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EDITOR'S NOTE

Starting with this issue Esteban Díaz joins our editorial group replacing Warren Simmons. Our sincere thanks to Dr. Simmons for his many contributions to our *Newsletter* during this past year. Thanks also to Catherine King, Kamala Deosaransingh, and Lehman Benson for their help in the preparation of this issue.

Luis C. Moll

Cognitive Development in Blind Children: A Challenge to Piagetian Theory

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Introduction

Research on the cognitive development of congenitally blind children offers a picture difficult to reconcile with Piaget's developmental theory. This discrepancy occurs even when the research is carried out within a Piagetian framework, as is the case with the present study. Our results reveal a very atypical structure of horizontal "décalages," and suggest, among other things, that the role of language in cognitive development is much more significant than Piaget acknowledged.

Although Piaget himself never worked with blind children, on at least two occasions he stated his ideas about the consequences of congenital blindness on cognitive development. Both times he emphasized the importance of sensory-motor development and assigned a minor role to language. Consider the following quotes:

> "Language is only a particular aspect of the semiotic or symbolic function. The deaf and dumb master perfectly well other aspects such as imitation, symbolic play, mental images, and sign-language. This is what allows them to develop their sensory-motor schemes into representative ones. The deaf and dumb arrive at the operational stage earlier than the blind, whose sensory-motor schemes and figurative tools are more deficient" (Piaget et al., 1966).

> "Blind children are at great disadvantage because they cannot build the same spatial coordinations as normal children during their first and second years of life. Therefore, the development of sensory-motor intelligence and coordination of actions are seriously affected in blind children. That is why we find a bigger delay in blind children's development of representational thought, and language is not enough to compensate for this deficiency in the coordination of actions. The delay, of course, is finally overcome, but it is a significant one, and much bigger than the delay in the development of logic in deaf and dumb children" (Lecture at Columbia University, quoted by Gottesman, 1973).

The study reported here refers only to blind children -- leaving aside for the moment the case of the deaf -- nevertheless, the data do not coincide with what Piaget expected. Before presenting our experimental evidence, however, we will describe some of the psychological features of blindness.

Life Without Sight

Clearly, the blind's phenomenological world is very different from the sighted: it's a world without sight, color, or light; other senses such as touch, hearing, and smell come to the forefront, and phenomena such as perception have a very different nature. Language is paramount for the blind to understand the world they live in, especially the world of the sighted, for through language the sightless become acquainted with things they otherwise could not experience. The meaning of words that we so easily take for granted can be different for the blind; imagine the meaning that expressions such as transparent, flying, propeller in motion, or sunset have for blind people. Hence, there exists a very special phenomena in the language development of blind children, that of "verbalism," namely, the use of words without a concrete referent (see, e.g., Cutsford, 1951; Henri, 1948). Nevertheless, language development does not seem to be seriously affected except for some articulation problems (Miner, 1963; Postel, Caillon & Neu, 1971).

Although lack of sight forces the blind to rely on their other senses, this does not mean "overcompensation," i.e., an increase in the amount of information collected by the senses. For example, many studies have shown that there are no differences in sensorial thresholds between the blind and sighted either in touch or hearing, with the exception of very specific tasks in which the blind have special training such as tactile point discrimination (because of reading Braille), or auditive tasks with a strong emphasis on attention. Even such a "mysterious" phenomenon as obstacle detection or "obstacle sense" has been found to result from the use of auditory cues that sighted subjects can learn to use (Warren, 1978).

When we talk of space in relation to the blind we have to differentiate between "near space" -- that which is accessible to hand or limb movements -- and "extended space" -- access that requires mobility. This distinction is made because of the cross-modal organization involved for the blind, but in both cases the haptic system has a very central role.

The term "haptic" was first used by Revesz (1950), but Gibson (1962, 1966) was the first to describe a "haptic system" as one of the perceptual systems, stressing its active intentional component. Kennedy (1978), following Gibson (1966), says, "haptic means a possible way of touching, making contact and exploring, in which skin, muscles, and joints work together to gather information." This system has many characteristics which make it different from sight, but perhaps its most outstanding characteristics are sequentiality and slow speed. Although sight shares a sequential character with touch, Gibson (1962) talks of tactile scanning as something parallel to visual scanning -- the relative slowness of touch makes this sequential character more evident (e.g., although a sighted person can recognize a ping-pong table at a "glance," a blind person needs to touch it and move around it at the same time).

Congenitally blind children get acquainted with the world through noises and smells that they cannot relate to objects they can see, and the amount of tactile and haptic information they gather is quite scarce, given that the number of objects that come into contact with their skin is small. This situation is often worsened by parental over-protection, which reduces even more the amount of information that reaches the child. The result is often a delay in sensory-motor development, and the development of object concept (Fraiberg, 1977) or the age they begin to walk (Norris, Spaulding & Brodie, 1957) can be at a later age than sighted children.

The intelligence of congenitally blind children, at least as measured by I.Q. tests, does not show significant differences from the sighted population. But it has to be taken into account that most of the studies have only used the verbal scales of tests such as the Terman-Binet (Hayes, 1941) or the WISC (Smits and Mommers, 1976), although some qualitative differences in the performance of the different scales have been observed. However, the results obtained in tests with a spatial-manipulative character -- such as the adaptation of Kohs' cubes (Ohwaki et al., 1960) -- show a level of performance far below the level obtained by sighted children of the same age.

The above characteristics, and many others not mentioned here (see, Rosa, 1980a; Ochaita, 1982), call for methodological precautions in research with blind children. Warren (1976) has indicated the need to avoid simple, comparative outlooks when studying the psychology of the blind; the object of research is to study psychological features of blindness, not to build up a catalogue of differences from the sighted. To this

warning we would add that the blind form a very *heterogeneous population*, differing on aspects such as the age of loss of sight, whether this loss occurred suddenly or as a result of a slow process, the degree of residual sight left, and the cause of this loss (sometimes loss of sight is only one consequence, among others, of a more extended illness). Attention should be paid also to the social characteristics of the subjects under study: whether or not they live in a specialized institution, the age they started to attend school, the degree of early stimulation they had in infancy, and the socioeconomic status of their families. All of these factors will affect the significance of the data gathered.

Study Design

Background

The study reported here is part of a series of research projects on the peculiarities of cognitive development in congenitally, totally blind children conducted by the authors at the "Universidad Autónoma de Madrid" during a span of four years. The starting point for our research program was provided by Hatwell (1966). She found that the blind showed a delay of several years (3 to 6) to reach an adequate level of performance in infralogical and operative tasks with a figurative-spatial-manipulative character (conservation of substance, rotation and movement of forms, and some forms of classification), while showing no delay -- or a much smaller one -- in tasks performed mainly on a linguistic basis (verbal seriations and classification). Hatwell found it striking that the age at which these different tasks were performed adequately was practically the same and that even some infralogical tasks were solved later than some verbal ones, the reverse of what Piagetian theory would predict. As she wrote: "this contemporary emergence of the blind child's logical possibilities have a particular significance; it points out that verbal operations seem to be able to develop in a relatively autonomous way and in spite of a grave deficiency in operations with a concrete basis. This quite surprising phenomenon not only contradicts Piaget's position, for whom actions upon objects is the starting point for any growth of knowledge, but is also against everything that psychological or pedagogical literature (notion of 'concrete help') has contributed to this field" (Hatwell, 1966, p. 179).

Our research tried to replicate systematically some of Hatwell's experiments and also gather new data.[1] Our intention has been to go deeper into the study of this apparent contradiction between some of the experimental data and the predictions of cognitive development derived from Piaget's theory.

Subjects

Three groups were studied: an experimental group (congenitally, totally blind children), and two control groups (sighted and blindfolded), with the three groups matched by age. All of the groups were divided into several age-levels, each age-level contained between five and eight children.

The experimental group was selected from children attending residential schools for the blind in Madrid and Seville owned by the "Organización Nacional de Ciegos de España."[2] All of the children in the experimental group were totally, congenitally blind, without any associated physical or psychological problems. They had a normal academic performance, as judged by their teachers, and a degree of residual sight not superior to the perception of light. Most of these blind children lived in the residential schools, and their family residence was usually not in either Madrid or Seville. The children's average economic status was low, and most of them were a couple of years behind in school grade that corresponded to their age. (Blind children's schooling in Spain usually starts with one or two years in an introductory group.) The majority of the subjects had spent all of their school life in these institutions. Almost the entire population of blind children with the above characteristics attending the schools used in the research formed part of our sample.

The two control groups were randomly selected among children who attended two residential schools in Madrid owned by the Provincial Government. All of the children lived in the schools and received their education in these institutions. The economic status of their families was very low, with either poverty or the existence of important family problems as the cause of their enrollment in these schools. All of the subjects selected had normal academic performance, and were free of any special problems according to their teachers' reports and the schools' psychologists. Whenever possible, the experimental and

control subjects were matched by sex, although sometimes the scarcity of blind children with the above characteristics did not allow matching.

Tasks and Procedure

Most of the research activities reported here were carried out from an orthodox Piagetian point of view. We started with a study of mental images (Rosa, 1980b, 1981a) in which some tasks adapted from Piaget and Inhelder (1966) were applied. A study of the development of spatial knowledge followed (Ochaita, 1984), with tasks adapted from Piaget and Inhelder (1947), Piaget, Inhelder and Szeminska (1948), Katsui (1962), and Hartlage (1976). The research culminated, for the time being with an extensive study (Rosa et al., 1983) on aspects such as classification, seriation and number concept (corresponding to the period of concrete operations); causal reasoning and combinations (period of formal operations); and a study on representation of information in memory.

This last part of the research refers to special aspects of the processing of verbal information by the blind. The tasks administered required recognizing and remembering different types of verbal material: short-term memory with shadowing tasks, with letters presented aurally and tactily; learning and memory of word-pairs with a high degree of visual and auditive imagery (adaptation of the technique developed by Paivio, Yuille & Madigan, 1968); and incidental learning with orientation tasks using words with great visual and auditive imagery (an adaptation of the techniques developed by Craik and Tulving, 1975).

All data were gathered using the Piagetian clinical method, except in the case of the verbal tasks in the formal operation studies where the subjects answered Longeot's questionnaire, and the memory study where a classical experimental method was used. Owing to the characteristics of the materials used in the memory tasks, only two groups were tested -- one experimental (blind subjects) and the other the control group (sighted subjects), excluding the blindfolded group as they did not know Braille.

Results were quantified and statistically analyzed, comparing differences in performance of the different groups and age-levels in the same task, as well as the various performances of each age-level in every group across all the tasks.

