

BEHAVIOR ANALYTIC RESEARCH IN AUTISM

Presented by

Vincent J. Carbone, Ed.D., BCBA-D
Carbone Clinic

Valley Cottage, NY
www.Carboneclinic.com

2009 National Autism Conference
Pennsylvania Department of Education
&
The Pennsylvania State University
State College, PA

August 3-7, 2009

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Introduction

- The purpose of this paper is to provide an overview of the application of behavior analytic methods to the treatment and education of persons with autism.
- The review of the issues and research is provided chronologically with emphasis upon important advancements in the field.
- A brief review of the disorder is necessary to provide a context for the discussion of behavior analytic methods.

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Brief History

- Matson & Minishawi (2006) provided a comprehensive review of the history of Autism Spectrum Disorders and I have used their work as an outline for what follows.
- Kanner in 1943, provided the first evidence of the disorder.
- He studied 11 children who demonstrated “extreme autistic aloneness” (p242).
- The core deficits were identified early on and were described as language abnormalities, social skill deficits and unusual behavior patterns that showed a tendency to preserve the environment (sameness).
- The behavior patterns observed are all somewhat familiar to us now and they included stereotypical behavior, echolalia, non functional vocal productions, failure to acquire social language skills, lack of interest in people, strong interest in objects, obsessive compulsive patterns, ritualistic behavior limited social reciprocity or eye contact, tantrums, self-injury, etc.

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- At the time these symptoms were often confused with childhood schizophrenia.
- However the age onset, family history and what appear to be at least average intelligence differentiated the disorders.
- “Kanner concluded his seminal paper by stating that children with autism were born with an innate ability to develop normal affective contact with other people” (Matson & Minshawi, 2006)
- Moreover, Kanner suggested that parents of these children were successful in their careers, highly intelligent, socially awkward and generally showed little affection.
- This analysis may have led to the development of theories of the etiology of autism in the child rearing practices of the parents.

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- In the 1960's many psychodynamically oriented explanations for autism were offered that included the role of the parents in the cause of autism.
- They generally focused on the pathological behavior patterns of parents and mothers in particular that led to the unusual behavior patterns of the children.
- The most famous of these was found in the writings of Bruno Bettelheim (1967) and his description of the Empty Fortress.
- But he was not alone there were other accounts of the psychogenic basis for autism.
- Other early etiological factors included stimulus deprivation, personality disorders of parents, and some interaction between the biology of the individual and experiences of the child.

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- In the midst of these psychogenic theories of the etiology of autism Ferster (1961) offered an entirely behavioral explanation for the development of the disorder.
- His analysis placed heavy emphasis upon the role of parents as mediators of reinforcement to account for the behavioral characteristics of the children.
- While equally as controversial as the psychogenic accounts his theory was never really taken seriously.
- However his work was helpful in establishing the role behavior analysis would ultimately play in the behavior analytic treatment of the disorder.
- With the advent of empirical studies, growing interest in behavior analysis and peer reviewed papers and journals the psychogenic theories have lost followers in favor of genetic, neurobiological and learning theories (Matson & Minshawi, 2006)
- The review of autism conducted and published by Rimland (1964) was influential in leading to an understanding of the biological factors that may be involved in causing autism.

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- Following Kanner the definition and diagnostic criteria went through numerous revisions and refinements.
- Most of the efforts by Creak (1961) and Rutter (1968) were differentiate autism from childhood schizophrenia.
- In the 1970's parents became much more involved and formed the National Society for Autistic Children. (NSAC)
- This group played a substantial role in garnering improved services and further defining and differentiating the disorder from schizophrenia.

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- By 1980 autism received official recognition as a disorder by inclusion in the Diagnostic and Statistical Manual of Mental Disorders (DSM).
- In addition, the flagship journal dropped the term childhood schizophrenia and changed the title to *Journal of autism and Developmental Disorders*.
- The DSM-III divided the category of pervasive developmental disorder into infantile ASD and childhood onset pervasive developmental disorder.
- In the revision of the DSM into the DSM-III-R in 1987, formally criteria were listed for ASD and PDD and age onset was not listed.
- Finally, a major revision occurred in 1994 with the publication of the DSM-IV.
- Rett's Disorder, Childhood Disintegrative Disorder (CDD) and ASD were classified under pervasive developmental disorders.

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- In the past 40 years the prevalence data have changed so dramatically that the current rate of 1:150 (Centers for Disease Control, 2007) as compared to 2-4.5:10,000 as reported by Lotter (1966) suggests a growing epidemic.
- There are now over 1.5 million persons with autism in the United States. (Matson & Smith, 2008)
- Each year 24,000 will be given a diagnosis of autism (CDC,2001)
- Autism is now more prevalent than Down syndrome, pediatric aids and diabetes combined (CDC, 2001)
- Matson & Mishawi (2006) suggest that it is easy to see how the changes in diagnostic criteria could account for the increased number of persons identified with autism.
ELABORATE
- This debate will no doubt continue.

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BEHAVIOR ANALYTIC TREATMENT OF PERSONS WITH AUTISM

- Behavior analysis did not come to this field because of a vacuum of theories or treatment methods.
- In general treatments were based upon three major theoretical perspectives in the 1950's and early 60's.
- They could grouped into three types
 1. Nonorganic
 2. Organic-Experiential
 3. Organic

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- The nonorganic theories were generally of the psychogenic type meaning that the source of the disorder was in the psychological make up of the individual.
- The psychological problems were thought to have initiated with the cold and unemotional child rearing practices of the parents.
- In fact, Ferster, (1961) suggested that parental practices that included weak reinforcement contingencies and heavy use of extinction might account for this childhood psychosis.
- While he didn't blame the parents for the outcome he did suggest they strengthen some of the aberrant responding.

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- The organic-experiential theories stressed the notion that autism was the result of maternal deficiency and underlying biological mechanisms.
- They were generally a combination of psychogenic and organic theories.
- Finally, the organic theories suggested that genetic and biological defects account for the behavior patterns of children with autism.
- Rimland was one of the early proponents of the is approach suggesting that a malfunction of the reticular formation which produces inadequate arousal to incoming stimuli and therefore accounts for the behavior patterns. (Hingtgen and Bryson, 1972)

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- It was generally found that psychotherapy and other forms of psycho-dynamically oriented treatments were not successful.
- These treatments mainly focused on providing an accepting environment and encouraging the expression of feelings and emotions (Matson et al. 1996)
- Rimland's (1964) review of the treatments generally found them to be ineffective beyond some spontaneous recovery rates.
- It was actually found that children who did not receive these treatments fared better than those who did.
- The National Institute of Health reported that efficacy studies showed no benefit of psychodynamic approaches to the treatment of children with autism.

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- It is now recognized that autism is a biologically based disorder and that many of the behavioral deficits of these persons, e.g. cognitive, social, language, play, etc. can be improved through the application of behavioral principles (Schreibman, 2001)
- Autism is considered a neurodevelopmental disorder that is biologically mediated (Bailey, Phillips, & Rutter, 1996,) with no clear indication of how the disorder is inherited and no reliable biomarkers have been identified. (Hixson, 2008)

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THE EARLY YEARS of ABA

- At the same time that traditional psychological treatments were showing limited success with children with autism the use of operant conditioning procedures were showing promise.
- In 1958, Ayllon and Michael had demonstrated that operant methods could be used to effectively treat the aberrant behavior of psychotic adults.
- In 1961 Bijou & Baer published their classic work on child development
- The book was an overview and compilation of the results of several years of experimental research on child development using behavior analytic principles.

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- Although most of their work was not specific to the treatment of autism but instead a general account of how humans develop, it laid the foundation for much of what was to follow related to the treatment of children with autism.
- Their work started with the assumption “All of these assumed ‘faculties’ can be described in their ontogenesis by combinations of the principles of operant and respondent conditioning” (Bijou & Baer, 1961, p.720). What follows is a brief description of their chain of propositions:
 1. Children are a sources of responses and stimuli.
 2. The responses are both respondent and operant and respondents may ultimately become operant given a certain history, e.g. early respondent vocal productions becoming operants (mands) due to their reinforcing or punishing effects upon others.

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3. The child's environment is a source of stimuli having both respondent and operant effects.
 4. The analysis of development follows from the ways these stimuli effect operant and respondent behavior. With knowledge of the basic principles and classification of stimuli as behavioral variables an environmental and testable account of childhood can now be offered.
- The authors concluded: "... the basic principles are adequate to describe much of the development discussed in child psychology". (Honig, 1966, p,721)

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- Given the influence that the emerging operant analysis of child development had on the likes of Ivar Lovaas and others, the foundation was laid for the application of the basic principles to the core needs of children with autism.
- During the 1960's about 100 papers had been published on the use of behavioral methods to treat children with autism. (Hingtgen & Bryson, 1972)
- These papers focused on treatments designed to overcome the core deficits related to language, social development and adaptive behavior.

FERSTER'S CONTRIBUTION

- In 1961 Ferster presented the first behavioral analysis of the behavior of children with autism.
- At that time the characteristics of the disorder were not well understood.
- It was believed that the study of this form of childhood schizophrenia might lead to effective treatments for the more prevalent form of adult schizophrenia.

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- Ferster (1961) stated “Infantile autism is a relatively rare form of schizophrenia and is not important from an epidemiological point of view”
- In this paper he attempted to demonstrate how the emerging knowledge of the principles of behavior could be used to both treat and account for development of the disorder.
- His assumption was that children with autism were born with a normal capacity to learn but the environmental arrangements organized by the parents led to the autistic behavior patterns.

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- Ferster concluded that extinction and differential reinforcement accounted for the absence of adaptive responses in the overall repertoire of the child with autism.
- Language and social development were assumed to be thwarted by the child’s prolonged exposure to extinction and intermittent reinforcement by uninvolved and distracted parents.
- It was hypothesized that increasingly severe episodes of atavistic behavior was shaped by gradual differential reinforcement in children who failed to acquire normal verbal behavior.

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- Ferster also suggested that the parents detached methods of managing the child led to few correlations between pleasant social interactions and other reinforcers.
- This led to a failure to develop conditioned and social reinforcers that could be used to strengthen social and verbal behavior.
- Ferster acknowledges the speculative nature of his analysis at the end of the paper and therefore calls for behavior analytic research to verify his assumptions.

