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A Behavior Therapy Approach to the Treatment of Childhood Schizophrenia

IN THE late 1950's Ayllon initiated the first large-scale investigation of the applicability of the principles of reinforcement theory to the treatment of adult schizophrenia (Ayllon & Azrin, 1965). Since then, researchers have investigated the utility of applying these principles in the modification of pathological behaviors in childhood schizophrenia (Wolf, Risley, & Mees, 1964), juvenile delinquency (Schwitzgebel & Kolb, 1964), and mental retardation (Bensberg, Colwell & Cassel, 1965; Birnbrauer, Bijou, Wolf, & Kidder, 1965). The present paper is an overview of a research project dealing with the application of reinforcement principles to childhood schizophrenia.

Within the last few years, interest in behavior therapy, the systematic application of learning theory to treatment, has become sufficiently extensive to provide a new look for clinical psychology. The basic conceptual framework for behavior therapy, however, is not new. Nearly seventy years ago, Thorndike isolated several of the empirical relations of rein-

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forcement theory. Over the years, this theory has provided the foundation for most experimental laboratory research on behavior theory in this country.

One might wonder why so many years elapsed between Thorndike's work and the application of the principles of reinforcement theory to problems within clinical psychology. In defense of such apparent conservatism, it might be argued that no application of *any* psychological principle to the treatment of abnormal behavior was made before Thorndike. Thorndike and Freud were contemporaries. Freud, and not Thorndike, was explicitly concerned with providing conceptual order to the myriad beliefs about insane, frightening, aberrant behavior. The security generated by adhering to psychoanalytic constructs is not easily relinquished, and one might resist an approach which threatens to negate the familiar through redefining both deviant behavior and its treatment.

Perhaps this explains why much of the early work on behavior therapy was done by psychologists unfamiliar with clinical psychology. It may also account for the fact that early attempts did not relate learning theory directly to abnormal behavior but were directed primarily toward translating learning theory into psychoanalytic constructs (see Dollard & Miller, 1950). Direct application involves certain methodological considerations that deserve brief comment.

Methodological Considerations

Relating reinforcement theory to treatment necessitates considering two main methodological problems: first, the delineation of the variables that constitute the treatment situation, and second, determination of methods for studying how these variables interact.

Hypothetical variables emerge so easily from observations of treatment relations that clinical psychology is virtually inundated by potential variables. Obviously, one has to rely on some criteria rather than others in the selection of variables. Behavior therapy is singular in its concern with definition of variables by their functional properties. To define variables by what works is not an unreasonable criterion, since the objective of treatment research is to facilitate treatment. The variables involved in treatment, then, will emerge in terms of their effectiveness in attenuating psychological difficulties. Thus the choice of variables becomes an empirical matter. One probable consequence of selecting variables by their functional properties is that most of the traditional nomenclature of psycho-

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pathology would be ignored. This nomenclature was not derived from empirical analysis yielding functional relations, but rather from descriptions of patients and their environments. It was organized via analogies with other disciplines and often according to the social ethics of the writer. Consider the hypothetical variable childhood schizophrenia, which seems to refer to a cluster of poorly intercorrelated behaviors. Over time, increasingly elaborate descriptions have been applied to this condition until the term has become broad enough to include almost any major disturbance of childhood. Despite extensive research, there are no studies that pinpoint the etiology of this condition or indicate its successful treatment. The absence of such studies could mean that childhood schizophrenia is particularly difficult to interpret or that it does not constitute a psychological variable in a functional sense. Since the term was coined before functional analysis, there is certainly no assurance that the phenomena that it encompasses would yield to such an analysis. Many similar clinical variables may be irrelevant to our ultimate goal of isolating the antecedents of and providing effective treatment for abnormal behavior.

Instead of addressing treatment to the hypothetical condition, "schizophrenia," one could concentrate treatment on some of the behavioral deviations covered by that term and look to experimental laboratory research on learning for initial guidance in choosing variables. One might then ask whether the behavioral deviations chosen are regulated or governed by the functional relations isolated in learning theory research. This kind of approach leads to the attempted modification of functionally identifiable behaviors in such areas as verbal, intellectual, and interpersonal behaviors. To the extent that the treatment variables have to fulfill functional criteria emerging from research, it is apparent that behavior therapy is an open system. It is a mistake to refer to this therapy as "operant conditioning therapy," since operant conditioning provides for only a beginning. Accordingly, our formulations cannot account for a child's becoming "normal" if this should happen in our setting because they do not describe all the nuances of man's interaction with his environment. There is more to human behavior than that contained within reinforcement theory.

The second methodological consideration concerns the manner in which one investigates the interaction of the variables encountered in treatment research. Since the main purpose of behavior therapy research centers on the isolation of functional relations, this research adheres to an experimental laboratory design. Such a design is selected because it re-

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duces errors of confounding and permits a more reliable isolation of functional relations. Behavior therapists have concentrated on single-subject replication designs. These designs have the advantage of literally forcing the investigator to exercise maximum control over concurrent variations in extra-experimental variables. They also help to isolate powerful variables. Single-subject replication designs are uniquely appropriate to treatment research since they reflect the clinician's concern for the single individual. Because of the large amount of time devoted to the study of a single individual, or a few individuals, much behavior therapy research has yielded limited information about how individual data might be generalized to apply to more subjects.

In the single-subject design, when one replicates the presentation of the independent or treatment variable, it is necessary to terminate temporarily the patient's progress or to make him more sick once improvement has been initiated. Insofar as the investigator is able to effect such changes in the patient's behavior, he will be more assured that he has in fact isolated the independent variables of which the patient's improvement is a function. The investigator's anxiety associated with this temporary termination of improvement is probably correlated with his uncertainty about his contribution to his patient's improvement.

The methodology of behavior therapy research also limits the investigator in his use of certain traditional clinical research tools. The case history, the psychiatric interview, and the Thematic Apperception Test (TAT), for example, entail such lack of control over the independent variables that they are virtually excluded from use. The difficulties in drawing reliable functional relations from observations employing these tools are roughly proportional to the investigator's lack of control over the independent variable. Specifically, the traditional procedures place severe limitations on the possibility of statements pertaining to (a) the precise aspects of the treatment situation that are affecting the patient's behavior, (b) the function of those aspects, and (c) the quantification of the relation between treatment and change in behavior.

The experimental laboratory design and the objective of isolating functional relations place restrictions on certain kinds of questions that the investigator may want to raise concerning abnormal behavior — for example, about the parent's role in the etiology of childhood schizophrenia. Answers to such questions, though often intriguing, entail so much con-

founding that they are meaningless in a functional analysis of abnormal behavior. Therefore, the questions are not raised at this time.

The Conceptual Framework and General Objectives

When one views the development of abnormal behaviors from a reinforcement theory framework, emphasis can be placed on deviations in behavioral development. For example, one abnormality might be defined as failure to talk. Similarly, deviations may be viewed as distortions in stimulus functions; for example, a child for whom a smile has no function might be defined as a deviant. Since the acquisitions of behaviors and functions are defined in terms of one another, it would be difficult to alter stimulus functions without simultaneously altering behaviors, and vice versa. However, the operations which govern the acquisition of behaviors are different from those which regulate stimulus functions. The use of one of these operations as a therapeutic intervention would require a treatment program of different construction than would the use of the other.

It is important to be more explicit about the interaction between the acquisition of stimulus functions and behavioral development. Although the child's behavior during the first few months of life might be regulated by primary reinforcers — the mother responds to the child's cry by feeding and cuddling him — acquired reinforcers soon take over an essential controlling function. This is particularly apparent in analysis of the emergence of social behaviors. The basic assumption of reinforcement theory is that many social and intellectual behaviors are regulated by acquired functions of the environment. Such acquired functions could include most stimuli generated by other people, such as closeness to others, affection, and support of peers. When a child emerges as a human being, he does so essentially on the basis of the effect of his behaviors on his social environment. For example, he may visually fixate on his mother's face to the extent that such fixation entails acquired reinforcement — it feels good to look at her. Similarly, the child may come to emit his social smile insofar as significant people in his environment can return a reinforcing smile. And he may explore his first sound or word production because he hears himself sound like his parents; that is, the matching of stimulus inputs has acquired reinforcing properties for him. An enormous variety of behaviors is regulated by social, interpersonal, or intellectual consequences that have acquired rewarding or punishing properties. Reinforcement theory illuminates rather than attenuates the great complexity of this interaction be-

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tween behavior and environment. Because the acquisition of secondary reinforcers may be a function of deviations both in organic structure and prior environment, there is ample opportunity for development to go astray.

Several authors have argued that schizophrenic or autistic children fail to develop normal behavioral repertoires because they are not affected by social reinforcers. Ferster (1961), who presents the argument within reinforcement theory, hypothesizes that the social environment has little and sometimes no secondary reinforcing function for an autistic child. Like Ferster, Rimland (1964) hypothesizes that autistic children do not develop normally because social stimuli do not acquire meaning for them. Rimland attributes this failure to central nervous system pathology, and Ferster relates it to inadequate parent-child relationships. Similarly, psychodynamically oriented writers point out that social stimuli fail to operate normally for autistic children. For example, Betz (1947) regards autism as the establishment of an impermeable interpersonal barrier which shuts off social stimuli. In psychodynamic orientations, such barriers are hypothesized to be defense mechanisms against prior interpersonal traumata.

Treatment of childhood schizophrenia from a reinforcement theory framework can be approached by building behaviors directly or by establishing acquired reinforcement. If treatment is centered on the first alternative, it follows from the previous argument that maximal change can be achieved only by relying on primary reinforcers. In most cases, teaching efforts based on acquired reinforcers would be ineffective. At present, there is ample evidence that schizophrenic children will acquire new behaviors when primary reinforcement is used. To maximize the power of these reinforcers, the child may be placed on mild food deprivation, such as reinforcing him with food at mealtimes and providing no food between meals. It should be apparent that direct manipulation of behaviors is necessary when they endanger the child's life, as in self-mutilation. Similarly, certain intellectual behaviors are so complex that they can be acquired only in specific environments designed to create them. The use of primary reinforcement and the direct shaping of behaviors have an obvious disadvantage in that special environments need to be established to develop and maintain the new behaviors. Until we have adequate knowledge about how to construct such environments, the results of therapeutic efforts probably will fall short of the ideal.

The second alternative is to concentrate treatment efforts on facilitating

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the schizophrenic child's acquisition of social reinforcers rather than on building behaviors. A treatment program centered on establishment of a normal hierarchy of social reinforcers gives the child's everyday social environment (his parents, teachers, peers, and so forth) the tools with which to build and modify the myriad behaviors necessary for the child to function effectively within that environment. In a sense, the person's behavioral changes would take care of themselves if he possessed a normal reinforcement hierarchy when moving from treatment to a normal environment. Such an approach is similar to more traditional treatments, like psychotherapy, in which the therapist works with the establishment or rearrangement of interpersonal meanings, rather than directly manipulating behavior. This approach is similar also to the situation in which the therapist conceptualizes his treatment efforts as initially establishing a relationship which he will subsequently use (to modify behavior). Conceptualizing these changes in terms of behavior theory offers the advantage of explicitly stated operations for bringing them about.

This treatment approach is independent of etiology. There are several advantages associated with such independence. First, it is advantageous to avoid assumptions about etiology when it is unknown and so difficult to research. Secondly, isolation of the controlling variables during the early stages of a disorder might be irrelevant in formulating subsequent treatment of that disorder. Topographically similar behaviors may be supported in their environment according to different laws at different times. For example, self-inflicted injury may be a function of purely emotional variables (such as frustration) in infancy (under respondent control). Later in life, the same behavior may be controlled by the consequences of the behavior on the person's social environment (an operant relation). The treatment prescribed would be qualitatively different in the two situations; one bears no functional relation to the other. In short, it is difficult to make valid statements about etiology, and even if such statements could be made, they might be irrelevant for treatment.