Results and Discussion

Our data fully confirms the panorama of cognitive development reported by Hatwell (1966). Below we review some of the most important findings. (For a complete presentation of results, see Rosa, et al., 1983.)

Concrete operations. At the stage of concrete operations our results indicate that all the tasks with a figurative component, such as the three mountain tasks, were especially difficult for the blind; they show a delay of three to six years in comparison to the performance of the sighted control group. This delay seems to a large extent to be the result of the sensorial modality (haptic) with which the task is carried out, as comparison with the blindfolded subjects suggest (see below). In contrast, on those tasks that are basically verbal in nature, as in the case of additive classification, quantification of inclusion, hierarchical classification, or syllogisms (independent of whether the terms of comparison are spatial), there is no delay in the blind compared to the control groups. What is more, the blind manage these tasks at an earlier stage of development than other tasks that should be accomplished during the same developmental stage (Rosa, et al., 1983).

The operational tasks of conservation, classification, seriation and number produced similar results. Verbal tasks are resolved from the earliest age-level studied, while those that include a figurative component (within which we included multiplicative classifications because the material used was a bi-dimensional matrix of objects) give the same profile of attainment as that of spatial or image tasks.

Formal operations. The gap between attainment levels for verbal and figurative tasks is even more evident when considering the results of the formal tasks. These tasks show that there are no significant differences between the various groups studied at any age-level. The blind children's level of attainment is typical of Western school-children; that is, the percentage of subjects that reach formal thought is about 50 percent. The only tasks in which blind children show a disadvantage compared to sighted children is verbal permutations. According to Piaget and Inhelder (1951), this is the most difficult combinatory task, and to this we should add, that along with the variations and combinations tasks, verbal permutations tasks were administered through the

use of a written questionnaire (Longeot's test). In order to perform properly, the blind children found it necessary to continually go over what they had previously written, which is especially tiring when using Braille. It should also be noted that this was the last task administered, so fatigue may have influenced the results. Also, and above all, the difference between the sighted and the blind groups was not apparent until the 17-18 age-level when the sighted groups' attainment improved considerably while the blind group maintained the level of performance of earlier age-levels.

Our results, therefore, offer a picture which is perfectly coherent with that of Hatwell (1966). Additionally, in our case, one cannot attribute the lower attainment of the blind subjects to the fact that they live in institutions, separated from their families. Recall that the sighted subjects also lived in institutions and often came from splintered social and family environments.

The case of the blindfolded. The results obtained from the blindfolded control group are worthy of further comment. The idea behind the use of this group was to differentiate the effect of sensorial modality from that of the possible consequences that the lack of vision from birth could have on cognitive development. We were perfectly aware that blindfolded subjects are not "persons made blind momentarily," given that they lack the experience of haptic exploration from which blind persons benefit. However, we were able to observe how the results and the ways of manipulating and exploring the materials were very similar to that of the blind-from-birth subjects. We do not believe that the blindfolded subjects' lower achievement is due solely to working within a sensorial modality which is especially difficult or even trying for them, although this is one factor that needs to be taken into account. On the contrary, the correspondence of their results with those of the blind subjects seems to make it clear that it is precisely the sensorial modality itself, as suggested here, which is responsible for this strange distribution of "decalages." However, one aspect of the results cannot be overlooked: When at certain age-levels a task was easy or seemed familiar to the blindfolded subjects, their attainments came closer to those of the sighted subjects than to those of the blind. This phenomenon has been noted previously and explained by the hypothesis of sensory transposition (Juurmaa, 1973), according to which these subjects are able to transfer particular tactile perceptions to a form of visual representation with which they are much more used to working.

Representation of information in memory. The results of the short-term memory experiments suggest that there is a simultaneous and independent coding of stimuli through touch and hearing, given that both forms of coding can maintain perceptual characteristics of each sensorial modalilty in a simultaneous and independent manner. The other two experiments attempted to test the hypothesis of the mediation of images (Paivio, 1971). The results are surprising. Although the blind subjects show higher attainment than the sighted in those words that have a tactile reference, there do not exist -- contrary to predictions -- differences in the attainment that both groups achieve in the tasks that include letters with a high aural and visual content. These results seem to suggest the existence of a semantic coding of information which allows tasks to be adequately completed which would in any other situation be difficult for the blind to complete. This way of coding information, according to the results obtained, appears principally from the age-level of 13-14 years onward, the same age at which the performance in formal operational tasks starts to reach its peak.

Conclusion

The results of the study indicate the existence of a separation between the operatory domains which are mediated through language and those that have a fundamentally figurative nature. The implications of this statement are important, as clearly irreconcilable with Piaget's theory wherein language is given secondary importance to figurative representation, also denying language's importance in the period of formal operations. We have shown how operational tasks carried out through language are in advance of figurative tasks. The argument that the blind have their linguistic abilities intact, while the sensorial modality with which they gather figurative information is slow thus providing them with more limited information than that offered by sight is common sense, but it cannot hide the radical divorce which exists between the profile of cognitive development in the blind presented by these results and what may have been expected from Piaget's theory.

That blindfolded groups have a level of attainment similar to that of the blind groups also posits an interesting challenge to the initial theory. How is it that working with one or other sensorial modality makes for such a dramatic change in levels of attainment? Is it that the acquisition of operational abilities in one sensorial domain cannot be transferred readily to a different one? Is it that each sensorial modality imposes a particular sequence in the acquisition of operations? These are questions that remain open for future research to address.

Finally, the results of the memory tasks, combined with those obtained from the aforementioned Piagetian tasks, appear to indicate that the haptic sensorial modality is responsible for the delays that were outlined earlier. It is just when the semantic coding of information comes into effect that the importance of the sensorial modality used to solve a task diminishes, making it possible, therefore, to satisfactorily undertake tasks based on the semantic code that by their very nature are especially difficult to approach in the haptic modality.

But this interpretation, in turn, poses new problems for Piaget's theory. According to the theory, cognitive development is independent of the various sensorial modalities. The results summarized here, however, suggest not only that the sensorial modality is a factor of prime importance and that language holds much more relevance than that assigned to it by Piaget, but that the logical structuring itself of the periods of development may not be adequate to describe the cognitive development of blind children. Tasks that theoretically should be solved at the same stage of concrete development present a horizontal "decalage" which is totally atypical. If to this we add that the existence of the horizontal "decalage" is precisely one of the most controversial aspects of Piagetian theory, it is clear how the results offered here are within the same stream as those that demand a critical revision of the theory from the Geneva school.

Notes

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[1]Surprisingly enough, Hatwell's provocative data did not attract much attention. Subsequent research did not try to explore these basic findings but focused only on the study of very specific tasks. Studies such as those of Miller (1969), Gottesman (1973) and Tobin (1972) -- all of them on consersation tasks -- argued that Hatwell's data could be reconciled with Piaget's theory by taking into account the nature of the sample of blind children with which she worked. These authors found that blind children who lived with their families did not show any delay in their performance with respect to sighted control groups, while there was quite a big gap between sighted and blind children when the latter were living in specialized institutions, as was the case with Hatwell's experimental group.

[2]The Spanish National Organization of the Blind -- an autonomous state organization administered and governed by the blind, which finances itself mainly through a very popular daily lottery -- provides most of the jobs that Spanish blind adults have, offers free education for blind children and gives grants for blind students attending universities.

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Following Instructions

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To discover some of the implicit and generally unrecognized cognitive tasks which underlie the achievement of coherent or "accountable" cognitive performances we examined videotapes of a series of science experiments in a third grade classroom. These experiments are part of a commercial "multimedia" science program, "Amazing Adventures." [1] This program is comprised of animated film-strips and illustrated story-texts depicting "Cosmos the Incredible" and his young friends performing extraordinary, seemingly magical feats; these turn out to be based on natural scientific principles which are the subject of student science experiments, conducted in accordance with instructions provided by "Activity Sheets" correlated with the film strips.

Our approach to these data is influenced most directly by the recent work of Harold Garfinkel and his students (Garfinkel, in press; Garfinkel, Lynch, and Livingston, 1981; Lynch, Livingston, and Garfinkel, in press). Garfinkel is concerned

with the practical contingencies, the "lived work," of accomplishing "naturally accountable" activities, such as forming service queues, following map directions, and making scientific discoveries. In our accounts, both as members and as social scientists, of human activities, we tend to ignore the mundane or seemingly insignificant details of how those activities were actually produced within a specific setting. Garfinkel writes of

> . . . "horizontal" properties of naturally available phenomena [such] as their historicity, their detail, their developing intelligibility, their circumstantiality, their contingent occurrence, and their embedded production. Canonical problems of social order are practical methods for theorizing the contents of everyday activities by furnishing grounds for treating the horizontal properties as irrelevant . . .
>
> The expressions, "unremark-able" and "unnotice-able" are hyphenated in referring to practices of such unquestioned efficacy and banality that no motive ordinarily exists, either in commonplace settings or professional inquiries, to make an issue of their methodic character. In the social scientific search for routine, predictable, standardized, and orderly states of affairs in the society, these practices are overlooked, while at the same time their routine, predictable, standardized, and orderly production of worldly matter of fact and conjecture incessantly "works for" the social science inquiry (Garfinkel, in press).

The indexicality, incompleteness, and ambiguity of rules and instructions, and the status of these properties as necessary and essential rather than incidental or remediable, has been a major topic of ethnomethodology from its early development (Garfinkel, 1967, Chapter 1; Wieder, 1970, 1974; Zimmerman, 1970) until the present. The recent work of Friedrich Schrecker (in press) on the progress of a laboratory experiment is of particular relevance in the present context. ". . . the sheet of lab instructions used by Schrecker in his lab work required of students that they locate the text's instructions and, accordingly, the answers and practical reasoning conveyed by the text's specifications, by turning away from the text and initiating embodied activities on the distinctive surface of the lab bench" (Lynch, Livingston, and Garfinkel, in press). Schrecker, like the children in our study, had to turn a set of instructions into a concrete course of work and face the practical contingencies created thereby. As we shall see, for children, the translation from instructions to performance is particularly hazardous, engendering diverse, unforeseen, and quaint difficulties. The result is not that the children do not learn, but that they learn something rather different from what the "experiment" is designed to teach them.