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- Ferster was one of the first researchers to utilize behavior analytic principles to address the learning needs of children with autism.
- In 1961 he and DeMyer conducted an experiment to determine the effects of behavioral principles on the learning of children with autism
- The study was fashioned after the animal research of the era. Mechanical responses were reinforced with automated equipment
- The target response was lever pressing
- The children who pressed the lever were reinforced with candy and tokens

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- The tokens could be used to obtain other items when a light was illuminated to establish discriminative control over motor responses.
- Within this line of research these results were replicated using motor responses and automated and laboratory equipment.
- DeMyer and Ferster (1962) extended their work beyond the laboratory to include the control of some general behaviors of psychotic kids using social reinforcers.
- Subsequent studies of this type (Ferster, 1966; Ferster & Simons, 1966) further extended the beneficial results of using behavior analytic methods to change the behavior of children with autism.

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- In another study of a similar type Hingtgen and Coulter (1967) demonstrated that children with autism could respond to auditory stimuli by pressing a lever under certain stimulus conditions. This is one of the first studies to show that operant discrimination training could be developed in children with autism.
- None of these studies provide evidence of a therapeutic effect but they did conclude that the behavioral patterns of children with autism were susceptible to the principles of behavior. It had been reasonably determined that the response patterns were operant and therefore likely to be influenced by the basic principles of behavior.
- These findings were instrumental in the development of the therapeutic interventions that followed including the seminal work of Ivar Lovaas.

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Wolf & Risley

- Contemporaneous with the Ferster and DeMyer work was the research being conducted at the University of Washington and University of Kansas by mainly Wolf and Risley.
- In 1964, Wolf, Risley and Mees in their now classic research study, eliminated the self-destructive behavior of a 3.5 year old child named Dicky
- Dicky engaged in high rates of head banging and face scratching that was reported by the mother as “he was a mess, all black and blue and bleeding”
- Dicky also had failed to develop social and language skills .
- Sedatives and restraints had been attempted with little success

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- He was admitted to the hospital for treatment of these issues and to teach him to wear glasses that were required following eye surgery.
- The authors reported that their therapy would make use of procedures such as handshaping, extinction and discrimination training that had been developed in experimental laboratories.

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- The problem behavior was treated mainly with extinction and punishment and differential reinforcement.
- Occurrences of problem behavior resulted in a timeout in a room. Once the target behavior ceased the door was opened since this acted as a form of reinforcement for all other behavior at that moment.
- Over several months the hospital staff were able to successfully implement this procedure to the point that very few problem behaviors were occurring.
- The parents were provided training to replicate these results in the home.

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- After several more weeks of treatment Dicky's behavior of wearing his glasses was shaped through the use of conditioned reinforcement in the form of clicker clicks correlated with food reinforcers.
- Proper eating behavior was established by using timeout from food as a punisher and the maintenance of the food plate contingent upon appropriate eating.
- The authors hypothesized that the verbal reprimands probably acted as punishers due to their correlation with timeout in the room.

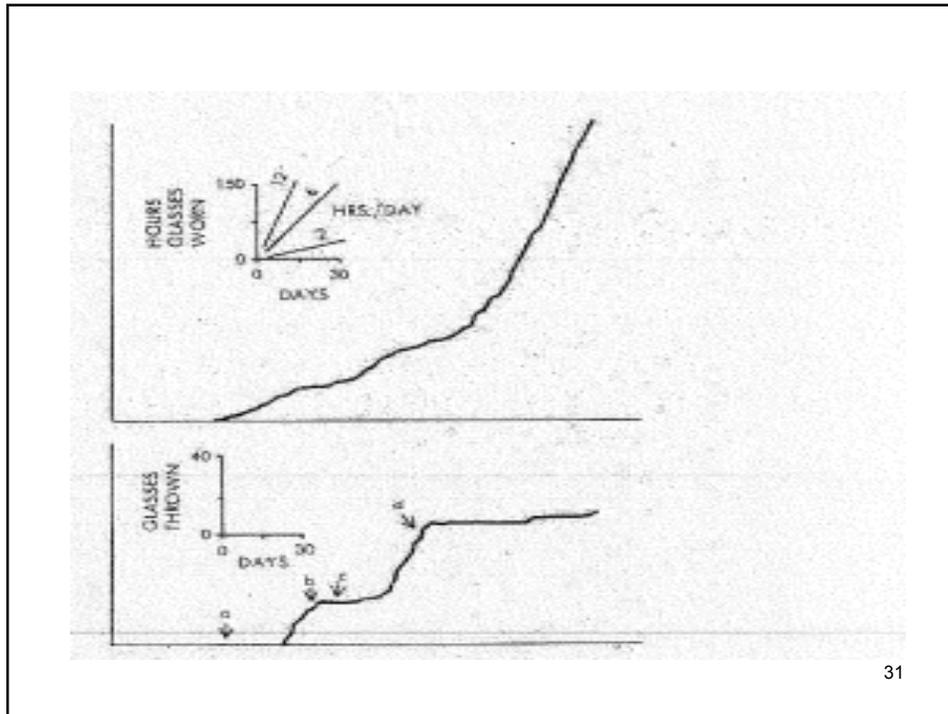
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- Finally, his verbal repertoire was shaped using food reinforcers for labeling pictures of common objects or animals. Dicky's echolalic behavior was transformed into tacting or labeling.
- To obtain this repertoire Dicky was denied food at breakfast until he emitted the responses. Only under strong reinforcement contingencies could the authors establish this limited vocal repertoire.
- After seven months in the hospital program and six months after completion of the work Dicky was living at home wearing his glasses, without tantrums, became verbal and was a source of joy to his parents.

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- This work is a classic in field of the treatment of children with autism.
- While experimental verification was lacking this case study provide evidence that behavior analysis could provide effective and lasting treatment to children with autism.
- It was interesting to note the use of a cumulative record to measure the effectiveness of the treatment.
- Moreover, the treatment was effective when other methods had been shown to be without benefit.

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- At the age of 5 Dicky enrolled in a preschool laboratory at the University of Washington.
- In a follow up study by Wolf et al., 1967, it was reported that Dicky's self slaps, patting and pinching had been dramatically reduced using the timeout and differential reinforcement procedures that were found to be successful in the hospital based program.
- Moreover, Dicky was toilet trained and his social behavior was significantly improved .
- Important gains had also been made in verbal behavior in the two years in the program.

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- Dicky was transitioned to a public school environment where he adjusted well and developed academic skills, e.g. reading, and improved language skills.
- The authors make the point that this was a “hopeless” case before the application of operant conditioning methods were implemented.

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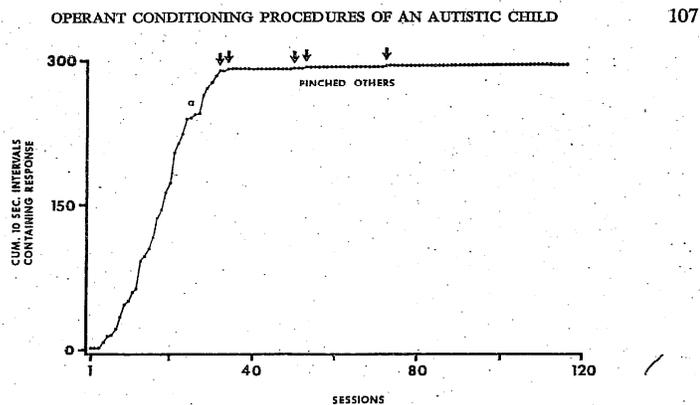
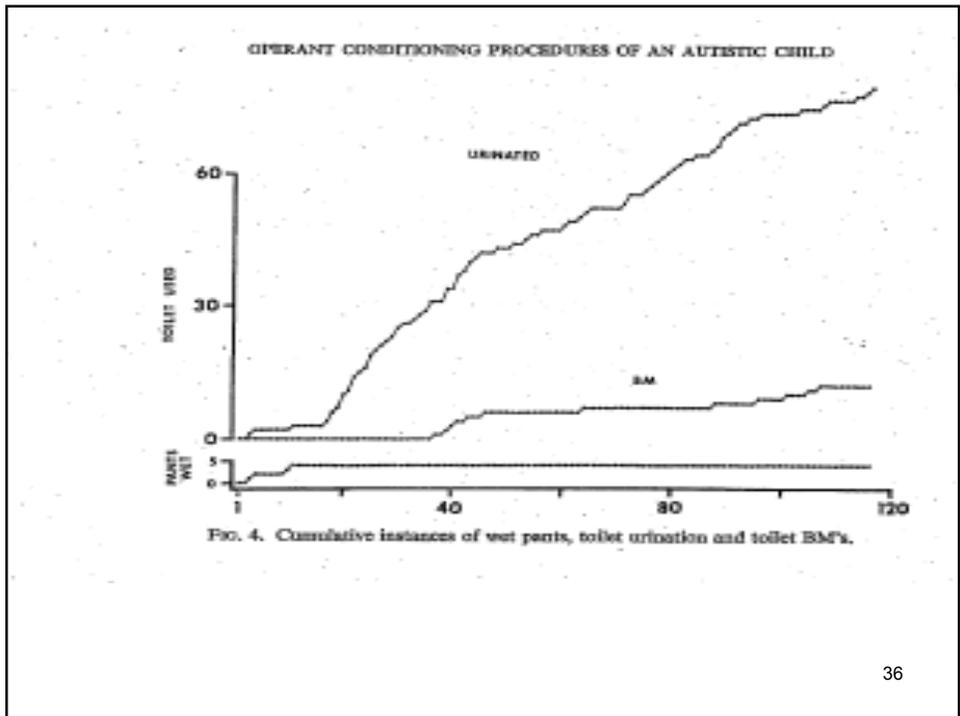
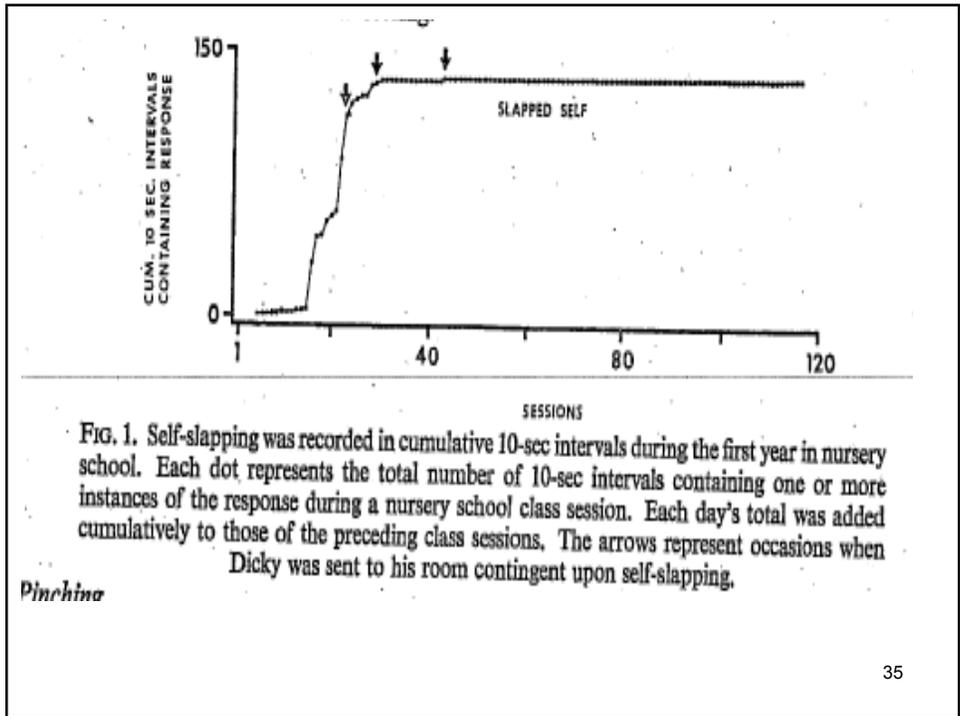


FIG. 2. Pinching of teachers and other children was recorded in cumulative 10-sec intervals. Each dot represents the total number of 10-sec intervals containing one or more instances of the response during one nursery school class session. Each day's total was added cumulatively to those of the preceding class sessions. The arrows represent the occasions when Dicky was sent to his room contingent upon pinching.

