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## Autotelic Responsive Environments and Exceptional Children

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In every society there are those who fail to learn the things which are held to be essential for carrying out the role of a competent adult, or who learn so slowly that they are generally out of phase with the age-graded societal demands imposed upon them. Slow learners are apt to be problems to themselves and to their friends. It is recognized, in scientific circles at least, that there are many and diverse causes for failure to learn at the socially prescribed rate: brain damage, emotional disturbance, social-cultural deprivation, and the like.<sup>1</sup>

What is not perhaps so generally recognized is that prodigies are sometimes out of phase with societal demands also; they tend to make people as uncomfortable as retarded children do. Both retarded children and prodigies unwittingly violate social expectations—they need help if they are to reach their full potential. Both the ultrarapid and the ultraslow are *exceptional* children. The main topic of this paper is to describe some methods whereby the acquisition of complex skills can be accelerated, for both ultraslow and ultrarapid learners.

For a number of years my staff and I have been conducting studies of early learning in prenursery, nursery, kindergarten and first grades, where children are in the process of acquiring complex symbolic skills. In the course of this work I formulated the notion of a responsive environment and decided to act on the assumption that an *autotelic responsive environment* is optimal for acquiring such skills (Moore, 1961). I will now try to make clear just what this assumption means.

I have defined a *responsive environment* as one which satisfies the following conditions:

<sup>1</sup>At present there is no way to measure the basic capacities of human beings independently of their experiences. Also, there undoubtedly are interactional effects between *capacities* and *experiences*. It is not assumed here that the retarded child is necessarily wanting in “basic capacity.” The use here of such terms as “gifted” and “retarded” is simply intended to be consonant with standard usage in the field.

For acknowledgements see the end of this chapter.

1. It permits the learner to explore freely.
2. It informs the learner immediately about the consequences of his actions.
3. It is self-pacing, i.e., events happen within the environment at a rate determined by the learner.
4. It permits the learner to make full use of his capacity for discovering relations of various kinds.
5. Its structure is such that the learner is likely to make a series of interconnected discoveries about the physical, cultural or social world.

My colleague, Alan Ross Anderson, and I have defined an activity as *autotelic* if engaging in it is done for its own sake rather than for obtaining rewards or avoiding punishments that have no inherent connection with the activity itself (Anderson and Moore, 1959). The distinction between autotelic and nonautotelic activities is somewhat vague, but it can be applied in some cases without difficulty. Consider tennis playing as an example: we cannot play tennis without getting exercise, playing at all is a sufficient condition for exercising—so if we play for this reason, among others, this is an intrinsic reward. However, if we play for money, then the activity is not autotelic, since tennis and money need not go together—witness, amateur players.

In general, setting up a system of extrinsic rewards and punishments for engaging in an activity makes the learning environment more complex. As an illustration, consider a child who is learning to read aloud a list of words such as “fat” and “fate,” “mat” and “mate,” and “rat” and “rate,” etc.; pretend also that an experimenter rewards or punishes the learner depending upon success or failure. Imagine that the reward is candy and that the punishment is mild electric shock.

Under these circumstances, the child not only has the task of learning to read and pronounce these words, but also that of figuring out the relation between candy and electric shock, on the one hand, and his own efforts, on the other. There is no intrinsic relation between the words to be learned or between the letters of the words and the pronunciation, or between candy and the sensation of being shocked. It should be easy to see that learning to read and to pronounce words *and also* to anticipate the candy or the shock introduces irrelevancies which may distract or confuse the learner. It is not irrelevant, however, that after the child masters the words “fat” and “fate,” he may be able to generalize to the words “mat” and “mate,” or that he may be able to decipher new words not on the list such as “tin” and “tine.” Children are pleased, and some become ecstatic, when they make discoveries of this kind. Pleasure thus derived, unlike the pleasure of eating candy, is inherently related to the

internal structure of the task (and more broadly to the structure of the spoken and written language)—it is *not* a pleasure arbitrarily associated with the task by the experimenter acting in accord with his own *ad hoc* rule. Of course, sophisticated adults manage to disentangle nonautotelic irrelevancies from the essential features of many tasks; but we hold that this is not an optimal situation for learning difficult things.

The distinction between autotelic and nonautotelic activities is sometimes confounded with the issue as to whether rewards and punishments are either necessary or sufficient for learning to occur at all. Our objection to the use of extrinsic rewards and punishments is that they make learning situations unnecessarily complex. In effect, they add relations to be learned. However, to grant that, generally, there are intrinsic rewards and punishments associated with learning is not to prejudge the questions as to whether learning could take place without them.

As a theoretical matter it is very difficult to see how a learning experiment could be designed, which would be in any way meaningful to the learner, and in point of fact, we assume (for the sake of conceptual clarity *vis-à-vis* the making of a distinction between learning and performance, i.e., practicing what has been learned) that rewards and punishments, whether intrinsic or extrinsic, are neither necessary nor sufficient for the occurrence of learning. But of course no one would want to deny that they are highly relevant to the willingness of the learner to continue to learn more and to his desire to practice what he has learned.

From what has been said above it is undoubtedly clear that not all responsive environments are autotelic, nor are all autotelic activities carried out within the context of responsive environments. It is the purpose of this chapter to describe an environment which is *both* autotelic and responsive. I feel that I have been able to contrive an environment of this kind, which takes the form of a research laboratory, for young children. Some aspects of the autotelic “responsive environments laboratory” to be described here are novel; for example, the children play with a “talking typewriter.” But in order to interpret the behavior of children within this environment, it is well to keep the system as a whole steadily in view—to see it as a social as well as a mechanical system. For this reason, a physical description of the laboratory is followed by a description of the norms under which the laboratory is operated. A cultural characterization of what is to be learned is counterbalanced by a description of equipment and procedures which facilitate the learning. No one aspect of the environment should be thought of as constituting its essence; the laboratory was designed to fulfill all the conditions of an autotelic responsive environment. The techniques of operation are intricate and presuppose careful planning. And since the description of an environment without some reference to the behavior of its denizens is

incomplete, at the end of this chapter information is given about the background and laboratory behavior of five children: two "educable retardates," one child on the borderline between the "educable retardate" and the "dull normal," one who is on the borderline between the "very bright" and the "gifted," and one "gifted" child (to use standard terminology).

The emphasis in this paper on exceptional children should not be construed as a lack of interest in those who are within the normal range. As a matter of fact, most of my work has been with normal children. However, extreme cases are sometimes illuminating. I hope that this is true here.

To return to the problems of those who do not meet the age-graded demands imposed upon them, the relevance of the research reported here on retarded youngsters is patent: anything which may help them become more competent is of educational interest. On the other hand, it is not at all obvious that accelerating prodigies is a socially useful thing to do; society seems to be organized so as to slow them down, if anything. However, a case can be made for the acceleration of prodigies. Indications will be given as to how prodigies can develop some of their own potentialities while helping other children in the development of theirs.

#### LABORATORY—PHYSICAL DESCRIPTION<sup>2</sup>

The Responsive Environments Laboratory is located at Hamden Hall Country Day School, Hamden, Connecticut, a few yards from the Hamden Hall preschool classrooms. It consists of two adjoining prefabricated metal sheds, each 20' x 40', set on concrete foundations. One shed is windowless and the other has windows only in a small office area; they are centrally heated and air conditioned. The sheds are as simple as modern construction permits; they are made up of one-foot modular sections, have exposed ceiling and wall beams, and so on. In Shed 1 are five portable soundproofed booths, 7' x 7' x 7', lined along two 40' walls, leaving a middle aisle as well as small aisles between booths for observation through windows with one-way glass. Through a face and by-pass system the booths are separately air conditioned. One booth has camera ports and built-in lighting equipment so that sound motion pictures can be made on a semi-automatic basis. Shed 1 also contains a desk, a conference table and a secretary's desk.

<sup>2</sup> The Responsive Environments Laboratory described here served as the model for four other laboratories. Two of the laboratories operate under my personal direction—the others work cooperatively with me.

In order to avoid confusion, everything that is said here pertains to the Hamden Hall laboratory although the children discussed in the section (below) "Children in a Responsive Environment," did not necessarily come to this laboratory.

A central two-way communication system permits the staff to speak or listen either at the main console or at the booths themselves.

The interior of Shed 1 gives an impression of psychological warmth despite its spartan construction. Perhaps this is because the booths, which are its most prominent feature, have a natural wood finish. (Booth interiors are finished with off-white, sound-absorbent tiles.)

Shed 2 is divided into three areas separated by natural wood partitions: a small classroom, an office-conference room which also contains a booth for testing, and a bathroom. From the standpoint of construction the 16' x 20' classroom is an over-sized booth. Like the booths it is sound-proofed, air conditioned, equipped with one-way glass, finished in natural wood (exterior) and natural wood and sound-absorbent tile (interior). Again there is provision for the making of motion pictures on a semi-automatic basis. Shed 2, like Shed 1, is warm and pleasant in emotional tone; together they form one functional unit.

This laboratory was designed in accord with one overriding objective, that of making it conducive to carrying out autotelic activities by young children: it is simple, distinct, and separate. a) Simple in the sense that a game board or a playing field is devoid of irrelevancies, b) distinct in the sense that a playing field has clear-cut boundary lines, and c) separate in the sense that a grandstand sets barriers between participants and spectators.

The parts of the laboratory used by children are windowless; windows are an open invitation to digress. The absence of windows also increases the children's sense of privacy. Inspection of Figure 1 makes it clear that the booth interiors are free of the attention-grabbing patterns and whirligigs so typical of nursery and elementary classrooms. The soundproofing muffles irrelevant noises and further enhances a sense of privacy. The buildings are air conditioned in order to produce a constant comfortable environment; it makes no difference whether it is raining or snowing, sunny or cloudy, the general laboratory atmosphere is invariant. One-way windows, camera ports, semi-automatic motion-picture controls, and the like, make it possible to observe and document children's behavior without intruding upon them.

*It is important to note that children spend only a small fraction of their day in this laboratory.* It is not suggested here that gay designs and intriguing novelties are not appropriate in many other contexts.

#### LABORATORY—AUTOTELIC OPERATIONAL NORMS

Behavioral scientists take it for granted that human organizations function within the context of sets of interlocking social norms; this is certainly true of the Responsive Environments Laboratory as a social organ-



Figure 1. Automated Booth, showing interior and exterior

ization. By *operational norms* I mean the social rules which govern the relations between laboratory activities, on the one hand, and the school, the parents, and children, on the other.

One problem with which I have been concerned in constructing a new environment is that of being explicit about its normative aspects. A fundamental part of the task of creating a special environment for carrying on activities autotelically is to differentiate these activities from other important aspects of children's lives.

It is worth noting that, in addition to the educational problems mentioned at the outset, all, or nearly all, human societies make provision for engaging in autotelic activities. This is not only a matter of specifying times and places for these activities—the basketball court at game time, the theater at 8:40—but it is also a matter of creating and observing norms which safeguard these activities as autotelic. For example, one is not supposed to bribe a basketball player to shave points. The general public reacts with moral indignation whenever it is discovered that a norm of this kind has been violated. A distinction should be drawn be-

tween the norms which surround or protect an activity in its autotelic status and the rules of the activity itself. For example in bridge, onlookers are forbidden to *kibitz*, but this injunction is not a rule of the *game* of bridge. More generally, it is always possible to relax the norms which make an activity autotelic while leaving the rules of the “game” intact. Conversely, autotelic conventions can remain invariant while the rules of the game are changed.

With respect to the Responsive Environments Laboratory, every effort is made to maintain a setting in which “kibitzing” by parents and friends of the children is virtually impossible [there is a rule against their visiting<sup>3</sup> and the physical arrangement ensures privacy *vis-à-vis* the “significant persons” in the child’s life—more technically, the “significant others,” in the sense of Mead (1934), are excluded].

