolers' private speech. We were able to categorize approximately 70% of mothers' speech with the same categories used for children's private speech, suggesting the validity of the internalization hypothesis. A large scale longitudinal study is now being conducted to expand the pilot study findings.

## **Summary and Conclusions**

Vygotsky has given us a rich and detailed theory of how language and thought relate and interact in development. The theory fills several gaps in Piagetian theory, allowing for an analysis of the effects of cultural, social and linguistic factors on children's cognitive development. Overall, the empirical work done in the 1960's and 1970's has supported Vygotsky's formulations. Nonetheless, some empirical findings and inconsistencies in the literature have challenged the validity of the theory.

The present paper discussed and addressed such challenges to Vygotsky's theory. The challenges and inconsistencies can be resolved when artifacts in the experimental conditions are closely reviewed. However, the challenges have produced a general disillusion and decline in the empirical study of private speech in the 1980's. This paper is written in part to overcome such disillusion and to direct investigators' attention to several important questions that remain to be examined empirically.

Further research is needed to answer three important questions: 1) How does the use of private speech affect the development of problem-solving skills? 2). How do the self-regulatory functions of children's speech originate and develop? and 3) What personality and/or cognitive variables explain the individual differences observed in the use of private speech? The present paper outlined several efforts to answer questions 1 and 2. Question 3 is posed by the consistent findings regarding within-subject variability in the production of spontaneous private speech.

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Tom had never found any difficulty in discerning a pointer from a setter, when once he had been told the distinction, and his perceptive powers were not at all deficient. I fancy they were quite as strong as those of the Rev. Mr. Stelling, for Tom could predict with accuracy what number of horses were cantering behind him, he could throw a stone right into the centre of a given ripple, he could guess to a fraction how many lengths of his stick it would take to reach across a playground, and could draw almost perfect squares on his slate without any measurement. But Mr. Stelling took no note of these things; he only observed that Tom's faculties failed him before the abstractions hideously symbolized to him in the pages of the *Eton Grammar* and that he was in a state bordering on idiocy with regard to the demonstration that two given triangles must be equal, though he could discern with great promptitude and certainty the fact that they were equal. Whence Mr. Stelling concluded that Tom's brain being peculiarly impervious to etymology and demonstrations was peculiarly in need of being ploughed and harrowed by these patent implements; it was his favourite metaphor, that the classics and geometry constituted that culture of the mind which prepared it for the reception of any subsequent crop.

George Eliot

# Child-Child and Adult-Child Interaction: A Vygotskian Study of Dyadic Problem Systems

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A major theme that runs throughout the writings of Vygotsky (1962, 1978, 1981) is that the origins of uniquely human, higher mental functions are to be found in social interaction. A concrete instantiation of this general claim can be found in his notion of the "zone of proximal development" (*zona blizhaishego razvitiya*). Vygotsky defined this zone as:

...the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving with adult guidance or in collaboration with more capable peers. (1978, p. 86)

Vygotsky used this notion in his analysis and critique of psychological testing that focusses exclusively on past accomplishments (i.e., the level of actual development) and fails to assess the potential for future growth through social interaction. Thus he was concerned with assessing how children can enter into instructional social interaction at different levels. He also utilized the zone of proximal development in his analysis of instructional processes involved at the level of potential development. Here he was concerned with identifying modes of instructional social interaction that are maximally effective in fostering growth of individual psychological processes.

Vygotsky's notion of the zone of proximal development has motivated several theoretical and empirical studies (e.g. Brown and Ferrara, 1985, Cole, 1985; McLane, 1981; McNamee, 1979, 1980; Wertsch, 1978, 1979; Wertsch, McNamee, McLane, & Budwig, 1980). In general, these studies have focused on ways in which the level of potential development is created in social interaction.

In order to deal with this problem, we need to specify the various ways in which collaborative problem solving takes place. This has recently been the object of a growing body of research literature on adult-child interaction (e.g., Ninio & Bruner, 1978; Wood, Bruner, & Ross, 1976; Wood, Wood, & Middleton, 1978; Wertsch, 1978, 1979; Wertsch, McNamee, McLane, and Budwig, 1980). Such research has been aimed at understanding how adults, especially mothers, organize what Vygotsky (1981) termed "interpsychological" functioning at the level of potential development in such a way that children receive assistance when necessary, but are simultaneously encouraged to take on increasing responsibility for the strategic steps in a task setting. Several studies (e.g., Ninio & Bruner, 1978; Wertsch et. al., 1980) have documented increasing transfer of strategic responsibility from the interpsychological to the intrapsychological plane of functioning with age, and other studies (Wood, et.al, 1978) have identified various interactional styles that encourage or fail to encourage this transfer of responsibility at a particular age level. In an attempt to extend our understanding of interpsychological functioning, we conducted a study of the "more capable peers" mentioned by Vygotsky (1978, p. 86) in his formulation of the zone of proximal development.

## Method

### Subjects

Eight child-child dyads and six mother-child dyads participated in this study. (The mother-child dyads were part of a larger investigation of mother-child interaction, see Wertsch et al., 1980) All the subjects were from intact, middle-class, English-speaking families, and all children were attending a Montessori preschool in a suburb of Chicago. Each child-child dyad consisted of a 5 1/2-year-old and a 3 1/2-year-old of the same sex. Each mother-child dyad consisted of a mother and her 3 1/2-year-old child. Three of these 3 1/2-year-olds were female and three were male.

### Task Materials

The materials in this study consisted of two identical puzzles depicting a truck--the model and the copy. The pieces for the truck puzzle fell into two categories. The first category consisted of the "non-cargo" pieces--i.e. the truck body, windows, headlight, wheels, and background. Each of the non-cargo pieces could fit into only one place in

the puzzle. There were no extra non-cargo pieces. Thus, the non-cargo part of the puzzle was self-correcting; there was no need to consult the model in order to insert these pieces. The second category of pieces consisted of the six, differently colored squares that made up the "cargo" section of the puzzle. These pieces were all the same size and shape, and each could fit into any part of the cargo area. Thus it was necessary to look at the model in order to place these pieces correctly. The copy puzzle was identical to the model, but was presented to each dyad with extra cargo pieces. The extra pieces consisted of a duplicate of each piece to be used in the copy puzzle plus two pieces with colors that did not match those in the copy (or the model) puzzle.

### Procedures

The observations took place in an empty classroom in the Montessori school which the children attended. The first author and two female research assistants served as experimenters throughout the observation sessions. These sessions lasted an average of 15 minutes for each dyad, and all dyadic interactions were audiotaped and videotaped in their entirety.

### Child-Child Dyads

Before beginning an interaction session with the 3 1/2-year-old, each 5 1/2-year-old was asked to do the truck puzzle by himself or herself. All eight of them completed this task correctly and without assistance. After completing the truck puzzle, the 5 1/2-year-olds were asked to help the 3 1/2-year-old put the copy puzzle together so it looked "just like the model puzzle." They were asked to help whenever they thought the 3 1/2-year-old needed help. The model puzzle was placed in front of the 5 1/2-year-old and the completed copy puzzle in front of the 3 1/2-year-old.