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- One of the earliest attempts to build speech production using operant methods in children with autism was reported by Lovaas et al., (1966).
- He developed an extensive four step process to accomplish this. The steps were as follows:
 1. Vocal responses were increased by providing reinforcers for any and all vocal productions. Look at the adult's mouth also resulted in reinforcement early on. Reinforcers were mainly food since social reinforcers had proven to be ineffective.
 2. Next, vocal responses that occurred immediately after the therapist presented stimulus would receive reinforcement.
 3. The child was then required to produce the therapist presented vocal stimulus to receive reinforcement. Prompting procedures were used to support the behavior.

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4. Interspersion of therapist sounds that resulted in correct vocal responses resulted in reinforcement.
- The results of this study were not verified using an experimental method however this case study demonstrated that the imitative vocal production of children with autism could be selected through the use of operant conditioning procedures.
 - Moreover, the researchers did demonstrate that when reinforcement was time based and not response contingent the imitative responses deteriorated providing some support for the conditioning effects of reinforcement.

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- For example, in the case of Dicky Wolf and colleagues were interested in developing vocal responding.
- It had been reported that Dicky was not mute but rarely vocalized in a functional manner.
- In all three of their early studies they shaped vocal production by first establishing imitation by providing food as a reinforcer for echoing.
- Once the vocal imitation repertoire was established they began presenting common objects and prompted the vocal response of the name.
- On subsequent trials they faded the prompt and transferred stimulus control for the vocal response to the item.
- Phrases and increased length of utterance was then added to the training regimen.
- These early speech and language studies served as a foundation for the more advance work to come in language development of children with autism.

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- What follows on the next few slides is first, a picture of an instructor providing discrete trial training to develop language skills.
- This was taken from Risley & Wolf, 1967, in their paper on teaching echolalic behavior in children with autism and reduction of problem behavior through punishment and reinforcement.
- This paper described one of the first uses of discrete trial instruction for children with autism.
- Following are some cumulative graphs depicting the improvements in behavior resulting from this early work on the treatment of children with autism using behavior analytic methods.

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FIG. 1(a)



FIG. 2. An illustration of a therapist extinguishing disruptive behavior by looking away from a child contingent upon disruptive behavior.

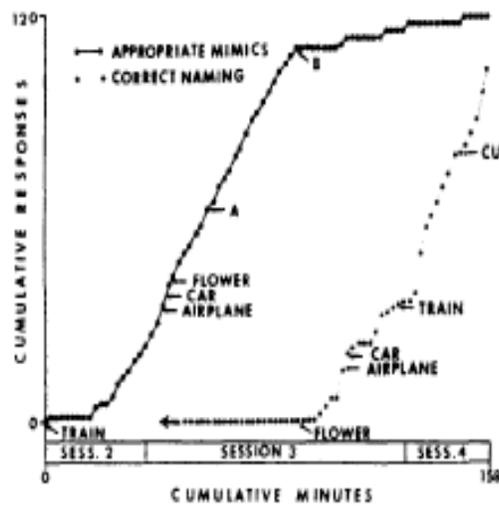


FIG. 6. A record of the initial rate of appropriate imitations (mimics) and correct naming of objects by Carey (see text). Each dot represents 2 min of session time.

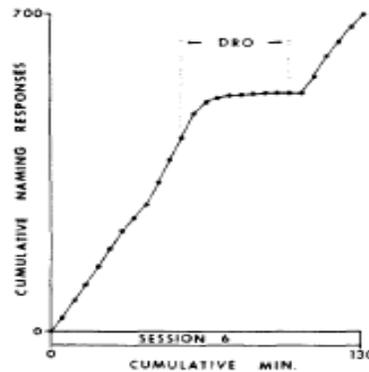


FIG. 7. A cumulative record showing the results of changing the food reinforcement contingency on Will's rate of correct naming. During the sixth session a DRO contingency (see text) was introduced for 9 min and Will's rate of naming decreased to zero. When the original food reinforcement contingency was reinstated the behavior increased to its pre-DRO rate.

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- One of the most important early studies involved the teaching of nonverbal imitation.
- Lovaas, Frietas, Nelson & Whalen (1965) demonstrated that children with autism could learn to imitate adults.
- Moreover, once the imitation had been developed that this skill could be used to shape important responses related to socialization, personal hygiene and even writing.
- By providing food reinforcers contingent upon simple to complex imitative behavior sophisticated repertoires could be developed in children with autism.
- This study laid the foundation for much of the work that followed.

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Punishment in the Early Years

- While the core repertoire deficits of children with autism were addressed using behavioral principles in the early years most of the studies focused on reducing problem behavior referred to as atavisms. Self-injury frequently accompanied the tantrums and other problem behaviors reported in the literature.(Lovaas & Simmons, 1969)
- Moreover, many of the studies attempted to reduce the interfering behaviors by using punishment and aversives.
- The three previous studies by Wolf and Risley and colleagues used punishment procedures to reduce aberrant behavior.

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- Wolf and Risley and colleagues in all of their early work with Dicky and developing vocal imitation skills in children they used extinction in the form of turning away to reduce mildly disruptive behavior.
- For highly disruptive and self-injurious behavior they frequently used placement in a separate room as a form of timeout to reduce the behavior.

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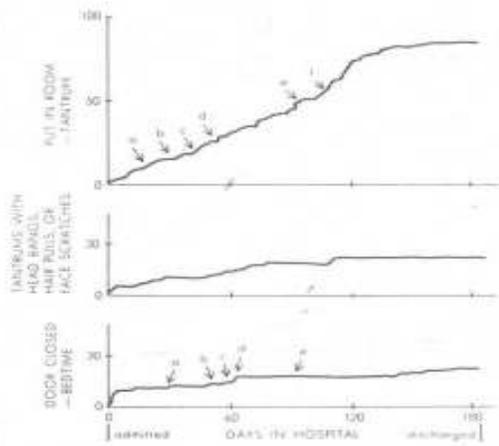


Figure 1. Three cumulative records showing the effects of extinction and mild punishment (time-out from positive reinforcement) upon the tantrums, severe self-destructive episodes, and bedtime problems of a hospitalized pre-school autistic boy.

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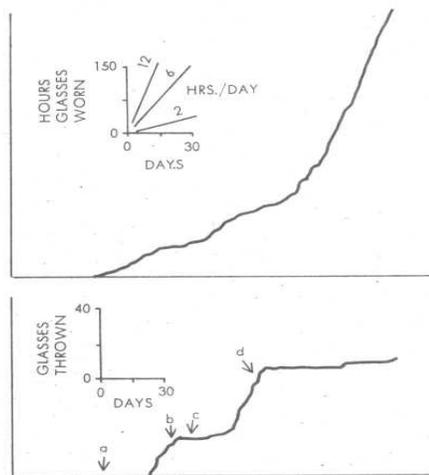


Figure 2. Two cumulative records showing the effects of positive reinforcement (bites of meals, etc.) upon glasses-wearing and the effects of extinction and mild punishment (time-out from positive reinforcement) upon the glasses-throwing of a hospitalized autistic boy.

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- For example in the vocal imitation study by Lovaas the first week of therapy was spent developing the attention of the child and reducing the tantrums and other forms of self-destructive behavior.
- Spanking and shouted reprimands were used to reduce the disruptive behavior by increasing the likelihood of developing the target of vocal production.
- In a controversial study Lovaas, Schaeffer and Simmons (1965) used electric shock to increase the social behavior of twins with autism.

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- What made this study particularly noteworthy was the use of shock to increase a behavior and the fact that shock was presented continuously until the target response occurred.
- The twins received continuous shock and could only terminate it by approaching an adult and hugging and kissing the person. The procedure was effective in increasing social interactions.
- The shock was presented manually through the use of an inductorium that could be pressed to the thigh or leg to produce about 1 second of very painful stimulation.

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- The shock was applied using a 1 foot long rod with two electrodes about an inch apart. About five flashlight batteries provided the power source.
- The device was commercially available from a company in Minnesota, which developed the mechanism for shocking cattle.
- Lovaas described the effects as painful and "...like a dentist drill on an unanesthetized tooth, but the pain terminated when shock ended.
- The use of shock to establish social responding under the control of negative reinforcement appeared in conflict with the goal of teaching social responding and therefore drew some mild criticisms at the time.

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- A now classic study in the treatment of children with autism was conducted by Todd Risley in 1968 and published in the first issue of JABA.
- A 6 year old child with autism exhibited high rates of climbing on furniture, doors and shelves. This behavior was dangerous and highly disruptive.
- Attempts to identify the reinforcing consequences has been unsuccessful and extinction had provided limited success in reducing the behavior.

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- Risley decided that punishment might be the only method to reduce this serious problem behavior.
- He had heard about the Lovaas et al 1965 study and decided to use the same shock applicator (inductorium) to deliver the aversive stimulation for climbing.
- The results were dramatic demonstrating a decrease in the climbing response.
- The same procedure was applied to aggressions and autistic rocking with similar results.