The staff seeks to make the laboratory a child-centered milieu. Even the introduction of a child to the laboratory is done by another child rather than an adult. A child guide takes the newcomer through the laboratory (equipment is turned off; the introduction to its operation is made later). Sometimes three introductory visits are needed before a newcomer seems to be at ease, although one visit is sufficient for most children. The guide also explains some of the relevant rules: 1) that he need not come to the laboratory unless he wants to, 2) that he can leave whenever he wishes, 3) that he must leave when his time is up (30 minutes maximum stay), 4) that he need not explain his coming or going, 5) that he go to the booth to which he is assigned for the day, 6) that if he says he wants to leave, or starts to leave, he *can* come back again the next day (but not the same day). Newcomers have the opportunity to explore every nook and corner of the laboratory. The guide watches this activity but does not interfere. After a while newcomers seem to feel satisfied that they have seen everything and are ready to leave.

It should be obvious that the role of the guide requires the ability to communicate clearly and to exercise self-restraint. The task of being a guide is assigned to gifted children; this is but one of many special tasks which they are given.

The laboratory staff is carefully instructed about treating the children. The import of the rules is that we want children to initiate activities. The staff is to respond to them rather than to teach them. Those who are in daily interaction with the children are not permitted to see the back-

<sup>3</sup> As a matter of practice, parents are allowed one visit per school year. The visit is arranged so that they do not see their own child in a booth and the child does not see his parents in the laboratory. However, the laboratory has many visitors—roughly 600 in the past three years. Most visitors are either behavioral scientists or professional educators.

ground information gathered by the project's professional staff; for example, the operating personnel do not know I.Q. test scores. Operating personnel are randomly assigned to booths every day. (There are two kinds of booths, automated and nonautomated. In nonautomated booths an adult is with the child. Since adults do not teach, we prefer to call them "booth assistants."<sup>4</sup> The members of the staff who are professional teachers<sup>5</sup> serve as supervisors of the laboratory as a whole, as well as booths.) No booth assistant should be uniquely associated with any given booth and its equipment, or with any particular child. (Children, as well as booth assistants, are randomly assigned to booths each day.<sup>6</sup>) The conduct of the operating staff is monitored by a supervisor who can talk directly to the booth assistant without interrupting a child. This is especially important in training new booth assistants. (The foregoing remarks are applicable to nonautomated booths. At present there is one fully automated booth, which requires no adult in the booth with the child; further details about automation appear below.)

The Hamden Hall children leave their classrooms (nursery, kindergarten and first grade) to come to the laboratory every school day. When

<sup>4</sup> Booth assistants generally have been the wives of graduate students. (This means we have to train new assistants quite frequently because their husbands graduate.) One of the qualifications for the job of booth assistant is a strong aesthetic sense. Teacher training is not necessary. The importance assigned to aesthetics is perhaps a prejudice on my part. I assume that those who are artistically inclined are likely to find the subtle workings of children's minds to be of continuing interest, and that they are not apt to impose their views on children. This assumption may be unwarranted but it has resulted in the selection of remarkably empathic, nondirective and patient booth assistants.

<sup>5</sup> It has been my experience that professional teachers who work out well as laboratory supervisors have both the ability to empathize with children and to organize efficiently. The role of laboratory supervisor is a critical one for the successful employment of the methods we are considering. It is in this role that the teacher, as a professional, can use her training and experience to good advantage. The seasoned professional teacher can draw on her years of experience to do such things as spot the child who is ill and should be home, or to analyze the hitches which arise in the process of performing a task which requires nicely coordinated effort on the part of the staff.

<sup>6</sup> Of the 102 children that I have studied there have been a few who, at times, have responded so much better to a particular booth assistant, or to the nonautomated equipment, or to the automated instrumentation than they did to the other conditions, that the laboratory departed from the usual procedure of random assignment until these children were able to play with pleasure wherever they found themselves. It will be made clear in the section "Children in a Responsive Environment" that it is important to take individual variability into account.



it is a child's turn to come, his classroom teacher<sup>7</sup> lets him know. He then either accepts or rejects his turn for the day. If he decides to come he takes his "pass" and goes by himself the few yards to the laboratory where he is checked in and goes to the booth assistant to whom he has been assigned. One of the most remarkable things about this environment is that, day in and day out, children elect to come to it. Sometimes several months go by without one child of the current group (which numbers 60) refusing his turn. However, it frequently happens that a child does not want to leave when his time is up, in which case he is gently picked up and told that another child is waiting.

From what has been said it should be clear that the adults the child encounters in the laboratory are *not* the significant adults in his life—they are *not* his mother, father, grandmother, etc. Those significant adults who ordinarily are in the best position to reward or punish him have no way of knowing how he spends his time in the laboratory on a day-to-day basis. It is therefore unlike Little League Baseball, with relatives and friends observing from the sidelines; the laboratory time represents 30 minutes *away from* the significant persons in his life.

To "cut off" 30 minutes from the rest of the day in this fashion does not necessarily mean that the experience is without consequences for the remainder of the child's day. Just as most autotelic activities make use of cultural objects (Anderson and Moore, 1957; Moore, 1958; Moore and Anderson, 1963; Moore and Lewis, 1963), which are formally isomorphic with significant features of many serious activities [as Anderson and I have argued before (Moore and Anderson, 1962): a) puzzles, b) games of chance, c) games of strategy, and d) aesthetic objects are formally similar to a) puzzling situations, b) the aleatory features of experience, c) cooperative and competitive undertakings, and d) the affective side of living] so, too, it is possible to design autotelic responsive environments in which a child can play with cultural objects, which though not ordinarily treated autotelically, are still structurally isomorphic with selected aspects of the world outside the laboratory.

#### GENERAL DESCRIPTION OF THE CURRICULUM

As remarked above, a responsive environment is so structured that the learner is likely to make a series of interconnected discoveries about the

<sup>7</sup> The regular classroom teacher, like the laboratory supervisor, is important to the successful employment of these methods in the context of a school. She must be flexible enough to organize her own classroom activities so that the short individual trips to the laboratory do not unsettle the general routine. Her attitudes toward early learning are also important.

physical, cultural or social world. A responsive environment may occur naturally, or it may be planned. In this chapter the main interest is in the latter, i.e., environments that are artificially contrived to achieve certain objectives. Therefore, it is essential to decide what the learners are to be exposed to in the way of a curriculum. It will be explained in the section, "Procedures and Equipment," that there is a wide range of subjects which can be learned in a responsive environments laboratory.

Recently, and for the past several years, attention has been focused on acquiring languages, especially languages in their written form. From the perspective of a cultural analysis, the topic is a natural language and the children's *task* is to learn how to handle it more effectively. It was taken for granted that the children would already be able to use their native tongue (to date, most of the work has been done with English). My objective, then, was to design an environment (within the microworld of the booths) in which children would learn another form of their language: its written form. This enterprise presupposes that, in the broadest sense, spoken English and written English are isomorphic. From this standpoint, we can think of written English as visible speech and spoken English as audible writing. It is true that written English is a very imperfect phonetic transcription of speech; nevertheless, in planning this environment, I decided to work on the assumption that the spoken and written forms of English are *sufficiently* isomorphic<sup>8</sup> to enable children to find for themselves some set of rules which would permit them to move back and forth between these two linguistic forms. Certainly, spoken and written English are more nearly isomorphic than are spoken English and written German or spoken Chinese and written Chinese.

One of the obvious differences between spoken and written English is that they are handled through two distinct sensory systems: auditory and visual. There are also social differences between the two linguistic forms in their appropriate occasions of use. But young children do not know this and perhaps by constructing an environment in which writing is on a par with speaking and reading with listening, it might be possible to avoid some of the more unfortunate consequences of our educational system; a system which tends to produce speakers who have difficulty in writing,

<sup>8</sup> By an *isomorphism* I mean something like the vague, usual use of the word in mathematics. Two structures are said to be "isomorphic" if there is a one-to-one correspondence between their elements which "preserves order" in some appropriate sense, i.e., which preserves corresponding relations defined on each structure. In practice we have to define isomorphisms, one at a time, for each structure in which we are interested. But the idea is at least sufficiently clear so that we can usually tell when we have one.

and tongue-tied writers. There also are avid readers who find it almost impossible to write—and good listeners seem to be in short supply all the way around.

I should like to make it clear (once and for all, I might add) that the Responsive Environments Laboratory is *not* just a place where children learn to read: approximately equal emphasis is given to speaking, writing, listening and reading. The underlying rationale is not only to treat speaking and listening, on the one hand, and writing and reading, on the other, as correlative processes, nor is it only to treat these two pairs of correlatives as elements of a four-cell matrix of linguistic relations. It is also to develop higher-order symbolic skills which are superordinate to these relations.

Speaking and writing are active processes and listening and reading are passive ones. An attempt is made to tie each of these four activities (or passivities) to the others, not only maintaining a balance between active and passive processes, but also avoiding the pitfalls of under-emphasizing or over-emphasizing any one of them at the expense of the others. The overall objective is to develop higher-order intellectual abilities which may be thought of as ranging over this complex of linguistic processes.

In order to determine whether such overall abilities are developing and, at the same time, to facilitate their development, it is necessary to set some task for the children which involves all four of the processes. There are many jobs which would do the work. The one which was chosen as a part of the laboratory curriculum was publishing a newspaper. The first grade class publishes its own newspaper (there are also contributions by nursery and kindergarten children) and the four processes (speaking, writing, listening and reading) are subordinate to the superordinate skill of *publishing a newspaper*. A child may begin a newspaper story by speaking into a microphone; later, he will type his own story from dictation—this means that he goes directly from the spoken word to the written word. After he has completed his transcription he may then read it critically before turning it over to one of the other children who is an editor. The editor first reads the typescript, perhaps reading it aloud to a fellow editor, and suggested changes are then discussed with the author. Next step: the children type the story on stencils along with other stories. Finally, they mimeograph, collate, staple and distribute the paper. If they wish to discuss the newspaper in their regular classroom, they may do so (with their teacher's permission). It is also permissible to take the newspaper home where it is sometimes subject to further discussion.

It can be seen, then, that publishing a paper, as the children do it, is an achievement which embraces speaking, writing, listening and reading. This activity provides guide lines on the basis of which the children set standards for spelling, punctuation, intelligibility, general relevance and

interest. The emergence of such a higher-order skill helps give to reading and writing the same kind of direction and meaning that listening and speaking have by virtue of their ordinary social uses.

Publishing a newspaper is an activity which ordinarily would be beyond the ability of a first grade class. Permitting the children themselves to set the standards for the newspaper seems like a risky educational practice; however, here again is another vital role for gifted children to play. They are capable of serving as editors and coordinating the efforts of the other children, which allows them to make extensive use of their intellectual abilities within the social context of their peer group.

By the time the laboratory children are able to publish a newspaper the subordinate skills have been learned well enough so that the *learning* problem has been replaced by the *practicing* problem. There are many intrinsic rewards and punishments associated with turning out a newspaper. To be sure, when the proud parents get copies there may be additional extrinsic rewards and punishments—but by this time it is too late for anyone to interfere with the learning of the subordinate skills.

The actual work of turning out the newspaper is done under the supervision of a teacher who introduces the children to the equipment (copy aid, mimeograph, Thermofax, etc.) and guides their first efforts. This takes place within the small classroom in the laboratory, already mentioned. This classroom is called the “transfer room.” What this name connotes is the *transfer* of skills acquired individually within the privacy of the booths to social activities. Just as we make explicit provision for the introduction of children to the laboratory with the help of gifted child guides, we also make explicit provision for relating laboratory activities to outside interests through the help of our more precocious children who serve as editors. The children are very proud of their newspaper—everyone contributes in his own way and most importantly it really is *theirs*. Several articles taken from the fourth issue of the paper are included in order to give the reader some notion of the general level of competence of the children. (See Figure 2).

In many schools the curriculum for the first six grades tends to treat reading and writing as separate subjects. Writing in the sense of composing original stories is yet another subject. Spelling and particularly punctuation are handled as special topics; and some punctuation marks (say), the ampersand, asterisk, colon, or semicolon, are entities whose appearance on the printed page remain a mystery to many even beyond the Ph.D. dissertation. The laboratory curriculum represents an attempt to deal with these skills and topics as part of an integrated complex of linguistic processes. In the next section we describe some procedures and equipment by which children can be led to such excellence.