The dyad was told that the experimenter would take the copy puzzle apart and that their task was to complete it so that it once again looked exactly like the model puzzle. They were warned to be especially careful about the cargo pieces, and they were told that there were extra pieces that did not need to be used. Finally, the 5 1/2-year-old was told to help the 3 1/2-year-old whenever the 5 1/2-year-old thought help was needed.

When the dyad had completed the task, the experimenter removed the completed copy puzzle, and replaced it with another, identical truck puzzle, in which all but the cargo pieces were glued in place. She told the dyad that this time they would only have to replace the cargo pieces in the copy and then left the children to finish the task.

### Mother-Child Dyads

Procedures were essentially the same as those used with the child-child dyads. Mothers, however, were not shown the materials before they were presented to the mother and child together, and all instructions for the task were addressed to the mother in the child's presence. The instructions for the truck puzzle were somewhat less explicit and redundant than those given to the child-child dyads, but otherwise equivalent.

### Coding

The entire truck puzzle task and the second "cargo only" task were coded for all dyads. All utterances by the experimenter, the 3 1/2-year-old, and the 5 1/2-year-old or the mother were transcribed. Coded information from the videotapes was added to the written transcripts so that various nonverbal behaviors could be represented as they occurred in relation to the participants' speech.

The behaviors coded for all participants (3 1/2-year-olds and 5 1/2-year-olds or mothers) included pointing gestures and handling puzzle pieces. In addition, the 3 1/2-year-olds' eye gaze behavior was coded.

**Pointing.** Behavior was coded to indicate when the point started and ended. The location or object to which the point was directed was also coded. Included were points to the model, the copy, the pieces pile or to a piece in either of the participants' hands.

**Handling of Pieces.** Handling of pieces was coded to indicate sorting (in the pieces pile), picking up, dropping, taking (or giving), and placing in the copy puzzle. Piece placements in the copy puzzle were coded as correct or incorrect.

**Looking.** The 3 1/2-year-olds' looking behavior was coded to indicate whether he/she was looking at the model, the copy, the pile of puzzle pieces; at a piece in either his/her hand or in the 5 1/2-year-old's or mother's hand; or at

the tutor (the 5 1/2-year-old or at the mother). Looks elsewhere--i.e., towards the camera, or at other objects in the room were coded as "off task." Looks by 5 1/2-year-olds and mothers were coded. All coding was carried out by the first author and a research assistant.<sup>1</sup>

### Episodes

After the above behaviors were coded, the task interactions concerned with the cargo section of the truck puzzle were divided into episodes. An episode was defined as a segment of interaction centered around the correct placement of a cargo piece in the copy puzzle; it includes the participants' speech and actions concerned with identifying the cargo piece to be used, selecting and picking up the piece from the pieces pile, and placing the piece in the copy puzzle. As the cargo section contained six pieces, and as each dyad was asked to complete the cargo section twice, each dyad could complete a maximum of 12 episodes. Each child-child dyad did complete 12 episodes, and five of the six mother-child dyads completed 12 episodes. (One mother-child dyad completed only nine episodes.) Episode boundaries were coded by the first author and a research assistant from written transcripts and videotapes. In cases of disagreement, decisions were made by the first author. Episode boundaries were determined by working backwards from the end of an episode to its beginning. Episodes ended with the completion of participants' speech and/or actions concerning the final correct placement of a cargo piece, and began with participants' speech and/or action concerning the selection of the piece. A third coder, working independently, scored episode boundaries for two child-child and two mother-child transcripts. The scoring of episode boundaries agreed within three words or one look (by the 3 1/2-year-old) 83% of the time.

### Analysis

Our system of analyzing these data is built around the strategic steps involved in the task. In order for a dyad to complete an episode of the truck puzzle successfully, the following task steps had to be carried out:

- (1) Consult the model puzzle. Since any cargo could fit into any part of the cargo area, and since each dyad was provided with extra pieces (some of which were not

included in the model puzzle), it was necessary to consult the model to determine which piece to pick up and where to place it.

- (2) Pick up the appropriate piece from the pieces pile.

- (3) Put the piece in the appropriate place in the copy puzzle.

A dyad could distribute the responsibility for these strategic steps in various ways. One participant might carry out all three steps alone, or the two participants might divide them up in various ways. For example, one participant could consult the model while the other participant picked up and placed pieces. In this case the member of the dyad who consulted the model could direct the piece pick-ups and placements made by the other member.

The strategic step of consulting the model was the most difficult aspect of this task for young children to grasp, and it was the last step children mastered. In their study of 2-1/2-year-olds, 3 1/2-year-olds and 4 1/2-year-olds working in this same task with their mothers, Wertsch et. al (1980) found that the older the child, the more often he or she consulted the model independently, and the more he or she independently used the model as the basis of piece selection and placement.

Each of the three strategic task steps outlined above was subjected to three levels of analysis (following Arns, 1981; and see Wertsch, Minick, and Arns, 1984). The first level of analysis for each strategic step consisted of identifying who physically carried out the task behavior under consideration-- i.e., whether the behavior was carried out by the 3 1/2-year-old tutee or by the tutor (the 5 1/2-year-old or the mother). The second level of analysis focused on those instances where the strategic step was physically carried out by the 3 1/2-year-old and determined whether the behavior was other-regulated or self-regulated. The third level focused on those instances where the tutee's strategic action was other-regulated and determined whether the other-regulation was "direct" or "indirect".



## Results

### 1. Looks to the Model

#### Level I: Who physically carried out the step?

When we consider looks to the model made by the 3 1/2-year-olds during the cargo episodes, we find that the mean proportion of episodes in which the 3 1/2-year-olds in the child-child dyads looked at the model was .27. The mean proportion of episodes in which 3 1/2-year-olds in the mother-child dyads looked at the model was .85. This difference is statistically significant (Mann-Whitney U Test,  $U=3$ ,  $p<.002$ ). The range of episodes with looks to the model by the tutee was 0-10 for the child-child dyads, and 6-12 for the mother-child dyads. Half of the 3 1/2-year-olds in the child-child dyads did not look at the model once during the episodes, while all 3 1/2-year-olds in the mother-child dyads did so in at last six--or half--of the episodes.

Clearly, at this level of analysis, the function of consulting the model was carried out very differently in the two groups. As a group, 3 1/2-year-olds in the child-child dyads were far less involved in this strategic step than were the 3 1/2-year-olds in the mother-child dyads.

#### Level II: If the 3 1/2-year-old looked at the model, was the look self-regulated or other-regulated?

Looks to the model were coded as other-regulated if one or more of the following behaviors occurred after the beginning of the episode but before the look; (a) the tutor pointed to the model puzzle; (b) the tutor made a complete utterance which explicitly mentioned the model puzzle (e.g., "Where's the red one on this puzzle?"); (c) the tutor made a complete utterance which indirectly or implicitly required the tutee to consult the model puzzle in order to respond appropriately (e.g. "What color do we need next?"). All tutees' looks to the model that did not meet these criteria were coded as self-regulated. Several cargo episodes contained more than one look to the model by the 3 1/2-year-old. For these episodes only the first look to occur after the beginning of the episode was used in this analysis.

In the child-child dyads, the mean proportion of episodes in which 3 1/2-year-olds' looks to the model were other-regulated was .38. In the

mother-child dyads, the mean proportion for the same category was .26. This difference is not statistically significant ( $U=31$ , n.s.)