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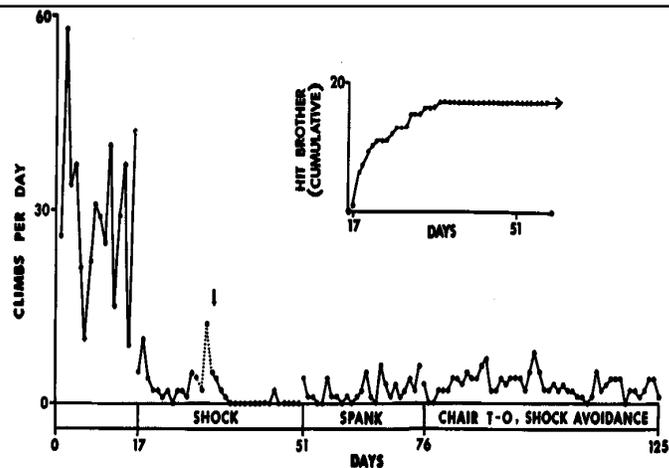


Fig. 4. Graphs of the frequencies of S's climbing and aggressions against her little brother at home. Each dot represents one day. Beginning on Day 17 each occurrence of either behavior was punished with electric shock. The dotted lines during the shock condition represent days when the shock device was malfunctioning. The device was repaired at the arrow. Beginning on Day 51 the shock device was removed from the home and the mother was instructed to spank the child for climbing. Beginning on Day 76 the child was given a 10-min time-out in a chair for climbing. Sitting quietly in the chair avoided shock.

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- The significant finding is that there were no undesirable side effects of the treatment.
- In support of the procedure was the increase in adaptive behaviors, e.g. eye contact, occurred once the problem behaviors were decreased.

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- Around 1965 Lovaas and colleagues conducted extensive studies published in the *Journal of Experimental Child Psychology* to determine the nature of self-injury and to identify the environmental events that might maintain it.
- This work demonstrated through the presentation of data that self-injury was lawful and was mainly controlled by the principles of behavior that had been verified in the experimental laboratory.
- This work supported the use of punishment to reduce problem behavior however, he also demonstrated in this line of research that self-injury could be diminished by the reinforcing incompatible behavior.
- In cases in which it was unlikely that treatment staff could be taught to consistently apply behavioral principles he suggested punishment might be the treatment of choice (Lovaas & Simmons, 1969).

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- Lovaas and Simmons (1969) presented convincing data of the operant control of self-injury.
- By arranging conditions of extinction, reinforcement and punishment in the form of shock the frequency of self-injury was manipulated.
- The authors summarize their findings with strong support for the use of shock as a method to control self-injury and other destructive behaviors.
- They note the immediate effects which preclude the slow decrease in behavior produced by extinction.
- They also note the increase in adaptive responses that are possible once the problem behavior is suppressed with punishment.
- They argue for strong and painful stimuli to produce these results lest the target behavior adapt to the stimulation.

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ABA Research from the Late 1960s to Present

- Beginning in the late 60's behavioral interventions for person with autism grew in number and sophistication.
- The start up of the *Journal of Applied Behavior Analysis* was instrumental in developing the field and providing an outlet for behavioral research.
- Moreover, the clear definition of the field and methods of applied behavior analysis by Baer, Wolf and Risley in the seminal paper titled "Some Current Dimensions in Applied Behavior Analysis" led to a growth in the development of methods to treat persons with autism.
- Additional target behaviors were treated and the era saw an increase in the types and complexity of the treatments applied to the learning needs of persons with autism.
- Over the last 40 years effective treatments have been developed to treat the core deficits of children and older persons with autism.

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- Moreover, comprehensive treatment programs with good efficacy data have been developed.
- Several outcome studies have been conducted leading to the declaration of applied behavior analysis as an effective form of treatment for children with autism.
- Finally, effective treatments have been applied across settings and people with evidence that parents can be effective providers of services to their children.

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Important Findings Over the Years

The Early Data

- The early findings of the treatment of children with autism was published by Lovaas, Koegel, Simmons & Long (1973) in the Journal of Applied Behavior Analysis.
- In that paper they reported the results of their on-going treatment program for children with autism.
- That paper reported some of the most promising results to date regarding the treatment of the core deficits of children with autism.

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- The Lovaas et al study presented the results of 20 children who had received behavior therapy for seven years at UCLA.
- In addition, follow up and generalization data were presented.
- The children were identified by using the Rimland Checklist which provided the most reliable measure of autistic behavior at the time.
- What follows is a description of the early behavioral programs to treat children with autism.

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- Lovaas first developed a system of data recording since he knew it was crucial to developing a research project that was based upon an inductive process. (Lovaas, Freitag, Gold & Kassorla, 1965)
- The purpose of his early work was to increase language of children who had not acquired it typically.
- However, he noticed that most of these children also engage in self-injurious behavior.
- He found the psychodynamic approach of providing unconditional affection and attention led to increases in these responses. (Lovaas, Freitag, Gold & Kassorla, 1965)
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- He reports, “Her psychotic episodes turned out to be rational and social behavior, controlled by known laws that regulated normal behaviors” (Lovaas, 1993, p.621)
- Lovaas describes his decision to use aversives came from an impulsive response to Beth’s self-injurious head banging.
- He smacked her on her bottom and noticed that the problem behavior stopped and she became more affectionate to him and other adults.
- This experience led to the line of research related to aversives to reduce severe problem behavior in his lab.

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- Lovaas was one of the first to demonstrate that social attention could be conditioned as a reinforcer through its correlation with food and other reinforcers(Lovaas,Freitag, Kinder, Rubenstein, Schaeffer & Simmons, 1966)
- He also noted that the value of social attention was increased when the person delivering the attention had also delivered punishment (Lovaas, et al., 1965)
- He hypothesized that this occurred because pleasant social attention was correlated with the termination of aversive stimulation.
- Finally, Lovaas and his colleagues were the first to conclude that many stereotypical behaviors may be the result of sensory/perceptual stimulation produced by the responses.

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- Based upon Ferster's early work and his clinical findings, high rates of reinforcement was used and mainly primary reinforcers were delivered

EMPIRICAL FINDINGS

- The children generally presented with disruptive self-injurious behavior including biting, pinching, head banging and hitting, etc.

TREATMENT: Contingent reinforcement, extinction, timeout, electric shock or slap,

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- Simultaneously, the therapist established early stimulus control by demanding some simple action by the child.

TREATMENT: Prompting and reinforcement.

- Language training then began which consumed about 80% of the program time.

TREATMENT: In mute children build echoing response in children who could echo, teach labeling and requesting.

- At the same time programs to teach social skills and self-help skills were initiated including compliance with demands.

TREATMENT: Using imitation training procedures reinforce and shape the responses.

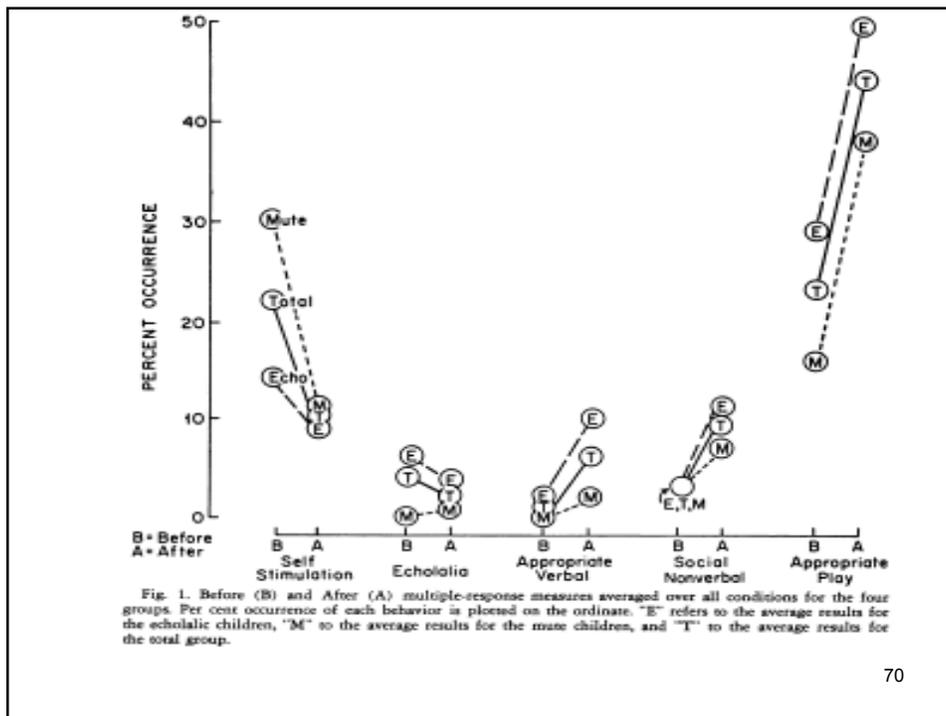
- Appropriate play was also targeted for treatment.

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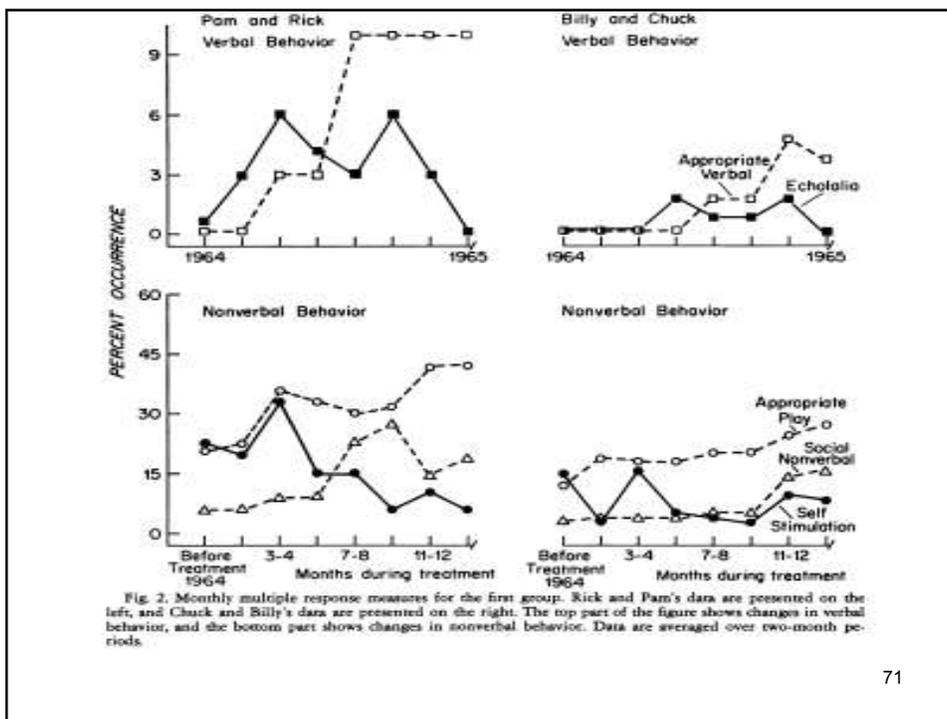
The Data

- Lovaas and colleagues concluded that the results showed effectiveness of treatment and some generality and durability.
- These findings suggested that applied behavior analysis (ABA) could improve skills within the core deficit areas demonstrated by children with autism
- Moreover, treatment methods were implemented by parents with mixed success. Parents who did better were willing to devote substantial time to the treatment, were willing to use strong consequences, e.g. spanking and shows of affection, and who categorically denied the illness model of autism.
- On the following slides are some of the reported data.