FURRY AND NUTTY  
by Venn Moore

Once upon a time there were two squirrels named Furry and Nutty. They were very cute squirrels; they would scamper up and down the trees to play. Also they would do cute tricks on telephone wires. These squirrels liked acorns, peanuts and walnuts. At night they hunted for food and dug a hole to store it in a secret place. They lived in holes in trees; sometimes they moved away to build a different kind of home.

One spring they had a baby and named it Bushy. The reason they wanted to name it Bushey was that they lived in bushy trees and they had bushy tails.

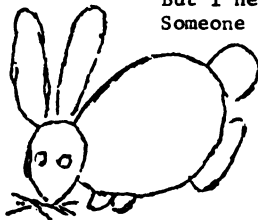
One day when they were doing tricks on the telephone wires, it was stormy and it lighteninged. It caught on to the wire, and Furry was electrocuted. Poor Furry was dead! Poor Bushy and Nutty were alone. From that time Nutty and Bushy were more careful than they used to be.

TWO FIRES  
by Jeffrey Batter

Once when we were going to school, there was a fire on Laurel Road. When the fire started, the children were already outside, and the mother was badly hurt. On March 31, my brother lit a fire beside the garage. The firemen next door put it out.

THE FUNNY BUNNY  
by Shirley Horne

If I were a bunny,  
I'd be funny.  
I'd earn money  
By selling honey.  
In the sunny  
It would get all runny.  
Isn't that funny?



THE PEABODY MUSEUM  
by Mary Ellen Burns

During vacation I went to the Peabody Museum with my Daddy and my brother, Joseph. We saw a big dinosaur, and it was so big that Joseph had to look up. In the same room we saw the largest turtle in the whole wide world.

OUR TRIP TO BOSTON  
by Lisa Whitcomb

We went to Boston and when we were driving we had to stop to have supper. We stayed with some friends. When we got there, it was ten o'clock-- way past our bedtime.

We woke up Mom and bothered her. I mostly watched TV. Daddy watched TV with me, and Mom talked with Ellie Priess. When Daddy was not watching TV, he was talking to Uncle Al. We had fun!

MY LOOSE TOOTH  
by Kathy Johnstone

I have a loose tooth and it is my first one. Whwn it come out I will put it in a glass of water and in the morning I will find a quarter under my pillow.

The fairy will leave the money for me. I may buy some groceries with it for my mother.

THE WOODPECKER  
by Tamara Plakins

I saw somebody peck  
And did wreck,  
But I never saw anybody smack  
Someone in the back.

Figure 2. Selections from the "Lab Record"

(continued)

The boys and girls in Kindergarten are one year younger than we are. They all made up their stories, and then they typed them for our newspaper. We showed them how to cut a stencil. "Lab Record" Editors.

THE ELEPHANT  
by Spencer Taylor

Once upon a time in the far away land lived a little elephant named Timmy. He ran away. He almost got run over.

THE HAUNTED HOUSE  
by Susan Connelly

The haunted house has ghosts and goblins and demons. It's scary to go in, and you might get killed.

SUSAN SQUIRTED ME  
by Pam Malley

My friend Susan squirted me with water on my new dress. Susan had to put her head down.

The Nursery school children just started to type their stories for the "Lab Record" and we helped them type the stencils. The Editors.

PAM  
by Melanie Canadeo

Pam, you could be a nurse someday. But when you be a nurse, you can not scream like you do now.

A MONKEY  
by Brian Symmes

I saw a monkey feeding peanuts to lots of people.

I LIKE SCHOOL  
by Carissa Whitcomb

I paint at Sharon's house. I like Ricky. I like God. He makes us healthy.

MY BIRTHDAY  
by Richard Wright

May 3 is my birthday. I will blow out the candles on my birthday cake. I want a fire engine.

MOTHER  
by Helen Greenspan

Mother is well now. The cast is off her leg. Now she can drive me to school. I am glad.

SOLDIERS  
by Jonathan Cahn

This is fun. We play combat soldiers. Davie and Stevie break through our team. We break through their team.

FISHING  
by Larry Batter

I went fishing with my Father and my brother and we caught a goldfish and a whale!

PIRATES  
by Charles Stainton

Larry and Charles are pirates. When my baby brother sleeps, my sister and I play outside.

KITES  
by David Black

I went to the ball field and flew kites. We didn't get to stay long.

*Figure 2 (continued)*

Useful as the idea of an autotelic responsive environment proved to be in constructing the laboratory and in laying down guide lines for its operation, it still did not have a sharp enough cutting edge to be of much help in planning the procedures and equipment to be used by children within the microworld of laboratory booths. I found that it was worthwhile, as an aid to my thinking at least, to make additional assumptions of a psychological kind about personality and human learning processes in order to get a purchase on the problem of designing practical procedures and equipment. Fortunately, I had been working for a number of years on the more general problems of formulating a theory of social interaction. This theory is still in an unsatisfactory state; nonetheless, the procedures and equipment described here are an application of some of its fundamental ideas. It lies beyond the scope of this paper to present even as much of the theory as has been worked out, but for present purposes it probably will be sufficient to say that this theory builds on the work of George Herbert Mead (1934), or, more accurately, it builds upon his work as I understand it. It also takes some account of the subject matter of other important psychological and social psychological theories.

*Phase 1. Free Exploration.* Let us turn our attention now to the interior of a booth and imagine that a child, already introduced to the laboratory in the manner previously explained, is ready for his first booth session. For convenience of exposition, pretend that he is to begin learning in an automated booth. (The reader may find it helpful to re-examine Figure 1 which shows a 2-year 11-month old child sitting at E.R.E.,<sup>9</sup> or what the laboratory children call a "talking typewriter.") The booth assistant helps him get into the elevated chair (because some children do not like to sit in a *high chair*, in the laboratory we call it an "elevated chair"), turns one switch, tells the child to enjoy himself and to raise his hand if he wants anything. Without further comment the assistant leaves the booth, closes the booth door and then goes to a control panel (shown in Figure 1) mounted on the exterior wall of the booth, presses appropriate buttons and begins to watch the child through a one-way window located just below the control panel.

The child is alone in the booth confronted with what may appear to him to be a typewriter with colored keys. (Prior to entering the booth

<sup>9</sup> E.R.E., the Edison Responsive Environment, is the product of a three-year collaborative effort with an engineering team of the Thomas A. Edison Research Laboratory of West Orange, New Jersey, a division of the McGraw-Edison Company.

his fingernails have been painted with non-toxic water colors. There is a match between the nail colors and the colored typewriter keys so that striking keys with matching fingers constitutes correct fingering. Also, there is a noticeable difference in pressure between the left-hand and the right-hand keys to help the child orient his hands. Behind the keyboard is a lucite housing which permits him to see everything in front of him, but which keeps his fingers out of the moving parts of the typewriter.) Whether or not he believes that the object in front of him is some kind of a typewriter, he is in fact in charge of much more than an electric typewriter—he is at the controls of a computer in-pu and read-out device, three distinct memory systems, an audio-recording system, and two visual exhibition systems, all of which are integrated by a central electronic logic and control system. Nevertheless, the operation of this complex instrument is under his management.

Of course, not all of the abilities of the instrument are needed for the child's first session. The booth assistant has set E.R.E. in what is called *Phase 1, Free Exploration*, i.e., the instrument is set so that the child can explore the keyboard freely. Whenever a key is struck, E.R.E. types the letter (in large type) and pronounces the name of the character that has been typed. (The "reaction time" of E.R.E. to a key operation averages 1/10th of a second.) When a key has been depressed and released no key can be operated for about one second; this gives E.R.E. time to pronounce the name of the character. No two keys can be depressed simultaneously; this makes it impossible to jam keys or to garble pronunciations. The moment any given pronunciation is completed, the keyboard is automatically unlocked so that the child can go on exploring. The keyboard of E.R.E. is, essentially, a full standard one. (It has some additional keys which are needed for foreign languages—E.R.E. can be switched to any of six languages and special accent marks are provided—the extra keys are covered when not in use.) Because the standard keyboard has both upper and lower case, and the young child probably does not know this, there are small lights next to the upper and lower case keys to show which case is operative. If the child were to play by himself with an ordinary typewriter he might get "stuck" at the end of a line because he does not know about the carriage return. E.R.E. automatically returns the carriage at the end of a line even though there is a carriage return key whose function the child will catch on to sooner or later. His exploration will not be interrupted by using up a sheet of paper; E.R.E. has a fan-folded tape of paper several thousand feet long. It should also be mentioned that E.R.E. is rugged; it withstands the pounding it sometimes receives.

Returning to the hypothetical child, the intriguing question is: What will he do when he is alone at the keyboard of the "talking typewriter"?



Until he strikes the first key he does not even know that the typewriter talks. (A motion picture was made of the first few minutes of a normal 2-year 7-month old boy's initial exploration of a keyboard (Moore and Anderson, 1960). This film shows nonautomated equipment with a booth assistant carrying out the various functions performed by E.R.E. This boy's behavior is typical of many normal children.) One thing we can say with near certainty about our hypothetical child is that he will not sit there for a half an hour simply looking at the instrument. Only one child out of the 102 children whom I have studied sat for as long as 10 minutes before striking a key. Most children begin immediately, using fingers, fists, elbows and an occasional nose—if the instrument were not jam-proof, the game would be halted in less than a minute, or if the keyboard were not locked during pronunciations, E.R.E. would babble. There are some children who proceed in a very thoughtful way; looking, listening, repeating what the instrument says, reflecting—in brief, they explore systematically. Some notice at once the relation between their colored fingernails and the colored keys and painstakingly match fingers to keys. If, at first, a finger is wayward, they use their other hand to guide it. Some children go on exploring for their full 30 minutes; others raise their hands and want to leave after a few minutes.

In order to guess what our hypothetical child is likely to do, it would be necessary to posit a great deal more about him. I will make one overall comment based on my experience with the laboratory children: he will like his first session and he will want to return to play with this fascinating "toy."

A daily record is kept of each child's performance in the laboratory. Some parts of this cumulative record are quite objective. E.R.E., for example, keeps track of the time the child spends in the booth and his stroke count, i.e., the number of times he depresses keys. Other aspects of the record are less objective, for instance, booth assistants' notes about a child's attitude. There is a daily staff conference at which each child's performance is reviewed. It is the laboratory supervisor's responsibility to decide when a child is beginning to lose interest in any given phase of the curriculum. There are children who will go on happily in Phase 1 for a number of weeks, whereas others' interest in this phase declines rapidly after as few as two sessions. Sooner or later every child's interest in Phase 1 will wane (at least every child the laboratory has encountered behaved this way) and before his interest completely disappears, he must be shifted to the next phase. If a child were permitted to completely exhaust his interest, he might very well not return to the laboratory. Quite clearly, the decision as to when to shift a child from one phase to another still is a matter of experience and judgment. In the very early days of this research I had to make this decision. Later, I trained super-

visors who now are fully capable of performing this task. For the most part, the more objective indicators of declining interest are a sufficient basis for judgment; for example, a child's sessions become markedly shorter and his stroke count drops off. Sometimes a child will simply say that he is tired of what he is doing—his opinion counts. As a general rule, it is safer to err on the side of shifting the child too soon. It will be made clear below that explicit provision is made for regressing from advanced phases to more elementary ones, and since no significant persons in his life are there to see this regression, there is little stigma attached to it. All the children whom I have studied have regressed from time to time. The children call Phase 1 (Free Exploration) "plain typing." It is not unusual for even a gifted child to say with a little laugh, "Today I just want to plain type."

*Phase 2. Search and Match.* When the laboratory supervisor makes the decision to shift a child from Phase 1 to the next phase, the learner receives no warning; he has to discover for himself that he is playing a new game with new rules. Phase 2 is called "Search and Match." In order to understand what this game involves, let us examine Figure 3.



Figure 3. E.R.E. (*The Edison Responsive Environment*) or "Talking Typewriter"

This is a close-up view of E.R.E. "opened up." The lucite housing is raised part way to show how the booth assistant can remove the child's paper. There is a picture of a barn on a rear-view projection screen (the open panel to its right shows where the projector is loaded). To the left

of the barn is an illuminated rectangular window (exhibitor cards can be inserted into this space through the open door on top). On the upper right side of E.R.E. is a triangular shaped open panel; this exposes controls for some of E.R.E.'s functions which are set by the booth assistant.