It is notable that the instructions provided to the children (examples available upon request from author) are not merely instructions -- they are also prospective accounts. That is, if the experiment is "successful," if it achieves its projected outcome, the instructions can serve as an account of "what was done," although in any actual performance a great deal more is necessarily done than can be comprised in the instructions. It is only when things go wrong that the details of the course of work require examination in the search for an account of what happened. This brings up another property of instructions: it is possible to imagine a set of instructions with no particular projected outcome. Perhaps one might even want to argue that such things occur in the realm of moral imperatives. In all other cases, though (at least those which we can bring to mind), either the instructions lead to a specified or generally known outcome, or to an outcome known to the writer of the instructions and to be discovered by the person undertaking to follow the instructions. Instructions have a projected outcome, known to the instructor and possibly the instructed as well. This property is not definitive of instructions, but it is crucial to the process of following them and accounting for "what happened," as we shall see in the data that follows.

Garfinkel has demonstrated and investigated the hidden (or, perhaps we should say, all-too-obvious) structure of ordinary activities by introducing anomalies into them. What happens, for instance, when a son behaves like a polite guest in his own home, when a blind man asks for place directions, or when a person wearing inverting lenses tries to sit down in a chair? In the case of Agnes, the transexual, Garfinkel (1967, Chapter 5) found a naturally occurring resource for his investigations of the structure of ordinary activity. Agnes, having been raised as a male, had to teach herself how to be a competent, "naturally accountable" female. Children, all children, are comparable to Agnes, and a comparable resource for social scientists, in that the child is incompetent in the ordinary, taken-for-granted skills of daily life. There could hardly be a more "perspicuous setting" (Garfinkel's phrase) for discovering the unremark-able and unnotice-able practices involved in instruction-following than a setting in

which young children are called on to follow a set of instructions.

Even when intended as a guide to a comparatively simple course of action yielding easily describable results, instructions and related explanations presuppose a range of competencies and conventional understandings, without which even the most detailed instructions are meaningless for organizing practical activities. This is particularly evident in those cases where the third-graders we studied lacked some of these skills or understandings, frequently with the effect of transforming the experiments into something quite different from what was envisioned in the instructions.

Courses of action prescribed by instructions vary considerably with respect to degrees of skill and comprehension required to carry them out, just as instructions themselves vary greatly in terms of clarity and completeness. But some of the competencies and understandings to which we refer, and those we are most interested in here, are of such a general nature, that is, they seem so fundamental to successfully following any set of (adequate) instructions, that they may be regarded as constituting the essential competence which enables one to follow instructions *per se*. Put another way, they define what one does in following instructions in general.

Successfully following instructions can be described as constructing a course of action such that, having done this course of action, the instructions will serve as a descriptive account of what has been done, as well as provide a basis for describing the consequences of such action. However, like instructions, this description leaves undefined the practical skills, the embedded activities, and the background knowledge, in other words, the competence by means of which constructing courses of action in accordance with sets of instructions is accomplished. We suggest that, rather than learning "science," the primary cognitive task confronting our subjects in these experiments was that of developing such competence -- a competence which, because of its problematic status, becomes explicit by virtue of being a resource for interpreting the children's behavior.

Perhaps the most important of the cognitive skills required for dealing competently with instructions is the ability to grasp at the outset some of the general relationships and possible connections between a projected outcome and a corresponding course of action on the basis of information given in the instructions, and in the case of the experiments discussed here, in the "Reason" or "Explanation." This despite the fact that in didactic experiments the discovering of such relations is envisioned as a *consequence* of following instructions, rather than as a *condition* for doing so. Yet it is only by inferring some sort of pattern that the necessarily incomplete nature of instructions can be developed into a coherent course of practical activity; that unavoidable ambiguities and unforeseen contingencies can be resolved appropriately; that one can distinguish that which is essential from that which is non-essential in the instructions; and that one can decide whether any particular action among the virtual infinitude *not* specified by the instructions might facilitate, interfere with, or prove totally unrelated to the outcome. As we will see, all of these skills are required for competently following instructions, though as a consequence of the reflexivity of a course of action and its outcome they depend largely upon anticipating relationships between these last two factors.

Consider, for example, the instructions for the experiment called "Keeping Dry Under Water." A napkin is to be pushed down into an eight-ounce plastic tumbler and the tumbler then inverted and plunged straight down into a plastic bowl half filled with water. The tumbler is to be held in the water for a second or two and then lifted straight out. The napkin will remain dry. It will be obvious to a competent adult that these instructions include a number of details that are not essential to the experiment. One could achieve the same result by plunging a 10 1/2-ounce soup can with a rag in the bottom into a bathtub three-quarters full of orange juice and keeping it there for an hour or two. Much of the content of these instructions is therefore determined by practical considerations which are irrelevant to the projected outcome. But one cannot presume that a third-grader would know this. And in fact one of the essential instructions, that the tumbler be lifted straight out of the water, was violated several times, resulting in failures to achieve the projected outcome. The apparent reasons for these departures from the instructions further illustrate the implicit competencies which underlie instruction-following. There is nothing in the instruction sheet that tells (or allows one to deduce) what will happen if the tumbler is tipped

while under water. Yet it is precisely this knowledge that is required to correctly understand the meaning of the word "straight" in this context. We would not, for instance, say that a ball did not go straight simply because it revolved in flight. Our understanding of the meaning of "straight" in the instructions is informed by our knowledge of what will happen if the cup is tipped. Rather than saying that several children failed to follow the instruction to lift the tumbler straight out of the water, it would be more accurate to say that they failed to follow the instruction as a competent adult would have interpreted that instruction. This appears to reflect also an unforeseen contingency which arose in the course of the experiment: the napkin often fell out of the tumbler, either before placing the latter in the water or upon lifting it out. Thus some of the children who had successfully gotten the cup and napkin into the water subsequently tipped the cup to ensure that the napkin would not fall out when they raised it. Some of the students met this contingency by suggesting that tape be used to hold the napkin in place, a method adopted by several others; but it is interesting to note that many of the children rejected this solution, preferring the challenge of trying to succeed without such assistance. The latter portion of this science lesson therefore evolved into a competitive social activity, students who succeeded without using tape being rewarded with cheers and applause from their classmates.

This denouncement is not inconsistent with what we have been saying about instructions. In making a competitive game out of following instructions which, in a very few years, they will find trivial and so easy to carry out as hardly to require conscious thought, these children are demonstrating that the ability to turn instructions into practical activities that achieve predictable outcomes is not yet an implicit, taken-for-granted competence, but a set of skills which they are in the process of developing. So it was not the problem of "air pressure" so much as the problem of constructing a coherent, "successful" course of action out of the experimental instructions with which they became engaged.

Several incidents we observed illustrate the need for recognizing connections between the projected outcome and the ongoing activity in order to avoid more or less random actions which interfere with the experiment. For example, in the case of "Invisible Writing," where students write with a toothpick dipped in salt water and subsequently produce an image by rubbing carbon paper across the residual salt crystals, we observed several children licking the salt off the toothpick before writing with it. Several others, in rubbing their fingers over the paper in order to feel the dried salt crystals, appear to have wiped the salt away. Not surprisingly, this experiment produced few unambiguously successful outcomes. In the experiment entitled "Making Water Wetter," in which dipping a soap-covered finger into the center of a cup of water sprinkled with pepper causes the pepper to move to the edge of the cup, according to the instructions as a consequence of the soap breaking the surface tension of the water, some students produced this effect simply by bouncing their fingers up and down or stirring them around in the water so vigorously as to create waves which pushed the pepper to the outside.

The pattern which inheres in a coherent set of instructions, and which in turn makes such instructions coherent, not only guides actions, but determines perceptions as well, in that it tells one what to look for, what to regard as relevant observations, and what to ignore. Such a channeling of perceptions is necessary not only in order to regulate the practical course of action but to determine if the projected outcome is in fact achieved. Thus competence in "viewing the world," or "seeing what is there," according to the account of things embodied in the instructions. Because they had not fully developed such a competence, our subjects frequently ascribed significance to observations which a competent adult would regard as irrelevant, "out of frame," or otiose with respect to a coherent "scientific" account of what was being done.

An example of this may be seen in the "Keeping Dry Under Water" experiment. To expedite carrying out this lesson two similar and functionally equivalent pans of water were placed on a table in the center of the room and the students were called on by pairs to try the exercise. Toward the end, when, as related above, this activity had become particularly competitive, one of the children approached a pan but was urged by classmates to use the other one because it was "luckier." We are not sure how this notion came about, although in a pair of trials closely preceding this comment the student using the "unlucky"

pan had failed, while the child using the other one had succeeded. At any rate, the student followed this advice and the experiment was successful. Both of the following two children rushed for the "lucky" pan, though the loser settled for the "unlucky" one (and succeeded nevertheless). In the case of the next pair, the second child waited for the first to finish using the "lucky" pan, and then also used it. The "unlucky" pan remained unused thereafter.

In another experiment, the children were instructed to hold a slip of paper just below their mouths and blow across the top of it. The expected result being that the paper would rise due to the reduced pressure of the air moving over it. One of the students was unable at first to produce this effect and a classmate suggested that she was holding the slip of paper with the wrong hand.

In neither case are such observations *by nature* illogical or irrelevant. If a child were having difficulty learning to, say, bat a ball right-handed it would be appropriate to ascertain, perhaps by experimentation, if he were left-handed; and if one were unable to decide which of two brands of automobile to buy, she might reasonably take into account the goods or ill fortune of any acquaintance(s) who had recently bought one or the other. But in these science experiments our understanding of the relationship between the practical course of action and its outcome seems to leave no place for "luck" or handedness. Therefore such factors become "noise"; they are outside of the frame of reference defined by the instructions.

This "framing," by which the complexity of the perceivable world is more or less spontaneously organized, is also evident in the decision as to whether an actual outcome sufficiently resembles the projected outcome described in the instructions that the experiment is to be regarded as a "success" or as a "failure." Phenomena often do not lend themselves unambiguously to such discontinous classifications, but in these instances, it is necessary to order phenomena so as to yield practical classifications in accordance with criteria given in the instructions. Instructions, furthermore, by their very nature lead us to expect that, assuming we have followed them correctly, the projected outcome will occur. Thus our interpretation of outcomes involves expectations not only concerning *what* should occur, but also *that it should* occur. As the following examples illustrate, competence in this regard requires producing conceptual order out of phenomenal ambiguity without letting prospective accounts of "what is there" preclude alternative, contingent accounts.

In the case of "Invisible Writing" with salt water, for reasons given above many of the children were unable to make anything even approaching legible writing appear, though by vigorously and persistently rubbing the carbon paper over their papers they did produce irregular blotches and streaks. They often tried to persuade themselves and their classmates that these constituted successful outcomes, attempting to show how certain random marks might be interpreted as particular letters. In the case of "Making Water Wetter," when the first student dipped his finger into the water some of the pepper sank while some went to the sides of the cup. One student immediately exclaimed "success!" while another said, "they're going down to the bottom." When the latter statement was amended by the teacher's observation that some (actually, only a few flakes) went to the bottom and some to the sides, consensus was achieved that the projected outcome, *viz.*, "the pepper will move quickly to the outside of the tumbler," had in fact occurred. The students here achieved a competent, "in frame" interpretation of the results, but only after a certain amount of negotiation. It might be argued that they learned something here about the proper seeing of results produced according to instructions.