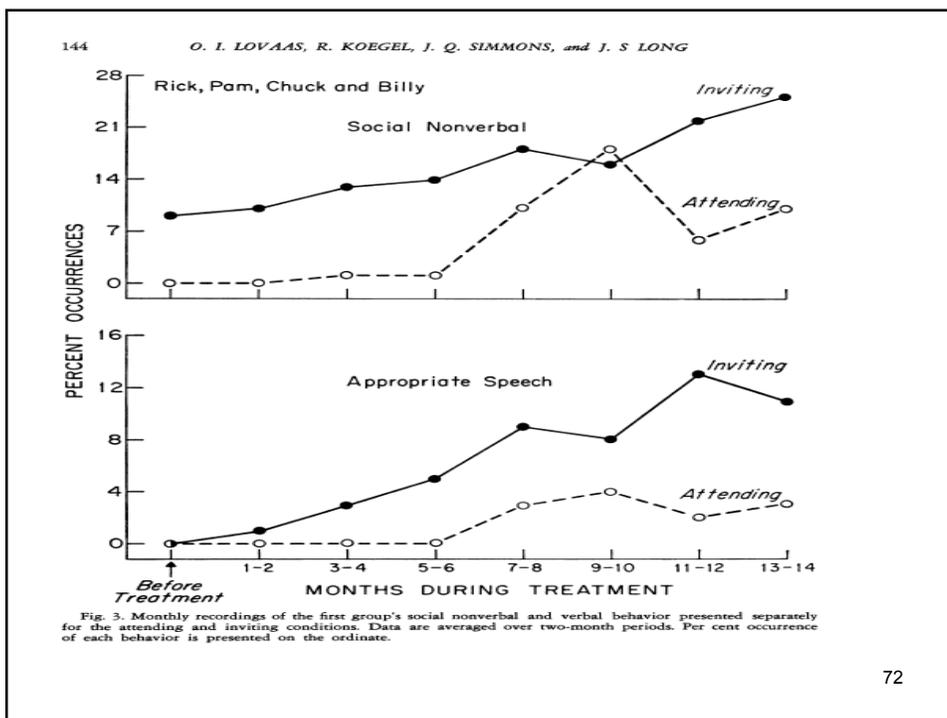
69



70



71



72

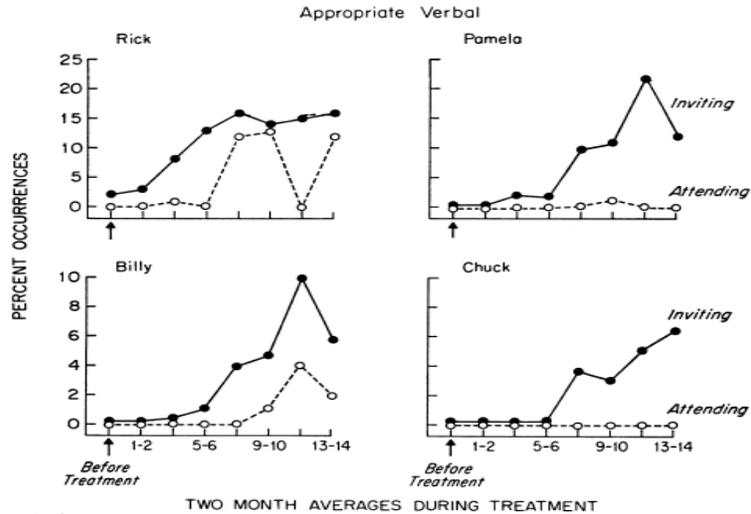


Fig. 4. Monthly recording of verbal behavior presented separately for the attending and inviting condition for each of the first four children. Per cent occurrence of the behavior is presented on the ordinate. Data are averaged over two-month periods.

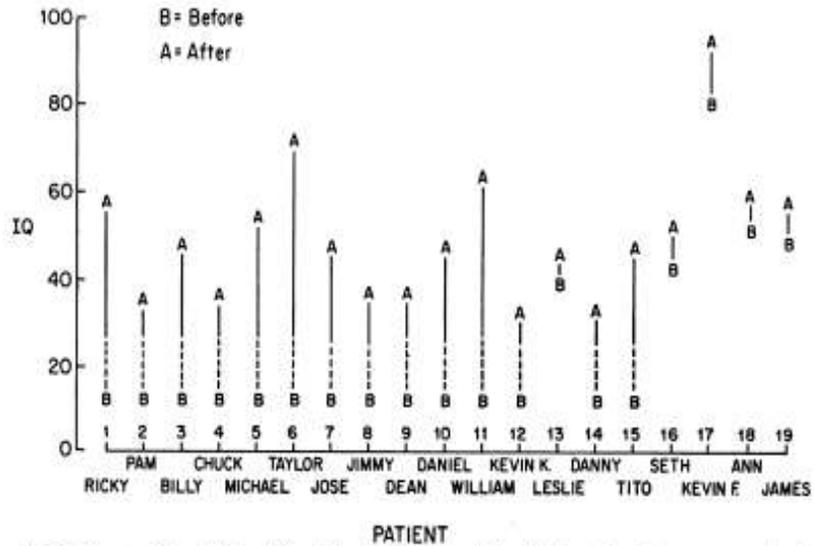


Fig. 9. IQ scores Before (B) and After (A) treatment. Dotted lines indicate the patient was untestable before treatment.

Overview of Treatments in the 1980s and 90s

- The successes recorded by Lovaas and his colleagues in the previous two decades led to substantial gains across many target behavior categories.
- Hundreds of studies were published over the next twenty years related to the treatment of children with autism.
- These studies target the core difficulties and repertoire deficits and excesses of persons and mainly children with autism.
- What follows is a brief overview of target behaviors addressed in these studies and the general behavior analytic methods used.
- What follows is derived from a review of the literature provided by Matson, Benavidez, Compton, Paclawskyj & Baglio, 1996, and a chapter in the book *Early Interventions for Autism Spectrum Disorders: A Critical Analysis* by Matson & Minshawi, 2006.

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Aberrant Behavior

- Given the high rate of disruptive and self injurious behavior demonstrated by children with autism a substantial number of behavior analytic studies were published on this topic.
- Based upon Matson and his colleagues work it was discovered that most of the studies addressed stereotypy, then aggression and then self-injury in descending order.
- The use of functional assessment and the deriving of treatments based upon function started during this era.
- More thorough review of this area of research appears later in this presentation.
- In the next page is an overview of the target responses and procedures derived from Matson's and colleagues work.

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TABLE 1
Target Behaviors and Procedures for Aberrant Behaviors

Target Behavior	Procedure			
	Positive	Aversive	Combined	Extinction
Aggression	13	5	7	
Stereotypy	12	14	4	2
Self-injurious behavior	9	2	9	
Repetitive/Inappropriate vocalizations	9	1	3	
Destroying property	8	1	2	
Tantrums	5	2	2	
Noncompliance	5			
Pica	2	1	2	
Grabbing	2		1	
Physical withdrawal	1		2	
Diurnal bruxism	2			
Spitting			2	
Inappropriate touching	1	1		
Out-of-seat	1	1		
Anorexia nervosa	1			
Phobias	1			
Grimacing	1			
Visual overselectivity	1			
Off-task	1			
Falling	1			
Stealing		1		
Tensing body			1	
Body rocking			1	
Mouthing objects			1	

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- During this period Azrin and Foxx were leaders in the development of methods to reduce disruptive and self-injurious behavior in persons with autism and developmental disabilities. (Foxx & Azrin, 1973)
- Through their research they demonstrated the effective reduction of problem behavior using a method they called "Overcorrection".
- Several different types of overcorrection have been shown to be an effective consequence for disruptive behavior, e.g. restitutorial, etc.
- Since that time Dr. Richard Foxx has argued strongly that the right to effective treatment does include the use of punishment procedures to reduce the most disruptive and dangerous behaviors of persons with autism.

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- He bases his claims on the evidence that suggests extremely disruptive and dangerous behavior has not been demonstrated to be effectively reduced through positive reinforcement and extinction procedures alone. (Foxx, 2005)
- Moreover, he contends that the Association for Behavior Analysis has endorsed the “right to treatment” meaning that persons treated by behavior analysts have a right to the most effective treatment available (Van Houten, 1988).
- His video of his work with Harry a 24 year old person with mild mental retardation is a classic in the field regarding how to reduce severe self-injury.
- The video is still available from Research Press.

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Social Skills

- The social skill deficits of children with autism require a program to teach the social deficits and excesses they exhibit.
- In fact, “The inability to develop normal social relationships is described as one of the most pervasive deficits of autism (Newson, Hovanityz & Rincover, 1988;Schreibman, 1988)
- The use of behavior analytic methods have been successful in overcoming deficits in this repertoire.
- Taylor (2001) states that peer interactive social skills have been taught across many target areas.
- Social skills training has increased children’s appropriate social responses to typical children, responses to other children with autism and to engage in reciprocal responding.
- On the next slide is a list of the type of social interactions that have been successfully targeted provided by Matson and his colleagues

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TABLE 2
Target Behaviors and Procedures for Social Skills

Target Behavior	Procedure			
	Positive	Aversive	Combined	Extinction
Social Interactions:				
Initiations + Responses + Reciprocal interactions	7			
Initiations + Responses	2			
Initiations + Reciprocal interactions	2			
Initiations	9			
Responses	5			
Eye contact	5			
Play skills	3		1	
Offering/Requesting/Providing assistance	3			
Sharing	3			
Conversational skills	2			
Greeting	2			
Terminating social exchanges	2			
Expressing affection	2			
Decreasing avoidance	2			
Physical approach	2			
Appropriate affect	2			
Appropriate sitting	2			
Recruiting praise	1			
Requests	1			
Appropriate speech content	1			
Appropriate voice tone	1			
Appropriate gestures	1			
Imitation	1			

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- The skills targeted for improvement include most often, social initiations, responses to social bids, and reciprocal interactions.
- The skill deficits in early learners and young children usually include few smiles, poor imitation, poor eye contact, poor joint attention, little interest in others, poor reciprocal play, etc.
- In older children problems usually exist in having conversations on a variety of topics, establishing and maintain friendships, difficulty with problem solving, language pragmatic skills, etc.