#### Level III: If the look to the model was other-regulated, was the other-regulation direct or indirect?

Other-regulation was coded as direct if one or more of the following behaviors occurred before the look to the model and after the beginning of the episodes: (a) the tutor pointed to the model puzzle; (b) the tutor made a complete utterance which explicitly mentioned the model puzzle. For example:

(1) 5 1/2-year-old boy: "Purple (points to purple square on model puzzle) next." (3 1/2-year-old looks at model).

(2) Mother: (3 1/2-year-old has misplaced the orange square.) "Now (as she points to the orange square on the model) where's the orange one'll go here?" (3 1/2-year-old looks at the model ...)

Other-regulation was coded as indirect if the tutor made a complete utterance which contained an implicit directive to look at the model. Such utterances are considered indirect because, although the model is not explicitly mentioned, the listener must look at the model in order to respond appropriately. For example:

(3) Mother: "What do we need next?" (3 1/2-year-old looks at the model).

The mean proportion of episodes in which the 3 1/2 year-olds in the child-child dyads made other-regulated looks to the model and in which the other-regulation was direct was 1.00. In the mother-child dyads this proportion was .83. This difference is not significant ( $U=29.5$ , n.s.)

To summarize our findings for the strategic step of looking at the model, there were significant differences between the child-child and mother-child dyads only at the first level of analysis.

### 2. Piece Pick-Up

#### Level I: Who physically carried out the step?

The mean proportion of episodes in which 3 1/2-year-old tutees in the child-child dyads picked up pieces was .75. For the mother-child dyads it was 1.00. Thus, 5 1/2-year-olds sometimes

assisted their tutees by picking up pieces, while mothers never did so. This difference is significant ( $U=6$ ,  $p < .01$ ).

**Level II:** If the 3 1/2-year-old picked up a piece, was the pick-up self-regulated or other-regulated?

A pick-up was coded as other-regulated if one or more of the following behaviors occurred after the beginning of the episode but before the pick-up of a piece; (a) the tutor made a complete utterance related either directly or indirectly to the selection or pick-up of a piece; (b) the tutor pointed to a specific piece in the pile; (c) the tutor identified a piece to be selected by pointing to the model puzzle. All pick-ups not coded as other-regulated were considered to be self-regulated.

The mean proportion of episodes in which 3 1/2-year-olds in the child-child dyads made other-regulated piece pick-ups was .33, while for the 3 1/2-year-olds in the mother-child dyads the figure was .18. This difference is not significant ( $U=18$ , n.s.)

**Level III:** If the piece pick-up was other-regulated, was the other-regulation direct or indirect?

Speech was coded as direct if the utterance included an explicit mention of the color of a piece in the pieces pile, and pointing was coded as direct if the point was to a specific piece in the pieces pile. For example:

(4) 5 1/2-year-old: "Now you do the next one. You do orange. (5 1/2-year-old then points to the orange square in pieces pile.) Orange." (3 1/2-year-old then picks up orange square.)

(5) Mother: "Then (mother starts to point to the purple square on the model) what comes (3 1/2-year-old looks at the model) after the purple one? (3 1/2-year-old looks at the copy, mother finishes point.) What color's (3 1/2-year-old looks at the model, points to purple square on model, looks at copy, points to place for purple square on copy) this? (3 1/2-year-old looks at the model.) White?"

3 1/2-year-old: "Yeah, white." (3 1/2-year-old finishes point.)

Mother: "Okay (3 1/2-year-old looks at copy) find (3 1/2-year-old looks at pieces) a white one." (3 1/2-year-old picks up white square.)

Other-regulation for piece pick-up was considered indirect when, in order to respond appropriately--i.e., to pick up the correct piece--the tutee had to consult the model puzzle, and then pick up the piece. For example:

(6) 5 1/2-year-old boy: "Do that part. (5 1/2-year-old points to cargo area on copy.) The same as that." (3 1/2-year-old picks up a piece).

(7) Mother: "What's the (mother points to yellow square on model) color (3 1/2-year-old looks at the model) in the bottom corner?" (3 1/2-year-old looks at copy, then at pieces.)

3 1/2 : "Yellow." (3 1/2-year-old picks up yellow square, mother finishes point.)

Episodes (such as (5) above) which contained both direct and indirect other-regulation for piece pick-up were coded as direct on the assumption that direct regulation "overrode" indirect regulation.

The mean proportion of episodes in which 3 1/2-year-old in the child-child dyads made piece pick-ups for which the tutor provided direct other-regulation was .59. In the mother-child dyads, the mean proportion of episodes in which other-regulation for piece pick-up was direct was .14. This difference is marginally significant, ( $U=12.5$ ,  $p < .091$ ).

To summarize, the management of the task step of piece pick-up, there are significant differences at the first and third levels of analysis.

### 3. Piece Placement

**Level I:** Who physically carried out the step?

The mean proportion of episodes in which 3 1/2-year-olds in the child-child dyads placed pieces was .62, while in the mother-child dyads this proportion was 1.00. Thus 5 1/2-year-olds frequently helped 3 1/2-year-olds by physically placing pieces in the copy puzzle for them. In contrast, mothers did not physically place any pieces,

so that 3 1/2-year-old working with their mothers made all piece placements themselves. the differences between child-child and adult-child at this level of analysis is significant ( $U=6, p < .01$ ).

When they made piece placements--as when they made piece pick-ups--5 1/2 -year-olds demonstrated an extreme form of other-regulation, something we might better describe as "other-doing." Such other-doing generally excluded the 3 1/2-year-old from any task participation (other than through observation).

**Level II:** If the 3 1/2-year-old made a correct piece placement, was the placement self-regulated or other-regulated?

A placement was coded as other-regulated if one of more of the following behaviors occurred after the beginning of the episode and before the placement of a piece: (a) the tutor made a complete utterance related either directly or indirectly to piece placement; (b) the tutor pointed to the model or the copy. (Note: In a number of episodes, the other-regulative behavior for piece placement also served as other regulation for piece pick-up and/or looking at the model.) All placements made by 3 1/2-year-olds that did not meet these criteria were coded as self-regulated.

If we consider the piece placements made by the 3 1/2-year-olds, we find that the mean proportion of episodes in which 3 1/2-year-olds in the child-child dyads made other-regulated piece placements was .55. In the mother-child dyads, this proportion was .34. This difference is marginally significant ( $U=13, p < .091$ ). Thus, 3 1/2-year-olds in the child-child dyads made self-regulated piece placements in a smaller number of episodes than did the 3 1/2-year-olds in the mother-child dyads.

**Level III:** If the piece placement was other-regulated, was the other-regulation direct or indirect?

Speech was coded as direct other-regulation if the utterance included an explicit reference to the location in the copy puzzle in which a piece was to be placed (e.g., "And that one goes right over there"). Pointing was coded as direct if the point was made to a specific location on the copy puzzle. Speech and pointing were also coded as direct if they served to identify a specific piece pile when only one place in the cargo area of the

copy puzzle remained to be filled. (Because of the nature of this particular task, regulating piece pick-ups in these instances also served to regulate piece placements.) Examples of direct other-regulation are:

(8) 5 1/2-year-old boy: "Boy, that goes right (pointing to the location for the purple piece on the copy puzzle) here." (3 1/2-year-old places the piece correctly.)