Description of Population

At the present time, we have ten children in intensive treatment research. In addition, we have performed isolated studies of several children who were residents of other institutions or who had been brought in for short-term observations. Although they have been variously diagnosed as schizophrenic, autistic, retarded, and brain damaged, I shall refer to these

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children as schizophrenic, since they have been given that label most often. In general, the more diagnostic work-ups available per child, the more varied were the diagnoses. Therefore, a brief behavioral description will be given here instead of diagnoses. Childhood schizophrenia encompasses a behaviorally heterogeneous population. In our work, we have concentrated on the least developed children. Some of them had been in treatment for extensive periods with no improvement; others had been rejected from treatment because they were poor risks. Some of the children were completely unresponsive to social stimuli and evinced no social or intellectual behavior. They were so oblivious to their surroundings that they behaved as if they were blind and deaf. They were completely engrossed in self-stimulatory behaviors, such as spinning objects, rocking in sitting or standing positions, twirling, flapping their wrists, and gazing at lights and at their cupped hands. In six of the children, vocal behaviors were limited to occasional vowel productions having no discernible communicative intent. The behavior of such children could be completely recorded under the two categories self-stimulation and vocal output. Self-stimulation took up 70-95 per cent of the child's waking day, and vocal behaviors 10-35 per cent. Changes in the child's environment had no effect upon the complete unresponsiveness of these children. For example, we could observe no concurrent behavioral variation upon change in the child's physical surroundings (such as presence or absence of toys) or in his social surroundings (such as when attending adults actively seek to interact with the child by calling his name, inviting him to play games). Four of the ten children initially had echolalic speech, and two of these children evidenced some appropriate play. About 75 per cent of the children would engage in tantrum behavior, which included smearing of feces, biting attending adults, and self-mutilation.

Five of the children studied were inpatients, the other five outpatients. Some of these children were in treatment for as much as two years on an eight-hour-a-day basis, whereas others were seen for as little as five hours a week over one year.

The reader who may want to familiarize himself further with characteristics of autistic and schizophrenic children should refer to Rimland's (1964) book. Several of the children we have treated may be classified as autistic, using Rimland's checklist. Furthermore, most of the children we have seen fulfill the Kanner and Eisenberg (1957) and Brown (1960) criteria for poor prognosis. That is, most of the children had failed to de-

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velop speech or engage in appropriate play by the time they were three to five years of age, and their future was certain institutionalization.

Such children, as described here, do not have the physical stigmata of a Mongoloid or many other retarded children. Although they may look beautiful, their behaviors are as primitive and constricted as the most retarded of children. They are untouchable — even more so than the lepers of old — for even though one wants to deal with them, reach for and love them, they do not perceive or respond to one's attempts. Most clinicians who have worked with these children have felt discouraged; outcome studies on psychotherapy with these children have so far rejected its usefulness (Kanner & Eisenberg, 1957; Brown, 1960). They are a sad and baffling lot. Despite the confusion, agony, and despair the children cause, their parents see more potential for their development than do clinicians. Perhaps this is not entirely wishful thinking.

Early Studies

It may help to understand our current research program if I describe how we started. In 1962, we initiated some exploratory studies on a nine-year-old echolalic girl, Beth. In planning these studies, we were influenced by Ferster and DeMeyer (1961), who were successful in establishing certain behavioral repertoires in autistic children by the use of primary reinforcers. Furthermore, we were influenced by Ayllon's (1965) work with chronic schizophrenics and knew of his success in extinguishing or suppressing pathological behaviors and establishing socially appropriate ones. Largely on the basis of these studies, we set out to explore some of the conditions under which we could suppress Beth's echolalic speech and establish more appropriate language behavior. By the use of food as reinforcement and by the withdrawal of food as punishment, we soon observed that Beth could learn. In fact, on certain tasks her acquisition was extremely rapid; within a matter of a couple of months, she had mastered a fifty-word texting vocabulary, and her echolalic speech was being suppressed. However, two observations led us to expand our investigations. First, although Beth learned very rapidly with primary reinforcement, her family and neighbors did not approach her with these reinforcers and could not maintain the newly acquired repertoires by the use of social reinforcers alone. Therefore, we attempted to isolate some of the conditions under which schizophrenic children could acquire social reinforcers. Second, with the increase in demands that we placed on Beth, we observed an

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immediate increase in her bizarre and self-mutilatory behaviors. Because of the potential dangers to her of the self-mutilation, we first had to investigate the conditions that would enable us to control her self-destructive behavior. One observation in these early studies was particularly significant in determining our future work: we learned that schizophrenic children responded to demands by becoming increasingly psychotic (e.g., self-mutilatory), and that this did not seem to be motivated by anxiety or by panic. On the contrary, our data seemed to indicate that we would reinforce the psychotic behavior if we removed the demands. Furthermore, if we ignored the psychotic behaviors, they eventually decreased in strength and stopped. The results from these interventions and observations were contrary to what some of us had expected on the basis of our clinical intuition. Also, suppression of the investigator's anxiety in these operations was not easy.

Again, Ayllon (1965), with adult schizophrenics, and Wolf et al. (1964), with schizophrenic children, had reported similar observations. Specifically, Wolf et al. had observed extinction of self-destructive behavior with removal of interpersonal relations contingent upon such behavior.

Our early studies, then, led directly into three major research objectives. First, the children's psychotic behavior necessitated an analysis of ways to control such behavior. Second, it became important to establish conditions for the acquisition of social reinforcers. Finally, we carried out a set of studies of ways to obtain optimum acquisition rates for social and intellectual behaviors, particularly such complex ones as speech.

Since our treatment research was carried out in lifelike situations or in free-play settings, we constructed an apparatus which could be used to record the children's behavior in these settings (Lovaas, Freitag, Gold, & Kassorla, 1965b). The apparatus keeps a running account of both frequency and duration of several simultaneously occurring behaviors of the child and concurrent changes in his physical or social environments. The procedure can be used for analysis of interrelated behaviors of the child, as well as covarying relations between the child's behaviors and those of the attending adults.

Analysis of Pathological Behaviors

The children with whom we have worked have shown three very salient forms of pathological behavior: self-destruction and tantrum behaviors, echolalic speech, and self-stimulatory behaviors. Although self-stimula-

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tion was present in every case, self-destructive and echolalic behavior was present in less than half the children we have seen for treatment. Because self-destructive behavior is particularly interruptive of treatment efforts, the studies of that behavior were initiated first.

Self-destructive Behaviors. Our first research on self-destructive behaviors has been published elsewhere (Lovaas, Freitag, Gold, & Kassorla, 1965a). In that report, we studied extensively the self-destructive behavior of one child using a single-subject replication design. The data from one of these studies have been presented in Figure 1. The abscissa indicates the various experimental manipulations in abbreviated form with all their respective sessions. The ordinate gives the frequency of self-destructive

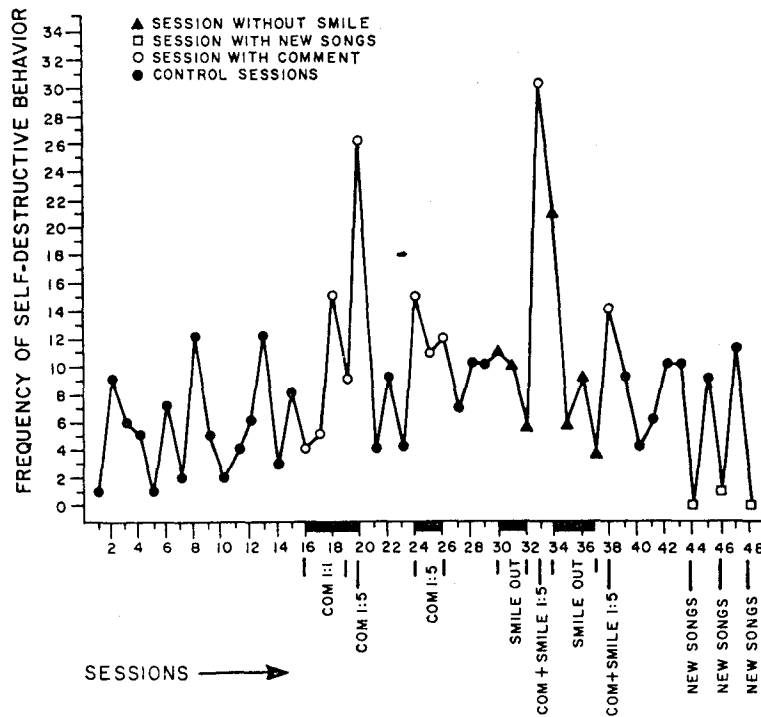


Figure 1. Frequency of self-destructive behavior over sessions when *Es* commented upon that behavior (16-20, 24-26, 33, 38), when *Es* withdrew smiles and attention from entire sessions (30-38), and when new stimuli were introduced (44, 46, 48). All other sessions were control sessions. (Reprinted by permission of Academic Press, Inc., from O. I. Lovaas, G. Freitag, Vivian J. Gold, & Irene C. Kassorla, Experimental studies in childhood schizophrenia: analysis of self-destructive behavior, *Journal of Experimental Child Psychology*, 1965, 2, 67-84.)

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tive behaviors during the sessions. This study was undertaken to investigate how self-destructive behavior could be controlled.

In an attempt to reduce the self-destruction, we had the attending adult say "I don't think you are bad" in an emphatic and reassuring manner after the child engaged in self-destructive behavior. The choice of the comment was made after consulting several professional people who concurred that the child's self-destructive behavior was a function of internal states, predominantly "hostile introjects" or guilt. It was hypothesized that the comment might reduce self-destructive behavior by effecting change in these internal states. Examination of the frequency of self-destructive behaviors during sessions in which the attending adults commented on that behavior (sessions 16-20, 24-26, 33, and 38) shows a definite increase in that behavior over the control days. The behavior appears to be under reinforcement control - that is, the comment served to reinforce the child's self-destructive behavior.

We have not made any further investigations of increases in self-destruction due to reinforcement control. However, we now have data on two other children with whom reinforcement withdrawal, in the form of interpersonal isolation contingent upon self-destruction, served to extinguish those behaviors. These data are consistent with those obtained by Wolf et al. (1964). Ball (1966) observed a similar relation in severely self-destructive retarded children. Williams (1959) also reports extinction of tantrums in normal children by use of a similar procedure.

In placing the child on extinction, the therapist temporarily exposes the child to danger because of the characteristic increase in self-destructive behavior accompanying the onset of extinction. In some children this behavior is particularly vicious. Some children have used their teeth to remove large sections of flesh from their own bodies. Others hit their heads so severely that they break bones in the nose or detach their retinas. Some self-destructive children have blinded themselves. In an attempt to overcome this problem, we have delivered painful electric shock contingent upon such behavior in two schizophrenic children (Lovaas, Schaeffer, & Simmons, 1965). The behaviors were suppressed within minutes and remained suppressed for eleven months. At the present time, we combine electric shock with interpersonal isolation contingent upon self-destruction.

It is appropriate here to define affection and punishment in relationships with children. These cannot be defined by describing the attending

adults' behavior, but must be defined in terms of the effect of the behavior upon the child. The preceding studies indicate that when one communicates affection to a schizophrenic child contingent upon his self-destruction, one may cause considerable harm rather than good. Similarly, the administration of interpersonal isolation or painful electric shock, contingent upon self-destructive behavior, to children who literally have spent most of their lives mutilating themselves is an act of affection when these interventions serve to free the children of the pathology.

It had appeared from a previous study that withdrawing reinforcement (affection, attention, and food) from a previously reinforced response served as the discriminative stimulus for self-destructive behavior — that is, the self-destructive behavior apparently was triggered when another response in the same situation was being extinguished. During sessions 44, 46, and 48 (Figure 1) such control was examined further by exposing the child to a stimulus situation in which she had not experienced reinforcement withdrawal. The figure shows that her self-destructive behavior fell to near zero during those sessions. To test whether removal of the stimuli themselves (affection, attention, and food) was functional in triggering self-destruction, we removed them during sessions 30–37. It can be observed that the child's self-destruction was left unchanged by this rather gross operation. Affection, attention, and food cue the self-destructive behavior when they have served as reinforcement for another response and have subsequently been removed. They are not discriminative for self-destruction when removed without first having served as reinforcers.