One of the other students suggested that the experiment would have the same outcome if small pieces of paper were substituted for the pepper, a prediction which most of the children responded to with disbelief, some even with derision. When this was tried, once again some of the pieces sank while others moved to the outside. In this case the overwhelming consensus was that because some of the paper had sunk, the experiment had failed.

In the initial experiment, the authority of the instructions was decisive in classifying the objectively ambiguous results. "What happened," as far as most of the students were concerned, was that the pepper moved to the sides, as predicted; negative instances were (eventually) discounted as irrelevant. But in the improvised experiment

(which was in fact the true "experiment"), lacking such authority and at the same time expecting failure, the children conversely refused to see as overriding those instances where the paper moved to the sides and instead classified the outcome in terms of the paper sinking, i.e., as a failure. (The fact that some of the pepper and paper sank might be seen as a powerful demonstration of the principle of surface tension, but it was not envisioned in the instructions. For the students, concerned with "success" and "failure" rather than with the scientific principles that the experiment was ostensibly teaching, the sinking was unexpected and untoward and consequently a sign of failure at the practical activity of instruction-following.)

Idealized notions of science as an abstract, disembodied enterprise are, as we have seen, a poor representation of the actual work of doing science. In addition, science is also conventionally presented as abstracted from the social setting in which it occurs. But, as *The Double Helix* by James Watson vividly documents, science is through and through a social enterprise, penetrated with social considerations, and this is at least equally true for scientific "experiments" done in classroom settings. It is not simply a matter of doing something and seeing the results. The results are classified as "success" and "failure" and thus are laden with social implications. The doing of the experiment and the interpretation of the results come to involve social support, competition, gain and loss of face. The nature of the results is a matter not merely for observation but for negotiation. Although we will not go further into these considerations here, any discussion of the socially defined outcomes of the pepper and paper experiments described above would have to take the social contexts of these experiments into account.

In many instances, as we have seen, there were failures to achieve outcomes predicted in the instructions. In virtually none of these cases was such a failure allowed to pass without at least one of the children offering an explanation. This would seem to reflect a common, if implicit, acceptance of instructions as prospective accounts of how projected outcomes are brought about; the correctness of these accounts remained unquestioned, though their completeness, in the sense of providing all relevant details, was often in doubt. A failure, therefore, might bring into question the completeness but never the correctness of the instructions. The "experiments" did not test the validity of a scientific principle, only the competence of the students at carrying out the instructions. The children were also provided with the occasion to practice a useful social skill -- accounting for discrepant outcomes within a framework of unquestioned authority.

In this sense, and unlike in the case of hypothetical experiments, it may be said that rather than learning how to use evidence to reason from controlled conditions, the students were learning the practical skills and imagination involved in rationalizing such evidence, that is, in *ad hoc* speculation concerning violations of or incompleteness in instructions. For example, in an experiment involving the use of liquid dish soap to blow bubbles through plastic straws, a few of the students who were unable to blow bubbles as large as those expected on the basis of the instructions took this as indicating that the brand of soap employed was inferior. The failure to produce a legible message in "Invisible Writing" was said by some to be due to using the wrong kind of paper.

A common feature of the failures to accomplish expected outcomes which we observed was their lack of any real theoretic interest; they were rationalizable in terms of retrospective accounts of practical courses of action, rather than explainable in terms of general principles. The result, as suggested earlier, is not that the children fail to learn, but that they learn something different from what the experiment is intended to teach them. What they learn are, most importantly, the practical and creative skills needed to successfully turn a set of instructions into an accountable course of action, or, if necessary, to account for failure without discrediting the instructions.

We have suggested that dealing competently with the instructions requires not just the apprehension of bare imperatives, but an understanding of general relationships and possible connections between a projected outcome and a corresponding course of action, of which the instructions are indexical. This indicates the reflexivity, or the mutually determinative nature of the course of action and its outcome, in which is grounded the meaningfulness and coherence of a set of instructions. The course of action is determinative of the outcome not only in a physical sense but in that the course of action, as it comes to be formulated in subsequent accounts, makes

certain aspects of the outcome noticeable, relevant, and mentionable. The perceived outcome, on the other hand, informs one's perception and account of what the course of action was. The same course of action may be differently described in accordance with what outcome it appears to have produced. This is especially the case when the projected outcome does not materialize and one has to examine one's course of action to see if and how it was consistent with the instructions. In such cases, previously insignificant and irrelevant details may become crucial in an account of the course of action. There is another aspect, though, to this reflexivity: One's sense of the course of action prescribed by the instructions is informed by one's knowledge of the projected outcome, just as one's sense of what will serve to constitute and be essential in such an outcome is informed by the prescribed course of action. It is in this way that the meaningfulness and coherence of instructions is grounded in the perceived relationship between course of action and projected outcome.

As our observations of these third-graders indicate, it is largely by means of achieving competence with respect to the indexical and the reflexive nature of instructions that one becomes able to recognize the essential and unessential features of the accounts embodied in instructions; to fill in the gaps in these accounts, both conceptually and through practical activities; to determine the relevance of particular acts; and to reduce ambiguity by means of practical classifications of phenomena. Although our subjects were in many respects less than competent in these skills, they seemed clearly to possess well-developed senses of "accountability" as an organizing and interpretive principle of practical activities (and their outcomes). By virtue of this sense of accountability as the form according to which meaning is ascribed to actions, and actions are constructed out of meanings, the cognitive skills tapped and developed by elementary science experiments were far less of a "theoretical" (in the usual sense) than of a practical nature.

Notes

[1]A copyrighted (1979) product of Nystromg, Division of Carnation Company.

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What's This? Maternal Questions in Joint Picture Book Reading with Toddlers

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There are many claims made in the popular press (e.g., Trelease, 1982) regarding the beneficial effects of parents' reading aloud to their young children, and the professional literature reveals similar views. Researchers have seen joint picture book reading as a means of developing concepts and familiarity with literacy (Teale, 1982), as well as a mechanism for acquiring vocabulary (Ninio, 1983) and other linguistic skills (Snow & Goldfield, in press).

Our research on mothers reading picture books with their infants and toddlers is inspired by the recent emphasis in the developmental literature on the social origins of cognitive skills (Bruner, 1977; Wertsch, 1979; Wertsch, McNamee, Budwig & McLane, in press; Wood, Bruner, & Ross, 1976). ("Reading" is somewhat of a misnomer, because there is little or no text in books for infants and toddlers, and parents often ignore what text there is.) We think of picture book reading as a joint cognitive endeavor in which either partner can spontaneously volunteer information, request information from the other, or respond to the other's request for information. We are interested in the structure underlying mother-child reading interactions and differences in that structure as a function of the age and linguistic ability of the child, a topic that has recently attracted the attention of other researchers as well (Ninio, 1980, 1983; Ninio & Bruner, 1978; Snow & Goldfield, in press).

In the present paper we focus on the questions that mothers ask their children during joint picture book reading. Posing questions about the pictured materials is a prominent part of most mothers' behavior in this situation. This questioning generally involves memory demands in which the child is asked to recall or recognize information related to the pictures in the book. It seemed to us that this early mnemonic experience might be important in the development of memory in young children. In our analysis of maternal questions, we have been especially concerned with the mother's adjustment of the type and level of her memory demands to the age of her child.

We have conducted two studies of joint picture book reading. In the first (De Mendoza, 1983), 30 mothers and their 12-, 15-, and 18-month-olds "read" a simple ABC book that had one picture corresponding to each letter of the alphabet. In the second reading study, 15 pairs of 18- to 38-month-old children and their mother talked about a complex farm scene from a popular children's book by Scarry (1963). The subjects were all white and middle-class although a wide range of family income and educational background were represented within the socioeconomic level.

We found that the frequency and type of question asked, that is, the memory demands made by mothers in the reading interactions, differed as a function of the age of their children. With the youngest children (12-month-olds), there were few questions; almost no memory demands of any sort were made. The mother tended to be the only active participant in the interaction, and her role was primarily limited to simply labeling the pictures as she pointed to them. The following segment from the protocol of a mother of a 12-month-old[1] includes everything the mother said about three successive pictures.

M(12): Look at the apple. Apple.
" Teddy bear.
" And Kitty.

Occasionally, the mother provided some additional information about the pictures, although this was most often limited to imitating the sound made by an animal or object. ("Frog. He goes 'ribbit, ribbit.'")

With older children, the mothers increasingly often sought information from the child, rather than simply providing the information for him or her. However, the mothers of the younger children in our sample (12- and especially 15-month-olds) frequently used a question format ("What's this?") without really seeming to expect a response from the child. In the clearest examples, the mother named an object herself and merely asked the child to confirm her label.

M(12): And that's a kite.
" Is that a kite, Josh?
" Isn't that a froggie?
" Isn't that a froggie?
" Oh! Is that an elephant?

The most that these confirmatory questions could require from the child would be to recognize and acknowledge the appropriateness of the mother's label. In practice, however, the questions appeared to be rhetorical; the mother did not really expect the child to confirm the correctness of the information. Although the mother's utterance had the form of a question, it appeared to function simply as a labeling statement.

In a similar vein, mothers of the younger children often asked for the label of an object ("What's this?") or other information, but then immediately, or with only a brief pause, went ahead and provided the requested information themselves. In the following examples, the mother's answer followed close on the heels of her own question.

M(12): That's a doggie.
" What does a doggie say?
" Arf, arf, arf, arf.
M(15): Do you know what that is?
" Elephant.

In other words, mothers of younger children frequently adopted a questioning format, but assumed both roles themselves (questioner and respondent) and did not really require or even expect the child to take an active (verbal) part. The mother's assumption of both roles in a dialogue with a very young child has often been reported in the mother-infant interaction literature (see, for example, Stern, 1977), as well as in picture book reading interactions (Ninio & Bruner, 1978). As a consequence of the mother playing both parts, the children received substantial experience with the question-answer cycle before being required to contribute anything other than attention to the cycle.

Starting around fifteen months, the children observed were expected to take an increasingly active role in the reading dialogue. The mothers started making clear memory demands, both for recall and recognition memory; and these demands increased both in frequency and complexity as a function of the child's age. In the earliest recall demands, the mother pointed to a pictured object, requesting that the child label it.