(9) Mother: "We'll put the purple (pointing to the location for the purple piece on the copy puzzle) one up here." (Mother points to the purple piece on the model puzzle. 3 1/2-year-old looks at model ... 3 1/2-year-old places the purple square correctly.)

Speech was coded as indirect when an utterance directed the tutee's attention to the model puzzle, and pointing was coded as indirect when the point was made to the model puzzle. Indirect other-regulation for piece placement could occur either before or after piece-pick-up (but it had to occur after the beginning of the episode and before placement of the piece). As in the case of piece pick-ups, episodes which contained both direct and indirect other-regulation for placement (e.g. (9)) were coded as direct on the grounds that direct regulation overrode indirect regulation. Examples of indirect regulation for placement are:

(10) 5 1/2-year-old girl: "What (as 5 1/2-year-old points to the black square in the cargo area of the model puzzle and 3 1/2-year-old looks at model) goes here?"

3 1/2-year-old girl: "Black." (3 1/2-year-old looks at pieces, picks up black square.)

5 1/2-year-old : "Right." (3 1/2-year-old places piece correctly.)

(11) Mother: (3 1/2-year-old has misplaced black square in copy puzzle.) "I think (as she points to model) you have to (3 1/2-year-old looks at model) check (3 1/2 shakes head, replaces black square correctly) over here."

The mean proportion of episodes in which 3 1/2-year-olds in the child-child dyads made piece placements for which the tutor provided direct other-regulation was .56. In contrast to this, the figure for the mother-child dyads was .07. This difference is significant ( $U=8, p < .021$ ).

To summarize, there were significant differences between the child-child dyads and the mother-child dyads at each level of analysis for the strategic step of piece placement.

### Discussion

As we have seen, 5 1/2-year-olds and mothers managed the task interaction very differently. The 5 1/2-year-olds were more likely to carry out task behaviors for the 3 1/2-year-olds than were the mothers; and when 5 1/2-year-olds provided other-regulation, it was more likely to be direct than when provided by mothers. When direct other-regulation was used in connection with piece pick-up and placement, the tutee was not required to consult the model and thus was allowed to select and place pieces as if those strategic steps had no relationship to the model. This means that when interacting with the 5 1/2-year-old, the 3 1/2-year-old children were more likely to be guided through the correct selection and placement of pieces without being required to consider the relationship of these behaviors to the overall goal structure of the task.

The high level of direct responsibility taken on by the 5 1/2-year-olds in this task situation reflects a difference in the way the child-child and adult-child dyads organized their joint activity. Even though almost all dyads finished the copy puzzle correctly, different dyads defined the task and social setting in which it was executed quite differently.

There are several possible reasons for differences between the two groups of tutors. The 5 1/2-year-olds may have perceived the 3 1/2-year-olds' tasks competence differently than the mothers, or the 3 1/2-year-olds in the two sets of dyads may have indeed had different requirements for other-regulation. However, there seem to be two factors that are more likely to account for the differences in the tutors' organization of interpsychological functioning. First, the 5 1/2-year-olds seemed to have perceived their role in the interactive task situation differently than did the mothers. Rather than following a strict tutorial mode of interaction, 5 1/2-year-olds often seemed to want to participate in a more direct way. For example, in a few instances one 5 1/2-year-old said, "Okay, now it's my turn" and proceeded to select and place a piece. Such an understanding of the setting was never manifested in

the mothers' interaction with 3 1/2-year-olds. Second, when trying to assist 3 1/2-year-olds, the 5 1/2-year-olds often seemed to lack the communicative flexibility required to provide other-regulation at a variety of levels. On occasion, they move directly from a vague hint such as "That's wrong," (after a 3 1/2-year-old's incorrect piece placement) to direct other-regulation such as "Put it there" (accompanied by a point to the copy). The absence of communicative flexibility manifested in such an abrupt change in level contrasted with the mothers' other-regulation which often invoked several levels of indirect other-regulation such as, "How can you tell if that goes there?" and "Look over here (at the model), and you find out."

These speculations about the reasons for differences in strategic functioning on the interpsychological plane call for further research. They point out that assistance provided by adults and assistance provided by more capable peers may be structured on different assumptions about the appropriate way to define the situation in which joint activity is carried out. As noted by Wertsch (1984), the issues of situation definition and situation redefinition must be addressed in a great deal more detail before an integrated account of the zone of proximal development will be forthcoming.

The present study does not directly address the issue of how different forms of intrapsychological functioning emerge from various forms of interpsychological functioning. However, its findings suggest some issues that must eventually be addressed in the study of this transition. Specifically, these findings suggest a dimension along which interpsychological functioning may vary and hence a dimension among which one may examine the transition to intrapsychological functioning. Vygotsky's claims about the social origins of higher mental functioning in individuals suggest that not only the timing of this transition, but the structure of its outcome may vary, depending on the form of its social precursors.

### Notes

This study was supported by a Spencer Foundation grant to the second author.

<sup>1</sup>It should be noted that all of these are observable behaviors, rather than categories of behavior which require inter-rater reliability. There were no "judge-

ment calls," and the few disagreements that occurred were resolved after repeated viewings of the particular behavior.

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## Achieving Displays of Computer Literacy: Unfolding Cunningham and Paris' Findings

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As Cunningham and Paris (1985, p. 125) recently asserted in this Newsletter, "reading, writing and computer use all involve remembering symbol strings and all require the ability to manipulate sets of symbols for communicative purposes." Thus it can be said that an important skill involved in literacy is the manipulation of symbols. Given this view, Cunningham and Paris' effort to assess how children learn to use a computer keyboard, from their very first exposure, is most intriguing. They demonstrate that it does not look to be too difficult for young children to learn to use a keyboard.

I would like to focus on one segment of their findings. The authors discovered that the young children in their study, median age 5-year-olds, "were capable of organizing an initially haphazard set of symbols." Children reduced their response

time between time 1 and time 2 under conditions where they had to depress number, symbol or letter keys in reaction to the random display of the latter on a video monitor. I am interested in the response time for the letter inputting task. A difficulty conjectured for children in this task was the random layout of letter keys on the QWERTY keyboard. Children had to search the keyboard to find the stimulus/target letter.

Cunningham and Paris found that "while practice facilitates response times for *both* skilled and less-skilled readers, it is the skilled readers who derive the *greatest* benefit from practice on the keyboard" (1985, p. 130). This seems a sensible finding, but what interests me is how children, or any users, can move from a stimulus to depressing a correct key. Something more than reading skill or prior knowledge of letters (numbers or symbols) can be involved. I call these things practices. For emphasis, I will call them embodied practices; they provide a vivid sense in which persons could be said to *manipulate* symbols.

The embodied character of writing, and especially computer writing, is not yet well understood, or much attended to. Theories of writing (Flower & Hayes, 1981) distinguish between composing and translating, or transcribing (Smith, 1982), but the composing side of writing activities receives the most attention. This organization is nowhere more interesting than with the novice writer working at a computer for the first time. Such a writer must search the terrain of the keyboard in order to find the letter of her intent. I would like to share my observations on how this searching can be done, and to link these observations to the findings of Cunningham and Paris.