The only available conceptual system which fits the observed data is reinforcement theory. However, we have no evidence that self-destructive behavior is *only* operant behavior. It is quite possible that when the child was an infant, these behaviors were elicited by emotional stimuli, and the self-destruction had an essentially respondent quality. Further, the child's parents may be able to supply information to support such an hypothesis. However, information about early relationships between parent and child, even though accurate, may be of no value in the treatment of these behaviors later in the child's life. Over time, the behaviors may have come under the control of a completely different set of functions. Finally, self-destructive behavior may be controlled by very different functions in children diagnosed as neurotic rather than schizophrenic.

~~Psychotic Speech.~~ We have studied four children with psychotic speech, such as echolalia and bizarre word combinations, and we shall present

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some of the data for one child here (Lovaas & Kassorla, 1966). The study deals with two kinds of speech behavior, psychotic and appropriate. Psychotic speech includes immediate echolalia, in which the child repeats within three seconds the attending adult's verbalization in its precise word order, and delayed echolalia, which refers to verbatim repetition of phrases heard before the experimental session. These phrases are contextually meaningless or unrelated to the action going on. A second category of psychotic speech includes strange word combinations and senseless, odd expressions, such as "spaghetti Irene" and "helicopter pillow." Appropriate verbal behavior is behavior which is contextually meaningful, such as "let's clean up" at the end of play session. Requests are appropriate when they are affirmative and make use of the appropriate pronoun—for example, "I want a cookie." Almost all of the appropriate verbal behavior that was recorded had been taught in sessions before the experiment, in a manner which will be described in the section dealing with language acquisition.

Observers also recorded nonverbal psychotic behavior which fell within two classes, self-stimulation and atavisms. Self-stimulation included grinding the teeth, crossing the eyes, jerky gyrating of the head, grimacing, and rocking. Atavisms included banging the head, picking at the chin until it bled, hitting and pushing, throwing, and scratching. Experimental manipulations of verbal behavior occurred within a preschool environment which included finger paints, modeling clay, snack time, and so forth. Figure 2 presents the strengths of the various behaviors on the ordinate; the abscissa denotes the various experimental manipulations, over days. It is apparent from the base-line measures that the child's psychotic verbal behavior is considerably stronger than her appropriate verbal behavior. The abscissa shows three acquisition periods for appropriate verbal behavior, in which the attending adult would reinforce the child with verbal approval and offer occasional sweets for appropriate verbal behavior. These acquisitions are interspersed with two acquisition periods for psychotic speech. In these periods, the attending adult focused on the reversal of the reinforcing contingencies established during the other phases—that is, reinforcement was made contingent upon the child's psychotic speech, and concurrent appropriate verbalization was ignored.

Examination of Figure 2 indicates that the child's psychotic speech comes under reinforcement control. The attending adult can increase this speech considerably by reinforcing it. With successive reversals, it takes

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less and less time to bring the child's verbal behavior under reinforcement control. Although the data are not plotted here, it was possible to control the child's psychotic and appropriate behavior, on any one day, depending upon what was attended to by the reinforcing adult. Ayllon and Haughton (1964) have also observed reinforcement control over psychotic and neutral verbal behavior, in an adult psychotic.

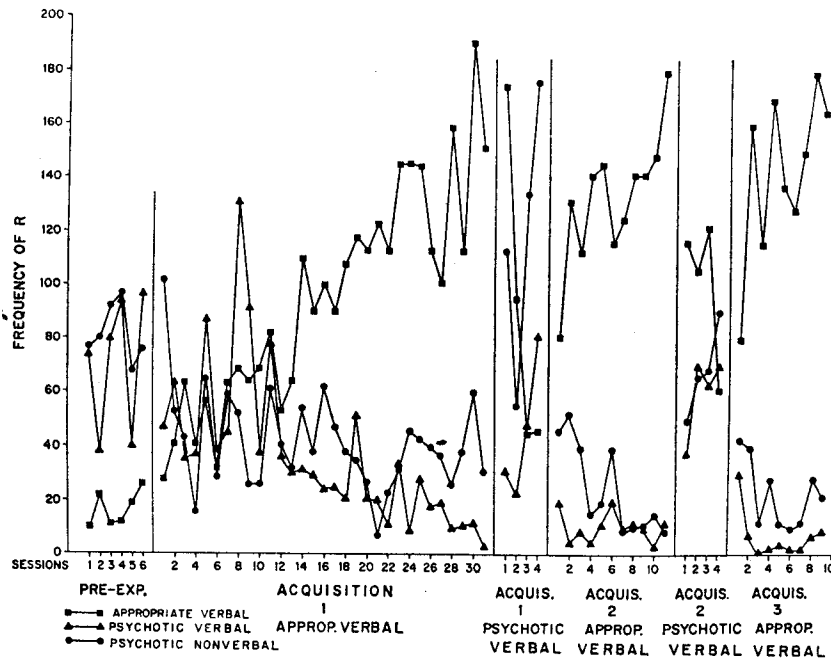


Figure 2. Frequency of appropriate verbal behavior and psychotic verbal and non-verbal behavior with changes in reinforcement contingencies for verbal behavior. The abscissa gives consecutive days (sessions). "Acquis." is used for acquisition, "Approp." for appropriate.

Apparently, psychotic speech may belong to a more extensive class of psychotic behavior, including nonverbal components. For example, Figure 2 shows that nonverbal psychotic behavior rises and falls even though we are directly manipulating only the verbal psychotic behavior. Analogous control over nonverbal behavior by manipulation of verbal behavior has been observed in normal children (Lovaas, 1964). The first study of self-destruction (Lovaas et al., 1965a) showed a very close and inverse relation between self-destructive and socially appropriate behavior—when

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self-destruction was high, socially appropriate behavior was low, and vice versa.

In subsequent studies we have not attempted to increase echolalic speech by reinforcement. However, we now have data on three additional echolalic children which indicate that ~~reinforcement withdrawal, contingent upon echolalic behavior, and reinforcement delivery, contingent upon appropriate speech, serve to decrease the echolalic speech.~~ Similar data are reported by Risley (1966). The children vary greatly in the rate at which psychotic speech is extinguished. With some children, we have been successful in suppressing most psychotic speech within a month or less, whereas others have required as much as a full year. We have no data that would enable us to predict this differential rate of extinction. Even though echolalic speech can be controlled by reinforcement contingencies, there exists no basis for assuming that such speech originated within a reinforcement theory paradigm. In fact, it seems impossible to account for the idiot-savant features of echolalic speech by assuming previous reinforcement for deviant responses.

Self-stimulatory Behaviors. Self-stimulation (autoeroticism) is by far the most frequent behavior in schizophrenic children. This category of behavior includes any response that seems to have no function other than providing the child with sensory input. It takes the form of rocking, spinning, twirling, flapping of arms, fondling of self. We have little data on self-stimulation, but it is interesting to speculate on the basis of the scanty information which is available.

Our observations of self-stimulation suggest that this behavior has an inverse relation to other forms of behavior. As appropriate behavior (e.g., social responsiveness) is strengthened by reinforcement, self-stimulatory behavior gradually decreases in strength, independent of any direct intervention. In preliminary studies, we have observed a similar inverse relation in normal children. When they are placed in situations that prevent social or intellectual behaviors, such as a barren room, they engage in various forms of self-stimulation, some of which are virtually identical to those exhibited by the schizophrenic children. One can observe a similarly high proportion of self-stimulation in infants before their acquisition of social behaviors and in adults when they are sitting idly and waiting.

Several conceptualizations could account for the observed relations. In the interest of theoretical consistency, we have tentatively hypothesized that this inverse relation emerges because behavior, in and of itself, is re-

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inforcing. When one form of behavior is high, reinforcement is forthcoming, and therefore the other form will be at low strength. A theoretically different, and perhaps more fruitful, point of view is that the central nervous system requires a certain level of sensory input to remain intact, and that behavior (including self-stimulation) generates sensory input which keeps the central nervous system at some optimum level of arousal. The latter hypothesis would render self-stimulation biologically meaningful, but psychologically meaningless. Self-stimulatory behavior may be representative of other forms of psychotic behavior. It is possible, for example, that hallucinatory behavior may be considered in the same class as self-stimulatory behavior; this would make such behaviors biologically significant, but psychologically meaningless.

In one aspect of current research we are focusing on a form of behavior which has the same topography as self-stimulation, but seemingly different functional properties. First of all, it appears to be elicited by certain kinds of visual stimuli; secondly, it interacts with other behaviors in a manner to suppress or delay their occurrence. We have tentatively termed this a visual-motor reflex with seizure-like properties. It can be described as follows: When confronted with a flickering visual stimulus such as a spinning coin, many schizophrenic children will seem drawn to the stimulus source, hunching over it, approaching to within a couple of inches, maintaining a rigid and glazed facial appearance. At the same time, the children may flap their hands rapidly at the wrists, while slowly moving them up and down along the sides of their bodies. Their arms are drawn back with elbows bent, this posture being maintained by rigidly contracted thorax and arm muscles. The children are dominated by and completely absorbed in the visual input. The light changes are also reinforcing. Some children will spend hours generating such stimulation, as when they twirl with their eyes open, deftly spin objects, run along picket fences, stare at striped surfaces, move their hands with their spread fingers in front of a light source with a stroboscopic-like effect, and so on. The same behaviors can also be induced experimentally, as when one spins a coin on the floor in front of the child. The ensuing behavior is so intense that the child can be described as being "hooked" or "out-of-it." The associated unresponsiveness has a seizure-like quality, such as petit mal. Some observations illustrate well this state of unresponsiveness. For example, in the process of retrieving food, such children get hooked on a shiny piece of metal, such as a door handle, emit the seizure-like visual-motor reflex, and miss the

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opportunity to eat, despite the fact that they have been deprived of food more than forty hours. Such children would starve to death if they were not helped to eat. In preliminary, more controlled studies, we have observed large fluctuations (two seconds to response failure) in these children's response latencies to auditory stimuli, the long latencies being associated with the seizure-like, visual-motor reflex, in either its spontaneous or its experimentally induced form. Such observations help further to define the schizophrenic child's gross inattention — a major obstacle to his treatment. The observations also suggest a neurological dysfunction or abnormality, which may characterize all these children to various degrees and which warns the investigator of these children's limitations, or at least vagaries, in response to treatment variables as we now know them.

Establishment of Reinforcement Functions

If the cause of childhood schizophrenia lies in the child's failure to acquire reinforcers, then concentration on the establishment of such functions should be of major therapeutic value. Two kinds of studies which deal with the acquisition of secondary reinforcers will be presented. It is argued that a particular interpersonal event will acquire the property of positive reinforcement to the extent that it has been associated with the presentation of powerful, positive reinforcers or with the removal of negative reinforcers. Our first studies dealt with the question of whether schizophrenic children could, in fact, acquire social reinforcers by the association of such stimuli with the presentation of primary and positive reinforcers.