In Phase 2 the exhibitor system on which the picture of a barn is projected is not used. The only new thing about this phase, in terms of visual display, is the use of the rectangular window. In this window characters can be exhibited in four different ways: 1) one character at a time with a red arrow pointing down to it; 2) a cumulative exhibit in which the red arrow points to a newly exposed character while all previously exposed characters on the same line remain visible; 3) all characters on one line are visible with the red arrow pointing to the one to be typed; and 4) all characters on the four lines in the rectangular window are exposed, again with the red arrow pointing to the one to be typed.

In Phase 2, unlike 1, E.R.E. takes the initiative in starting the game. All typewriter characters appear in the rectangular exhibitor window one at a time in random order. When a character appears with the red arrow pointing to it, E.R.E. automatically locks the keyboard with the exception of the appropriate matching key and pronounces the name of the character. If the child wants to get a response from E.R.E., he must find the right key. As soon as he strikes the matching key which causes the character to be typed, E.R.E. repronounces the character and then covers it up before exposing a new one. The game becomes a little more difficult when the new character is in a different case. Under this circumstance, E.R.E. first says "upper case" or "lower case" (as the case may be), the appropriate case light flickers, and the keyboard must be changed to the proper case (when this is done, E.R.E. again pronounces it) before the matching character is named by E.R.E. and can be struck by the child. It should be mentioned that if a child is fast enough at pressing the appropriate key, he can cause E.R.E. to speed up by omitting redundant pronunciations. If a child's attention has wandered so that he missed the first pronunciation, or if he has forgotten it, there is a repeat cycle which the booth assistant can start, using a delay appropriate for the given child. A dial can be set which will delay E.R.E.'s repronunciation in order to give the child a chance to speak first. E.R.E. is not restricted to pronouncing the names of characters—it also can give phonetic values for them (or, for the linguistic purist, hints as to phonetic values).

What has just been described is the simplest version of Phase 2, Search and Match. As interest wanes in this first version of Phase 2, the booth assistant (following the laboratory supervisor's instructions) can make the game more challenging in many ways. For example, the assistant can cause (by pushing buttons or setting dials) E.R.E. to omit its first pro-

nunciation of characters, or the second, or both. The window display can be changed to show characters cumulatively, one line at a time, or four lines at a time. A blank card can be used in the window so that the match is solely between pronunciations and keys.

I have found that adults, as well as children, like to play with E.R.E. in both Phase 1, Free Exploration, and the various versions of Phase 2, Search and Match. These activities are especially interesting to adults when E.R.E. is switched to a foreign language—one unfamiliar to the players. Of course, for children who are learning to read, the written form of English is a new language. Both children and adults discover that they always can succeed in finding the appropriate key in Search and Match by the simple-minded expedient of trying each key. This is a tedious and boring way to go at it on a continuing basis; both children and adults prefer to learn the characters.

*Phase 3. Word Construction.* When a child has eliminated nearly all of the “search” from the Search and Match game, it is time to shift to a new phase of the curriculum. Phase 3 is called “Word Construction.” There are two forms of this game. One form leads to reading, the other to writing, i.e., writing in the sense of composing original stories. We will designate the former as “WC-R” (Word Construction-Reading) and the latter as “WC-W” (Word Construction-Writing). When a child has been shifted to Phase 3 he alternates in his booth sessions between these two forms of the game. Let us take up WC-R first.

*Phase 3. WC-R.* Up to this point, the child has been dealing exclusively with the building blocks, or primitive elements, of the written language (in this, punctuation marks have not been neglected). He has been exposed to and can discriminate among the basic set of elements from which all meaningful written expressions are formed. He is in a position to begin to get some sense of the formation rules of the written language. Now other of E.R.E.’s abilities can be brought into play.

Imagine that a child, who has become quick at finding individual characters, is confronted without notice with several of them at a time, isolated either by a margin and a space or by spaces. For instance, the first letters might be *b-a-r-n*. So, the child types *b-a-r-n*. E.R.E. pronounces these letters before and after each is struck and then, following the pronunciation of *n*, it calls for a space. A light flickers just under the space bar, and after the bar is pressed, E.R.E. says, “Space, *b-a-r-n*, barn.” E.R.E. may also exhibit a barn on the projector as shown in Figure 1. (As a matter of fact, pictures have been used very sparingly because they can be quite misleading in the early phases of learning to handle written symbols. The referent of many important words such as “if,” “then,” “either,” “or,” “some,” etc., cannot be pictured in the same way that the

referent of the word “barn” can be. Other words which are relational, but not obviously so, such as “mother,” “father,” “sister,” etc., are not as easily denoted through pictures as some writers of children’s primers seem to think. The use of pictures comes into its own when E.R.E. is “teaching” foreign languages or in Phase 4 where content, e.g., maps for geography, is important.)

From the standpoint of planning the curriculum, WC-R offers an indefinitely large number of choices with respect to the selection of a beginning or basic vocabulary. The question is: What words should come first? There are a great many plausible criteria which have been offered by reading experts, linguists and others who have concerned themselves with this topic. For example, 1) word frequency, 2) letter frequency, 3) pronounceableness, 4) word length, 5) familiarity, 6) stimulus similarity, 7) grapheme-phoneme correspondence, etc. It is apparent that at least some of these conflicting criteria, for instance, many familiar words are phonetically irregular. A sophisticated analysis could be carried through in which a vocabulary was selected in terms of a multidimensional weighting system based on the contribution various “dimensions” of words make to easy learning. I have no doubt that careful experimental studies would be of value in selecting an optimal basic vocabulary.

For my own part, faced with the problem of selection, I preferred a direct solution, namely, to choose those words which are constituents of interesting stories—that is, stories which have proved to be intriguing to children and adults over a long period of time, for example, *Aesop’s Fables*.<sup>10</sup> Many children can be expected to have lost interest in WC-R long before they have mastered a vocabulary large enough to enable them to read a wide variety of stories. Therefore, it is essential to be able to shift them to at least some stories—this only can be done if they have mastered enough of the words to get started reading stories. If the stories are of some intellectual and aesthetic value, it is highly probable that the words out of which they are composed will offer a sufficient basis for making sound inferences about the relations between letters and sets of letters, on the one hand, and appropriate verbalizations, on the other.

The inventor, Samuel Morse, was faced with a similar problem when he was devising his code consisting of spaces, dots and dashes. He wanted, in the interest of efficiency, to have the shorter symbols for the more frequently used letters, and the longer symbols for those less frequently used. If he had been like some contemporary investigators, he might have launched a rather extensive research project sampling the distribution of letters of the alphabet in various writings—but he did

<sup>10</sup> I have also made use of word lists suggested by linguists and at times have combined these lists with those compiled from interesting stories.

nothing of the sort. What he did instead was to count the number of types in the various compartments of a printer's type box. He assumed that printers would have discovered empirically the right proportions of letters to keep on hand in order to set type, and incidentally, this solution to his problem was within 15 percent of an optimal one.<sup>11</sup>

I assume that stories that have stood up over long periods of time use words in ways that are compatible with the intricate sets of relations holding between the spoken and the written forms of the language. I am not quite as sanguine about some of the concocted stories found in contemporary "basal" readers, although children can learn to read using basic vocabularies that are, in all likelihood, far from optimal.

*Phase 3. WC-W.* The WC-R form of the Word Construction game, explained above, is somewhat arbitrary from a child's standpoint. The experimenter has decided, in advance, what is good for him. It is especially important, from the point of view of sustaining children's interest, to let them take the initiative. It is also important to see to it that at times there is an almost perfect correspondence between their verbal skills and the written symbols with which they will be dealing. WC-W serves these purposes. The first step in this activity is to have the child go to the Transfer Room (the small classroom) where he is encouraged to talk—he may talk about anything he pleases—and everything that he says is recorded. Later, an analysis is made of his utterances and a list is compiled consisting of those words which are constituents of coherent statements on some topic in which he was engrossed. Sometimes it has taken weeks with a child to elicit such material. The next step is to program this word list in E.R.E. (E.R.E. is easily programed—it is not necessary to translate material into a machine language, hence, there are no technical difficulties to get in the way.) The child is virtually certain to find some of his own words meaningful.

An alternative version of WC-W involves the use of a standard recording-reproducing unit attached to E.R.E. or to an electric typewriter. This version does not require programing. The child simply talks into a microphone and then takes his own dictation, word by word. In this version of the game, he responds to his own voice. (Interestingly enough, from a social-psychological perspective, some children reject their own voice, but will type other children's dictation.) A motion picture (Moore, 1960) was made of a girl 3-years 11-months in which she first read a story—her voice was recorded—and then typed the story from listening only; she handled the dictation controls (start, stop, repeat) by herself.

<sup>11</sup> The foregoing information about Morse is found in Pierce's valuable book on Information Theory (1961).

This second version of WC-W eliminates the presentation of written symbols; the child goes directly from verbal utterances to the corresponding written symbols. Visitors who have watched this process are often surprised by children's ability to spell new words that are nonphonetic, or markedly irregular. Indeed, this is extraordinary! I have concluded that there must be some subtle lawfulness holding between the spoken and written forms of English, otherwise young children would not spell as well as they do in this version of WC-W. This should give pause to enthusiasts for spelling reform. In any case, this relation seems worthy of serious study.

*Phase 4. Reading and Writing.* Anyone who has followed children's progress from Free Exploration to Search and Match and on through Word Construction easily can see that the shift to Phase 4 comes very naturally. E.R.E. is at its best here. It can read a sentence, a paragraph, or tell a story before or after a child types, while at the same time it can continue to respond to individual characters and words. In sum, it can deal with reference to the earlier learning sequences.

E.R.E., of course, can ask questions, just as teachers do. The questions may pertain to what is visually exhibited in the rectangular window or on the projection screen. The questions may call for subtle interpretations. Answers can either be typed out or expressed verbally on E.R.E.'s own recording-reproducing unit.

The material programed for E.R.E. can be as banal as the dullest courses in school or it can be as stimulating as the best of new programs, for example, some in modern mathematics or science. (It should be noted that E.R.E. can handle many aspects of mathematics and of science programs—numbers and some arithmetic symbols are on the keyboard.)

Every effort is made to select materials which give children a chance to make imaginative interpretations. As a general principle, it seems advisable to select materials that permit several levels of interpretation. A good case in point is *Alice's Adventures in Wonderland*. Retarded, normal, and gifted children can all begin reading this story with enjoyment just because it starts off with a little girl and an extraordinary rabbit. Even though gifted children like the manifest content of Alice's adventures, at the same time, they can begin to get glimpses of deeper meanings. A serious objection to many stories found in beginning readers is that they confine children to one interpretation since the manifest content of such stories is all there is to them.

It is in Phase 4 that the methodology presented in this chapter must

come to terms with the traditional school curriculum.<sup>12</sup> The bridging mechanism between the laboratory booths and the school classroom is the Laboratory's Transfer Room. Here, children who have been working alone have an opportunity to engage in cooperative activities, for example, publishing a newspaper, under the guidance of a teacher. Discipline emerges from the interaction of the children with each other.

When children go to first grade, having reached Phase 4 both in reading and composing original stories, a new curriculum is needed. Most of the things which ordinarily are taught in first grade lie far behind them. (At the end of first grade, the Hamden Hall Country Day School children who had been in the E.R.E. program at least two years, read, on the average, at the beginning sixth-grade level, according to the Metropolitan Achievement Test. Their competence in composing original stories can be judged by examining their newspaper (Figure 2). For second grade they again will require a totally new curriculum.) The half hour a day the children can spend in the laboratory is certainly not a substitute for the rest of the school day. Fortunately, at Hamden Hall there has been strong administrative support for curriculum revision.<sup>13</sup> However, an adequate curriculum is not the whole answer either. Competent teachers are equally necessary. Teachers find that they have independent students on their hands, students who are accustomed to solving problems on their own or in cooperation with their peers.