M(15): What's this?
C: Bah.
M: Ball.
M(18): You know what this is?
C: Kite.
M: A kite. Yeah.

Thus, the child was asked to retrieve from memory the name that applied to a single, visible, clearly demarcated object.

The mothers often skipped pictures in the alphabet. The decision between skipping or including a picture, as well as the decision between labeling a pictured object herself or asking her child to label it, seemed to be based on the mother's beliefs about her child's knowledge. For all ages in the alphabet book study, if a mother thought her child could say the name of an object (i.e., if she reported that her child spontaneously produced the word), she usually asked the child to give its label. For words that the mother reported the child did not know, she was more likely to provide the label herself. The mother was much more likely to skip pictures that she thought were unfamiliar to her child than pictures the child knew something about.

One could characterize the mother as acting in a way that maximizes her child's contributions to the interaction. The mother tracks the development of the child's vocabulary, and whenever there is a good chance that the child can respond at a higher level (verbally), the mother gives him or her the opportunity to do so. The mothers adjust to their children's current level of competence in many other ways that are not tied to simple vocabulary growth.

Evidence of maternal adjustment to the child's level comes from the fact that increasingly more was demanded of older children. For example, rather than simply asking for recall of the names of simple, single picture objects, the mothes of older children stepped up their demands by asking for indirectly specified information: that is, they asked for information that was related to the pictured objects but that was not actually in the picture.

M(29): What do bees make?
C: Honey.
M: Good.
M(30): Where does the baby bee live?
C: (unintelligible)
M: Lives in a bee hive.

Older children were also sometimes asked to draw inferences based on the picture.

M(27): That's a horsie.
" And look what he's going to eat.
C: Apple.
M: Apple.

With recognition memory, the mothers' demands varied as a function of both the child's age and the difficulty of the required response. Sometimes, instead of pointing to an object and telling the child its name, the mother gave the name of an object and asked the child to point to it ("Where's the Kitty?" "Show me the duck"). In this case, the memory requirement for the child was simply to recognize the picture that matched the mother's label. In the study that used a very simple ABC book with only four spatially separated pictures of single objects visible at a time, even 15-month-old children were asked to point ("Show momma the doggie"). In the other reading study, however, in which an elaborate farm scene was the stimulus material, pointing requests occurred quite infrequently for any but the oldest (3-year-old) subjects ("Do you see a sheep anywhere?"). Thus, whether the mother asked for a point response depended not only on the child's age, but also on the difficulty of isolating the named object.

One mother converted the request for pointing into a relatively complex mnemonic exercise. She repeatedly asked her 38-month-old child to point to objects, but the objects were only indirectly specified. For example, rather than saying, "Show me the barn," this mother said, "Show me where the horses sleep at night." She also asked a series of questions that were of the form,"Can you find an animal that says ['oink, oink'] ['moo']?" Thus, this mother provided a retrieval cue -- a characteristic of an object -- which the child could use to retrieve the name of that object. The child then had to search the picture to identify the corresponding object.

It is tempting to see this example as a method of adjusting to an older child for whom the picture book was relatively simple. This child was well beyond the level where he had any difficulty labeling or pointing to the objects in the picture, so the mother may have adopted this format to make the reading session a little more challenging for him. This would then represent an example of "upping the ante" (Bruner, 1977; Wertsch, 1979), continually increasing the level of performance asked of the child.

Several examples of mothers making the opposite sort of adjustment -- reducing the demands on a child -- were also observed. If her child was not forthcoming with some information requested, some mothers gave clues.

M(13):	What do bees make?
C:	Bee, bee, bee, bee, bee . . .
M:	What do bees make?
"	What does Winnie the Pooh eat?
C:	Honey.
M:	Yeah. Look at these beehives where the honey is made by the bee.

In this example, the mother seems to be motivated to do two things at once: to avoid providing the response to her own question (something the mothers of younger, less participative children were not at all reluctant to do) and to get the child to give the correct response. Another idiosyncratic technique that a few mothers employed to elicit a correct response was to tease the child, primarily by mislabeling pictured objects.

C(31):	What's that? (Pointing to a horse in the pictured farm scene.)
M:	You know what kind of animal that is.
"	What is that?
"	That's a bird, that's a bird.
C:	That's a horse.
M:	That's a bird.
C:	That's a horse.
M:	No, that's a bird. Hi, bird. Hi, bird.
C:	That's a horse.
M:	You sure?
C:	Yeah.
M:	You're sure?
C:	Yes, that's a horse.
M:	You're right. I was kidding you. Putting you in the trick bag.

The mother seems to want and expect the child to contradict her inappropriate label, with the mislabeling designed to draw from the child the information she believes he knows.

The mothers we have observed thus seem to be trying to balance two different goals -- to challenge the child and to help him of her respond correctly. The mother wants the child to participate at the highest level at which he or she is capable, so she continually increases the level of her demands. At the same time, she wants her child to perform successfully. We can think of the mother's behavior in the picture book reading interaction as an attempt to situate the

interaction within what Vygotsky (1978) refers to as the child's zone of proximal development (Wertsch, 1979). She presents some of the material at a level that exceeds the child's capacity to respond, and then she provides various forms of support to help the child arrive at the correct response.

Another example of a technique that the mothers often used to assist their children was to relate the pictured material to the child's personal experience, explicitly drawing a connection between the child's own memory and the pictures in the book.

M(12): Frog. You have a frog, a stuffed one.
M(15): Look at the house. We live in a big house, don't we?
" . . . Indian.
" Is that Chief Illiniwek?
" Huh? Is that like Chief Illiniwek? (The University of Illinois mascot.)
M(18): Look at the little mouse.
" Just like the one Daddy works with.

Examination of these personal references revealed two main points. First, this technique seemed to be employed more often by mothers of younger children. Almost every one of the mothers of children who were 18 months or younger at least once related something in a picture to the child's past experience (as opposed to half of the older children's mothers). Most of these references were quite brief (as in the examples above), although a few were extensive. Second, the great majority of these personal references were to general aspects of the child's experience, rather than to specific events. Mothers tended to comment that a pictured object was similar to something the child owned, something the child did nor didn not like, or some activity the child engaged in habitually. Only a small proportion referred to a specific event that the child had experience and might be expected to remember. The following references to particular events were *atypical.*

M(18): Mmm. You had some jelly this morning.
M(22): What happens with the bee?
" Does the bee sometimes sting you like it stung Daddy?
C: Yeah.
M(29): Do you remember, Robbie, when the farmer was plowing the field behind our house?
M(29): Do you remember that farmer on the big tractor?
C: Uh-huh. Cutting down.
M: What did he cut down on his field?
" What did the farmer grow?
" Do you remember?
C: No.
M: He grew corn, remember?
" Big corn stalks.
C: Uh-huh.
M: Remember that?

We were intrigued by the mother's strong bias toward relating the picture book content to enduring or repetitive rather than specific experiences. To examine how mothers question young children about their memory for particular events, we have recently observed pairs of mothers and their 24- to 36-month-old children looking at family photograph albums at home together (only pictures taken within the last six months), an activity that most of the mothers reported engaging in two or more times per month. Here, a large proportion of the pictures have to do with the child's own personal experience; indeed, the child is the main focus of many of the photographs. We expected that the mothers would do much more prompting of their children to recall and reminense about specific events.

The results we have to date (on 16 pairs) are not what we had expected. The most striking result, and the first thing that surprised us, was the very low frequency of specific memory questioning by the mothers. Although the mothers asked a great many questions about the pictures, the preponderance of their question were couched in the present tense; they rarely said, "Do you remember . . . ?" For over three-fourths of the pictures, the mother asked the child to describe, but not to recall, the content of the pictures: She asked the child to name the people present ("Who's that?"), to tell where they were located ("Whose house is that?"), or to describe what was happening.

(Looking at a photo of the child on his mother's lap, drinking from a bottle.)

M(24): What's this picture show?
C: Tristan.
M: Doing what?
C Tristan.
M: Snuggling with mommy? Hmm?

C: What's at?
M: But what is Tristan holding?
C: Holding a baba [bottle].
M: Yeah.

The questions thus required recognition and interpretation by the child, but in only a minority of the cases was the child asked to recall a particular pictured event. One especially revealing example in this regard is the following:

(Looking at a photo of child, who has just taken a drink of tonic water meant for her father.)

M(24): . . . You're drinking that nasty stuff in the bottle, huh.
C: Baby.
M: *Did* you like it.
" *Do* you like that drink of Daddy's?
" *Doesn't* look like it.
" No. but that *was* funny.

Here, the mother began by asking her child about an unique event in the past tense but then changed to the present tense, thus switching from asking the child to remember the event to asking her to infer her reaction to the event from her facial expression shown in the picture. In her concluding comment, the mother switched back to past tense.

These data suggest that mothers of 2-to 3-year-old children did not expect them to be able to report specific events, but only general knowledge. This was true even in the context of looking at photographs, which one would expect to maximally effective cues for retrieval of stored experiences.

When we looked further at the instances of recall demands that did occur, we found that when the mother of a young child did ask the child to recall an experience, that event was almost always a unique or unusual.

(Looking at a vacation photo of mother and child in front of the Statue of Liberty.)

M(30): What's this . . . ?
" The Statue of Liberty.
" Did you, did we go and see her?
C: Mm Hmm.
M: Remember we went on the boat?
C: Yeah.
M: We were on the boat right now in that picture -- we were riding on the boat.
C: Oh.
M: Who took our picture?
C: What? Daddy?
M: Right.
" Did you like the boat ride?
C: Yes.
M: We walked all around the Statue.
C: Mm Hmm.
M: And we climbed up the steps.
C: Yeah.

Most of the examples of recall demands have involved non-recurring, distinctive events -- holidays, vacations, or visits -- and pictures containing information that clearly separates that event from the child's everyday experience (e.g., different clothes or costumes, decorations, atypical setting, etc.). It should be emphasized that even pictures of highly unusual events were most often discussed or described in the present tense.

In both of the reading studies, which used common books produced for young children, and in the family photo study, mothers of young children showed a strong bias to ask their children to report general knowledge rather than to recount specific events from personal past experience. These data parallel those of Nelson and her colleagues (Nelson, 1983; Nelson & Ross, 1980), who have found that young children provide coherent recall of general or scripted information earlier than they produce integrated accounts of specific past experiences. The mothers we have observed tend to ask their children for just the type of recall Nelson has shown are capable of giving.