Establishment of Social Reinforcers by the Use of Food Presentation. Although empirical evidence (see Kelleher & Gollub, 1962) shows that one can sometimes establish a previously neutral stimulus as an acquired positive reinforcer via the classical conditioning paradigm, we failed to observe such effects in the two children with whom we worked (Lovaas, Freitag, Kinder, Rubenstein, Schaeffer, & Simmons, 1966). These children were without any social responsiveness. We did pair, in several hundred trials, the word good with food delivery — essentially, the investigator would say good and at the same time give the child a bite of food. Subsequent tests of good for secondary reinforcing properties were negative; there was no modification in the child's behavior when it was accompanied by good. In fact, despite all these pairings, the child behaved as if he had never heard the word; he did not attend to, or otherwise respond

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to, our behavior. We had anticipated this failure for two reasons. First, the experimental manipulations merely replicated, to a lesser degree, what these children had experienced in two years of inpatient treatment before the experiments. During that time, the hospital staff had lavished affection on them, fed them, rocked them, played with them, tickled them, and so forth. In short, the staff had consistently associated themselves with delivery of primary reinforcement. Despite two years of this intensive work, the children behaved as if they had never seen or heard of the staff; they remained completely unresponsive to any social stimuli, as if they were blind and deaf. Our second reason for anticipating this failure was based on the literature on classical conditioning (see Maltzman & Raskin, 1965), which points out that, unless the organism attends to or orients toward a conditioned stimulus, learning will not occur. Casual observation suggests that schizophrenic children fail to attend to social (or almost any external) stimuli to a profound degree, and this failure is exactly what Bernal's (1965) data support. When Bernal used the galvanic skin response to novel stimuli as indicative of attention (orienting behavior), schizophrenic children either evinced no attending behavior or did so only sporadically. Such treatment efforts should fail if one assumes that some aspects of psychotherapy with schizophrenic children conform to the classical conditioning paradigm. This assumption seems plausible on the basis of written accounts of the therapist's associating himself with gratifications that he offers to the child, with the intent of establishing himself as meaningful, as a symbol of gratifications. For example, Rank (1950) writes, "in order to make contact with the child, the therapist offers her person as a token of the outside world. Bodily closeness is combined with rhythmic movements and musical sound . . ." (p. 58). Bernal's and our data suggest that such interventions would be unsuccessful. The apparent failure of autistic children to condition classically may point to their gravest defect; it should also account for their failure in acquiring reinforcers.

The procedure which we developed, whereby the social stimulus eventually acquired reinforcing properties, involved an initial training in which the child was forced to respond (hence to attend) to the social stimulus. This procedure is consistent with the Dinsmoor hypothesis (1950) that a stimulus will take on reinforcing properties insofar as the subject can discriminate it as a necessary concomitant of reinforcement or nonreinforcement. The social stimulus was tested for acquired reinforcement properties under two conditions—in one, it was maintained as discriminative for

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food, and in the other, its discriminative stimulus properties were extinguished. The data from one child during these tests are given in Figure 3. The child's rate of response is in the form of cumulative curves; the hatch-marks pointing upward on these curves indicate delivery of the social stimulus as reinforcement for bar pressing. The A-sessions involved testing for reinforcing properties while the social stimulus was maintained as discriminative for food. In the E-sessions, the social stimulus was tested for reinforcing properties while its discriminative stimulus properties were being extinguished. The hatch-marks pointing down indicate the presentation of the social stimulus as discriminative for food during the A-sessions and the feeding time during the E-sessions.

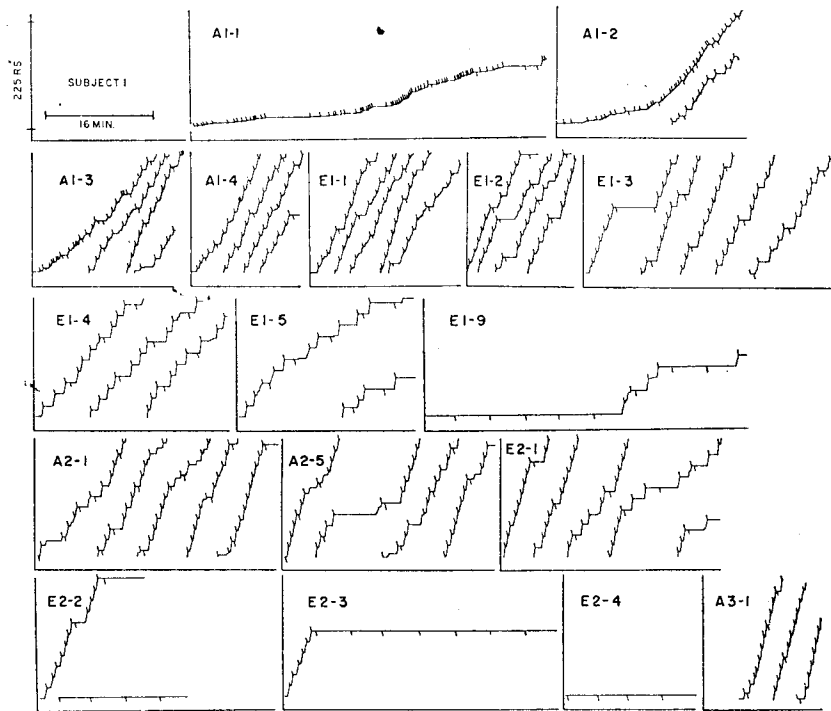


Figure 3. S1's performance on the bar as cumulative curves. The hatch-marks on the curves pointing up indicate delivery of the social stimulus contingent upon bar pressing. The hatch-marks pointing down indicate the presentation of the social stimulus as discriminative for food during the Acquisition (A) sessions and mark time out for feeding during Extinction (E) sessions. (Reprinted by permission of Academic Press, Inc., from O. I. Lovaas, G. Freitag, M. I. Kinder, B. D. Rubenstein, B. Schaefer, & J. Q. Simmons, Establishment of social reinforcers in schizophrenic children using food, *Journal of Experimental Child Psychology*, 1966, 4, 109-125.)

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As we can observe, the child's behavior for the social stimulus is built to a high strength during the A-sessions. We also observe the gradual reinforcement loss of the social stimulus during the E-sessions, where its discriminative properties are being extinguished. Reinstatement of the discriminative properties of the social stimulus reinstates its power as a reinforcer.

The sample of two is obviously too small to generalize about schizophrenic children. However, once the child has been trained to respond to the social stimulus in a given setting (e.g., during verbal imitation training, which will be discussed below), pairings of social stimuli and primary reinforcing stimuli should bring about the desired result. That is, discrimination training should serve as an adequate basis for establishing conditioned reinforcement within a classical conditioning paradigm. Our entire treatment program emphasized discrimination of social stimuli; hence the children eventually should be amenable to classical conditioning.

Establishment of Social Reinforcers by the Use of Pain Reduction. Psychological or physical pain is perhaps as characteristic of human relationships as is pleasure. The extensive presence of pain in everyday life suggests that it may be necessary for the establishment and maintenance of normal human interactions. Despite the pervasiveness of pain in daily functioning, and its possible necessity for maintaining some behaviors, psychology and related professions have shied away from, and often condemned, the use of pain for therapeutic purposes.

In their day-to-day life, extremely regressed schizophrenic children, such as those with whom we work, rarely show signs of fear or anxiety. If, as most therapist-authors have stated, the experience of discomfort is a prerequisite of improvement, perhaps the failure of severely retarded schizophrenic children to improve in treatment can be attributed in part to their apparent lack of anxiety or fear. This was one of the considerations which formed the basis for our studies of pain.

Pain can be used therapeutically in three ways. First, it can be used directly as punishment to suppress pathological behaviors. Second, it can be employed in escape and avoidance learning. Its third use is probably the least known and perhaps the most intriguing. Any event which is associated with, or discriminative of, pain reduction acquires *positive* reinforcing properties — that is, an organism will work to obtain those stimuli that have been associated with pain reduction. This is a major premise underlying our work on pain. Casual observations of parent-child relationships

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suggest this use of pain. A parent continually rescues his child from discomfort. During the first year of life, an infant will fuss, cry, and give signs of pain or distress, whereupon a parent will attempt to remove the discomfort. Later in life, parents and other significant people are instrumental in terminating distress and anxiety produced by social or intellectual failures. We argue that perhaps these releases from pain contribute to the basis for meaningful relationships between people. People become important to one another by having faced and worked through a stressful experience together.

To induce anxiety in schizophrenic children, we electrified the floor on which they stood, and terminated the painful electric shock contingent upon their seeking the company of the attending adults. This study has been reported in detail elsewhere (Lovaas, Schaeffer, & Simmons, 1965), and the data can be summarized as follows. First, people who were associated with pain reduction acquired positive reinforcing properties. Before the experiment, the two children in this study were unresponsive to any form of social stimulation; subsequently, they would work hard merely to observe the attending adults. Second, when we induced approach behavior in escape-avoidance training, we observed change not only in a particular response which was shaped but in a large class of behaviors as well. We objectively recorded some of the generalized changes, such as the increase in the children's physical contact with the attending adults. Some of these data are in Figure 4 — the ordinate gives the value of the various behaviors as a proportion of the total observation time, and the abscissa gives the dates of the observation and the various treatment sessions. In the pre-shock sessions, pathological behaviors occurred 65 to 85 per cent of the time; physical contact with adults was absent. In the shock sessions, the pathological behaviors were immediately suppressed and remained so during the following eleven months. In addition, the social behavior of maintaining physical contact with the attending adults replaced the pathological behaviors. During the physical contact, the child would mold or cup onto the adult's body. This response was not shaped by the investigator, and it is significant to note that failure to cup and mold is diagnostic of autism in children. Many changes that occurred during successful shock avoidance training were not recorded but are evident in the filmed records we made of the sessions. One of the most surprising findings was that the children engaged in social smiles during successful shock avoidance. As far as we know, these children had never before given social smiles. Risley

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(1964) also observed a more generalized and therapeutic effect of electric shock with an autistic child. Following shock administration, behaviors that endangered the child were suppressed, and acceptable social behavior, such as looking the adult in the face, increased.

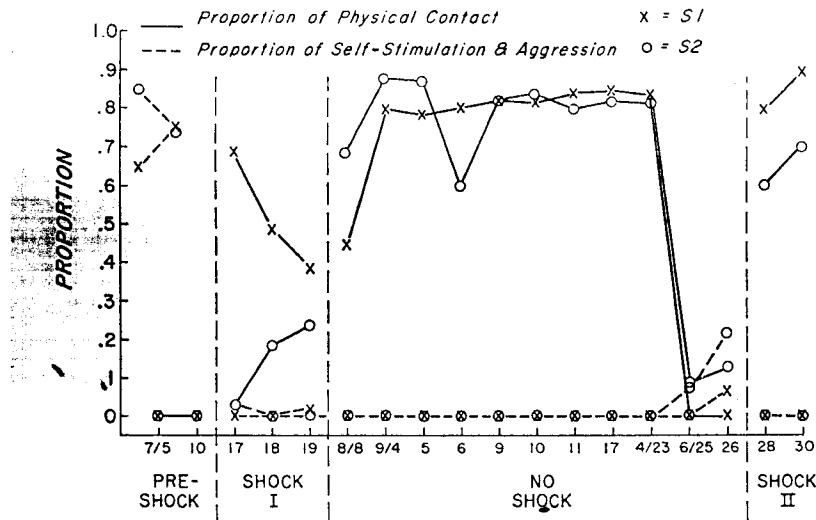


Figure 4. Proportion of self-stimulation and aggression (pathological behaviors) and physical contact (social behavior) with shock and no shock. The abscissa gives month and day (sessions). (Reprinted by permission of Academic Press, Inc., from O. I. Lovaas, B. Schaeffer, & J. Q. Simmons, Experimental studies in childhood schizophrenia: building social behavior in autistic children by use of electric shock, *Journal of Experimental Research in Personality*, 1965, 1, 99-109.)

The effect of shock avoidance training is eventually extinguished, although we believe it is much more durable than behavior based on food reinforcement. For example, the seeking of physical contact lasted for approximately eleven months before extinction. Furthermore, one non-contingent shock (shock in Figure 4) completely reinstated social responsiveness and suppressed the pathological behavior. These very durable behavioral changes were accomplished by the employment of only the minimal amount of shock necessary to observe behavior change.

We have replicated some of these procedures and results with other schizophrenic children. We have been particularly concerned with conditions that would maintain the behaviors that we have built on the basis of food reinforcement and to suppress those pathological behaviors that interfere with training efforts. Our observations have led us to conclude ten-

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tatively that children who are severely undeveloped and unresponsive have a deficiency in anxiety and that this is one of the major obstacles in their treatment. Operationally, this implies serious limitations on available or potential reinforcers.