*Handwriting.* One of the five booths is reserved for learning to write by hand. The writing equipment in this booth is primitive. It consists of a lined blackboard, chalk and eraser. On a random basis children spend about one-tenth of their time in this booth after they have completed Phase 1. I assumed that after children had been exposed to the characters on the typewriter they would begin to reproduce them manually if they had the opportunity. Children begin by scribbling or drawing pictures on the board, but it appears that some would go on doing this indefinitely if they were not subtly guided by a patient booth assistant.

<sup>12</sup> There is a Phase 5, the Dialogue (Moore, 1961), which is not presented here for two reasons: 1) to keep this chapter within reasonable bounds, and 2) as yet, I have had no experience with children in this phase. Essentially, the Dialogue has to do with children's interpreting group interaction and taking what is said in dictation, adding the necessary punctuation and connecting commentary so as to create a plausible reconstruction of on-going social situations in which they were participants. The Dialogue is of theoretical importance because of its connection with the Meadean concept of the "generalized other" (Mead, 1934).

<sup>13</sup> It is not within the scope of this chapter to present the school curriculum which is still being developed. However, in broad outline, the curriculum is based upon the notion of folk models (Anderson and Moore, 1959) and their scientific formalization.



The difficulty lies in the fact that the environment is not sufficiently responsive. (Automated equipment could be devised for facilitating the development of this skill.)

The children are exposed to cursive or manuscript writing, as opposed to printing, through the use of typewriters with cursive type. This serves to familiarize them with this form of writing. Even two- and three-year-olds, including retarded children, can learn to print and write in the cursive style. A motion picture has been made of the printing of a few preschool children in order to show what they can do (Moore and Anderson, 1960, 1960, 1960).

I promised at the beginning of this section to try to explain the various phases of the learning sequence in terms of the use of automated instrumentation. However, in the development of this program of research, work began with nonautomated equipment—modified electric typewriters, projectors, recording-reproducing units, and so on. The functional specifications for automated equipment were obtained by coding the activities of booth assistants using nonautomated devices.

In the nonautomated form of Phases 1 through 4, the booth assistant sits in a chair beside the child who is at a modified electric typewriter. The booth assistant has a switch which is used to control the typewriter in the same way that E.R.E.'s logic and control circuitry does. The booth assistant is instructed to be passive just as is E.R.E. Of course, not all booth assistants carry out this role perfectly day after day—some have a strong tendency to intrude upon children. It requires constant monitoring by the laboratory supervisor to keep booth assistants from teaching.

At present, four of the five laboratory booths are nonautomated, thus there is a human instructor with the child on an average of four sessions out of five. In time, all booths will be automated, but this does not mean that they always will be operated in a fully automated way—with no human being in the booth with the child. It is not known whether children would continue to come to the laboratory on a daily basis over a long period of time if they were interacting with automated equipment only. Even if they were able to go through all phases on automated equipment this might produce undesirable psychological or social psychological side effects. No one knows now the optimal mixture of automated and nonautomated equipment. It is reasonably certain, however, that a one to four mix will work; at least it has worked with the children who have come to the laboratory.

One of the interesting consequences of having a fully automated booth has been its effect on assistants. Before such equipment was available, it was difficult to explain to new personnel what was expected of them. Also, some of them apparently did not believe that children would work out problems for themselves—so they tended to be too *helpful*. The auto-

mated equipment proved to be a good instructor for new booth assistants. With reference to this point, there is an illuminating film made of some laboratory children working on a prototype of E.R.E. In one sequence, a little girl (Moore 1962, last sequence), who was in Phase 4, forgot where the lower case key was. At first she seemed to be nonplused; finally, she regressed to a systematic trial of every key—the right key was almost the last to be tried. Many viewers of this search sequence said that they felt an almost irresistible urge to help her. She, unlike these viewers, was calm about the whole matter—confident in her ability to find her way. Like E.R.E., well-trained booth assistants do not intrude. In my opinion, in too many situations in everyday life adults rush to the aid of children, thus depriving them of the opportunity of making discoveries and consequently undermining their confidence in their own resourcefulness.

#### CHILDREN IN A RESPONSIVE ENVIRONMENT

Before a child enters the Laboratory for his introductory session quite a bit is known about him. Each child is given a general physical examination, an eye examination, and a hearing test. A speech evaluation is made with special attention paid to a child's ability to produce utterances in conformity with the phonemic structure of the language. A clinical psychologist obtains a developmental history from the mother and gives the child an intelligence test as well as projective tests. A sociological analysis is made of the family in terms of socio-economic variables. In sum, an attempt is made to characterize the child's family with reference to its position in the broader society, to see the child within the context of his family, and to understand something about the child himself in the light of this developmental history. The various tests and observations are repeated on a semiannual or annual basis depending upon their nature; for example, I.Q. tests are given annually.

A daily record is kept of each child's behavior in the Laboratory, and the child is examined periodically to determine his level of skill.

Let us now consider children who have gone through the phases presented in the preceding section. Some background information is given with each case. The first two children to be discussed are in the nebulous range between the normal and exceptional. The last three are clear-cut cases of exceptional children—two are educable retardates, the third is gifted.<sup>14</sup>

<sup>14</sup> Since it has been the policy of the Responsive Environments Project to protect the anonymity of children and their families, we have seen to it that there is not a one-to-one correspondence between children shown in pictures (either stills or

## *Billy*

Billy's mother enrolled him in an integrated public school kindergarten when he was five years old. After a few weeks his teacher reported to her supervisor that he was unable to follow directions and that he disrupted the classroom—for instance, he rolled on the tables and stubbornly refused to move. Nothing was done about her complaints until a month later when she delivered an ultimatum: "Either Billy goes or I go." At this point the school psychologist was called in and Billy was given a Stanford-Binet intelligence test with the result that he was classified as an educable retardate with an I.Q. of 65. It was recommended that he be placed in a nursery group for the mentally retarded. The mother, a former special-class student herself, was irate about this recommendation; she caused so much difficulty over it that the school, in self-defense, sent Billy to an outside expert who confirmed the prior evaluation. (This second examination was slightly more hopeful in that it placed him on the borderline between the educable retardate and the dull normal.) With great reluctance, Billy's mother acquiesced to his removal from public school at mid-term and to his placement in a nursery group for educable retardates.

When Billy was six years old, he came to the Laboratory under the auspices of a state agency. The Laboratory's initial evaluation of Billy's intelligence (I.Q. 72) agreed with the more promising of the two prior reports. However, it was obvious at once that there were at least two sides to Billy in terms of his ability to get along with adults; for example, the examiner commented, "In the testing situation, Billy was a pleasant child, friendly and responsive and anxious to please." This judgment says something about both Billy and the examiner. This examiner is very skillful in establishing rapport with children and it is a difficult child indeed who does not respond positively to her.

So we have Billy, age six, already out of the mainstream of education. He either could not or would not take directions; what is more, he was willing and able to cause disturbances.

Billy, a light-colored Negro, is always neatly dressed. His appearance is normal but his physical movements are somewhat clumsy although he has an alert manner. He always has been in excellent health; his vision and hearing are normal. However, his speech was very difficult to

motion pictures) and case history material. In addition, the children described here are drawn from several responsive environments centers located in five cities and three states. Background and personal data which would be sufficient to identify a particular child and his family have been changed so as to protect their privacy. Although I have personally worked with only 102 subjects on a day-to-day basis, there are over 250 children who have been part of the Project, taken as a whole.

understand even at six; the speech evaluation showed, for instance, that he omitted most final consonants. Also, there were many repetitions and hesitations in his speech and his mother said that he, unlike her other children, did not talk until he was four. Whatever else, Billy had not done a very good job of mastering his native tongue—he had not developed the requisite verbal skills to express his needs or interests.

The eight members of Billy's family share five rooms in a low-income row house: a reasonably large living room (with a record player and a monstrous TV set), a large kitchen, and three bedrooms. There are three older boys in their middle teens and Billy and his younger brother and sister, ages 5 and 4. The family is crowded but the apartment is spotless and tastefully decorated. There is a large bookcase nearly full of books topped by a complete set of super-market encyclopedias. At present, the family is wholly self-supporting, though off and on in the past it has been on welfare. Billy's father, a small, meek, self-effacing person, is an unskilled laborer who generally works in construction. A social worker, who has known the family for years, classifies the whole family as dull normal.

Billy's mother is the dominant figure around whom everything turns. She is a heavy-handed, strict disciplinarian who can wither her husband and children with a glance. In or out of the family, she is a formidable woman who is articulate about her ambitions for her children, but she lacks knowledge about how to advance them. She had hoped that the older boys would be able to go to college, but their academic records are so poor (she is forcing them to stay in school) that the guidance counselor has told her that college is out of the question. Though the older children are disappointing to her, she still has great hopes for her two youngest children who are developing more rapidly than any of the others did. Billy is the only child who has her worried. He was later than the others in standing, walking, talking and toilet training. Toilet training must be a nightmare for Billy, because as she says, "Whenever he goes in his pants, I whack him in front of everybody." (Billy still has accidents quite frequently). The other members of the family are very fond of Billy, baby him, and try to cover up his many mistakes before they are discovered by his mother. His mother says that Billy is not dumb, he is "stubborn and lazy." When Billy does something that really pleases her, she picks him up and enfolds him in her enormous arms while smothering him with kisses.

Billy's introductory session was calm. He quietly followed the guide around; he could not be drawn into conversation. Once in a while he smiled and in general was wide-eyed. In his second introductory session he explored some on his own but spent most of the time holding the guide's hand. By the end of this session he was becoming curious about

the equipment and seemed quite relaxed, and so he was scheduled for the automated booth the following day. The third day he came in, noisy and confident, and permitted the booth assistant to help him into the elevated chair. He watched her leave and then turned his attention immediately to the keyboard. What happened next is best described as an attack upon the instrument. In 30 minutes he typed 1302 characters. The booth assistant had to turn off the instrument and lead him out of the booth when his time was up. For the next nine sessions he continued to “machine gun” the instrument at a gradually slowing pace. In his eleventh session there was a sharp drop in strokes; the booth assistant wrote, “He seems to be getting interested in looking at what he has typed.” The laboratory supervisor shifted him from Phase 1, Free Exploration, to Phase 2, Search and Match. Billy was startled and angry—he put up his hand over and over to call the booth assistant in. Billy evidently thought the instrument was broken and that the assistant would not fix it. All previous sessions had lasted 30 minutes but Billy stopped this one after 9 minutes. He had made five matches by accident (he had not come up with a way of systematically trying all keys). The laboratory supervisor switched him back to Phase 1 for his next session and he was very pleased, although he proceeded more cautiously than he had before—looking, listening, and occasionally repeating what was said. After another five days his time dropped to 15 minutes and the supervisor again switched him to Phase 2 for the following session.

This time he was calmer about the change. After five minutes he was pressing every key with his thumb—he clapped his hands when he made a match. At the end of this 30-minute session he said he wanted to take the “typewriter” home. For the next 60 days he played Search and Match in its increasingly difficult versions. There seemed to be no diminution in his interest. This was the game for Billy—he made it more complex for himself by shutting his eyes while finding keys, by “dive bombing” the keyboard, by first using one hand and then the other. He was still not using the color coding of fingers to keys, however. The supervisor switched him to Phase 3, Word Construction, R and W, even though his interest had not waned. He could find the characters to make words but he did not want the words; he told the instrument to “shut up.” His time dropped down to 3 minutes after five days. He was shifted back to Phase 2. In WC-W he had been nearly mute; he kept mumbling something about “it’s not broken.” Billy continued in Phase 2 for another 30 days, still eager and interested. His refusal to go on to words was perplexing because by this time he was very expert at finding all characters and was using the color-coding system. Also, he had learned to print all the characters in the handwriting booth (this included the ampersand which most booth assistants have to learn, too).