What role might these maternal memory demands play in the child's development? For one thing, the child receives practice in the retrieval of information on demand, and this practice takes place with maximal environmental and social support. In terms of environmental support, the presence of the picture or photograph virtually eliminates any ambiguity regarding the referent of the mother's comments or questions. In terms of social support, the child's mnemonic activities take place in the context of a warm, pleasurable interaction, and the mother structures the situation to elicit the best the child has to offer. However, some of the mother's demands are aimed above the child's current level: At every age, the mothers ask for some information that the child is probably incapable of supplying. When the mother does so, and her child fails to respond, she

almost always supplies the response that she has requested or provides some assistance to help the child respond. Thus, the child is provided with a a model of the response that he or she is currently incapable of producing alone or is given subtle guidance to produce it.

We have characterized the mothers that we observed as adapting their questions to their perception of their child's knowledge -- talking most about familiar things, asking the child for any labels he or she can say, increasing their demands as the child's competence grows, aiming their questions to the child's zone of proximal development, and providing the necessary assistance to help the child respond correctly. To what extent would the mothers we have described in this way recognize this interpretation of their behavior? De Mendoza (1983) interviewed the mothers of the 12- to 18-month-olds in her study. She asked the mothers, among other things, why they talked about some pictures and ignored others, what they thought their child learned from picture book reading, and what, if any, long-term benefits they foresaw from this activity.

The mothers' responses indicated awareness of many of the aspects of their behavior that we have commented on. Almost all of them expressed an intentional bias toward talking primarily about pictures that were familiar to the child or that made contact with the child's current knowledge.

M(18): In this book I know there are things that she knows, or is beginning to know, so I concentrated on those and skipped some of the other things. If there was something that I thought she had no idea about I kind of skipped over it and moved on to something I thought she might be familiar with.

M(12): [I choose pictures] if I can point out something about the picture or make a sound or relate it to her -- like the animals make sounds or the house is where she lives with mommy and daddy.

M(15): I know there were a couple of things that I just never talk to him about . . . I can give you an example -- like queen. He's not to the age of reading stories about queens, so how do I even talk about a queen? I might say the lady; but right now even that's too much for him.

Several mothers indicated that words that their child said had a special status in determining which pictures they focused on, although not every mother who mentioned this influence on her selectivity seemed aware that it led her to ask the child to label the picture.

M(12): There are certain words that she knows, that I've heard her say, so I try to get her to say them. That's how I choose some of the pictures.

M(15): I talk first about the things I know she knows, and especially the things she can say. Like she says 'quack, quack' for duck, so I talk about the duck, and she can say 'kitty.' So the things she can say I do first, or I make sure I mention those.

A few mothers talked about consciously increasing the level of the interaction as a function of the child's growing knowledge.

M(18): I skipped some of the things because he doesn't know what they are yet. Then, as he learns more, I go on to something else, something that he can relate to. He doesn't really know what a kite is but he knows his brothers go to fly a kite, so I feel I can talk to him about that. He still might not know what the kite is but he relates it to something that his brothers do. At least that's how I feel I'm teaching him. I don't know what he really thinks in his mind.

M(15): After we've gone through [the pictures] a few times, so she knows what the things are, then I'll ask her to point them out to me.

Thus, most of the mothers knew that they were selective in their input and demands from the child. But what leads them to this selectivity, to this matching the child's current level? Is the behavior of these mothers guided by an intuition of sound educational practice, by an implicit understanding of the zone of proximal development? All of the mothers indicated that they expected their child to learn something from the picture book interactions (with the most frequently mentioned products being increased vocabulary, expanded concepts, and a lasting love of books and reading). Should the mothers therefore be viewed as sensitive teachers striving to attain educational goals?

I think that most mothers do see themselves as teaching their children by reading books to them (although the reading also serves other goals, such as providing a quiet time for the child and a sense of closeness). However, it is not clear that the teaching function governs their immediate

behavior, that it is responsible for the ways that they adapt their input to the child's level. I suspect that these modifications take place in the service of an immediate goal of communicating effectively with the child (Newport, Gleitman, & Gleitman, 1977), of getting and maintaining the child's attention. Because picture book reading sessions are most often terminated by the child's losing interest, a major part of the mother's role is to keep the interaction going. A few mothers explicitly gave this rationale for why they generally talked about pictures the child was already familiar with.

> M(18): He'll look at [a picture], and if he doesn't know what it is, he's not interested. So I try to call his attention to things that go with something he already knows, or that he knows something about.
>
> M(12): I think I was probably pointing at things she already knew . . . I was probably geared toward trying to capture her attention with things she knows.

I am suggesting, then, that the middle class mothers we observed do view joint picture book reading an important educational experience, but that the specific techniques they employ in the process of the ongoing interaction are primarily dictated by the necessity of communicating with a limited partner, a partner who is not capable of playing a fully complementary role in dialogue. Because a successful reading interaction requires sustained attention on the part of the child, the mothers do what they believe will capture and hold the child's interest, including talking about familiar things, presenting a limited amount of new information and relating it to the child's experience, and assisting the child to respond correctly. It is a happy coincidence that the very techniques that are adaptive in the shortrun to attract and keep the child's attention also happen to be especially effective teaching tools.

Notes

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[1]The number in parentheses with each quotation indicates the age of the child involved.

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A Conceptual Framework for Studying the Long-term Effects of Comprehension Instruction

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The purpose of this paper is to describe the conceptual framework for a line of research examining the long-term effects of instruction on the development of reading comprehension skills by elementary school students. This research is being conducted from a perspective influenced by Vygotsky's ideas (for a detailed discussion, see Au & Kawakami, 1984). Thus, attention is focused on interactions between teachers and students which contribute to the learning of skills in reading comprehension. The analysis centers on videotapes of naturally occurring classroom reading lessons given by teachers to groups of five or six children, homogeneously grouped for reading instruction. Looking at lessons given to children at different levels of reading achievement should make if possible to identify changes in instructional interactions across time. Close examination of these changes should yield answers to two questions, which are actually sides of the same coin. First, what differences occur in *teacher behavior* as lessons are given to students with more and more competence in reading comprehension? Second, what changes can be detected in *student behavior* over time, which seem to reflect greater sophistication in comprehension?

Two kinds of factors are being considered in studying these changes: 1) the skills being emphasized in instruction and 2) students' mastery of these skills. Shown in Figure 1 is a model of comprehension instruction outlining the steps teachers might take children through in reading comprehension lessons. These steps correspond to the skills considered to constitute the first kind of factor. It should be emphasized that the number of steps and their definitions have not been validated empirically; the steps listed are only working hypotheses at this time.

As shown, steps in the model appear to be organized in three larger, interrelated phases. It is assumed that different steps and then phases would be attended to as students become increasingly competent. Once individual steps are mastered, teachers probably should concentrate on helping students execute combinations of steps or phases in an intergrated, more automatic way. Similarly, after each phase is mastered, the teacher helps students execute combinations of phases and then all phases together in an intergrated, automatic way. A fuller description of the model is presented below.

With regard to the second kind of factor, the assumption is that students' learning of particular steps or phases in the model will proceed through three stages. In each of these stages, comprehension performance is thought to have two aspects, metacognitive and cognitive. The metacognitive aspect has to do with knowing what step should be performed, while the cognitive has to do with being able to execute the step identified as appropriate (for further discussion of this distinction, see Brown, 1980). In stage 1, the teacher lends support to both the metacognitive and cognitive aspects of comprehension performance. She may model and perhaps explain the step in question, and provides a great deal of assistance in helping students to execute small pieces of behavior involved in the step. In stage 2 there appear to be two possible situations. In the first, the teacher controls the metacognitive aspect of performance, giving students cues about the steps which should be executed. However, once a cue has been given, the students are able to execute the step with little teacher assistance. In the second situation, the students control the metacognitive aspect of performance, i.e., they show that they know what step should be performed, but the teacher still must help them execute it. Finally, in stage 3, the students control both the metacognitive and cognitive aspects of performance, able to determine which step needs to be applied and also to execute it.

In summary, lessons are being compared along two dimensions: the steps or phases of the comprehension process being emphasized in instruction, and the apparent stage of student mastery of the steps or phases at issue. This approach should make it possible to look at the externalized, slow-motion working out in a group lesson, of what in the mature reader would be a completely internal, highly automatized process, carried out individually.

The Model of Comprehension Instruction

It should be emphasized that this is a model for teaching comprehension, not a model of the comprehension process itself. Given the methods used in this study, which focus on teacher and student talk, it is impossible to determine whether the steps teachers take students through in the comprehension lessons are the same as those students actually follow to comprehend the text. Correspondences can only be inferred on the basis of students' verbalizations.

The present model grows out of earlier work with the experience-text-relationship or *ETR* method for structuring reading comprehension lesson (Au, 1979). Both for the purposes of teacher training and research, a more detailed model has been required. As shown in Figure 1, the model incorporates three phases, according to the source or sources of information students are required to use in the comprehension task (of course, this is a question of emphasis, rather than an exclusive reliance on one source or the other). These categories are based on the taxonomy of questions developed by Pearson and Johnson (1978) and on work by Raphael (1982) on question-answer relationships. The sources of information are 1) scriptal or prior knowledge, 2) text information, and 3) a mixture of scriptal knowledge and text information. In a parallel manner, the three phases of instruction are labeled Scriptal, Text, and Combinative.

The movement of the phases of instruction, within and across sources of information, is as follows. During scriptal phases, before the text is encountered, the teacher has the children call up general and then specific background knowledge relevant to the text to be read. She next has them make initial prediction about text content, usually on the basis of the title or pictures accompanying the text. Beginning with scriptal knowledge, this phase of instruction moves the students toward the text.

The students read silently, usually just a page or two of the text for first and second graders, but more with older ones. This period of silent reading signals the start of the second kind of phase, the text phase. After the students have finished reading silently, the teacher asks more questions, having them evaluate the predictions made earlier and discuss related details of the text. She then may have the students clarify text information not explicitly anticipated and make connections among different text ideas. Students are also asked to make inferences about the feelings, motives, and point of view of story characters. This phase of instruction at first functions to focus students' attention on the text itself. Then, as they are asked to interpret text, to respond to text implicit rather than only text explicit questions, it moves them back toward scriptal knowledge as a major source of information.

During the third phase, the combinative, the teacher asks question which lead the students to apply text information to their own experiences. These are questions of the following type: "What would you do if you were in the same situation as the story character?"; "Could the same thing happen to you?" This step seems to involve the use of text information to enhance and perhaps reorganize or change existing knowledge structures. The teacher then asks questions leading students to make predictions about the sections of text about to be read. A period of silent reading may follow. The movement within this phase, then, is first largely within one's knowledge base and then back toward text information. As shown by the arrow in Figure 1, text and combinative phases of instruction continue in alternation until the end of the lesson.