At present, we are expanding our studies of acquired reinforcement in two ways: The first concerns the possibility of establishing imitation as an acquired reinforcer and will be reviewed below. The other set of studies, for which we have inadequate information for formal presentation, investigates the reinforcing properties of play behavior — that is, we employ one class of behaviors as reinforcement for another. This principle is probably as old as child rearing, although it was first systematically investigated by Premack (1965). Essentially, we first teach a child some behavior such as chasing or hide-and-seek, and subsequently, we employ the behavior as reinforcement to build other behaviors. When we investigate the satiation characteristics of play behavior, we find the children are virtually insatiable, despite the fact that several of the adults who play with them are worn out. The children, seemingly, would rather play than eat. We have no information about what stimulus aspects of play behavior provide the reinforcement. More significantly, we have no information about why play behaviors maintain themselves without apparent extrinsic reinforcement.

The Speech Training Program

Speech is complex behavior. It is my intention to present in some detail the procedures for establishing speech, since these procedures illustrate our programs for establishing complex behaviors in general. With most children, the problem of teaching speech never arises — speech develops within each child's particular environment without his parents' and teachers' having to know much about how it does so. Yet, because of deviations in their organic structure or prior experience, some children fail to develop speech. Schizophrenic children show poor speech development (Rimland, 1964). The literature on childhood schizophrenia suggests that a child who fails to develop speech by the age of five years remains withdrawn and does not improve clinically (Kanner & Eisenberg, 1957; Brown, 1960). Hence, the presence or absence of speech is an important prognostic indicator. Obviously, a child who speaks can engage in a more therapeutic interchange with his environment than one who does not speak.

Failure of some children to develop speech as a natural consequence of

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growing up poses the need for more knowledge of how language is acquired. A procedure for the development of speech in previously mute children not only would be of practical importance, but also might illuminate the development of speech in normal children. Although several theoretical formulations have attempted to account for language development, their empirical basis probably is inadequate. Here is outlined one procedure by which speech can be acquired; undoubtedly there are or will be other ways. Our program will be presented in two phases: (a) the establishment of vocal behaviors in previously mute children (verbal imitation training), and (b) the establishment of an appropriate context for speech.

The technical terms used in our description are defined as follows: A *neutral* stimulus (e.g., a verbal request to place the book on top of the table or to point to my nose) is one which, before training, does not cue (give rise to) the correct response. A *training* stimulus is any neutral stimulus to which a correct response will be trained. A *prompt* is a stimulus which cues the correct response before training or after minimal training. Examples of prompts are (a) manually moving the child's hand through a correct response (e.g., moving the child's hand, making it hold a book, and releasing the book on top of the table), or (b) giving the child the correct answer (e.g., saying, "the book is on top of the table"). *Fading* denotes the gradual removal of the prompt over trials. Some examples of fading a prompt are (a) gradually reducing the attending adult's participation in the child's response (such as lessening the hold on the child's hand, then touching only his arm, then only his shoulder), or (b) reducing the decibel level of the verbal prompt or supplying only components of the prompt (such as "the book is on t—"). Use of prompts proceeds as follows: (a) a training stimulus is paired with a prompt, and appropriate behavior is positively reinforced; then (b) the prompt is gradually faded until the training stimulus alone is sufficient to elicit the correct response. *Correct response* is defined as the appropriate response to the previously neutral stimulus, unaided by a prompt. It should be noted that the *rate* of fading of the prompt is determined by the child. The prompt employed should be the least potent one that will elicit the correct response. Sometimes the correct response will be emitted with sudden fading; at other times, considerable prompting is necessary. This training paradigm is virtually identical to the one employed in programmed learning. If properly

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done, it has the advantage of minimizing errors (as in errorless discrimination [Terrace, 1963]).

Incorrect or inappropriate behaviors (such as tantrums or echolalic repetition of the adult's instructions) have been accompanied by a five-second removal of all positive reinforcers (the attending adult assumes an inattentive position and removes the food). When the inappropriate behaviors are exceptionally strong, they are accompanied by more extensive positive reinforcement withdrawal, such as half an hour of isolation, or by a noxious stimulus, such as a slap on the child's bottom or hand, immediately contingent upon the inappropriate behaviors.

Verbal Imitation Training

The initial phase of the program, establishment of verbal imitative repertoires in children who were previously mute or had inadequate vocal repertoires, will be presented first. It is appropriate to introduce this program with some comments on our earlier unsuccessful efforts in building speech. Working within the reinforcement theory paradigm, we employed a shaping procedure in our earlier efforts. In direct shaping of speech, we initially reinforced (with bites of food) random vocalizations, raising the frequency of their occurrence, and subsequently reinforced only those sounds more and more similar to the desired product. This procedure is similar to that employed by Hayes (1951) in establishing a three-word vocabulary in a chimpanzee and to that employed by Isaacs, Thomas, and Goldiamond (1960) and Sherman (1965) in reinstating verbal behavior in adult schizophrenics. Although our patients learned a few words in this manner, it became apparent that despite extensive efforts we could produce only a very restricted vocabulary.

Casual observation suggests that normal children acquire speech not by environmental shaping of each word but by hearing others speak — that is, they learn to speak by imitation. Mute schizophrenic children with whom we worked did not imitate. Thus, establishment of imitation appeared to be the most beneficial and practical starting point for building speech. The first step was to establish conditions in which imitation of verbal responses would be learned. The method we eventually found most feasible for establishing verbal imitation involved a discrimination training procedure and consisted of four distinct steps. In step one, the child was reinforced for all vocalizations. The child was fondled frequently and aversive stimulation was avoided in order to increase the frequency of vo-

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cal responses. During this stage of training, the child was also rewarded for visually fixating on the adult's mouth.

Step two marked the initial attempt to bring the child's verbal behavior under the verbal control of the attending adult in such a way that the adult's speech would ultimately evoke speech from the child. Mastery of this second step involved acquisition of a temporal discrimination by the child; he was reinforced only if he vocalized within six seconds after the adult's vocalization.

Step three was structurally similar to step two but also required that the child match the adult's verbalization before receiving reinforcement. In this and following steps in imitative training, the adult selected verbalizations from a pool of possibilities that had met one or more of the following criteria. First, it was necessary that the vocal behaviors could be prompted. Second, words or sounds with concomitant visual components, such as the labial consonant *m* and open-mouthed vowels like *a*, were selected. These sounds were chosen after it was found that the children could discriminate words with visual components more easily than those with only auditory components. The guttural consonants *k* and *g* were, for example, extremely difficult to train. Third, sounds emitted most frequently by the child in step one were selected.

Step four was a recycling of step three, but with a sound not previously presented. To make the discrimination between new and old sounds as easy as possible, we selected a very different sound from that presented in step three. To be assured that the child was actually imitating, we randomly interspersed the sounds of step three with the sound of step four. Each introduction of sounds and words required increasingly fine discriminations by the child and, hence, provided evidence that the child was matching the adult's speech. Inattention of schizophrenic children is a major problem in all teaching efforts. Discrimination training (selective delivery and withdrawal of reinforcement, rotation of stimuli, and so forth) is our primary tool for enabling or forcing the child to attend to the relevant stimulus dimensions.

All steps beyond step four consisted of replications of step three, using new sounds, words, and phrases. In each new step, the previously mastered words and sounds were rehearsed in a random order. Each step was introduced after the child had shown mastery of previous steps by making several consecutive, correct replications of the adult utterances.

The six children who have been exposed to our imitation training pro-

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days to train a single word during the first two weeks of the program, several words were learned each day during the last two weeks. The positive acceleration of the curve illustrates the form of the acquisition curves in all the children.

Test for Necessity of Reinforcement. The imitation training took place in a rather complex environment, with many events happening concurrently. We hypothesized that it was reinforcement, given contingent upon imitative behavior, which was crucial to the learning of imitation. Therefore, it was expected that removing reinforcement for correct responses, but changing nothing else in the situation, would bring about a deterioration in imitative behavior.

Chuck was selected arbitrarily for the test of the reinforcer after three weeks of imitation training. The first hour served to establish the pre-experimental or base-line rate of correct and incorrect responses. During this first hour the reinforcement was delivered contingent upon correct responses (hence, "response-contingent"), as described in the method section of the imitation training. During the subsequent three and a half hours, reinforcement was shifted from a response-contingent to a time-contingent delivery — that is, reinforcement was delivered after a certain time had elapsed since the last reinforcer (fifteen seconds after, on the average), and not within five seconds of a correct response. Thus, the child received the same number of reinforcers over time as he did during response-contingent delivery, but the reinforcers were not delivered contingent upon correct responses. Complete withdrawal of all reinforcement would have altered a number of variables other than the one of response-contingent delivery. For example, the child's interaction with the attending adult would be affected. The time-contingent delivery was followed by one and one half hours of response-contingent delivery during which rate of imitation should be recaptured if response-contingent reinforcement were crucial.

The data from Chuck during the shift from response-contingent to time-contingent and back to response-contingent delivery of reinforcement are presented in Figure 6. The ordinate gives the percentages of correct and incorrect responses (the sum of correct or incorrect responses over the sum of the adult's responses). The abscissa is divided into twelve half-hour units, and shows the particular reinforcement contingency involved.

As can be observed, the shifting from response-contingent to time-contingent delivery is accompanied by a loss (extinction) of imitative behav-

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ior. The reintroduction of response-contingent delivery is accompanied by a recapturing of imitative behavior. The same operations were repeated with Chuck and Billy after ten months of language training. Both children had large imitative vocabularies by then. The effect of shifting from response- to time-contingent delivery was the same at the end of ten months as it had been after three weeks, with the exception that imitative behavior was more resistant to deterioration after ten months than after three weeks of training.

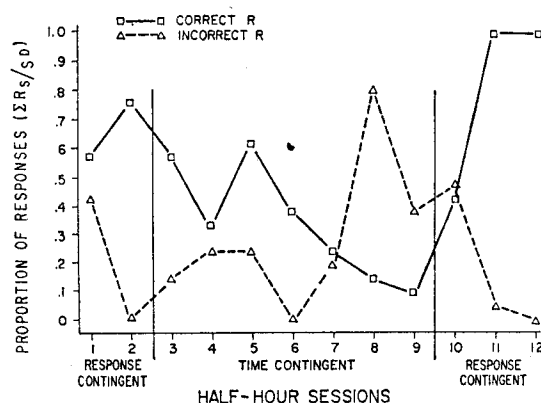


Figure 6. Change in Chuck's imitative behavior upon change in reinforcement contingency.

It is concluded, therefore, that reinforcement immediately following correct, imitative behavior (and no reinforcement following incorrect responding) is a crucial variable in maintaining imitative behavior in these children. The same finding has been reported by Baer and Sherman (1964) for imitative behavior in normal children.

Imitative Behavior as Its Own Reinforcement. As the child acquires the discriminations necessary for imitative behavior, the imitative behavior is consistently associated with primary reinforcement, and should acquire its own reinforcement value. As a result, the event of the child's making his own verbal behavior like that of the adult's should be reinforcing in and of itself, without the continuous receipt of primary reinforcement. In other words, the child should improve in his imitative behavior without extrinsic reinforcement.

After eleven months of language training, with extensive histories of reinforcement for imitative behavior behind them, both children were ex-

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posed to Norwegian words (three for Billy, two for Chuck). Norwegian words were selected for two reasons: first, it was unlikely that these words would be reinforced accidentally in situations outside the experiment, and, second, the children would be unable to reproduce them perfectly when first presented, but could improve in their imitation with increased exposure. Each word was presented every five seconds for a total of 300 presentations per word, with only one word presented each day. No extrinsic reinforcements were delivered; the adult simply stated the word, and the child invariably repeated it. However, on the average of every seventh presentation of the Norwegian word, the child was presented with three to five English words which the adult reinforced when correctly imitated. This procedure was necessary to maintain the hypothesized acquired reinforcement function of imitation — complete failure to reinforce imitative behavior might have resulted in imitation's losing this function altogether.

The sessions with the Norwegian words were tape-recorded, and then scored from the tapes by two raters working independently. To eliminate changes in scoring based on time or amount of scoring, each rater started scoring at random points within the sessions. Consequently, the raters sometimes started with the beginning of the session, other times with the ending. The children's enunciations were scored according to a prearranged point scale (0–14) with close approximations receiving higher scores than remote ones. For example, the Norwegian word *ettermiddag* would receive one point for each vowel, consonant, and syllable correctly reproduced, as well as points for correct reproductions of their order. Pearson's r , calculated for three randomly selected sessions, exceeded .92, indicating high agreement between raters.