An interviewer was sent to Billy's home to find out if something unusual was going on there. His mother said that she had caught Billy "playing with himself," and that she had whipped him and told him he would hurt himself. This made it much clearer what Billy was mumbling about. In WC-W the assistant pointed to his penis when he said "it's not broken." She said the word "penis" and spelled it. It was put on the dictation equipment for him in a nonautomated booth. He typed the word "penis" twelve times with manifest enjoyment. In his next WC-W story-telling session he said, among other things, "When my dad took the prayers away, my mother got sick and died." The constituent words of this story were made into a word list for the next WC-W typing session. Billy liked these words and now was willing to accept word lists in WC-R.

Billy was shifted to Phase 4 in his 130th session. At the end of his laboratory experience (172 sessions) he was reading pre-primer and beginning first-grade stories, he could print nicely, and he could type 5 words a minute with correct fingering on the automated equipment. His typing was comparable to that exhibited by other children classifiable as educable retardates.

When Billy was transferred from public school to the nursery for educable retardates at mid-year, he established a satisfactory relation with the skillful teacher in charge of this group. However, he would not accept her assistant. The end-of-the-term report stated, "When he is helped or scolded by the assistant he becomes very belligerent and disrespectful." Billy began his laboratory sessions in late spring while still in this nursery class. Public school officials were invited to watch Billy in booth sessions. They were so impressed by his good manners and by his ability to concentrate that arrangements were made to re-admit him to public school kindergarten in the fall. Given this second chance he managed to get on with this new teacher, and at the end of the year she passed him to first grade.

Billy entered first grade with 172 laboratory sessions behind him as well as with the benefits of a constructive experience in the nursery group and kindergarten. The laboratory, of course, was interested in following his progress even though he was no longer in its program.<sup>15</sup>

Billy was placed in a "combined" first grade, that is, a class with a reading readiness group and a first-grade group. He was assigned to the

<sup>15</sup> The project, taken as a whole, has conducted a number of pilot studies to determine whether it was feasible to work with various kinds of exceptional children. Billy was part of one such study (and an evaluation of its success or failure) and the establishment of long-term programs. Billy, his family and the Project would have liked to have had him go on.

latter section on the basis of a reading-readiness test. His teacher wrote, "When we began our work, Billy was ahead of the other children. He could write and recognize his numbers to 10 and count up to 29. He knows his colors, alphabet, and his knowledge of phonics is very good in that he knows the sounds of each isolated consonant and can tell with what letter various words begin. What he needs now is to develop his comprehension not only in reading words but in picture interpretation. As you know, to get the idea of a story in the pre-primers and primers, the child should understand the picture. Billy's reasoning and associations are oft times far fetched. I must ask him many questions before he gets the point of the picture. He finds it hard to follow directions, but he will ask many questions in order to get the directions correct. There are now children who have caught up to Billy but he still has an edge on them because he has a better background and the work I am doing now is not completely new to him. The proof of the pudding must wait until I begin to teach in completely new areas, for example, addition and subtraction."

Billy finished first grade successfully and will be in second grade next year. He did have trouble with arithmetic.

Billy was retested by the Laboratory at the end of first grade. His I.Q. score is now 79. The appraisal of his speech placed him in the normal range with respect to the making of phonemic discriminations in speech production; the repetitions and hesitations have disappeared. Billy now can express his needs and interests verbally in a much more adequate way and, as his teacher mentioned, he is able to ask many questions in order to understand directions. One year of first grade did not improve Billy's reading significantly—for all practical purposes, he was held back, though his skill at picture interpretation undoubtedly improved. It is my overall impression that Billy is still a vulnerable dependent child who will rebel if he is not skillfully handled. A second year in the Laboratory would have afforded him a good deal of protection. It would have been especially helpful if his introduction to arithmetic could have been carried out within the context of a responsive environment.

Billy's family is proud of him and now they let him work more things out for himself. His mother feels completely vindicated: all the psychologists, social workers and teachers were wrong—Billy is not dumb, he is simply a "stubborn and lazy" child who needs a good whack.

### *Edward*

Edward's mother was slim, attractive and beautifully groomed. She graduated summa cum laude from a midwestern college at 20 and married immediately after graduation. The marriage ended in divorce three years later, with the husband keeping their two-year-old daughter. After a

year she married Edward's father who was three years her junior and who was working as a tennis instructor at the time—he had completed only two years of college. A year after they were married, Edward was born; she went to work part-time at a style shop to help pay for her husband's education (she also had an annual income from a trust fund), and voluntarily began what turned out to be three and a half years of psychotherapy.

Edward came to a Project laboratory at four years of age as a referral from a private psychiatric clinic. At three and a half years of age, he had developed food allergies and was having difficulty in sleeping through the night (he would wake up screaming). When Edward first came to the Laboratory his father was just leaving for another part of the country to take a good position in a large firm (by this time he had gotten his B.A. and an M.A. in business administration). Edward's mother did not think it advisable to break off her psychotherapy, so she and Edward did not go with him.

Edward and his mother lived alone, then, in an elegant apartment during the time in which he came to the Laboratory. His mother had stopped working and so she was free to make the daily trip to bring Edward.

Up to the age of four, Edward had spent most of his time with "sitters," except for the hours from 5 to 7 in the evening when the family had dinner and his mother devoted herself exclusively to him. His father had spent almost no time with the boy. Edward himself was the very opposite of an athlete. He was a thin, frail little boy who was afraid of almost everything physical—cats, dogs, playground equipment—but who was extremely verbal. His mother reported that he began saying words at one year of age, and she had used those daily two-hour devotionals to teach Edward all manner of things. Edward looked and acted like what many people think of as a prodigy. He enjoyed embarrassing children and adults by asking such questions as, "How many planets does Saturn have?" and before an answer could be given he would add, "Stupid! It doesn't have planets, it has rings!" His mother said, "Edward could read at three . . . he picked it up entirely on his own, but now he will have nothing to do with books." She also said, "I really don't care whether Edward learns to read at the Laboratory so long as it is a creative experience for him." His increasingly negative attitude toward learning, his allergies, and his sleeping problem upset her a great deal.

Edward's laboratory experience almost ended before it began when his mother found out about the rule prohibiting parents from watching children. She had seen the film, *Early Reading and Writing* (Moore and Anderson, 1960, 1960, 1960), and was looking forward to watching Edward every day. She wanted to know what she could do with herself while he was having his session; it was annoying to her to have time on her hands. Arrangements were made for her to go to a library.



She had purchased a typewriter for Edward to use at home. In her first interview she wanted to know the color coding system so that she could duplicate it. The information was given to her, but as it turned out, Edward would not type at home until much later.

The Laboratory's evaluation of Edward was virtually a duplicate of the clinic's, including the analysis of his responses to projective material. Edward was an extremely tense child, impersonal in outlook, with excellent speech, and his I.Q. placed him on the borderline between very bright and gifted (I.Q. 139). He was difficult to test and free with insulting remarks. He was very much aware of his failures and he categorized difficult test items as "stupid." In fact, everybody was stupid but Edward, with the possible exception of his mother. Edward's mother felt that he should spend more time with children his own age, but there were no acceptable children in the apartment house. He played occasionally with a thirteen-year-old girl who sometimes filled in as an emergency sitter.

Edward greeted his child guide, a girl of four, with the statement, "You have an ugly face," followed by, "What are you doing here, I hate it!" The guide shot back, "Don't be ridiculous!" and took him by the hand. He followed meekly. When he went into a booth with a typewriter, he said, "My typewriter at home is better." He did not explore the Laboratory on his own. During his second visit, he was equally prickly and paced back and forth by himself. In his third introductory visit, he quizzed the guide and was taken aback to find that she knew "bigger" words than he did. He asked if she could type. When she said, "Yes," he said, "Show me!" The guide replied that she did not have to prove it. He shouted derisively, "You can't! You can't!" The guide laughed and Edward announced that he was going to "learn the typewriter" and that he would be much better than the guide. The supervisor scheduled him for his first booth session the next day.

Edward went willingly into a nonautomated booth. He was extremely serious. He painstakingly matched his fingers to keys, for, as he said, "My mother told me to look at my fingers and press the keys with the same colors." Edward did not explore the keyboard. Instead, he searched out the upper-case alphabet, avoiding all punctuation marks and numbers. After a while he was going through the upper-case letters in alphabetic order. After ten minutes of this, he asked for the pictures. He said, "At home my books have colored pictures," and before the booth assistant could say anything, he added, "I hate this stupid thing—I want to go." The assistant immediately turned off the equipment and lifted Edward from the elevated chair. He said, "I want to do it some more." When he was told that he could come back the next day, he cried, "I want to do it now!" Edward left the Laboratory complaining bitterly, but he greeted his mother with the statement, "Their typewriter is better

than yours.” For the next four sessions, Edward confined himself to the letters with which he was familiar and each day he tried to elicit punitive responses from the booth assistants.

In his 6th, 7th and 8th sessions, all less than 15 minutes in length, he stopped matching his fingers to keys and tried to get the booth assistants to say how good he was for knowing all the letters. His 9th session marked the first major change in Edward’s behavior. Instead of sitting stiffly, he slumped down and began to pick away at the keyboard, spending most of his time on characters new to him. He noted that *period* was the same whether “up or down,” he liked the end-of-the-line warning bell and the carriage return. For the first time he stayed 30 minutes and did not insult anyone. Edward’s interest grew each day—he repeated aloud nearly every character after it was pronounced by the booth assistants.

The supervisor switched him to Phase 2, Search and Match, for his 15th session. He announced that he was tired of this game during his 21st session—he could match quickly and accurately.

Edward liked WC-R immediately. In free story telling for WC-W he told long complex stories about how he was going to be his father’s partner in doubles tennis. He told about not having a ball of his own and that he was spanked for touching his father’s tennis racquet . . . but the balls and racquets were gone now. Edward would not listen to his own voice in dictation. He wanted the little girl’s voice (the guide’s); he very happily typed her dictated word lists. For the next 30 sessions, Edward stayed in Phase 3. All of his typing was done with one finger of each hand and he became very pleasant to have in the Laboratory.

In Edward’s 10th week, his mother asked for a conference about his behavior. She said that at home he had become very “sloppy,” for example, he would not put his toys away. More importantly, he had become rude and disrespectful to her. He would not play with the typewriter at home, and, as far as she could see, he had *learned nothing*. He would not look at his books; he had told her that the “Lab” did not have pictures and that pictures were stupid. His allergies were worse, if anything, but he was sleeping a little better. She said she wanted to withdraw him from the program but that he looked forward to the trip every day. What she said she wished to discuss “at a theoretical level” was whether the program tended to make children self-centered.

She was told that it was her privilege to withdraw Edward, but that it would be advisable for her to take him to the referral clinic for a re-evaluation. She accepted this advice. The clinic reported to Edward’s mother that he enjoyed his laboratory experience (a representative of the clinic came to the Laboratory to watch Edward for four sessions) and that it was unlikely his sessions were disturbing to him. On the contrary,

he seemed to be a little less tense and apprehensive. The question as to whether Edward was learning to read or not was irrelevant from the clinic's standpoint, so long as he found pleasure in this activity. The clinic advised her to put the typewriter at home away until he asked for it. Also, the clinic reiterated the advice it gave when he was three and a half years old, namely, "Find some children of his own age for Edward to play with." The Laboratory staff re-examined Edward from the standpoint of assessing his emotional stability. The examiner did not find, or expect to find, any marked change, though Edward was friendlier. Edward's mother decided to keep him in the program and she also enrolled him in a nursery school for the mornings.

Edward liked the nursery school from the first day on. The experienced teacher slowly and skillfully got him to join in group activities. She also succeeded in getting Edward to play with the group's mascot, a puppy.

In Edward's 53rd session, he was shifted to Phase 4, Reading and Writing. He worked his way rapidly into *Alice's Adventures in Wonderland*. His mother bought the book and record set. He would listen to the records at home, though he would not touch the book.

Edward stayed in Phase 4, without regressing, from then on. At the end of his laboratory experience (93rd session), he passed a standardized reading test at the second grade level.<sup>16</sup> His printing was poor, though legible (he never did get along with assistants in the handwriting booth). His typing was rapid but with two fingers only. He came to accept his own voice in dictation. His I.Q. had jumped to 152, his speech continued to be excellent. There were no detectable changes in his personality structure although he had learned more satisfactory ways of dealing with others. His food allergies continued—his mother reported that he was sleeping restfully almost every night. His mother stated that he now liked to go to the library with her to check out books and that he was looking forward to seeing his father.