The purpose of conducting the pilot study described below was to assess the strength of the conceptual framework offered by the model comprehension instruction and the stages of student mastery. Details of the results of this study are viewed as less important at this point than the process of evolving the constructs and methods needed to carry out such work. Nevertheless, preliminary data are presented to illustrate the possibilities offered by the approach.

Figure 1: The Model of Comprehension Instruction

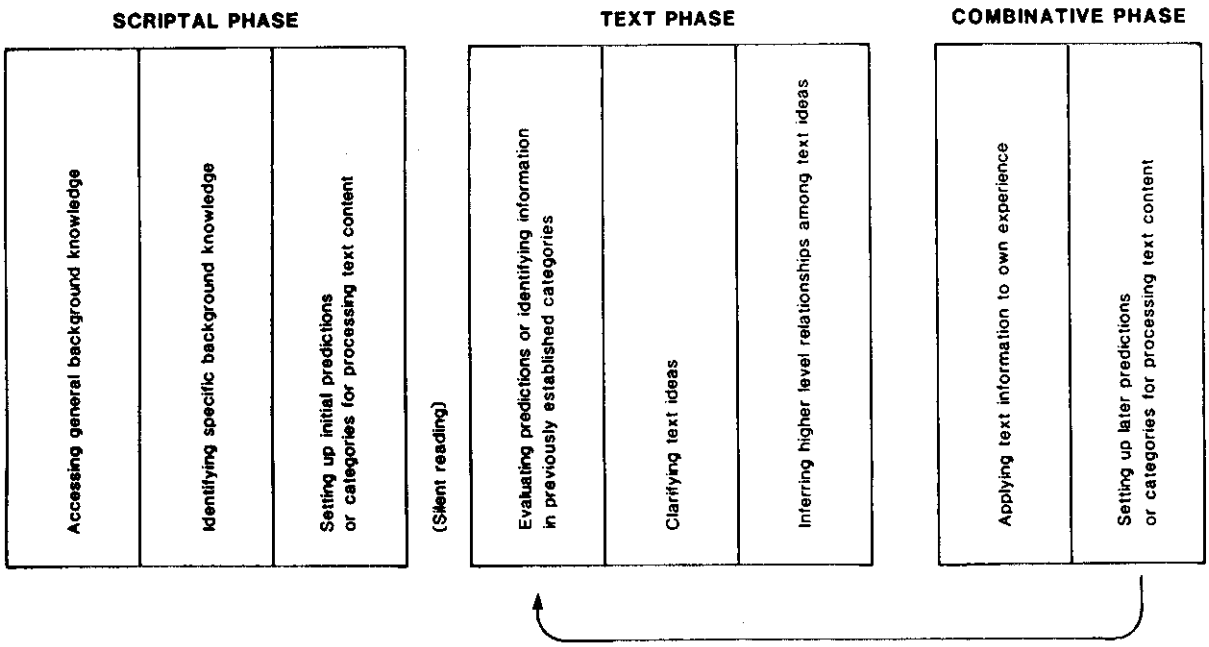

Table 1
Percentage of Discussion Time
in the Phases and Steps within Lessons

	LESSONS			
	First Grade-A	First Grade-B	Third Grade-A	Third Grade-B
Steps				
General Background	36.51	-0-	23.96	-0-
Specific Background	12.31	26.90	4.64	8.65
Initial Predictions	2.61	16.70	-0-	15.25
Scriptal Phase	51.43	43.66	28.60	23.90
Evaluating Predictions	10.62	17.23	-0-	14.66
Clarifying	10.03	9.83	48.43	28.00
Inferring	5.23	6.34	22.96	21.70
Text Phase	25.88	33.40	71.39	64.36
Applying	4.47	4.97	-0- *	-0-
Later Predictions	18.21	17.97	-0- *	11.73
	22.68	22.94	0	11.73

* Missing data -- last minute of lesson not videotaped

Methods

Subjects, Setting, and Design

The teachers and students in the lessons analyzed were all participants in the reading program developed by the Kamehameha Early Education Program (KEEP), in Honolulu, Hawaii. The target students of the KEEP reading program are disadvantaged children of Polynesian Hawaiian ancestry, who normally score as a group at about the 30th percentile on standardized tests of reading achievement through the third grade (Tharp, 1982), after which their achievement seems to be even lower (Thompson & Hannahs, 1979). When enrolled in the KEEP reading program, which emphasizes comprehension, classes of first through third grade students achieve at about the 50th percentile on standardized reading tests (Tharp, 1982).

Classrooms in the KEEP reading program generally have small homogeneous reading groups, each with five or six children. All groups meet with the teacher for a 20 or 25 minute reading lesson every day. Most of the time in these lessons is spent in comprehension instruction; in most cases this means guided discussion of a basal reader story.

Four basal text discussion lessons were analyzed, two given to first graders and two given to third graders. All lessons were videotaped in the KEEP laboratory school. The lessons were taught to different groups of children by three different teachers (both third grade lessons were taught by the second author), all experienced and well-trained. They did no special preparation for the lesson, which occurred as part of the children's regular program of instruction. One reason for selecting these lessons for analysis was that all appeared exemplary, incorporating many if not all of the features of small group comprehension instruction believed central to the effectiveness of the KEEP program (Au, 1982a, 1982b). Another reason for their selection was that they seemed to represent distinct points along a continuum.

Analysis of the Videotapes

All analyses were based on the discussion portions of the lessons (i.e, time in transitions and silent reading was excluded). About a minute of discussion at the very end of one of the third grade lessons was not videotaped, but all other lessons were intact. Student and teacher speech in three of the lessons was transcribed as completely as possible. Also noted on the transcripts were nonverbal behaviors relevant to instruction, such as the teacher's writing on the board and the student's opening of their books. In one of the first grade lessons, only the teacher's questions were fully transcribed, although notes were made about important student responses and nonverbal behaviors.

A number of different units of analysis were employed in examining lesson discourse. The two which proved most significant were the utterance and the interchange. An utterance was defined as an unbroken turn of speaking. At the level of the utterance, teacher questions or statements setting tasks the students were to perform were of particular interest. An interchange was defined as a unit of topically related discussion, usually initiated by a teacher question. An interchange concluded when a text or text-related idea was established or agreed upon through the process of group discussion (for further details and examples, see Au & Kawakami, 1984). Boundaries were established for interchanges in all lessons, and the number of seconds in each interchange was determined.

Teacher-student interchanges were the units categorized according to the steps or phases in the model of comprehension instruction shown in Figure 1. Interchanges were also the unit examined in making judgments about the stage of students' mastery of a particular step or phase. Operational definitions of the steps were drawn up, and interchanges were coded accordingly. Phases could consist either of single interchanges or set of interchanges; steps were assigned to phases in the manner depicted in Figure 1. Operational definitions of the three stages of development were also prepared. The two variable considered in the coding of interchanges according to stage were 1) whether the teacher or the student initiated the topic of discussion, and 2) whether the teacher's questions and statements cued the students about the type or content of information to be provided, or essentially just kept the discussion flowing (stage 1= teacher initiation, teacher cued performance; stage 2= teacher initiation, uncued performance *or* student initiation, teacher cued performance; stage 3 = student initiation, uncued performance). Interobserver reliability, at a 90% level of agreement, was achieved in the coding of

the interchanges both by step and by stage.

Results

Discussion occupied 19 minutes, 46 seconds and 15 minutes, 46 seconds in the first grade lessons. In the third grade lessons, there were 13 minutes, 17 seconds and 11 minutes, 22 seconds of discussion. Table 1 shows the percentage of time in each lesson spent in each step and phase.

When the first grade lesson were compared to the third grade lessons, differences in the time spent in each phase could be seen. In the first grade lessons, about half the time was spent in the scriptal phase and about a fourth each in the text and combinative phases. On the other hand, in the third grade lessons, only about one-fourth of the time was spent in the scriptal phase, with about two-thirds in the text phase.

The first and third grade lessons were also compared in terms of the percentage of time in each of the steps. The first grade lessons were similar in that only about five or six percent of the time was spent in the Inferring and Applying steps. In both third grade lessons about one-fifth of the time was spent in the Inferring step and none in the Applying step.

Apart from these within-grade similarities in text and combinative phase steps, certain cross-grade similarities between pairs of lessons were observed in steps in the scriptal phase. As seen in Table 1, one of the first and one of the third grade lessons were similar in showing more time in the General Background step, less in the Specific Background step, and little or none in Initial Predictions. In contrast, the other first and third grade lessons showed some time in these last two steps, but none in the General Background step.

When students' stage of mastery was considered, differences between first and third grade lessons were apparent. In both first grade lessons, almost all of the time in discussion (85%) was spent in instruction at stage 1. A high percentage of stage 1 interaction was consistently seen across all three phases of both first grade lessons, ranging from 70 to 100%. In contrast, in the third grade lessons, less of the discussion was conducted at stage 1 (60%). Also, although a relatively high percentage of the text phase was in stage 1 (70 to 80%), only 40 to 50% of the time in scriptal and combinative phases was in this stage.

Discussion

Both the results showing differences in time spent in various instructional phases and steps, and those relating to degree of student mastery, seemed to follow patterns consistent with the proposed conceptual framework.

Analysis of the time spent in various phases indicated that the emphasis in instruction shifted to different phases of the model when the students were at different levels of reading proficiency. In the first grade lessons the emphasis was on the scriptal phase, while in the third grade lessons the text phase was emphasized. Much time in the first grade lessons was spent in helping students to gain access to and recognize the importance of relevant prior knowledge for reading comprehension. The third graders seemed already to have this ability, and so lesson time was devoted instead to helping them process text information.

Analysis of time spent in steps also revealed differences between first and third grade lessons. In the first grade lessons a very small amount of lesson time was spent in the Inferring and Applying steps, which both seem to require higher or deeper levels of processing. First graders can well be expected to have difficulty processing text ideas at these levels. In contrast, much more time in third grade lessons was spent in Inferring, probably because the texts were more complicated and could not be well understood only through lower level thinking. With these more difficult texts, story ideas may be better understood within the framework set by the text itself than with reference to the students' own personal experiences. Thus, going through an Applying step does not necessarily improve text comprehension.

Two patterns of instruction were seen in the emphasis on different steps within the scriptal phase, in cross-grade pairs of lessons. One pattern showed more time in the General Background step, while the other showed more time in Specific Background and Initial Prediction steps. The first pattern seemed to prepare students to encounter text by helping them to establish categories in which to slot text information, while the second pattern seemed to lead students to generate specific hypotheses about text events. Both patterns appeared equally effective in preparing students to encounter text.