Performances in the enunciation of the Norwegian words can be seen in Figure 7. The ordinate gives the mean score over twenty trials, and the abscissa shows consecutive sets of twenty trials. Each word has been plotted separately for each child.

It is apparent that the children improved in the imitation of the Norwegian words over time, as if they were reinforced for improved behavior. In view of the data in Figure 6 pointing to the need for reinforcement in maintaining imitative behavior, and in the absence of extrinsic reinforcement, we argue that the reinforcement was intrinsic and a function of the prior imitation training. There is one implication of this finding which is of particular interest for therapeutic reasons: children may be able to acquire

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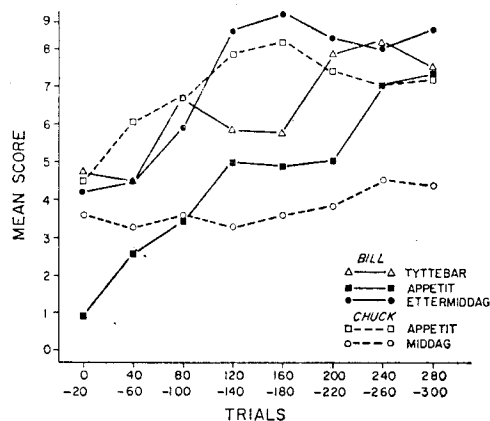


Figure 7. Acquisition of Norwegian words without extrinsic reinforcement. The ordinate gives the mean score over twenty trials, and the abscissa shows consecutive sets of twenty trials.

new behaviors *on their own*. (This finding contrasts with the frequent stereotype of a conditioning product, namely, that of an automaton unable to function independently.)

Schizophrenic children are a heterogeneous group with respect to their speech histories and behaviors in general, and our children have failed in development to a profound degree. With such a diverse population, it is likely that numerous procedures could be helpful in establishing speech. Both Dameron (1965) and Hewett (1965) report success in establishing speech within an operant conditioning paradigm, but they emphasize extinction of the aversive properties that speech may have for some of these children. With extinction of the aversive properties, elaborate imitative speech suddenly appeared. This contrasts with our children, whose speech was more undeveloped and who required very detailed, step-by-step discrimination and imitation training of each vowel, consonant, intonation, and decibel level.

After a certain point in training, the children could imitate new words with such ease and rapidity that merely adding verbal responses to their imitative repertoire seemed pointless. At this stage they were introduced to the second part of the language training program, wherein they were taught to use language appropriately, as described below. Essentially, the newly acquired imitative behaviors were shifted away from the model and brought under the control of a larger environmental context.

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The Establishment of an Appropriate Context for Speech

The training program for appropriate use of speech proceeds through three stages which can be characterized as of increasing complexity. In the first, the child is taught to label and identify correctly common objects and behaviors of himself and others. In the second, he is trained to use and respond to increasingly abstract terms, such as prepositions, pronouns, and words denoting time relations. In the third stage, the child is trained to use his language for spontaneous and conversational speech.

Subsequent to verbal imitation training, almost all language training can be viewed as the establishment of three basic discriminations, summarized in the outline below.

Outline of the Language Training Program

<i>Discrimination No. and Stimulus</i>	<i>Response and Examples</i>
1. Nonverbal	Verbal
Objects	Labeling or describing environment
Symbols	Texting
Behavior of self or others	Describing behavior of self or others
2. Verbal	Nonverbal
Self or others	Instructions (giving or receiving)
3. Verbal	Verbal: conversation
No experimentally manipulated stimulus	Verbal: spontaneity

Training a Labeling Vocabulary. In this training, the child is involved in both Discriminations 1 and 2, as given in the outline: to label correctly objects and behaviors of himself and others and to identify correctly the same objects and behaviors when requested to do so. A large number of everyday objects (such as toast, bacon, chair, table, book), personal possessions and parts (shirt, shoes, eye, ear), and common behaviors (walking, laughing, pointing) are selected. The training then proceeds along the following paradigm. The attending adult presents a training stimulus, such as a piece of bacon. As soon as the child visually fixates the stimulus, the adult states the prompt, *bacon*. The child responds to the prompt and then is reinforced. The training stimulus is immediately removed, presented again at the next trial, and fading is initiated. Once the child responds reliably to the first stimulus object without the prompt, a new training stimulus is introduced (maximally different from the first—e.g., a glass of milk). In order to ensure that the child is actually responding to the particular objects (training stimuli), previously mastered stimuli are inter-

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spersed with new stimuli. It is impossible, then, for the child to respond correctly unless he is attending to the correct object.

Once the child has mastered Discrimination 1, on ten to twenty objects, he is introduced to Discrimination 2, in which the adult asks the child to identify nonverbally (e.g., point to) a particular object. This training is carried out in a manner analogous to that for Discrimination 1. As soon as the nonverbal identification of the first object is mastered, the child is moved on to the second object. These two objects are then intermixed (displayed simultaneously) as in previous training, to make certain that the child is attending to, or discriminating, the correct training stimulus.

In order to ensure that the child discriminates the particular attributes of the object, such as a table or a chair, numerous examples of each object are introduced. Indeed, one can argue that the child has mastered the particular concept when he has generalized — that is, gives a correct label for or correctly identifies — members of classes of objects upon their first presentation. Figure 8 gives the acquisition of verbal labels (Discrimination 1) in a five-year-old, previously mute, schizophrenic boy, Taylor. The labels are printed in lower-case letters for the days they were introduced and trained, and in capital letters for the day they were mastered. Near the end of training, Taylor often mastered labels in a single trial — that is, the adult merely labeled (prompted) the object, and this was sufficient for him to learn that label.

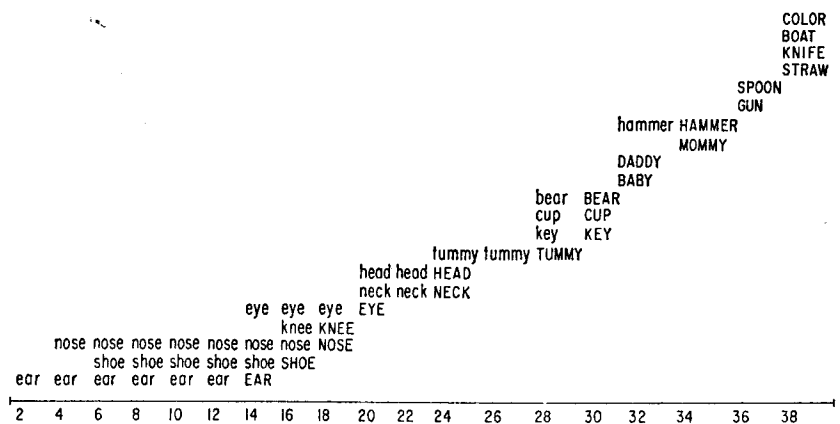


Figure 8. Acquisition of a labeling vocabulary by Taylor, a previously mute boy. The abscissa denotes training days. The objects are printed in lower-case letters to mark the days they were introduced and trained and in capital letters for the days they were mastered.

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The eleven schizophrenic children we have seen to date have all acquired extensive labeling vocabularies. They have varied enormously in their rate of acquiring these discriminations, particularly during the early stages of training. The variation extends from three or four trials upward to several thousand. Each acquisition curve is positively accelerated, as illustrated by Taylor's curve (Figure 8). It is interesting to note that all the children have generalized (formed concepts) with apparent ease. Once the child can correctly label a chair, as compared to a table, he can almost simultaneously label most of the members of the class of chairs.

Echolalic children pose certain problems not characteristic of the mute children who have been taught an imitative vocabulary; they imitate too extensively—for example, they persist in repeating the instructions. In order to extinguish these inappropriate responses, we have introduced echolalic children to a somewhat different program during the early stages of language training. Essentially, echolalia is accompanied by removal of positive reinforcers or presentation of a noxious stimulus. As part of training on Discrimination 1, to extinguish echolalia the adult may, in addition to presenting an object, ask the child, What is this? The echolalic child will invariably repeat the question, and the adult responds with reinforcement withdrawal. After five seconds of reinforcement withdrawal, the adult will prompt the child by correctly labeling the object, *chair*, and reinforce the child for responding to (echoing) this prompt. Over successive trials, the echolalic child will inhibit his re-statement of the adult's question and respond to the prompt. Once this has been accomplished, the adult will start to fade the prompt. During the last stage of this training, the adult merely points to the chair and asks the question, at which point the child gives the correct response. Discrimination 3 provides an ideal setting for extinguishing echolalia. Here the adult may ask the child, What is your name? and then extinguish the echolalic response, prompt the correct response, fade the prompt, and so forth. In cases where the echolalia has been difficult to extinguish by mere withdrawal of positive reinforcers, we have resorted to a loud no and an occasional slap on the hand. It is important to note that while this extinction is going on, the child *must* be reinforced positively for correct verbal behavior, and the adult must construct a situation (such as presenting a prompt) where the child can respond appropriately. This is needed both to maintain the child's language and to enable him to make the appropriate discriminations about when he will or will not be reinforced.

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The extinction of echolalia generalizes; that is, once the echolalia has been extinguished in one context, it can be extinguished more easily in another context. The echolalic children vary enormously in their rate of extinction of echolalic behavior. Some will be essentially free of echolalia after one to two months of training, whereas others may require a year.

Training of Abstract Speech. Once a labeling vocabulary is acquired, the child is moved on to the training of more abstract speech. Ordinarily, the next step includes prepositional and pronominal terms. The basic training paradigm is identical to that employed in establishing a labeling vocabulary — that is, it involves a discrimination training procedure. This can be illustrated by outlining the steps for training prepositional terms. Objects are selected which the child encounters in everyday life and which he can correctly label and nonverbally identify. Discrimination training may then proceed: The adult places two objects in a particular arrangement and asks the child to describe the arrangement (e.g., Where is the book? The book is *on* the table.). He will prompt, fade, rotate stimuli, and so on as in previous discrimination training. Similarly, he will train the child to respond nonverbally to a verbal request containing a preposition (Put the book *on* the table.). These two discriminations are carried out concurrently, and new prepositional relations (under, beside, and so forth) are introduced when old ones are mastered. The child is considered to have generalized, or understood, the prepositions when he can place and describe the placement of any two new objects on the first set of trials without any prompts. With four prepositions, this would require eight discriminations.

The pronominal training is carried out in a similar manner. Pronouns are used in relation to common behaviors and possessions of the attending adult and the child and in both the nominative and the possessive case. The stimuli include combinations of verbal and nonverbal events (e.g., the adult is scratching his head, and asks the child, What am *I* doing?). To facilitate the discrimination of the particular pronoun, he may tell the child to scratch his own head and may ask, What are *you* doing? As before, these stimuli may be presented in a random order to ensure that the appropriate discrimination is being made. Generalization is assumed to exist when the child can use the correct pronoun in a consecutive series of trials with behaviors and possessions not previously encountered in the discrimination training and with variation of the appropriate pronoun from one trial to another.

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During the latter stages of training, we have combined both pronouns and prepositions and all the discriminations involved in the training. Objects are placed in various relations to other objects in the room, and the child is instructed to engage in an action at the same time as the attending adult engages in a different action. Within this stimulus complex the child is asked specific questions involving pronouns and prepositions (e.g., What am *I* doing? *You* are sitting *on* the table.). At this stage of training, the child will generate his own sentences, employing correct pronouns and prepositions referring to complex and subtle environmental events.