The referral clinic made a similar assessment of Edward. The clinic's final report stated, in part, "The laboratory and the nursery were positive for Edward. His ability to cope with the demands of his mother is much improved. Edward needs the companionship of his father if he is to keep the gains that he has made."

Although Edward's mother had not planned to leave the area during the school year, she abruptly changed her mind in mid-February. She informed the clinic, the laboratory and the nursery of her decision only one week prior to their departure.

<sup>16</sup> It should be noted that passing standardized reading tests call for formal academic skills in addition to the ability to read meaningfully. Edward could read and answer questions about, for example, *Alice's adventures*, yet he passed the test only at the second grade level.

## *Betty and Jane*

Betty and Jane are physically sturdy, normal-appearing, identical Negro twins. They entered an integrated public school kindergarten at five, and after a month they were referred by their teacher and principal to the school psychologist for examination. During this month they had not spoken to anyone or actively participated in kindergarten activities. For the most part, they sat quietly, smiling irrelevantly from time to time. Children who knew them said that they did not talk but just made noises. When the children in kindergarten stood, Betty and Jane had to be taken by their hands and helped to their feet; when it was time to sit, the twins continued to stand until again they were taken by their hands and shown to their chairs. They constantly sucked their fingers or stuffed their whole hands into their mouths, with saliva flowing freely down their arms and over the fronts of their dresses.

They went willingly with the examiner to take intelligence tests. She reported, "They cannot understand or follow any directions, even when blocks were placed in their hands, they could not put them in tower formation. Their chronological age is 5 years 2 months, but they were unable to pass any test at the 2-year level or beyond." On the basis of the psychological tests and their behavior in kindergarten, it was decided that they were too limited in mental development to profit by kindergarten attendance. They were excluded immediately from school for one year and re-admittance was to be dependent upon the outcome of tests to be given the following year.

The question of re-admittance to public school did not arise the next fall because a social worker, who assisted the family, was able to get the twins into a state agency's class for retarded children. The twins started coming to the Laboratory in late spring after they had attended this special class for eight months. At the time they came to the Laboratory, according to the psychological examiner for the special class, Betty's I.Q. was 55 and Jane's was 56 as measured by the Stanford-Binet intelligence test. The children still drooled, and toilet training had not been completed.

The twins with their family live in a small, three-room apartment in a double-entrance, tumble-down, brownstone complex. The back yard and front sidewalk are littered with scraps, glass and discarded beer cans. The apartment is cramped and dingy though not filthy. The furniture is in a terrible state of disrepair, plaster hangs from the walls and in places is simply missing. The door to the kitchen balances precariously on one hinge.

The family consists of two younger children, the twins, the mother, and a maternal grandmother. The grandmother seems to be the one who

takes the initiative in holding the family together and she is doing her best to raise the children. The twins' mother, who may be thought of as a loving older sister, frequently plays with them on the floor in a child-like unrestrained manner. The grandmother exercises firm, though gentle, control over the twins by confining them, most of the time, to the apartment or to the back yard. It is her opinion that the twins cannot defend themselves in the streets where the neighborhood children play. The twins thus have had very limited experience with other children or adults. Also, city life is new to the family; only three years before they had moved from the South where they had lived in an isolated area. Since coming north the family has been totally on welfare; there is no breadwinner.

The eight months the twins had spent in the special class before coming to the Laboratory served to widen their horizons. According to the teacher the children were extremely shy at first and did not speak to anyone. At the end of several months they began to whisper to each other and to the teacher. Within eight months they were able to "shout, scream and talk to the teacher, children, and any other person who enters the classroom." Their teacher reported that in strange situations they were still very shy. The twins enjoyed the class and felt comfortable with the teacher, assistants and other children. In social interaction Jane was the more dominant one, Betty seemed to be stronger in "intellectual" pursuits. However, the twins are so similar in appearance and behavior that even those who know them reasonably well frequently mistake one for the other. At six the twins had not yet learned to exploit, as most identical twins do, the social possibilities inherent in their identity.

The Laboratory's evaluation of the twins concurred with that of the psychologist for the special class with respect to their intellectual abilities. They were definitely in the category *educable retardate*. There was nothing wrong with their general health and eyes. It was not feasible to do initial speech and hearing analyses because of the difficulty of eliciting an adequate number of utterances. The twins were uniformly pleasant but nonresponsive. It was also difficult to determine much about the structure of their personalities. The finger-thumb-hand sucking, the inane smiling, the extreme shyness and so forth, all would have to be taken into account, of course, in any adequate analysis of their development.

The Laboratory had agreed in advance with the state officials that it would accept a small number of retarded children, free of charge, if the children were "certified" as retarded by the state's experts. When the twins were sent to the Laboratory, there was no way to have one be a control subject without violating the agreement to accept whatever children were assigned to the Laboratory. It would have been desirable for some scientific purposes to have worked with only one of the twins. Yet,

if the laboratory experience proved to be a valuable one, this would have been unfair to the neglected twin and might have had untoward consequences for them in their close relationship to each other. Under these circumstances, I decided to think about the twins from the standpoint of assessing their identicalness. Just how identical are identical twins when each is faced with a new environment?

Betty and Jane were introduced to the Laboratory together for fear that they might be frightened alone. They accepted their guide passively, they asked no questions—in fact, they did not say anything—they drooled and sucked their fingers. Nevertheless, they did not seem to be especially fearful. Their guide was very gracious; she omitted spontaneously the discussion of the Laboratory rules and, instead, assured them over and over that they would like the “Lab.” It was decided to have them go separately into nonautomated booths after one introductory visit because they might be passive for weeks.

Betty permitted herself to be seated in the elevated chair without comment. She sat up straight and appeared to be interested in the keyboard. After about one minute she began to rapidly press keys with an odd sort of looping movement of her right hand using her middle finger. She continued to do this for the full period at a nearly constant rate. Her stroke count for the period was 2204. She struck 27 of the 52 keys. However, she concentrated heavily on three keys, the slant, the comma and the period (these keys are located next to each other on the right side of the bottom row). Forty-nine percent of the keys she struck were these three keys, and of these, the slant was most frequently struck—she produced 815 slants. At the end of her session she was led out of the booth and did not say anything.

Jane permitted herself to be seated and appeared to be interested in the keyboard. After about one minute she began to rapidly press keys with an odd sort of looping movement of her right hand using her middle finger. She continued to do this for the full period at a nearly constant rate. Her stroke count for the period was 3189. She struck 35 of the 52 keys. However, she concentrated heavily on three keys, the slant, the comma and the period. Forty-three percent of all the keys she struck were these three keys, and of these, the slant was most frequently struck—she produced 807 slants. At the end of her session she was led out of the booth and did not say anything.

In their 2nd through 5th sessions the twins continued to be very similar in their approach, but they never again were as identical as they were during their first booth session. At the end of five days, Betty’s stroke count was 8571 and Jane’s was 8724—a difference of 153 strokes. During the 2nd week they began to diverge; Jane became noticeably more active in the booths. Their graphs for stroke counts crossed after three weeks

at 14,377 strokes for Betty and 14,202 for Jane. From then on Betty remained slightly more active than her sister. At the completion of 150 sessions, Betty had typed 10,109 more characters than had Jane. On a day-to-day basis, this means behaviorally that Betty did about a line and one half more typing—a very small difference but an observable one. The girls were more closely matched in booth time than in stroke count. Each almost always stayed the full period. (Their similarity in time is, in part, an artifact of the methods used in handling them. The girls would stay almost anywhere you put them until told to leave.)

The twins stayed in Phase 1 for 19 sessions. It was decided to shift them to Phase 2 in their 20th session because their stroke count was beginning to fall off rapidly.

They had no difficulty in adjusting to Phase 2, though they were slow in working out a systematic search pattern for finding the correct keys. Neither Betty nor Jane used the color-coding scheme. By their 70th session each was quick to find the appropriate keys. Betty was slightly more accurate.

They were shifted to Phase 3 in their 71st session. They would accept word lists in WC-R; but for five weeks they would not talk in WC-W; also, they would not respond to other children's dictation. Finally, Jane began to make a few disjointed comments during her 97th session in WC-W, Betty during her 100th session.

Leaving aside the WC-W recording sessions, the girls began to talk above a whisper during their 5th week at the Laboratory. They both have deep rich voices. It was hard to guess when they would speak up. Occasionally, they would make rather surprising remarks. For example, the first time Jane encountered the cursive typewriter she shouted, "Dig this crazy typewriter!"

Once the twins were speaking with some regularity in WC-W, it was feasible to do a speech analysis (recall that there were no speech and hearing evaluations because of the difficulty in eliciting utterances). Both were rated as having intelligible speech; Jane's speech was marked by a w/r substitution, Betty made the same w/r substitution and in addition had consonant blend substitutions. Their hearing was checked at this time and it turned out to be normal.

In Betty's 115th session and Jane's 120th, they were shifted to Phase 4. They clearly liked stories, although it was very difficult to tell how much they understood of the stories they typed. It was useless to quiz them about what they had typed because this tended to make them withdraw. Once in a while they would make a fairly incisive comment which indicated some understanding of the material.

The twins completed 150 session (see footnote 15). By this time they could print all upper- and lower-case letters as well as the punctuation

marks and other symbols on the typewriter. On automated equipment they could type four words a minute. There was strong indirect evidence to indicate that they could handle first-grade stories if they would only speak freely. Drooling had almost ceased and they no longer wet their pants in the Laboratory.

With respect to their I.Q., Betty scored 64 on the Stanford-Binet and Jane scored 60. Both were weakest in the verbal language tasks. Betty successfully passed one item at the 6-year-old level; Jane passed none at this level.

Even though the twins had to be dropped from the laboratory program, as was mentioned before, a follow-up investigation was made one year later. The twins had been re-admitted to public school and assigned to a special class. Their teacher had visited the Laboratory the year before and had seen them at "work." She was favorably disposed toward the girls. She emphasized in her report that they were very different from the rest of the class. In her opinion it was their lack of social experience rather than low I.Q. which was holding them back. Their individual performances in class fluctuated so much that she felt that there was not a sufficient basis for determining which twin performed better. The teacher began to have them read books at the beginning of the spring term (until that time she felt that they were not ready for work at this level). She was uncertain about how much they had retained from their experience at the Laboratory, but she said that at the beginning of school the girls remembered letters and numbers though they apparently had forgotten sounds.

A Laboratory observer, who sat in on the class during a reading session in the second term, reported that the twins read aloud from the Ginn first pre-primer. Each read her own selection both accurately and quickly; the selection was unfamiliar though simple. The twins did not have reading every day. As the Laboratory observer arose from the reading session, Betty, half hiding behind her teacher's skirt, screeched, "Lab, Lab! I wanna go Lab!" The observer's report reads as follows: "I then completed my discussion with the teacher and went to speak to the girls. I had hoped that I would be able to talk to each one individually, but I found that impossible because Betty kept hovering over the table mooning at us. Rather than risk Jane 'turning off,' I let them talk with me together. They both recalled many details about the Lab; red building, white chalk, yellow station wagon and colors on their fingers. Jane kept babbling about the yellow station wagon. They both remembered typing, reading books, writing on the table and coloring their nails. Jane recalled they 'played games,' Betty remembered the talking typewriter for 'the story about the golden chicken.' (In all likelihood this is the *Aesop Fable* 'The Goose that Laid the Golden Egg.')



fun playing at the Lab, and they obviously wanted to come back again. Initially, I was leery about their enthusiasm because the teacher had alerted me to the fact that their grandmother had a record of prompting the girls. Nevertheless, Betty and Jane did recall a lot about the Program that she (the grandmother) could not have known about, and I didn't feel that they were sophisticated enough to show a sustained and artificial enthusiasm, even prompted."