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- Overall it has been found that following procedures are necessary to achieve the best outcome when teaching social skills: (Taylor, 2001)
 1. Specific behavioral procedures of prompting, fading, reinforcement, shaping, etc. are necessary to teach the requisite skill.
 2. Specific reinforcement procedures must be imbedded during the instruction to produced the desired effects.
 3. Methods to encourage generality must be programmed.
 4. Specific methods to reduce dependency on prompts is necessary.
- One of the more promising methods for teaching social skills using ABA principles is Video Modeling.
- Recently, advanced social skills in the form of joint attention have been successfully taught using behavior analytic methods. (Taylor and Hock, 2008)

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Communication

- Due to the failure of many children with autism to develop functional communication, behavior analytic treatments have been applied to this important skill area.
- Early language programs were developed by Dr. Don Baer and his colleagues at the University of Kansas.
- They worked on skills such as plural morphemes (Guess, D. Sailor, W. Rutherford, G. & Baer, D. M. 1968) asking questions (Twardosz, S. & Baer, D. M., 1973) use of adjectives (Baer, D. M. & Guess, D. 1971) and articulation training (Mann, R. A. & Baer, D. M. 1971).
- This work on linguistic skills resulted in very outcome for Dicky in the early 1964 study.
- Following these early works language programs based upon discrete trial instruction methods were developed that followed a structural or formal language developmental model, (Lovaas, 1981, 2003)
- Early on the use of sign language was recommended for children who were not echolalic. (Carr, 1981)

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- Early language programs progressed through teaching labeling both expressively and receptively to labeling actions.
- Later language programs included teaching parts of speech, adjectives (size and color), prepositions, pronouns, time concepts, yes and no and then ultimately phrases and sentences.
- Answering and asking questions, reciprocations, describing objects, recalling events, retelling stories, etc. were eventually added to the curriculum (See Maurice, Green and Luce, 1996)
- The curriculum was generally built on a linguistic model following the work of Bloom and Lahey, 1978.
- The curriculum was guided by the development of the formal aspects of language including semantics, grammar, syntax/morphology, phonology and pragmatics.

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TABLE 3
Target Behaviors and Procedures for Language

Target Behavior	Procedure			
	Positive	Aversive	Combined	Extinction
Expressive				
Verbal				
Answering questions	5		1	
Labeling	5		1	
Spontaneous verbalizations	4			
Prompted verbalizations	3			
Pronoun use	3			
Answers to "Wh-" questions	2			
Sentence use	1			
"Yes" and "No" as mands	1			
Multiple descriptors	1			
Verbalizing past events	1			
"I/You" responses	1			
Verbal tacts	1			
"Give me-" as mands	1			
Naming pictures	1			
Preposition use	1			
Adjective use	1			
Nonverbal				
Prompted sign use	6		1	
Spontaneous sign use	2			
Pointing	1			
Requesting	1			
Answering questions	1			
Alternative communication			1	
Mixed				
Labeling	3			
Pronoun use	1			
"Yes/No" Responses	1			
Preposition use	1			
Articulation	1			
Receptive				
Labeling	3		2	
Noun/Verb/Adjective use	1			
Preposition use	1			
Receptive + Expressive				
Sign language	1			

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- Language programs ultimately moved away from just a discrete trial instruction method and towards more incidental teaching methods (Schepis et al, 1982; Fenske et al, 2001) to increase generality and to bring the responses under the naturally occurring daily environments.
- The language curriculum continued to follow a structural approach and made no use of Skinner's analysis of verbal behavior.
- Many of the advances in language training were developed by Koegel & Koegel, 2006, through the use of the natural language paradigm.
- The development of language programs based upon Skinner's analysis of verbal behavior began in earnest in the 1980's through the work of Mark Sundberg.
- This advancement will be discussed later in the discussion.

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Daily Living Skills

- Children with autism frequently fail to develop skills of daily living (Harris, 1998)
- As a result they remain dependent upon caregivers for extreme amounts of care which takes time away from the teaching of other skills.
- Behavioral principles have been successfully implemented to overcome these deficits.
- The skill areas which have been addressed with behavioral methods include all those listed on the next slide and provided by Matson and his colleagues.

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TABLE 4
Target Behaviors and Procedures For Daily Living Skills

Target Behavior	Procedure			
	Positive	Aversive	Combined	Extinction
Self-help skills				
Dressing	3			
Tying shoes	1			
Brushing teeth	2			
Food preparation	2			
Eating	1		1	
Washing face	1			
Combing hair	1			
Drinking	1			
Setting table	1			
Cleaning sink	1			
Doing laundry	1			
Making bed	1			
Deodorant application			1	
Toileting	1			
Community skills				
Crossing street	2			
Purchases	2			
Checking out books	1			
Leisure skills				
Toy play	4		3	
Ball play	2			
Choosing recreational activities	1			
Vocational skills				
Cleaning restroom	1			
Increasing production rate	1			

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- Self help skills that enable to care independently for their bodily needs have been effectively taught.
- In addition, skills related to community activities have been taught. These skills allow a person to access community environments, e.g. transportation, purchasing of items, etc.
- Leisure skills have also been effectively trained in person with autism.
- The use of reinforcement, modeling, instructions and feedback and punishment to decrease disruptive behavior have all been used to overcome these deficits.

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- Vocational skills have also been taught to persons with autism.
- One of the most effective methods for teaching these independence skills is task analysis and stimulus response chaining (Foxx, 1981)
- A task analysis is a specific breakdown of the individual skills when chained together lead to successful completion of a task.
- In his book on increasing the behavior of persons with autism Foxx provides very specific instructions on how to develop task analyses and how to link the skills into stimulus response chains to teach these very complex responses.
- This line of research has produced substantial benefits for person with autism in terms of independent responding and self-sufficiency.

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IMPORTANT ADVANCEMENTS

- Since the publication of Lovaas and colleagues 1973 study, showing that ABA was an effective form of treatment, several advances and refinements have occurred.
- This next section of the paper will address some major advancements in the application of behavior analytic methods to the treatment of children with autism.

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Incidental Teaching

- During the early years heavy emphasis was placed upon discrete trial training to teach language and other important skills (Lovaas, et al. 1966)
- However, generalization of language skills to novel and untrained situations frequently did not occur. (Lovaas, Koegel, & Schreibman, 1979)
- A method for teaching language to typical preschoolers had already been developed by Hart & Risley (1975).
- During on-going play activities teachers would arrange the motivation for children to talk and through a series of prompt and prompt fades would evoke vocal responses from the children and increased length of utterance.
- Greater generality and more natural and functional communication developed.
- Schepis, et al. (1982) taught manual signs to persons with autism and mental retardation during daily routines in a residential program.

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- Previous attempts to teach sign in contrived situations had been successful but with little transfer to naturally occurring activities in the person's day.
- Schepis, et al. were the first to demonstrate the incidental teaching was an effective method of teaching language skills to children with autism and that greater generality and functional was derived from the method.
- In 1985 McGee, Krantz and McCLannahan compared discrete trial instruction to incidental teaching.
- They found that the use of prepositions was more successfully acquired during incidental teaching.

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- Incidental teaching has been shown to support the acquisition of reciprocal interactions (McGee, et al. 1992), receptive object labels (McGee, Krantz, Mason, & McClannahan, 1983) and reading instruction (McGee, Krantz & McClannahan, 1986).
- An extension of the incidental teaching procedure is the natural language teaching paradigm (Koegel, O'Dell & Koegel 1987)
- This method includes teaching in daily life situations of the student, using natural reinforcers, in naturalistic language exchanges with stimuli with are functional and varied and all attempts to communicate are reinforced.

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- The research has found that the natural language paradigm produces improved imitation along with greater spontaneous responses across novel situations as compared to contrived training of these same skills.
- Laski, Charlop & Schreibman (1988) were able to teach parents to successfully implement the natural language paradigm with their children with autism.
- Sundberg and Partington (1998) recommend the use of natural environment teaching (NET) as part of a comprehensive language training program for children with autism.
- This approach shares many of the characteristics of the natural language paradigm.
- One important difference is the identification of the language responses trained as verbal operants classified according to Skinner's analysis of verbal behavior.

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Treating Disruptive and Self-Injurious Behavior

- As discussed in a previous section it was shown that punishment in the form of electric shock, slaps and loud reprimands were very effective in reducing the problem behavior that frequently occurs in persons with autism.
- In fact, Lovaas suggested that his greatest treatment gains by 1973 were in the reduction of problem behavior.
- He had demonstrated that attention could maintain problem behavior and extinction could reduce it.
- He suggested that encouraging remarks following problem behavior might well strengthen it.
- In the mid 1970's the notion of treating problem by teaching a replacement behavior was beginning to emerge.

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- Carr, (1977), was writing about the relationship between reinforcement and self-injurious behavior.
- He was suggesting that it appeared that these types of responses may be operant behavior, as suggested earlier by Lovaas, and therefore potentially treatable with behavior analytic methods.
- He hypothesized that the motivation for many self-injurious might well be related to social reinforcement and escape from demands.
- As early as the late 1970's and early 1980's Carr and his colleagues had demonstrated escape motivated behavior was occurring during the high demand situations customarily found in classroom settings.
- By the late 70's the operant relationship was well established and what followed was flood of research on the use of behavior analytic derived from an analysis of the function of the behavior to select methods to reduce disruptive and self-injurious behavior.

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- Most persons are now aware of the seminal work of Dr. Brian Iwata and his colleagues (1982/1994) and the publication of their study demonstrating the operant functions of self-injurious behavior and the effective treatments that follow from that analysis.
- This line of research clearly established the relationship between behavioral variables and self-injury and other disruptive responses in persons with autism and related disabilities.
- Through his work at the University of Florida, Dr. Iwata and his students have published many studies demonstrating the benefits of reinforcement based methods for reducing and replacing problem behavior.
- Treating problem behavior by function and teaching replacement behaviors has become the standard of care in the field.
- This work is so well known and appreciated that I won't review everything that followed to the present.
- For a thorough review See Hanley, Iwata and McCord, ⁹⁹ 2003, for a review of functional assessment methodology.