As part of a pilot project on student collaboration during computer writing (Heap, 1986), I conducted observations in October, 1983 in a first grade classroom where students were being introduced to the computer via software for familiarizing them with the keyboard. The classroom was run by an experienced Primary Level teacher, who was a graduate student colleague of mine, Mrs. Sharon Purdy. Mrs. Purdy, along with her husband, had designed the word processing which she used in her class. *Write/One* (Purdy & Purdy, 1983) has three readiness programs which display, in random order, numbers, letters, and words. In response to the stimulus on the screen, students have to depress the correct key. As the

program ran on an Apple II+ computer, the classroom events which I observed were the natural cousins of those created under laboratory conditions by Cunningham and Paris. There were differences, though. The children I observed were older, being at the beginning of first grade. Further, I had no information on differences between children as to reading ability to recognize and pronounce letters. An important difference is that Cunningham and Paris did not model appropriate behaviors for students. Mrs. Purdy used a large TV monitor connected to the Apple to demonstrate the keyboard familiarization programs of *Write/One*.

The one search practice worth noting was the one used by the students whose response time was the fastest, and who seemed to experience the least amount of frustration. Those who did not use this practice just let their eyes roam over the terrain of the keyboard. Those who did use the practice roamed the terrain with their finger. The practice involved moving, typically, a forefinger over the keys, using the finger as a pointer. The movement of the finger was not random. Instead, it was remarkably consistent between students in the serpentine path it covered.

After looking at the letter displayed on the screen the student would usually begin with the finger at the left side of the keyboard, at the key marked with the first letter of the alphabet, A. From the A key the finger would move down to the Z key, at the left of the bottom row. Students then would sweep to the right along that row. At the right end of the row, the finger would move up a row and sweep left, then up a row and sweep right, thereby covering all the letter keys of the Apple II+ keyboard. There were variations in how this practice was carried out, but it assured that most of the keyboard's terrain would be searched, resulting in the letter being found. If it was not found, the practice was repeated.

A few comments can be made about the use of the practice. It often was accompanied by a sounding of the letter by the student. Students using this practice rarely "lost their letter" and had to look again at the screen. This suggests that they recognized the shape of the letter, in upper case on the screen, and knew their alphabet well enough to be able to name the letter, repeating it as they swept the keyboard.

For students who did not use this practice, my impression was that there was more looking back and forth between the keyboard and the screen, but not a great deal of this eye/head movement was observed even among these students. Had students not known the name of the letters of the alphabet, then I would have expected the task for them to have been more of a grapheme matching effort between the screen display and what appears on the summits of the Apple II+ keyboard. This conjecture is in line with Cunningham and Paris' findings that "skilled readers" (i.e., children who could recognize and name letters of the alphabet) performed better than non-skilled readers.

Of more interest is the kind of trouble the children evidenced in using the practice. They tended to "clip the corners" of their serpentine turns. As an aid, consider this approximation of the layout of the letters on a QWERTY keyboard.

Q W E R T Y U I O P  
A S D F G H J K L  
Z X C V B N M

After sweeping right, over the bottom row, and completing their leftwards sweep over the middle row of the keyboard, students would often move up from the A key to the W key. In so doing, they missed the Q key. This "clipped corner" only became a problem when the letter Q was the target letter of the task. The second running of the practice, to find the Q key, was often done at a faster pace than the first running, and even clipped the corners more in some cases. A slower, more methodical, i.e., "unclipped" running usually produced the correct result: the Q key was found.

On other occasions, the P key was not found. The last key to be covered with this search practice, run from the bottom row up, was the P key. To me it appeared that by the time the three rows of keys nearly had been scanned, there would have been reason for novice keyboarders to believe that they must have missed the key. More than 2 out of 23 students who carried out the task turned to me after using the searching practice a couple of times, but not finding the P key. I read

the look on their faces as a plea for help. Not wanting to intervene, I merely told them that the letter/key really was there, and that they should look again. Eventually, all students were successful in finding the letters presented to them as stimuli.

The point I wish to make from this is that the reaction to the letter display was embodied and enacted, by some children, through a particular practice. How it is that they all used the same practice, I do not know. One can imagine a number of finger-guided search practices over a keyboard. What is important is that response time depended on more than prior knowledge of letters. Students had to find the letters, in a way that they do not have to "find letters" when they write with stylus and paper. While the slow response time for Q and P stimuli may be connected with letter knowledge, and with problems arising from graphemic similarities between these two letters and others (O and R), it was the use and path of the serpentine search practice which, in the end, bodily mediated the relation between the letter on the screen and hitting the correct key. Response time depends, to an unknown extent, on search practices, the pace and manner of their embodiment, and where keys lie along the path thereby searched. Students cannot "manipulate" symbols they cannot find.

Ethnomethodologies of computer use remain to be written. Their writing will have to attend to the peculiar work we can, and have to do, with keyboards. That writing perhaps will be of help in producing more encompassing theories of writing, as they can be made to apply to word processing. In the meantime, perhaps it may be of pedagogic value for teachers of novice users to model search practices which can render keyboard terrain familiar and ready-to-hand (cf. Heidegger, 1962).

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## Review Article

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**Street, Brian.** *Literacy in Theory and Practice*. Cambridge: Cambridge University Press, 1984.

Street's clear statement of his aims and intentions, his definitions of key terms, and description of how he will fulfill his stated aims, greatly facilitate the task of the reviewer. My objective will be two-fold: (1) To convey how Street sets about achieving his explicit aims, and to what extent his book represents an achievement in those terms; (2) to consider in more critical detail the conception of the book, and in that context, the evidence the author invokes to formulate his arguments. The heterogeneous nature of the book's intended audience is a constraint on its overall effectiveness.

Street defines "literacy" in the initial sentence of the introduction. "I shall use literacy as a shorthand for the social practices and conceptions of reading and writing" (p. 1). As any reader interested in the general subject of literacy and orality knows, the term is all too often left undefined, or at best is only defined implicitly. Street goes on to make clear that he does not view literacy as a unitary or neutral concept, but rather that a given society supports particular practices and concepts of reading and writing.

The skills and concepts that accompany literacy acquisition, in whatever form do not stem in some automatic way from the inherent qualities of literacy, as some authors would have us believe, but are aspects of a specific ideology. (p. 1)

Hence it is Street's intended goal to question assumptions about the nature of literacy and to develop the beginnings of a theory capable of accounting for a conception of literacy as social practice.

The fundamental assumption, which Street seeks to challenge, is that literacy is a "neutral technology that can be detached from specific social contexts" (p. 1). According to the author, this assumption is widely held by western academics. It is used to substantiate certain of their arguments which might otherwise appear ethnocentric. For examples, Street provides the following: Linguists, such as Lyons, exploit the assumption in order to make claims about the objectivity of the English language (p. 7); social anthropologists, such as Goody and Clammer, subscribe to the view that a distinction between literate and non-literate cultures helps to explain differences in the organization and behavior of their respective populations; psychologists, such as Olson and Greenfield, assume that the acquisition of literacy has certain cognitive consequences for an individual, Greenfield claiming that "unschooled" Wolof children lack cognitive flexibility in comparison to their "schooled" peers.