The particular paradigm employed for establishing an appropriate context for language has been used to teach the acquisition of several abstract terms, such as those denoting color, size, form, and place. One of the most important aspects for future use of speech is the establishment of appropriate use of and response to temporal cues. The first step in this particular program is training the correct response to terms such as *after* and *before*. The adult may touch object A, then object B, and ask the child, What did I touch *before* I touched B? The child is then prompted, the prompt is faded, and the stimulus presentation is reversed and intermixed in order to ascertain that the child is, in fact, attending to the temporal cues. The training is then extended to the child's behavior — for example, the adult tells the child to stand up and to sit down, and asks, What did you do *after* you stood up? Next, the temporal interval between behaviors is extended, for example, to going out for a play period and then coming back to the laboratory (What did you do *before* we came back in?). In this manner, we can teach the children to describe weekend activities, trips to the zoo, and other experiences. The adult may initiate such conversation by asking the child, What did you do this morning? or What did you do *before* you had breakfast? Three of our schizophrenic children have reached the point where they can recall weekend activities in some detail.

The exact method and data pertaining to the discrimination training of prepositions and pronouns have been presented elsewhere (Lovaas, Berberich, Kassorla, Klynn, & Meisel, 1966; Lovaas, Dumont, Klynn, & Meisel, 1966). The data reflect enormous differences in the rates at which the children master the more abstract language. The previously mute children, even after almost two years of intensive training, are still experiencing considerable difficulty in correct usage of pronouns and prepositions. Because of this slow development, we have been unable, so far, to initiate programs

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for teaching concepts to them. Previously echolalic children have progressed much faster. One of them, after only a very short training (three hours per week for eight months, supplemented by informal teaching by his parents), carries on meaningful and spontaneous conversations that often exhibit sophisticated use of abstract terminology.

Before outlining the program for the training of conversational speech, some of the data concerned with assessing the effectiveness of reinforcement in maintaining abstract speech will be presented. Figure 9 shows the effect of shifting from response- to time-contingent delivery of reinforcement for correct use of pronouns and prepositions by Pam and Ricky, two previously echolalic children. The ordinate gives the percentage of correct usage of these abstract terms; the abscissa gives the sessions as successive

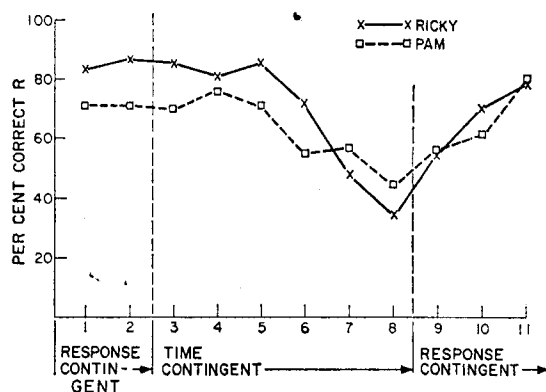


Figure 9. Percentage of correct responding to abstract terms by Ricky and Pamela with shift in reinforcement contingencies for that behavior. The abscissa denotes days.

days and the particular reinforcement contingency involved. We observe that the shift to time-contingent delivery is accompanied by a drop in correct behavior for both children. The previously correct level of responding is recaptured with re-introduction of the response-contingent delivery.

Training of Spontaneous and Conversational Speech. Although several children had been in the language training program for considerable time, with one or two exceptions, they rarely volunteered to speak. They seemed overtrained, since they responded only to specific cues given by the attending adults. It was this problem which prompted us to consider training spontaneous and conversational speech. This program has been presented in detail elsewhere (Dumont, Klynn, Lovaas, & Meisel, 1966).

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It was apparent that the establishment of spontaneous and conversational speech would be the most significant and useful training program for the children. We proceeded in this training in much the same manner as we did in others, placing the emphasis on bringing the child's verbal behavior under the control of an increasingly large array of stimuli, which often can be inferred only ad hoc. These are stimuli that the child encounters in his day-to-day environment rather than in the training sessions. The training consisted of two somewhat overlapping phases: the establishment of demands and the development of comments and stories, which include recall.

The establishment of demands consisted simply in prompting the desired response, then fading the prompt, and finally waiting the child out. The child received no rewards unless he asked for them, although in the initial phases we helped him as much as possible in formulating the correct requests. The child was trained to issue orders to an adult (Clap your hands, Sit down). The adults immediately fulfilled any such requests from the child. This procedure invariably became reinforcing for the child and generated considerable spontaneity. As he acquired mastery of this kind of speech, the criterion for delivery of rewards was gradually increased in a manner that would either postpone rewards (we go outside *after* you have finished your work) or withhold them contingent upon more elaborate requests.

We used the same paradigm in teaching the child to ask questions and to seek information in general. For example, the adult would select an object and ask the child what color it was. When the child responded correctly, he was prompted to ask the adult the identical questions (Say, What color is it?). Finally, prompts were faded altogether, and the adult merely told the child, "Ask me some questions." Eventually, the questions might pertain to what the adult was wearing or what he was feeling and to other elaborate situations. Informal observation suggests that, at this level, the children received a considerable degree of reward from the use of speech and were frequently insatiable in their questions. It is also at these stages that the child begins to evidence a real feeling for speech.

To further increase speech, we have asked the children to talk about a broad topic, such as a picture of a social interaction between child and mother. The questions and prompts needed to establish such behavior are virtually limitless (Who is this? Mommy; What is she doing? Giving the baby some food). Children at this stage can tell rather elaborate stories.

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One of the most important aspects of spontaneous speech, or conversation, involves recalling past events. People converse to some extent because they share common elements in past experiences. The training program for discrimination of temporal cues leads directly into conversation. For example, the adult who took the child to the zoo has something to talk about with the child. Obviously, the child must already have mastered time concepts in order to converse at this level.

We receive elaborations on the children's language which we did not place there by design. One of the best examples of this is given in Ricky's comment on growth. After about one year of intensive language training, Ricky was taught the concept of size, and in the training we talked about all kinds of large and small things, including large and small boys, and large and small plants. When we told Ricky (a small boy) that small plants grow up to become big plants by our putting water on them, Ricky reflected for a moment, then said, "Put some water on my head." No doubt, the children contribute much of their own to the training program, and we observe distinctively human behavior. I mention this, because one of the objections to a program such as the one outlined above is that it will generate trained seal or robot-like qualities. Organisms such as seals would behave like seals and fail miserably in our program.

Several authors, such as Miller (1965), have expressed reservations about the adequacy of the instrumental (operant) learning paradigm in producing a flexible language. Breger and McGaugh (1965) have made similar premature pronouncements about limitations on generalized behavior change which ought to be observed under the instrumental paradigm. The question is not whether flexibility is present or absent, but how extensive it is. For example, we find that the children can be taught to both recognize and generate meaningful sentences with patterns of words that they may never have used before. In general, the specification of what is learned under these circumstances demands much further investigation. This question has been illustrated in our work on temporal relations—what happens on one morning is different from what happened on another, but the child who has been trained to discriminate time in our program can describe his experience on any one morning. However, we do not know the extent to which this learning facilitates his understanding of other orders, such as numerical order or birth order. We will return to this problem in the section "Generalization."

It was my intention in this section on establishing speech to give only an

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outline of the manner in which we attempt to establish complex behaviors. The reader who wants additional information about the language program should consult the more detailed presentations referred to in the context of this paper. Smith, Kline, and French (1966) have produced a film which covers part of this program and may be helpful in further illustrating the steps. The studies of Risley (1966) provide a particularly detailed presentation of a program which is similar to the one described here. Similarly, Hewett (1965) provides information about a language program originating from reinforcement theory. The speech program is new, and there are a large number of problems and questions associated with its methodology. One of the most immediate problems concerns the rate at which we proceed to build new speech: We have held the children to a very high rate of acquisition. In one month of imitation training, the children acquire what the normal child acquires in twelve months. The procedure involves a large number of non-reinforced trials and the possibility that language may acquire aversive properties. The normal environment is not so exacting as our training procedures. In the long run, one might obtain more speech by being less demanding.

Shift in stimulus control has been a major problem. Some children shift (from the prompt to the training stimulus) with ease, whereas others shift with great difficulty. In the case of slow shifts, we have attempted to force the shift by making the prompt increasingly minute and the training stimulus very salient. Furthermore, we have attempted to facilitate a shift by withholding reinforcement for continual responding to the prompt at certain stages in training — although one cannot completely withhold all reinforcements since the behavior would extinguish. Despite these efforts, some children will continue to respond to the barest remnants of the prompt with minimal reinforcement. These difficulties raise the question of why some children shift in the first place. Other questions relate to speech content — What does one talk about during conversational speech training? How does one engineer situations that relate nonverbal and verbal behaviors? Answers to these questions would contribute much to the speech training.

The Establishment of Nonverbal Imitation

To facilitate the children's acquisition of complex social and preschool behaviors, we have employed an imitation training paradigm similar to the one employed for the establishment of verbal behavior. The behaviors in

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self-help, athletics, helping with household chores, playing, drawing, and writing are so complex that the shaping of each component would be virtually and practically impossible. In normal children, the acquisition of these behaviors appears to be facilitated through imitation — that is, the child acquires certain nonverbal behaviors as a function of observing others perform those behaviors. Bandura and Walters (1963) have given detailed accounts of how such imitation may affect the acquisition of complex behaviors. As in the language training program, the children are first introduced to a program that attempts to establish generalized, nonverbal, imitative behavior. Subsequently, the newly acquired behaviors are used to establish social, intellectual, and play behaviors.

The acquisition of nonverbal imitation covers approximately eighty tasks, ranging from simple to complex. In simple imitations, the child is required to attend to and match a simple bodily action (standing up, pointing) or to manipulate a single object when only that object is present (cranking a toy ukulele, dialing a telephone). Complex imitations are matching the adult's behavior in relation to a whole set of objects, which may differ in color, size, and shape (such as placing a ball in a cup, instead of a bowl, or selecting one of four geometric shapes). Later stages in complex imitation include beating rhythms on a drum and placing pieces of a puzzle together in a certain sequence. The complex training tasks have the advantage of ensuring that the child is in fact imitating the nuances of the adult's behavior.

The training method is virtually identical to that employed in the establishment of verbal imitation and has been presented in detail elsewhere (Lovaas, Freitas, Guilani, Nelson, & Whalen, 1966). The acquisition of nonverbal imitation shows essentially the same form as that of verbal imitation. There is a saving over tasks, although introduction of new stimulus dimensions (for example, moving from color to shape cues) is accompanied by a temporary rise in errors. The first training tasks require over fifty trials before mastery, whereas later ones were acquired on the first presentation. Ten children have participated in this phase of nonverbal imitation. In each case, the acquisition curves are positively accelerated, but the children vary enormously in their rate of acquisition. After successful training on these sixty tasks, the child has acquired what might be described as generalized imitation — that is, he will imitate the attending adult in many situations.

As with language training, nonverbal imitative behavior acquires mean-

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ing and therapeutic value because of its context. Therefore, we shift the newly acquired imitative behaviors away from the model to the control of an appropriate stimulus context. For example, although the child's drawing of a landscape might initially be under imitative control, we fade these stimuli and bring in new ones, such as saying, "Draw me a picture."

Five groups of behaviors appear to be important for these children to learn, and the mastery of a few rudimentary tasks in each group became our immediate training goal. We set up tasks in the areas of (a) personal hygiene and self-help, which included washing hands, brushing hair, and making beds; (b) games and learning to follow rules, such as playing tag, kickball, and tetherball; (c) some appropriate sex role behaviors—for example, gardening, pounding nails, doing exercises for the boys; preparing simple snacks, curling hair, and ironing clothes for the girls; (d) drawing and printing; (e) greeting and affectionate behavior, such as hugging and kissing.

For each of these more complex tasks, there are a number of dimensions in which learning and eventual mastery proceed. A child can learn to put his clothes on more quickly, more carefully, and so on, and each of these improvements may depend on the mastery of a number of subskills—for example, buttoning buttons or discrimination of right from wrong side out. Hence it is difficult to establish a meaningful scoring system. Instead, we kept a record of the amount of time spent training each task, and a verbal or pictorial account of how well a child was able to perform. When necessary, the adult would prompt the behaviors being trained, although once the child had successfully mastered the first stage of training, this was the exception rather than the rule.