- Of particular note is the line of research at the University of Iowa under the direction of Dr. David Wacker.
- Through his work and his colleagues he has demonstrated the functional assessment methods can be effective in reducing disruptive behavior during brief outpatient visits (Asmus, Ringdahl, Sellers, Call, Andelman, Wacker (2004).
- In addition, through another line of research demonstrated the effectiveness of functional assessment methods to reduce problem behavior in the home of persons who exhibited high rates of disruptive behavior. (Derby, K. M. Wacker, D. P. Berg, W. DeRaad, A. Ulrich, S. Asmus, J. Harding, J. Prouty, A. Laffey, P. & Stoner, E. A.,1997)
- In this study parents acted as the therapists and long term benefits of parent implemented treatment was demonstrated.

- Also deserving note is the study by Carr and Durand (1985) on “Reducing Behavior Problems through Functional Communication Training”
- This seminal work from about 25 years provided the template for hundreds of studies that have followed related to the treatment of problem behavior with the teaching of a functional equivalent through reinforcement of a replacement behavior.
- When extinction is added to this treatment it has been found to be a very effective method of behavior development and reduction.
- Literally hundreds of studies have demonstrated the benefit of this approach for persons with autism and developmental disabilities.
- The approaches developed by Carr and Durand and Iwata and colleagues have become the standard of care in the field of behavior analysis related to behavior replacement and reduction.

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Pivotal Response Training

- Pivotal Response Model (PRT) is a treatment for children with autism that makes use of applied behavior analysis and developmental approaches to the treatment of children with autism (Koegel & Koegel, 2006).
- It is considered a comprehensive treatment model that attempts to overcome the behavioral deficits of autism in multiple settings and in important core deficit areas, e.g. social, language, academic, etc.
- The methods within approach have greater support than the does the overall model.

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- Robert Koegel's work began in Lovaas' laboratory in the 1960's.
- Since that time he has researched methods to overcome relevant behavioral deficits and excesses in children with autism. (Koegel, Koegel, Harrower, & Carter, 1999)
- His analysis suggests that there are certain pivotal responses that if targeted and remediated lead to substantial improvements in areas that were not specifically targeted for treatment.
- Koegel et al, 1999, presented an overview of the method and the research that supports their efforts.

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- Primary focus of the intervention is communication and social behavior with little emphasis upon drills with preprinted pictures.
- The pivotal areas targeted include
 1. Responding to multiple cues
 2. Child motivation
 3. Self-management
 4. Child initiations. (Koegel, et al. 1999)
- These pivotal responses are taught intensely to young children across many environments and interventionists.
- Parents play an important role in delivering the therapy to their children.
- The goal is to insure that the trained responses occur in all of the child's environments.

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- Koegel as part of the early work of Lovaas concluded that the interventions were too costly and time consuming.
- This led to his interest in pivotal responses that might bring about quicker and more broad changes in behavior.
- The pivotal responses are:
 1. Overselectivity or Multiple Cue Responding- Some research has shown that children with autism respond to limited portions of stimuli and therefore their learning is restrictive. (Koegel & Schreibman, 1977).
- Methods to overcome responding to irrelevant aspects of stimuli have been developed.
- For example, within stimulus prompting can help to reduce this tendency in children with autism (Schreibman, 1975)
- Other methods related to teaching conditional discriminations have been effective

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2. Motivation: many children with autism respond poorly to environmental stimuli, e.g. few responses, weak responses with long latencies.
 - Teaching methods that include task variation, interspersal of mastered tasks, reinforcing attempts, child choice, naturally occurring reinforcers, etc. seem to bring about improvements.
 - Use of the natural language paradigm included these elements and rendered data that suggested the benefits. (Koegel, 1987)

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3. Self-management: the purpose of self-management methods is to shift the burden for managing behavior from the interventionist to the child.
- This method has led to teaching children to identify target responses, self-monitor those responses, self-reward and recruit reinforcement from the persons in the environment.
 - The child is actively involved in the change process and increasing the likelihood of generality across responses, settings and people.
 - This approach increases the chances for success in inclusionary environments which is one of the primary focuses of PRT.

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4. Self-Initiations: procedures to develop self-initiations are thought to increase the learning opportunities of the child without the need for specific programming by an interventionist.
- The focus has been upon teaching children to ask questions to increase social interactions and to increase learning of new responses.
 - It has been reported that children have learned to increase length of utterance, improve grammar and increase social communicative language.

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- By focusing on pivotal responses the authors have attempted to achieve widespread improvements across settings and behaviors.
- It is assumed that by addressing behaviors that have collateral benefits instead of just focusing on target responses the treatment will be less expensive and time consuming.
- Data to support PRT has come mainly in the form of studies of individuals and their acquisition of specific skills.
- Limited experimental outcome data are available but the analysis of the data that are available show substantial gains for the children. (National Resource Council, 2001)
- Matson & Minshawi (2007) suggest that it is unlikely that thousands of responses are affected when a pivotal response is acquired but it is clear that the larger repertoire is influenced by Pivotal Response Training.

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Use of Activity Schedules

- Use of photographs, pictures and line drawings have been used to develop sophisticated repertoires in persons with autism.
- An early line of research demonstrated the benefits of picture prompts on the acquisition of complex responses by persons with developmental disabilities. (Wacker & Berg, 1983; Wacker & Berg, 1984; Wacker, Berg, Berrie & Swatta, 1985)
- Skills such as assembling, meal preparation, laundry tasks, self-care and daily routines, time management, computer use, etc. have all been successfully taught using sequences of pictorial icons. (MacDuff, Krantz & McClannahan, 2001)
- This approach was derived from the basic research on stimulus control.
- Beginning in the 1970s at the Princeton Child Development Center Drs. McClannahan and Krantz began this fruitful line of research that has led to extensions into the development of leisure activities and social interactions including conversation (McClannahan & Krantz, 2002)
- As stated by MacDuff et al. (2001) "In clinical practice we use photographs to cue students to complete lengthy chains." p.40
- Attempts to fade the pictures occur in most instances leading to independent responding by the individual.

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- The developers of this approach have done extensive work on stimulus control transfer procedures and effective methods to fade prompts (MacDuff, 2001)
- They have demonstrated that persons with autism can learn to follow extensive activity schedules under the stimulus control of picture based or textual activity schedules and therefore achieve a level of independence not previously possible.
- Recent work has demonstrated the benefits of audio textual scripts that can be activated by swiping through a language master to support the teaching of conversation and social interactions within classroom environments and other environments. (McClannahan & Krantz, 2005)

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Picture Exchange Communication System

- As many 50% of children fail with autism fail to develop functional vocal repertoires. (Schreibman, 1988)
- Consequently methods of alternative communication are necessary to teach communication skills.
- Picture Exchange Communication System (PECS) was developed by Bondy and Frost (1994) as a form of alternative communication for nonvocal children with autism.
- It is based upon the basic principles of applied behavior analysis and is said to be derived from Skinner's analysis of verbal behavior (Sulzer-Azaroff, Hoffman, Horton, Bondy, Frost, 2009)
- In 1994, Bondy and Frost, in a non-experimental demonstration showed that a 36 month old child learned to communicate by exchanging a picture for desired items or activities and that speech followed after about 2 years of treatment.

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- Since that time there have been 34 published reports of the effectiveness on PECS in developing initiated communication responses in the form of manding.
- While many of the reports listed in a recent review of the literature on the topic are non-experimental case studies (Sulzer-Azaroff, Hoffman, Horton, Bondy, Frost, 2009) it does appear that PECS can be a very effective method for developing a requesting or manding repertoire in children with autism.
- In addition, there is some evidence to suggest that PECS can support the development of vocal production in some children with autism. (Tincani, 2004;2006)
- In some of these cases this may lead to children no longer requiring the alternative form of communication.
- The result of this work has been the development of very specific training procedures that have been manualized and therefore have led to widespread distribution and implementation.

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TEACHING VERBAL BEHAVIOR

- Many language training programs within ABA programs do not make use of the analysis of verbal behavior developed by B.F. Skinner (1957).
- In fact, the five manualized programs for treating children with autism published between 1981 and 2003, Lovaas, 1981, 2003; Maurice, Green & Luce, 1996; McEachin & Leaf, 1997; Maurice, Green & Foxx, 2001; fail to make any use of Skinner's analysis of the motivating operation as described by Jack Michael in several papers (Michael, 1982; 1988; 1993; 2007)
- The ABA programs that do not make use of Skinner's analysis generally present a linguistic approach to language with behavior modification procedures used to teach the structure of the responses
- This observation was the motivation for Sundberg and Michael (2001) to publish their paper "The Benefits of Skinner's Analysis of Verbal Behavior for Children with Autism".¹¹⁴

- This paper followed the publication in 1998, of the book Teaching Language to Children with Autism and Developmental Disabilities by Sundberg and Partington.
- This book provides a manual for teaching verbal behavior based upon the behavioral categories and analysis of verbal behavior.
- Since the publication of this book there has been a growing interest in incorporating the analysis and procedures that follow from the analysis into programs for children with autism.
- Greer and Ross, 2008, have published a book that provides a comprehensive overview of several years of research on the topic at Columbia University and in the context of the CABAS program they have developed.
- McElrath and Axelrod provide an overview of the differences in behavioral programs to that include Skinner's analysis vs those that don't include the behavioral approach to language instruction.

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- Sundberg and Michael (2001) indicate that failure to include this analysis of language in programs for children with autism seems to inconsistent with the behavioral interventions within the programs.
- They suggest that the advantages of including this analysis into already existing ABA programs for children with autism is as follows:
 1. It provides a precise definition of verbal behavior and the functionally independent categories in which the different responses occur, e.g. mand, tact, intraverbal.
 2. This will lead to more effective assessment and treatments through stimulus control transfer across the categories to develop more sophisticated responding.

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- They suggest that the analysis will lead to a clearer distinction between speaker and listener behavior as well.
- By identifying the basic unit as the operant the practitioner will avoid some of the mistakes that come from use of the more common unit of the “word”.
- Methods for teaching each verbal skill have been derived from this analysis and methods for transfer across the categories to increase the verbal repertoire.
- Moreover, an understanding of the meaning of responses is fostered by identifying the controlling variables rather than looking for causes within the individual.
- The analysis will help to guide the assessment of the language of the student and also will help to emphasize the importance of mand training early in the program implementation.