Street's comprehensive introduction tells us that, initially, he will challenge this assumption (that literacy is a neutral technology) and provide a critique of the arguments which follow from it (Section 1, *Literacy in Theory*, Chs. 1-3). Thereafter, he poses an alternative perspective derived from his definition of literacy (Section 1, Ch. 4). The practical consequences of adopting his alternative theory is then explored in relation to the author's own fieldwork in Iran (Section 2, *Literacy in Theory and Practice*, Chs. 5 & 6). Finally, Street considers how literacy programs, for example UNESCO's, have worked in practice. In general, he claims that the assumed economic benefits of literacy have motivated most of these programs. Street concludes by calling for future literacy projects to be based on his *ideological* theory of literacy (Section 3, *Literacy in Practice*, Chs. 7 & 8).

Street's "master plan" for convincing us of the validity of his thesis lies in his comparison between what he terms the *autonomous model* and the *ideological model* of literacy. The former is associated with those who assume that literacy is a neutral technology, the latter with those like Street who view literacy as social practice. The *autonomous model*, he claims,

assumes a single direction in which literacy development can be traced, and associates it (literacy) with 'progress,' 'civilization,' and individual liberty and social mobility.



It attempts to distinguish literacy from schooling. It isolates literacy as an independent variable and then claims to be able to study its consequences. These consequences are classically represented in terms of economic 'take-off' or in terms of cognitive skills. (p. 2)

Thus, for example, Anderson has asserted that a society requires 40% literacy for economic advance, but how literacy is to be evaluated or defined is not made at all clear. Street challenges the assumptions underlying the autonomous model by examining the claims its proponents make for the cognitive consequences of literacy. The claims are that literacy effects cognitive processes in some of the following ways: It facilitates empathy, abstract context-free thought, rationality, critical thought, post-operative thought (Piaget's usage), detachment and the kinds of logical processes exemplified by syllogisms, formal language, elaborated code, etc. (p. 2). Put in this way it is hardly surprising that Street seeks to consider a possible alternative approach to literacy, its nature and consequences.

Hence, against the above, he poses an *ideological* model of literacy. Street argues that writers who support this model would focus on the specific social practices of reading and writing, recognizing that such practices are culturally embedded.

The model stresses the significance of the socialization process in the construction of the meaning of literacy for participants and therefore is concerned with the general social institutions through which this process takes place and not just the explicit 'educational' ones. It distinguishes claims for the consequences of literacy from its real social significance for specific social groups. It treats skeptically claims by western liberal educators for the 'openness,' 'rationality' and critical awareness of what they teach, and investigates the role of such teaching in social control and the hegemony of a ruling class. It concentrates on the overlap and interaction of oral and literate modes rather than stressing a 'great divide.' (pp. 2-3)

Street acknowledges that his models serve as *ideal types*, but suggests that this helps him to clarify the differences between the writers he wishes to criticize and those ideas he seeks to promote.

The motivation behind this book appears to be simple. The author has set out to expose one literacy myth and to replace it with another (Section 1). His aim in the remainder of the study (Sections 2-3) is, of course, to persuade us that his alternative is not a myth but a powerful and valid theory of literacy, which could be tested and, to some extent has already been tested in practice. Does he succeed?

For the first part, the answer must be yes. Street provides a detailed and comprehensive critique of those who see literacy as a neutral technology. He shows, by exposing the interrelationship between literacy and ideology that the qualities associated with literacy (logical thought, cognitive flexibility, objectivity, etc.) are a reflection of the social values held by a given society. Proponents of the autonomous model have been understandably, if not forgivably, uncritical of the assumptions on which the autonomous model depends, as it elevates the qualities associated with their profession. Street illustrates his argument with well-chosen and telling examples from Olson, Greenfield and Goody. His challenge builds on the work of the psychologists Scribner and Cole (1981). They ask the question: Is the introduction of literacy into a culture necessarily accompanied by cognitive development in the newly literate? Scribner and Cole realize that to answer this question the variable of literacy has to be isolated from other crucial variables such as schooling. The evidence they collect from fieldwork among the Vai people of Liberia suggests that particular literacy practices promote particular cognitive skills. They conclude that schooling, as opposed to literacy alone, is the likeliest cause of cognitive change and development.

However, for the second part, proposing the *ideological model* as an alternative, the answer can only be a qualified yes. A book of this sort faces two main problems. First, the author is dealing with an interdisciplinary topic, and second, with a heterogeneous audience. Street attempts to satisfy the varying demands of the specialist social anthropologist, or social historian as well as readers interested in allied fields, "such as sociology, folklore, and literature" and in addition, to those "interested in the general subject of literacy and orality" (see the series' brief on the book flyleaf). This complex set of demands, I would argue, has led Street to construct the two ideal

models, the *autonomous* and the *ideological*, in order to simplify his thesis for the general reader. However, in so doing he tends, on occasion, to oversimplify the issues by replacing one conception of literacy with another. For example, he states that "the acquisition of literacy is in fact, a socialization process rather than a technical process" (p. 180), and "the analysis recognizes the importance of the social meaning of these practices for the participants, the political imperatives that generated the change, and the 'ideological' rather than 'technical' nature of reading and writing" (p. 111). Remarks like these are guaranteed, for this reader at least, to provoke the response, "Isn't it a combination of both, and not one rather than another?" Street covers himself to some extent by admitting that the models are *ideal*. Nonetheless, one is left with the impression of a dichotomy between the positions and the suspicion that opinion will come to advocate that combination of factors which are involved in the development of an individual's literacy skills.

This weakness could have been minimized, had Street taken a little more care to contextualize his approach within other "critical" perspectives. By critical, I mean a commitment to dialectical theory and method, and a recognition of the complex interconnectedness of things related to social life. (For further explanation of a critical perspective and its associated terms, critique, see Fairclough, 1984). As a reader coming from the allied field of linguistics, I realize that a critical perspective is one which seeks to "unpack" the implicit propositions underlying a given topic, and has been used for example, as an approach to discourse analysis (e.g., Fowler, Hodge, Kress & Trew, 1979). It would perhaps be unfair to expect Street to be aware of this literature; however, I understand that in the fields of social anthropology, history and sociology, a critical perspective, in this Marxian sense, is common place. Had Street contextualized his *ideological* approach with reference to similar approaches in related disciplines, his model would not have appeared so idealized and alternative. Furthermore, I would suggest that labelling his model *ideological* causes some confusion. After all, through offering this model Street is attempting to indicate the ideological nature of the *autonomous model* and by implication is claiming that his theory is not ideological, or at least is less so than the former. In the

light of a commonly used critical approach, in which Street's ideas seem to fit, he might have chosen simply to label it the *critical model* of literacy.