As expected, third graders showed more mastery than first graders of the overall reading comprehension process, as reflected in the instructional model, and of the phases within it. Still, while approaching independence in scriptal and combinative phase performance, they required considerable assistance in text phase performance.

Conclusion

In short, the results of the pilot study indicate that differences among lessons can be identified, and sense made of these differences, using the framework defined by the model of comprehension instruction and the stages of student mastery. Although these results are preliminary, and must be viewed with caution, the approach seems promising.

Much remains to be done in working out the details of the proposed approach for studying the long-term effects of comprehension instruction, especially in testing the veridicality of the model of instruction. A next step is to collect videotapes of lessons representing other points along the continuum. Longitudinal research, tracing through the sixth grade the learning of comprehension skills by a sample of children currently in kindergarten, has also begun. Finally, an effort will be made to identify or develop suitable experimental tasks. These tasks would be administered periodically to determine whether steps observed in lessons that are moving into stage 3 can in fact be carried out independently by individual children.

Notes

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XLCHC: A TELECOMMUNICATION MESSAGING SYSTEM

In addition to print communications, the NEWSLETTER editors are interested in expanding our efforts in telecommunications (see Bannon's review, this issue).

We hereby invite submissions to the NEWSLETTER via this new medium and, when space permits, we will publish telecommunication addresses of our readers. We begin with the Source account numbers of long-term associates of our Laboratory who are interested in discussing issues of culture, technology and thinking.

XLCHC (UC San Diego): TCN268
Dennis Newman (Bank Street College): TCX928
Alessandro Duranti (Pitzer College, CA): BB4131
Andrea Petitto (University of Rochester, NY): STN593
Community Educational Resource and Research Center (San Diego): BCP 174

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Hiltz, Starr Roxanne. (1984). *Online communities: A case study of the office of the future.* Norwood, NJ: Ablex.

The provision of "electronic mail" facilities that allow for communication between people in remote locations is now commonplace on most mainframe computer systems. Such facilities provide flexibility in sending messages to individuals or groups, as they can be composed and responded to at the convenience of the user. The term "computer conferencing" has come to refer to computer systems that facilitate communication between users. The use of the word "conferencing" in this context is somewhat misleading, as normal usage of the term is reserved for meetings where people are simultaneously present. Most computer conferencing systems operate asynchronously, with people accessing the system and responding to messages and discussions at their own convenience. Typically, computer conferencing systems allow users to send and receive messages from one or more people in a private fashion, as with an electronic mail facility. Additionally people can form groups or "conferences," which can be designated private (admission by invitation only) or public (admission open to anyone on the system). In a conference, public messages are displayed for all to see, and a transcript of the continuing discussions is available. Facilities are provided for accessing earlier discussions, and for adding personal comments to the public discussion file. A directory of participants is usually available. On some systems, facilities are also provided for composing text and developing joint working papers.

There are a number of well-known conferencing systems available, including the New Jersey Institute of Technology's EIES (Electronic Information Exchange System), designed principally by Murray Turoff; the University of Michigan's CONFER system, developed by Bob Parnes, the Institute for the Future's PLANET and FORUM system, developed by Jacques Vallee, Robert Johansen and others, and the Swedish COM and PortaCOM systems, developed by Jacob Palme and colleagues. The EIES system has been the subject of numerous investigations, many of which were conducted by Starr Roxanne Hiltz, a sociologist who has collaborated for many years with Turoff on studies of EIES. Online Communities is a summary of a number of these earlier studies, together with some organizing material that puts the evaluation of the system into a more general context. Because much of the material in the book has already been presented at conferences and has appeared in print, the value of the book lies more in the collation of the material into a single accessible reference than in any new empirical information provided. Indeed, one problem with the book is that the bulk of the data comes from studies done in the late seventies. When reading the book in 1984, one needs to keep in mind that most of the EIES users did not have terminals in their offices, and the terminals available were generally hard-copy, 30 character per second, dumb terminals. The fact that many users persevered in using the system despite these constraints points to either the dilingence of the user groups, or the usefulness of the medium.

First, some general comments on the book layout and contents. The writing style is informal and the book is quite readable, except for certain sections where the reader is overwhelmed with tables (there are 66 tables in the book) and details of the statistical analyses performed. It might have been more appropriate to have moved some of this material to the appendices. I found some of the tables in the book difficult to interpret, and would have preferred further selectivity in the presentation of the data. Each chapter has a summary or conclusions section. The summaries give a useful précis of the main findings from the chapters, but the conclusions drawn sometimes verge on the banal: "Perhaps EIES is like an intellectual lonely minds club or singles bar" (page 187).

The book is organized into eight chapters. The initial chapter provides a framework for the case study of several selected groups using EIES. It contains useful information on the general approach used by the investigator, and comparisons with some other research studies of a similar nature. The remaining chapters focus on specific aspects of the evaluation. The final chapter is a disappointment for those seeking a comprehensive account of what can and cannot be expected of computer conferencing, as these final six pages do little to analyse what has been exhaustively documented in the earlier parts of the book.

In this evaluation study of EIES, there were five separate conference groups involved, varying in size from 20 to 50 members. All of the members of the groups were drawn from the sciences or engineering disciplines. The rationale for this selection was based on the belief that these professionals were at the leading-edge of the "post-industrial society," and so might give useful pointers to the potential of new computer-mediated communication systems in the workplace. Whatever the merits of this argument, it certainly does not seem apt to refer to the study as a case study on the "office of the future," as indicated in the book title, except in a very loose sense, as there is little in common between the discussions of the research groups investigated and the day-to-day practicalities of running an office.

Evaluation of the system was based on a variety of measures. There were several questionnaires administered to the users -- before starting on the system, and subsequent followups after three months and 18 months on the system. Short, online questionnnaires were also used at times. EIES itself monitors the usage of the system, allowing for usage statistics to be calculated. A log file of messages sent to user consultants (part of the HELP facilities available) was of use in determining the kinds of problems users had with the system. The experimenter also played a role as participant observer in the various groups, and had access to the transcripts of the discussions. Unstructured interviews with the leaders of the various user groups were also utilized in the evaluation.

Let us now look at some of the research findings. Chapter 2 is concerned with the determinants of use of the EIES system. Hiltz notes "it is motivations of the participants and their location within a particular social context, not system characteristics, which are the primary determinants of use, at least in terms of initial system acceptance." Surprisingly, statistics showed that 40% of the scientists invited to have free access to EIES either never signed on at all, or never really mastered the system (less than 5 hours total connect time). The major reasons for this high "dropout rate" are unclear, although certain patterns can be noted. People who were "dropouts" listed a major reason for so doing as not having anyone on the system that they wished to communicate with. Surprisingly, despite the large number of variables that were considered, the most important predictor of use of the system is participants' own estimate of the time that they will want to spend online, before ever using the system.

Hiltz makes an important observation about how social characteristics of the group can affect the evaluation of the system, in other words, the technology is mediated by the social process, and any evaluation must take this into account. For instance, the role of the conference leader was discovered to be a crucial determinant of group effectiveness (as perceived by the group members). This person is responsible for two kinds of activities: an administrative support role, orienting new members, etc., and a conference management role, getting feedback from group members about various conference arrangements, summarizing discussions, etc. Over time, the role of the leader can change, and the need for a clear "leader" may decline, with various people in the group performing different "leadership" roles as the occasion warrants.

Rather than try to summarize the remaining chapters, which is unfeasible given the large number of research findings, I will concentrate on a few findings which I found of particular interest. One interesting finding regarding the support facilities provided for EIES users was their strong predilection for using consultants that could be reached online. For virtually all users, irrespective of experience with the actual EIES system, human help was judged as the most frequently used -- over the other facilities which included an online newsletter (CHIMO) containing information about new system features and activities, "short explanation" facilities, and extended explanations. This finding -- of the importance of human support services -- is corroborated by other observations of children using computers in a classroom setting

(Mehan, in preparation), and in my own informal observations of researchers and administration personnel in a research laboratory environment. Elsewhere (Bannon, 1984) I have discussed the importance of including human support networks in our designs for user support facilities.

In several places, Hiltz shows how specific social forces were responsible for user dissatisfaction with the system, implying that focusing on the technology alone will not show the reasons for failures or successes of systems. For example, an attempt by one group to develop an electronic journal failed partly because of a failure of communication within the group as to how to proceed. Hiltz quotes a group member as noting "the failure to produce a journal was not a result of the hardware and software aspects of the system, but rather a result of the failure of the group to recognize and apply appropriate maintenance and task functions which would have facilitated the work of the group."

Later in the book, Hiltz seems to ignore earlier admonishments to focus on the social context of the technology and attempts to show how the computer conferencing technology had an "impact" on the research groups (Chapter 6) and on productivity and communication (Chapter 7). Discussing the effects of EIES on clarifying theoretical controversies within a field, Hiltz notes "Overall, about half of EIES users felt that the use of the system had clarified theoretical controversies within the field. It was generally not felt that there had been a 'great deal' of clarification, but only that there had been 'some.'" Here is a case where it appears Hiltz would like to have shown a clear set of effects from use of EIES, notwithstanding the earlier view that specifics of the system, group makeup, prior expectations, etc., all affect how users subjectively assess the system. I feel that such general questionnaire items and their responses must be interpreted with some caution in this particular setting, given the fact that subjects knew they were taking part in a study on the effects of a new communication medium. Perhaps one general opinion of the users is of interest -- that the system is good for discussing different points of view, and generating ideas, rather than for resolving conflicts. Again, whether this opinion is a result of the specific facilities of EIES or is an inherent limitation of computer conferencing systems is a moot point.

The case study supports other studies (Palme, 1981) in the view that most of the communication engaged in through computer conferencing is "new" communication -- i.e., there is no large-scale substitution of face-to-face meetings, or letter-writing, or phone calls, as a result. To my mind, the "substitution model," which lay behind many early claims about massive improvements in productivity as a result of computer communication, is an inappropriate model. What we should be thinking of is a model whereby each communication technique has its "ecological niche," and what we should be working on is attempting to delineate the strengths and weaknesses of each technique for different situations.

So, what conclusions can be drawn from the book about the future of the medium? Despite the large number of observations made, and the many statistical analyses performed, one searches in vain for a cogent analysis of all this data. There are many interesting pieces of information in the book, but what is lacking is a framework in which to interpret them. Perhaps this is being too critical, as these systems are still evolving, and even knowing what questions are the right ones to ask is no easy task. But given the time-lag between the final technical report on this case study, which appeared in 1981, and the publication of the book, in 1984, one might have expected some further analysis and critical evaluation of aspects of this new communication medium.

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CUMULATIVE INDEXES

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