It might be of interest to illustrate one way in which we have employed this nonverbal imitation. Some of the play skills established were used to train the children to occupy their free time in play behavior rather than in pathological behavior such as self-stimulation. We began by training some of these behaviors (drawing and coloring, putting puzzles together, cutting with scissors) by direct imitation of the adult's behavior. We subsequently shifted the control of the child's behavior to a new set of stimuli, the adult's request for the child to draw. Later, the adult would remove himself from the training situation and place the child alone in a room with the training material. Gradually, it became possible for a child to remain occupied in appropriate behavior for more than an hour before resorting to self-stimulation. A picture drawn by Pamela, one of our most undeveloped schizo-

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phrenic children, during one of these sessions is presented in Figure 10. This figure is the result of very extensive training in nonverbal imitation, starting with training Pamela to imitate the drawing of vertical and horizontal lines, then circles and squares, then elementary shapes such as the outline of houses, and so on in gradual steps of increasing complexity. In various stages, Pamela's behavior was shifted away from imitating the attending adults to imitating pictures of objects in magazines or to responding to requests by the attending adults to draw pictures. The picture in Figure 10 was drawn by her while alone.

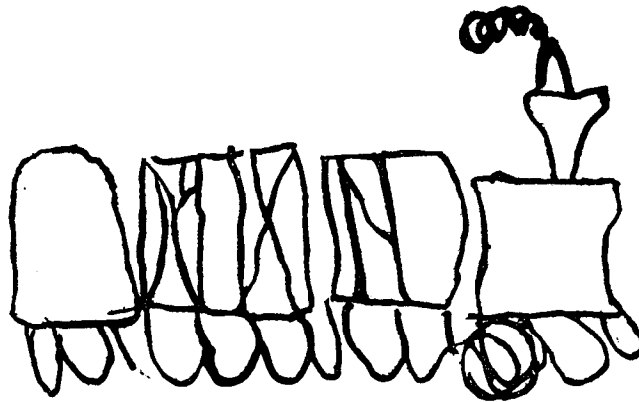


Figure 10. Picture drawn by Pamela while alone.
(Observation August 6.)

Metz (1965) has used principles of reinforcement theory to establish nonverbal imitative behaviors in schizophrenic children, and our program in nonverbal imitation took direction from his work. Baer et al. (1965) have presented a similar program for the acquisition of imitative behavior in profoundly retarded children. It is apparent that such modeling or imitation approaches can be employed as a helpful adjunct in therapy and teaching programs with children. In retrospect, it seems virtually impossible to have brought about certain behavioral changes in these schizophrenic children without an imitation approach.

It is apparent at this stage that the variables we have isolated do produce imitative behavior (6 out of 6 in verbal, 10 out of 10 in nonverbal). We are, however, dissatisfied with the limited extent of such imitation. In the verbal area, the previously mute children show little feeling for language; they do not play with or explore speech the way normal children

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do. In the nonverbal area, we do not observe the extensive kind of imitative behavior described as identification or incorporation. Our efforts at this time are directed toward making the new behaviors more reinforcing for the children, in part by becoming more reinforcing to the children ourselves (in other words, we want the children to become more attached to us). This need not be taken as evidence that the current imitation training program is incorrect, but rather that there are additional antecedents of imitation yet to be isolated.

Generalization

Generalization is a problem in any treatment approach, although certain conceptualizations tend to mask it. The problem involves assessment in two dimensions: how well the behavior maintains itself with changes from the treatment environment (stimulus generalization), and second, assessment of change in behaviors that were not explicitly manipulated in treatment (response generalization). These are big problems, and relate to the definitions of stimuli, responses, and learning.

There is no doubt that generalization is the rule, rather than the exception, in behavioral therapy work. Several instances of response generalization have already been presented (for example, changes during shock avoidance). Some behavioral changes were completely unexpected — for example, the change from toe-walking to normal gait after six to eight months in treatment, change toward more normal and childlike facial expressions, increased and more varied appetite.

We have been in the position to give some attention to stimulus generalization and to measure how well the newly acquired behaviors stand up outside the training room. As a test for such generalization, we have devised a procedure wherein the children are placed in a situation completely different from the training one. The child is placed in an unfamiliar room which is furnished with toys and preschool materials in typical play-room manner, and observed in three somewhat different situations. In the first, he is alone in the room; in the second, an unfamiliar adult is present, attending to him but not initiating any behavior; and in the third, the adult initiates a set of prescribed interactions, such as "What is your name?" "Please come and sit with me," "Let's do some drawing." Several of the child's behaviors are recorded on our free-play measuring apparatus. These behaviors, which have been described more fully in another paper (Lovaas et al., 1965b), include self-stimulation, tantrums, eyes on the

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adult's face, physical contact, appropriate play, echolalic and bizarre speech, grammatically correct speech related to the context, and social nonverbal behavior. Figure 11 shows the changes in Pamela's and Ricky's behavior on these generalization measures. It gives the percentage of occurrence of various behaviors on the ordinate; the abscissa gives times during which the behaviors were recorded: pretreatment measures and averages over two-month periods from the monthly recordings which were obtained during the first ten months in treatment. The insert in the figure gives appropriate play behavior while the children were alone. Change in this behavior is perhaps most noticeable in Pamela, who showed no appropriate play behavior until the seventh month of treatment. The figure

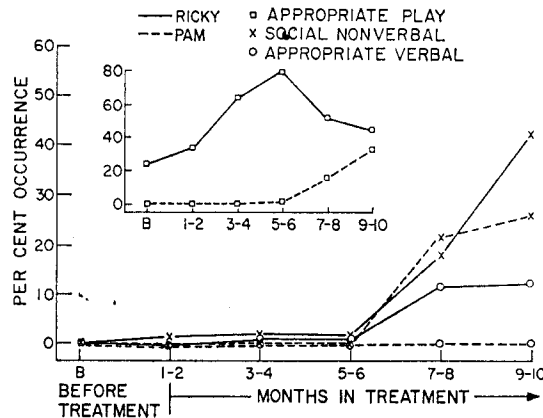


Figure 11. Changes in various behaviors of Pamela and Ricky during generalization measures. The figure proper gives behaviors with adult attending, the insert gives behaviors while the children were alone.

proper gives behaviors during the sessions where the adult stranger is in attendance, but is not initiating any interactions. In both Pamela and Ricky, social nonverbal behavior emerged by the seventh month in treatment (social nonverbal behavior is appropriate behavior dependent upon cues given by the attending adult for its completion or initiation, but does not include eyes on the adult's face or physical contact). Only Ricky engaged in appropriate verbal behavior (related to the context, directed to the attending adult) in this setting during the first ten months of treatment. Since both records were obtained outside the training situation, without prompts or other invitation, they may be considered as indicators of spontaneous behaviors. Clinically, Pamela was among the sickest children we

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have seen. She had received four years of intensive, psychoanalytically oriented treatment and two years of inpatient residential treatment without any improvement. She was engrossed completely in self-stimulation and echolalia before the behavioral therapy treatment.

This recording procedure also allows for the assessment of the kinds of behaviors and levels of social interaction manifested by the children before treatment, which should serve as predictive variables. It may also be useful in that it is sensitive to both minor changes — such as eyes on face — and major changes — such as the emergence of appropriate verbal behavior. For methodological reasons, it seems important to arrange situations so that even minor changes in the child's behavior are apparent because this ensures immediate feedback to the investigator about the nature of his efforts. Bijou (1966) has made this point explicitly.

It is appropriate to comment now on parents' participation in the treatment program. Poor generalization to life outside the hospital would be virtually guaranteed unless the parents were employing the training procedures in the child's day-to-day environment. For this reason, and many others, we have the parents participate in their children's treatment from the very beginning, with gratifying results. The particular principles of training have the advantage (compared with those of other approaches) of being easy to communicate and of not estranging us from the family.

Current Research and General Comments

As the children progress in treatment, we are forced to investigate more complex programs that permit much less control than we had in the early studies — for example, we are currently concerned with training programs in phantasy behavior and spontaneity. At the same time, the children are placed in larger, more complex interpersonal environments, such as preschools. There are obvious methodological problems in this extension of our work. For example, although our children's preschool activities with normal children appear to boost the acquisition of social behavior (and the special class retards them), we have no simple means of defining the dependent variables. Similarly, the nursery school is a broad independent variable, and we do not know exactly how to begin slicing it up.

Other problems we face presently are conceptual. This can be illustrated by a conversation I had with a child we have treated for about two years. In response to my question about his making strange faces, Ricky, who has become rather facile with language, replied that he was trying to scare

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away a particular school task which had given him considerable difficulty. I see this as a conceptual problem for us, since I don't know how this interaction could be treated within reinforcement theory – it demands empathy.

We have only recently turned to systematic investigations of variables hypothesized to have direct impact on the children's affect. Considerations of such variables enter the moment one introduces noxious stimulation, and probably form the more important aspect of such interventions. Clinically speaking, the children's mastery of anxiety should contribute to a pleasure of accomplishment and a sense of relevance to their environment. Our observations also suggest that the mere induction of anxiety triggers certain basic reflexive human orientations. Their molding, touching, and seeking of bodily contact suggest a newly found security in human companionship. The need for complex and rich environments becomes particularly pronounced as we observe many of the children appearing retarded after they have lost some of their pathology and acquired a basis for communicative speech. They don't have much to talk about. In most cases, our training program has not unearthed rich experience on which we could build. Perhaps we employ the wrong program to accomplish this end. On the other hand, it may be that most schizophrenic children have lived in such an unresponsive manner, even physiologically (see Bernal's data, 1965), that life has not registered upon them. Exactly what kinds of environments and interpersonal experiences would facilitate social development in schizophrenic children is an empirical question. It is conceivable, then, that our treatment studies ultimately require engineering whole environments.

It might be of interest to comment briefly on some of the differences between treatment of childhood schizophrenia by a behavior theory approach and treatments that have originated in psychoanalytically or interpersonally oriented formulations. An important difference lies in the fact that our data cannot be derived from psychodynamic formulations. When the two approaches are considered on an empirical level vis-à-vis the therapist's behavior, the differences become more obscure and, conceivably, diminish. The translation of psychodynamic theories into empirical operations is difficult. Clinicians of similar theoretical orientation vary considerably in their empirical approach to treatment. Boring (1961) makes a pertinent comment in this regard: "Most people, I think, do not realize how little of conventional psychoanalytical theory and terminology there

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needs to be in an analysis" (p. 131). Problems of comparison also arise because the content of a reinforcer often is left unspecified. As the adult becomes familiar with a child, and vice versa, the range of reinforcers can become surprisingly large, and may include hugs and kisses. Apparently, the term reinforcement has acquired a very restricted and unpopular meaning for many people who have come to associate it with food delivery in pigeons and rats. The Smith, Kline, and French (1966) film should help to illustrate a wider range of reinforcers.

The most important differences, by far, lie in certain methodological considerations and research strategies. Some of these have been discussed in the introduction to this paper. Although reinforcement theory provides only an introduction to treatment, we do not envisage separating our efforts from empirical behavior theory. The choice to deal with behavior as a subject matter in its own right is made on a methodological basis. We have refrained from employing hypothetical inner determinants (such as "impermeable, autistic barriers" based on early traumatic experience). We have neglected these for methodological reasons, since it has proved difficult to reject statements that contain such constructs. Procedures for treatment that originate from theories expressed in these terms resist change and do not allow for flexibility in exploring new methods.

At the level of empirical intervention, some of the main differences may be summarized as follows. We place immediate demands on the child, and he has to learn to cope with reality at the level we present it to him. Variables of relation are central to our work, as they are in psychodynamic treatments. However, we prescribe such variables in contingent form. There will be no growth without responsibility. We do not allow for expression of pathological behaviors, but actively suppress these expressions. We see no scientific basis for assuming need for the expression of pathology. The treatment program follows carefully engineered procedure, where each step is spelled out in detail. Improvement is incremental.

The exploration of aversive stimuli may seem new in this program. Indeed, it is not shared by most other behavior therapists. However, clinicians have subjected their patients to considerably more stress than that entailed by our use of electric shock — the therapeutic intent of confrontation may involve facing the child's parents with the possibility that their inadequacies caused the child's pathology. The stress produced by electric shock assumes a completely insignificant role in such a comparison.

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