Specialist social anthropologists and historians will know better than I whether the author's historical and anthropological evidence is valid. This type of data might be unfamiliar to the general reader, and he or she may find the book on this count rather difficult to read. This could also be true of Chapter 3, the evidence from the field of linguistics. However, I found interesting the connections Street drew between the study of the language system and the view that language can be neutral and objective. Street rightly, in my view, pointed out the dangers of regarding meaning as residing wholly in the text, and used effective material from a range of sociolinguists to support his argument. Nevertheless, I would like to have seen more reference to the work of contemporary pragmatists such as Levinson (1979), and Leech (1981), who have demonstrated through the analysis of actual data, both written and spoken, that in practice communicative intent (pragmatic meaning) takes precedence over literal meaning. The body of work appearing in this vein, and in represented publications like *The Journal of Pragmatics*, would have convinced Street that what was perhaps a minority interest in linguistics a few years ago, is now a major force.

Related to this is the work being carried out into the differences between spoken and written language, (Ong, 1980; Olson, 1980; and Tannen, 1982). These scholars argue that many of the features normally associated with oral discourse can also be found in written texts. For example, Olson, whom Street views as an opponent, shows that oral cultures can do many of the same things with speech that literate cultures do with writing. He argues that ritualized speech and written expository texts are devices for "managing authority," as in both, the language originates from somewhere other than the speaker's mind, (1980, p. 192). This has the effect of making the words in the two modes impersonal and objective, qualities which in 1977 Olson was only attributing to essay-text. Olson concludes by stating that "when viewed in terms of their function then, ritualized speech in a traditional society and written texts in literate society turn out to have much in common" (ibid, p. 194).

## Grandmothers, Teachers and Little Girls

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This paper is a demonstration of two instances of computer-use which I see as enabler vehicles: one, a personal interaction enhancement and the other a communication enrichment which could empower members of the three groups in my title: grandmothers, teachers, and little girls.

This dialogue, (Figure 1), a "scripted dialogue," (Nelson & Gruendel, 1979) was produced by two seven-year-olds in my lab this winter. We have been seeing four groups of eight second graders each Saturday. Half of them use word processors in activities which we label a "Writing Workshop," and the others participate in a "Mathematics Workshop" in which they use the programming language Logo to carry out geometric problem solving tasks. Our goals this year have been to prepare for a three-year longitudinal study of the integration of microcomputers as tools in a primary curriculum (Cameron, 1985). We are focussing on assessment of the applications of word processors (Smith, 1984) and Logo (Papert, 1980) in an enriched educational environment. Our research team includes a teacher, a computer consultant and a psychologist. We will have one target computer-using class and two comparison groups. The children in the computer class will participate with the assistance of computers in a range of projects which we are calling modules. One comparison class will partake of the same set of modules, only they will conduct all their work by hand. The third class will be simply a baseline control group. This group is necessary because our interventions will be what could be called an enriched experience, so we need information on the development of literacy and numeracy skills of children for whom there have been no enhancement interventions. As well as these three classes, which we will observe longitudinally, we will monitor a half dozen classes cross-sectionally with these children being taught in a standard classroom with perhaps one computer or a small number of computers in the room.

However, in view of the fact that Street's book is required to satisfy the demands of an interdisciplinary subject and an audience made up of various specialists as well as general readers, the author has produced a commendable piece of work. The arguments are sound, the examples are carefully selected and always pertinent, and the book is clearly laid out. For the reader with limited time, the introduction is "a must." Here Street explains exactly what he is trying to do and how he is going to achieve it. It is pleasing to see an author challenge underlying assumptions. I would suggest that with regard to literacy studies it has been these assumptions, more than the arguments which follow from them, which require the kind of aggressive questioning employed by Street. Thus, in spite of the reservations stated above, it is not easy to see how anybody could have written a more effective and convincing analysis of literacy, given the present, not particularly advanced "state of the art."

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∞ ∞ ∞ ∞ ∞ ∞ ∞ ∞ ∞

*Common sense as its name shows and 'practicality' as its name does not show, are largely matters of talking so that one is understood.*

B. L. Whorf

wolf let me in little pig

pig not by my little chin

wolf then i'll puff and i'll puff and i'll blow and i'll blow your house dune

pig go a hed I do't kare if you blow my House dune

folf i'll climb dune the chemne this pig is smart.

pig- theyr is a blasn fire in the chemne this wolf is smart too,

wolf- your House is on Fire pig come out and see

pig no it is't because my house is made of bricks.

the end

the wolf is by \_\_\_\_\_

the pig is by \_\_\_\_\_

Figure 1: Scripted dialogue.

I believe the type of comparisons we are preparing for is rare but necessary, if we are then to make a careful assessment of the effects of the technology on the cognition of youngsters.

You might ask why I chose to work with such young children. Of course, little ones are nicer to work with because they do not come to a task with lots of preconceptions and this was important for at least two reasons. First, there is some evidence that males and females respond differentially to the technology and we want to start as early as possible so as to avoid as much of that

as possible. Second, we know that children learn very quickly when they enter school that to err is unacceptable. So we want to work with children who have as little experience as we can find with the humiliation of being negatively formally evaluated. This is particularly important when in both software applications, error-management can be a radically different experience than it often is in traditional writing and problem-solving. Finally, we want to try the technology at a stage that makes the most pedagogical sense, viz, at the beginning of the formal learning experience.

The currently available scientific literature, such as it is, is replete with reports which either give us a warm and happy feeling about the wonders of little ones using machines, or warn us that all this is an entire waste of time. The many thousands of dollars schools are putting into computers could buy many shelves of books for the school library, or salaries for recently-declared redundant art and music teachers. The question I have is: Is the investment in the technology worth it? But, you must be forewarned that sine I too have only one year of experimentation under my belt, my claims, like all the rest, will be in the realm of the happy anecdote. So with this, back to pig and wolf.

You will notice that this is a nice conversation between two protagonists. We gave the children an opportunity to choose from a range of situations. One was to pursue using a computer as a communications medium. In the case from which the transcript in Figure 1 was drawn the children communicated with each other while constructing texts. Two children sat side by side at one microcomputer. We provided the children with two types of topics, everyday events, and fairy tale scenes. I selected the sample in Figure 1 because it is from one of the situations which we introduced to the children in which the medium provided a very unique context for productivity. Look at the generativity of this scripted dialogue. Pig and wolf created, after a couple of rather standard utterances, a unique interaction, including use of asides and I can assure you that these particular children were not especially fluent verbally. The educational benefits of this type of creative communication exercising developing literacy skills seem promising. We suspect that it would not have been nearly so simple to communicate in this fashion were a piece of paper and a pencil and eraser the only tools available. In the next three

years we may find out. We submit these protocols to a variety of psycholinguistic analyses such as Miller & Chapman's (1984) Systematic Analysis of Language Texts.

Let me give you another example. One little lad, Marc, was allowed to choose three objects from a "grab bag;" he put his hand on a sea shell, a brass bell, and a yellow bangle. Figure 2 is his creation vis a vis these objects.

### The Bell The Shell And The Ring By Marc

Once there was a rich old sea shell, it's name was Herman.

It was very sad.

It was very lonely too it's only two friends was a rich old bell, and his name was Charlie. His other friend was a big rich yellow ring, and his name was Joe. They were very bord all they had to play with was a card game, and the only game they knew how to play was go fish.

And they were getting tired of playing one game, they wanted to play at least one other kind of game, like poker or something like that.

One day they got a book on how to play cards.

And they got to know all kinds of games.