### *Sandra*

It is the general policy of the Laboratory to obtain children by working with schools, clinics, government agencies, and so forth. In this way the Laboratory gains the benefit of whatever information the relevant organization has about the children in question, and the Laboratory's findings can be integrated with those of other organizations which serve children. This policy also obviates the necessity of dealing on an *ad hoc* basis with numerous families. Nevertheless, parents call the Laboratory; most calls are about handicapped children and we suggest that they see their pediatrician or other appropriate specialist.

There is one kind of telephone call which the Laboratory follows up, in an informal way, whenever possible. For instance, a mother may call and say that she has a three-year old who can do extraordinary things—that he is a mathematical prodigy or that he reads like a whiz. Time permitting, an interviewer goes out to see the child in his home, explaining that our concern is to better understand exceptional children.

One of the things that has impressed us about these visits is the lack of information parents have about the achievements of children. Parents are in the unfortunate position of having to judge the possibly unusual achievements (i.e., accomplishments as opposed to the ability to achieve as estimated by some standardized test) of their own child by the standards derived from reading and personal experience. They may conclude that they have a *wunderkind*.

There is also great vagueness about what constitutes reading. We have been in some homes where a child is said to be reading brilliantly when he can only identify a few words. Parents say, almost uniformly, that whatever the child does, he learned all by himself. Yet even casual inspection of the living room reveals flash cards, slates, or educational toys directly related to the child's accomplishments. Questioning the parents closely is generally sufficient to reveal the method of instruction which the mother, father, grandmother, older sister, or neighbor used. In a few cases, when parents stoutly maintained that the child has had no instruction whatsoever in reading or numbers, we have said to them that if their child, unaided, can discover so much, then perhaps he could

help at the University to decipher some heretofore untranslated hieroglyphics that had even the specialists wondering whether to start from the right, left, top or bottom. At this point parents quickly volunteer that, of course, they answered all the child's questions.

I do not wish to impugn the ability of these children to learn, or to minimize their accomplishments in any way, or to make light of the pride their parents take in them, or to discourage such parents. The plain fact is that parents lack comparative information about children's accomplishments, and even if they were to search the relevant scientific literature, generally they would not receive very much help.<sup>17</sup> Behavioral scientists, including myself, are pretty much in the dark about extraordinary accomplishments. It is for this very reason that we are appreciative of the opportunity to observe children who strike their parents as prodigious.

Sandra's mother called to ask questions about enrolling her four-year-old daughter in a Laboratory program. She said that Sandra, an only child, was beginning to learn to read by herself and that she did many precocious things. A visit to the home was arranged.

Sandra lived with her parents in a rambling winterized beach house which they had rented four years before when they moved to this area. Sandra's father is an engineer and her mother is a painter who occasionally accepts commercial assignments. The house was filled with the accouterments of their work. One room was set aside for the father's extensive files. Sandra was probably the only person who knew where everything was.

Her parents were swimming when the Laboratory interviewer arrived and Sandra introduced herself (she was waiting) and asked if he wanted to see her photographic equipment. Her father had set up a miniature studio for her with a dark room three months before. She explained in great detail the complete process of taking pictures and developing them. She also showed some of her work with a running commentary on the quality of each picture. She explained that the current project was to use mirrors in taking pictures. She distinguished clearly between those things which she did by herself and those things which her mother or father helped her with. Also, anything that might be dangerous she would do only when a parent was present. There was no doubt in the interviewer's mind that basically the studio was hers even though she received a great deal of technical assistance.

In about half an hour her parents came in, wearing their beach robes, and sent Sandra out to play. They reminded her to stay out of the water

<sup>17</sup> Terman's monumental study (1925, 1959) is a gold mine of factual information for those who are interested in gifted children.

and to stay within view—the interview took place on the porch where Sandra could be watched. She took a pail, a shovel, a few toys and a camera with her. Her mother apologized for not being there when the interviewer arrived but said that she wanted him to visit with Sandra first.

Sandra's father was 40 and her mother 35. The father received his degree in engineering, the mother went to art school. They wanted to learn about the Laboratory program and also wanted to know whether the interviewer agreed with them that Sandra was some kind of prodigy. Their attitude seemed to be one of concern about what would be best for Sandra. They said she got along reasonably well with the neighborhood children; nevertheless, most of the time she preferred to pursue her own projects. She would have liked to have played more with some of the older children in the neighborhood, but she could not get them to stay in her studio long enough—besides, they messed things up. The parents had not intended for her to get so wrapped up in photography, but once started she had kept after them to tell her more and more about it. She had other hobbies: collecting shells, painting (trying to copy things) and currently she was tying her various hobbies together through photography. She had learned the alphabet while getting things for her father from his files and now she wanted to learn to read so that she could help her parents better and read instructions for herself, especially those related to photography.

Her parents, who were quite relaxed, were somewhat appalled by the thorough, relentless way in which she pursued her interests. They thought that though she was friendly and helpful, even affectionate, she was rapidly becoming more and more exclusive. The only way to get close to her was to become a part of her projects. The parents had great sympathy for the idea of a child pursuing interests independently, but they did not think it was healthy for her to become so absorbed in her own affairs.

The interviewer suggested that Sandra be sent to a clinic for a thorough examination and to see if the clinic felt that it was advisable that the Laboratory accept her. It was pointed out that the clinic probably would recommend that she go to nursery school in conjunction with the laboratory sessions. This recommendation would have to be followed. The parents agreed.

All during this conversation (approximately 45 minutes) Sandra played. When the interviewer was leaving they walked up to see what she was doing. She had made an elaborate sand castle decked out with toys which she was in the process of photographing.

Sandra came to the Laboratory in September and also started nursery school. She was an attractive child, big for her age, in good health, and

had normal vision and hearing. Her speech was excellent and her I.Q. tested 160. Her general personality development was sound; she was without marked tensions or anxieties. The examiner commented that she seemed to be somewhat wanting in spontaneity and humor and thought that she needed the companionship of other superior children. The overall assessment was that she was a gifted child in good psychological health. There was no evidence of coaching for the tests or academic pressure at home. She liked the examination and said she wanted to do it again sometime.

Sandra was intrigued by the Laboratory in her introductory visit. She noted the photographic equipment, she said she thought she would like the typing "studio," she got along beautifully with her guide and her main disappointment was that she had to wait till the next day to play with the equipment. The supervisor scheduled her for a nonautomated booth session the next day. When her fingers were painted she wanted to know why; she was told that she would find out. The moment she sat in the elevated chair and looked at the keyboard carefully she remarked that now she knew—from the first she matched fingers to keys. Sandra's search pattern, even in free exploration was deliberate; she tried every key row by row. When she encountered the lower-case key she started over again, trying each key both ways. She told the booth assistant that it was not necessary to say the letters that she already knew, that she would say them. Sandra stayed 30 minutes and was quite annoyed about having to leave though she controlled her temper. Her stroke count was 410. Her 2nd and 3rd sessions were spent in the same way. At the end of the 3rd session she said that she would like to do something else.

The supervisor switched her to Phase 2, Search and Match, for her 4th session even though she did not know the names of all of the keys. Her first reaction to the new game was to say that she understood it. She went quickly through the increasingly difficult forms of the game. At the end of her 13th session she knew the keyboard cold and continued to use correct fingering. She asked when she could have a "really" new game. The supervisor gave her one the next day.

Sandra spent 18 weeks in Phase 3, Word Construction, R and W. In WC-W she talked freely and happily about her projects. She brought material from her studio to copy as well.

In her 103rd session she was shifted to Phase 4 because her stroke count and eager interest were falling off. With her ability to retain whatever she was exposed to, she immediately began reading pre-primers, and two weeks later she was reading first-grade books. Occasionally she asked to go back and do some special word lists. At the end of spring term (170 sessions) the reading test showed she was at the second grade eighth-month level. She could type eight words a minute on nonauto-

mated equipment. She printed all typewriter characters with precision.

Sandra's experience in nursery school was not altogether satisfactory to her. She liked her teacher and a few of the children but she complained, in a lady-like way, that it was all too babyish. She attempted to mother the other children and some of the boys said that she was too "bossy." Unfortunately, at the time she came to the Laboratory there was no newspaper project to challenge her, nor was there any other common activity for laboratory children. As things stood, she was a leader *sans* followers.

A recheck of her I.Q. showed it to be 169. At home she added reading and writing to her other projects. She did very little in the way of creating original stories. Her favorite book, which she had just started to read, was *Tal*.

The personality assessment showed no basic change. However her parents felt that she had changed significantly. She wanted to discuss the stories that she read and it was their opinion that this greater common area of interest was drawing her closer to them again. She continued to pursue her projects independently, but as her father put it, "She is running into ideas that cannot be captured in a photograph."

The family moved to a large city in another state when school was out. Sandra was enrolled in a special class for gifted children. Her parents write occasionally to keep the Laboratory posted. At present, she is in a class with an ungraded program. Thus far, this class has provided a challenge which she enjoys.

#### CONCLUDING COMMENTS

At the beginning of this chapter it was pointed out that slow learners are likely to be out of phase with the age-graded societal demands imposed upon them and that they are apt to be problems to themselves and to their friends. The three slow learners that we have considered, Billy, Betty and Jane, are certainly cases in point. As soon as they appeared in school the duly constituted authorities decided that they were not "ready." In all likelihood, the authorities were correct—these children were not "ready" to be taught by conventional methods. Nevertheless, they could be reached and the procedures through which they learned did not depend upon a rescue by one of those rare marvelous teachers who, through empathy, insight and intelligence, can reach the nearly unreachable.

It also was stated that ultrarapid learners, too, may create problems for themselves and others. Edward and Sandra, in very different ways, made people uncomfortable. Neither Edward nor Sandra had had the opportunity to take part in the full Laboratory program where they could

have used their intellectual skills within the context of a meaningful group that was heterogeneous in ability.

The vignettes of the background and laboratory behavior of the five children just considered perhaps have served to clarify both the operation of the Laboratory and some of its effects upon exceptional children. It might have been more revealing to have presented some of the children who started coming to the Laboratory at two and three years of age and who are still in the program on a daily basis. Cases of this kind demand a more lengthy and systematic treatment. Also, in my opinion, very early exposure to a responsive environment produces deep personality changes, and it would be inappropriate to analyze children thus exposed outside the context of a theoretical interpretation of personality development. Hence, I have focused attention here on children who began their experience at the Laboratory at four, five or six years of age and who remained in the program for only one academic year (or less). These children gained useful skills and attitudes which, with the help of clinicians, nursery school teachers and others, enabled them to deal somewhat more effectively with pressing individual and social demands.

Another reason for selecting these children was that they make manifest some of the subtleties and complexities of the psychodynamics and sociodynamics of learning. This may serve as an antidote to the dangerous notion that a responsive environments laboratory grinds out results in a purely mechanical way. The role of the supervisor was highlighted throughout in order to emphasize that a responsive environments laboratory, though phases of it are automated, does not run by itself. It would be equally foolish to assume that well-designed instruments do not have an important part to play in the daily operation of a laboratory.

It was the purpose of this chapter to describe an autotelic responsive environment which facilitates the learning of complex symbolic skills. It was suggested initially that no one aspect of the environment should be thought of as constituting its essence. In part it is a mechanical system, in part it is a social system, and in part it is a cultural system. All of these parts are constituents of the total system—all of them must be taken into account if the Laboratory is to be understood. The task of designing optimal environments for learning is in its infancy, and the theoretical problems of understanding what is going on in the Laboratory are staggering. One would have to be very insensitive to its research possibilities not to imagine quickly a hundred and one experiments that could be carried out within it which might increase our understanding of human beings. For example, the startling similarities between Betty's and Jane's first sessions practically demand further studies of identical twins. The behavior of Billy and Edward may be of special interest to psychoanalytically oriented researchers.

For the present and for an additional year or so I intend to continue to operate my laboratories as a demonstration project rather than as a controlled experiment. I may be mistaken in this policy, but there are hazards connected with focusing sharply on one or another aspect of human behavior before one gets a full sense of its variety in longitudinal perspective. This easily can lead to lop-sided theorizing and debilitating polemics. The Responsive Environments Project is endeavoring to remain open and responsive to whatever changes the continuing observations of children's behavior seem to call for, although it is easy to deceive oneself about such matters.

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