Most times Herman won the card games, but if he lost a game Charlie or Joe would win, if it was poker and Herman lost then Joe would win, but if it was Black Jack Charie would win. When Herman found the book called, BETTER CARD GAMES FOR SHELLS AND OTHER SEA THINGS WHAT EVER THER CALLED Joe said, "Hey that's a bad name I'm not a sea thing, I may live by the sea but I don't like being referred to as a sea thing.

Me too said Charie. Well it dosn't matter said Herman what relly matters is that we know how to play cards. YEH!

Figure 2: Marc's first version.

We were contemplating adjectives as modifiers (implicitly not explicitly), so the following week, he returned to his text and produced Figure 3. The ease with which these alterations are possible is remarkable both to us, and to the children.

So, next year we will test the potential of microcomputers to facilitate the writing, reading and problem-solving activities of primary children. It is possible that we might learn for whom the

### The Bell The Shell And The Ring.... By Marc

Once there was a round sea shell, it's name was Herman, but most of the other sea shells called him Hermie.

He was very sad.

It was very lonely too it's only two friends was a brass bell, and his name was Charlie. His other friend was a big yellow ring, and his name was Joe. They were very bord all they had to play with was one card game, and the only game they knew how to play was go fish.

And they were getting tired of playing one game, they wanted to play at least one other kind of game, like poker or Black Jack.

One day they got a book on how to play cards.

And they got to know all kinds of games.

Most times Herman won the card games, but if he lost a game Charlie or Joe would win, if it was poker and Herman lost then Joe would win, but if it was Black Jack Charie would win. They were very happy when Herman found the book called, BETTER CARD GAMES Joe said, "Hey that's a nice name I like it. Well it dosn't matter said Herman what really matters is that we know how to play cards. YEH!

And they lived happily ever after, And when one of them went to a beach party he would bring the cards and the book, just in case.

THE END

Figure 3: Marc's second version.

technology works, and in what conceptual areas. But it is questions beyond the ken of this present research that I would very much like to address now. It seems that the similar methods of analysis to those which I have just described in my attempts to get a handle on the implications for children might be used with the other two groups I would like to highlight. I have indicated my interest in children, and in passing, little girls, the children who may serve most to gain from early mastery of the technology. But who today is most likely to lose? Other speakers mention my two other favorite groups, the ones I feel are on the front lines of the technological changes which we are all observing. The first is teachers, and the second, our grandmothers.

I have finessed to this point the implications for teachers of the work I am doing, but I'm not oblivious to the effects. In New Brunswick the Department of Education has just "invested" in a half million dollars worth of hardware (Tandy 1000's) and has placed one computer in every school in the province. Please visualize with me the reactions of our principals and teachers to the advent of that little machine in the school. The in-service training provided was described to me recently by one principal who said, "Can you imagine what it was like to go with 70 other people to a whole day of diligent note-taking on 'You and your MS-DOS?'" "When I went home that night I carefully reviewed my notes. I realized that I do indeed now know how to turn the machine on and off, but what else can it do? What will I do on Monday morning that that stupid machine can help me with?" Many classroom teachers are threatened by societal expectations and are not so fortunate as I and many of you, to be able to take a sabbatical year to read, think, and acquire the necessary experience that allows me to return to my lab *in charge* of the technology instead of the reverse. Using word processors as a tool in the literacy support of primary school children is a valid task to primary teachers.

When I decided to get my hands dirty in this business of computers and cognition, the first thing I did was a review of currently available software for the target group five to eight years. It is *all* awful. There was nothing I could find that I could with any courage have offered to a good primary teacher to use with her students. So then I introspected. Being that kind of developmental psychologist who, after twenty years of

research, has not noticed too many differences between kids and adults, I thought, what use is the technology to *me*? My answer came in terms of writing, and problem solving. And when I remembered that the focus of the primary classroom is specifically in these two areas, I was set to explore the application of word processors and programming for children in first to third grades. As I said earlier, the literature on these two applications is lyrical in its promise of educational revolution, but this lyricism is based on small, often very special samples of children, and few implementations have involved comparisons with the use of graphite technology.

The teacher has every right to protest as they do at every meeting I attend: "When will you be able to tell us if all this stuff will benefit kids?" Why should they put out the effort to adjust what many now do perfectly well because the marketplace tells them it is the thing to do? For whom is a machine an educational bonus? When? And how? Now I know teachers can be a conservative lot, but surely they have the experience with the children in the classroom that few of us have (Linn & Fisher, 1983). I personally cannot confidently imagine using creatively one machine, and no printer, and a pile of cheap commercially produced software (that is the New Brunswick norm) in a standard classroom. The support for the teacher leaves a great deal to be desired. I am overwhelmed by the needless pressure this places on people, especially on those whose self-concepts are likely *not* to include a friendly attitude to technology. So even if we find that computers are a tremendous boon in the classroom, and they may well be (though I insist that day is not yet here) the teacher *must* be supported in becoming a master of the interface between the technology and the teaching process. They need not be technicians, but they *must* be comfortable with their tools.

And that brings me to grandmothers. I chose them because they are possibly poor, probably elderly, and certainly female, the epitome of a technologically disadvantaged group. They represent the people least likely to benefit from information technology unless concerted efforts to the contrary are made (Social Impacts Subcommittee, 1983). Besides, they are a group with whom I sympathize. I include myself, as I am aging fast, in the ranks of grandmothers. However, unlike your typical grandmother, I have a

healthy salary, and a brazen sense that new things might be worth knowing about, and are certainly knowable. Most of my colleagues in "grandmotherhood" have neither the money nor the confidence to confront the technology. They may have a fixed income, and they probably have learned the lesson our society so well teaches women, that technology is not for them. I would like to argue that our grandmothers, our teachers and our little girls are all deeply interconnected in the family of human relationships which serve to benefit from the use of a technology which can enhance interpersonal communications like that between wolf and pig, and alleviate expression difficulties and error management like the author of *The Bell, the shell and the ring*. What are we going to do to realize this potential?

I propose that we find gentle ways to bring our three protagonists together and that we support their mutual exploration of the uses of technology in their lives. It would be even better if we could allow them the knowledge and power to resist those applications which are not appropriate to their interests and needs. I want technological configurations to empower grandmothers, teachers and little girls, and believe that there is a distinct possibility that they could. I easily see the links in my work between young children and their teachers, and perhaps two out of three isn't bad, but I am having more trouble with my grandmothers, and invite you to speculate how we might approach their dilemma. Failure to explore the possibilities will impoverish us all.

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### Assistance Requested

Help is requested on compiling an annotated bibliography on equity in testing. We are looking for discussions of tests which were designed to attempt to eliminate bias against minority group members by (a) including minority group cultural practices or (b) by involving the subject in the learning of novel knowledge/skills to include "history" in the test situation rather than relying on assumed shared historical experience (generally WASP).

If you have information pertaining to this issue, especially recent references, please respond to Catherine King in one of the following ways:

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We would also like to encourage you to contribute items to our annotated bibliography section on an ad hoc basis. Any book or article that you have read recently (old or new) that you are enthused about and want to share with others is a likely candidate.

Please send three copies of all submissions and use the style suggested by the American Psychological Association for your references. All figures and illustrations must be submitted in original, camera-ready form.

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