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- Skinner’s analysis forces a practitioner to make use of the concept of the motivating operation (Michael, 1982, 1988; 1993, 2007) since manipulation of this important behavioral variable is necessary to effectively teach mand and other verbal operants.
- Michael in his series of papers on the topic provided the field with an analysis of motivation that heretofore had been unavailable.
- His conceptual analysis of conditioned motivating operations, e.g. CMO-R, COM-T, have made it possible to develop procedures to teach children with autism sophisticated responses such as manding for missing items (Sweeney-Kerwin, et al, 2007) and manding for information.
- In addition, the conditioned MO has supported the teaching of tacts, intraverbals, echoics, etc.
- The work of Michael on this topic has been a major advancement in the field of behavior analysis and instrumental in helping to teach language and other skills to children with autism. (See Carbone, Morgenstern, Zecchin & Kolberg, 2007)

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- Sundberg and Michael (2001) suggest that related issues such as the selection of alternative communication methods may be guided by the behavioral analysis of language.
- When topography based verbal behavior (manual sign) is compared to selection based (PECS) and analyzed in terms of Skinner's analysis a practitioner may make a more informed decision about what type of alternative communication method to recommend.
- The benefits of manual sign training become more obvious when Skinner's analysis is applied. (Carbone, et al, 2006)
- The number of studies that consider this analysis are growing.
- The journal *The Analysis of Verbal Behavior* which has been published since 1982 continues to publish peer reviewed work on the topic.
- For a thorough review of the empirical literature see Sautter & Le Blanc, 2006.
- More research in this area is needed to ultimately meet the promise that this analysis holds for children with autism ¹¹⁹

Feeding Problems

- A large percentage of persons with developmental disabilities have some type of feeding problem (Ahearn, 2001).
- These problems can generally be characterized as insufficient food intake (refusal), skill deficits (self-feeding, swallowing difficulties) or disruptive behavior that interferes with eating (self-injury, spitting out food)
- Ahearn (1996;2001) has suggested that these behaviors may well be the result of a learning history in which the responses that leading to a feeding problem are maintained during the social interactions that occur during mealtimes.
- From this analysis have come a body of behavior analytic literature that has demonstrated the benefits of applying behavioral principles to this important difficulty of person with autism and developmental disabilities.
- The guidelines published by the American Occupational Therapy Association's Practice Division (1980) identified the behavioral approach as one of one two recommended methods for overcoming eating problems with persons with developmental disabilities.

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- The most effective procedures have been manualized in a book by Williams and Foxx (2007) titled “Treating Eating Problems of Children with Autism Spectrum Disorders and Developmental Disabilities.
- For a review of several published studies on the topic see the Journal of Applied Behavior Analysis.

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Parents as Therapists and Leaders of the Treatment

- In the preface to the ME Book, (1982) Ivar Lovaas points out the mistakes that were made early on by treating children in hospitals and clinics instead of schools and homes.
- Moreover, he suggested that the treatment of children autism should delivered by parents who have the greatest interest and access to the child across all environments.
- In fact the ME Book was written as an instructional guide for parents and teachers of children with autism.

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- The emphasis upon parent directed and delivered ABA programs has continued through the years.
- Maurice, et al, 1996, devote several chapters in their book to role of parents in organizing, managing and delivering instruction to their child with autism.
- The demand has been so great for ABA services that the only solution was to train parents to manage and direct their programs for their children
- The question was whether home based parent programs could produce comparable results to what was reported by Lovaas in 1987.

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- One of the first studies to investigate that was conducted by Sheinkopf and Seigel, 1998.
- Using an experimental comparison group design they assessed the differences in outcomes between 11 children who received intensive home based ABA and 11 school based children who received the regular provision of school based services.
- The findings were that there were substantial improvements in IQ and other measures at follow up.
- It appeared that home based parent driven programs can produce good outcomes without affiliation with a university provider.

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- In the United Kingdom where there was limited resources for the implementation and supervision of an ABA program, parent directed programs became quite popular in the 1990s.
- In a paper by Mudford, Martin, Eikeseth and Bibby, the authors warned that the characteristics of these programs did not match those of the UCLA YAP.
- Consequently, they warned that it was unlikely that a similar result would emerge in terms of child outcomes.
- They suggested that levels of supervision, fewer hours of therapy, and competency of the supervision all seemed to be factors that would contribute to their unfavorable prediction.

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- In 2002, Bibby, Eikeseth, Martin, Mudford and Reeves, gathered sufficient data to draw conclusions on the outcomes of children in the UK who were receiving ABA based home programming.
- Their conclusion matched their predictions.
- They found that the outcomes did not compare to those obtained in the 1987 study by Lovaas.
- And, that many of the factors related to competent provision of treatment, supervision and hours of treatment seemed to lead to the results.
- Their conclusion was that home based programming with the elements presented in the 1987 study could not expect to generate similar results.

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- A more favorable report was produced by Luiselli, Cannon, Ellis and Sisson, 2000.
- In a retrospective study they found that the outcomes in home based ABA programs seemed to be related to the age of the child and the intensity of the services.
- They found that children's whose program began before age three showed better improvements over the years.
- In addition, children who remained longer in the programs had better outcomes.

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- Despite these mixed findings parents continue to manage and deliver services to their children.
- In Ireland, Dillenburger, Keenan, Gallagher and McElhinney, 2004, reported that a sample of parents running home ABA programs felt their results were quite good.
- They reported substantial changes in their children and improvement in family life and functioning.
- These results are encouraging since the parents reported an overall improvement in their lives as a result of the ABA program.

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Discrete Trial Training

- One of the most frequently implemented procedures for treating children with autism is the method of discrete trial instruction.
- The method was originally conceived through the work of Sid Bijou and demonstrated first in the early work of Wolf et al. with the child Dicky.
- Almost every program for teaching children with autism and certainly within all the outcome studies that are presently published discrete trial methodology has been utilized. (Smith, Donahoe, & Davis, 2000)
- Skills that have been taught with discrete trial training include, language, social, vocational, cognitive, behavior reduction, imitation etc. (Smith, 2001)

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- Smith (2001) suggests that it is the only proven method to be effective for teaching new skills and new discriminations to children with autism.
- Smith (2001) indicates that a discrete trial has five components:
 1. Antecedent stimulus becomes a discriminative stimulus
 2. Prompt
 3. response,
 - 4 consequence
 - 5 intertrial interval
- Notwithstanding the importance of discrete trial instruction it is not without its limitations.
- Smith suggests that prompt dependency may develop and spontaneous responding may be suppressed.

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- In addition he states that it is highly intensive and therefore requires a great deal of effort on the part of teachers.
- Finally, it appears that some skills are best taught outside the context of the discrete trial format and therefore incidental teaching may be an appropriate method for teaching some skills.
- A meta-analysis by Delprato (2001) showed that incidental language training demonstrated greater functionality and generality as compared to discrete trial training.
- Koegel, Camarata, Koegel, Ben-Tall & Smith (1998) found that speech intelligibility was improved to a superior level when the responses were taught within the context of incidental teaching as compared to discrete trial training.
- The authors report that the improved motivational conditions and more natural responding with relevant reinforcers during incidental teaching seem to lead to the superior results.
- Sundberg and Partington, (1999) provide an easy to read description of the need for both discrete trial training and natural environment teaching.
- They provide a table describing the types of skills that can be effectively taught with each method and the advantages and disadvantages of each.
- See Ghezzi, 2007; and Tarbox & Najdowski, 2008, for recent reviews of the research on discrete trial training.

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WIDESPREAD DISSEMINATION OF BEHAVIOR ANALYTIC TREATMENT

- The work at UCLA by Lovaas in the 1960's through to the 1990's led to the widespread dissemination and acceptance of applied behavior analysis as the treatment of choice for children with autism.
- The work in 1973 already discussed led to many findings that ultimately shaped the work that followed and resulted in the first outcome study in 1987 of the treatment of children with autism using behavior analytic methods.
- That study alone fostered the acceptance of a behavioral treatment for children with autism and led to widespread dissemination of the effective treatment.
- Lovaas, 1993, reported that the lessons learned from the 1973 work led to changes in how they went about their work.

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- The 1987 outcome study was shaped by the following lessons learned:
 1. The youngest children did the best
 2. Treatments were situation specific and therefore training in home and other environments might be best .
 3. Response generalization did not occur so they trained all responses.
 4. Parents were the best teachers.
 5. Treatment should occur all day long and should continue for over two years.
 6. A set of data-based methods had been derived from previous work that could not be reliably applied during treatment.

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- With this useful information from past work 19 children with autism were enrolled in a multi year study at UCLA.
- The treatment was based upon the principles of applied behavior analysis that had been demonstrated to be effective in previous studies.
- Treatment focused on reduction of disruptive behavior and development of language, social, play and general cognitive skill development.
- The procedures implemented were described in Lovaas' Me Book published in 1981.
- Parents played an important therapeutic role since was a home based program of treatment.
- Aversive treatments were used with some subjects.

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- Children were assigned to groups and all were younger than 46 months.
- There was one experimental group and two control groups.
- The experimental group received 40 hours of treatment and the control group less than 10 and no aversives.
- A second control group of children received treatment similar to control group one but the service was provided by another agency and not the Young Autism Project.
- The results were remarkable and unexpected by even Lovaas himself.

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- About half of the treatment group showed major gains resulting in normal intellectual and educational functioning while only 2 percent of the control had a similar outcome.
- These results were the first report of clinical outcomes of a multi year program to treat children with autism.
- The results spread quickly within the lay community through media coverage and ABA was declared by the surgeon general of the United States in 1999, to be a proven effective treatment for children with autism.
- Several reports followed the 1987 study including the 1993 follow up study on the participants in the 1987 study.
- McEachin, Smith and Lovaas (1993) found that the effects of the treatment were durable and resulted in lasting changes over several years for eight of the nine original participants.
- In addition, the comparison group children did not change in ways that would suggest the results were due to maturation alone.

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- Other researchers initiated projects to replicate the findings.
- One notable study was conducted by Birnbrauer and Leach, 1993, in Australia.
- They conducted a similar study with very good results from some but not for the group overall, in what was called the Murdoch Early Intervention Program.
- An important follow up to the 1987 study was the research of Anderson, Avery, DiPietro, Edwards and Christian (1987)
- They found that the application of behavioral procedures in an early intervention program within a home could result in significant beneficial outcomes.
- Although they did not have a control group with whom to compare the results of the treatments they provide an important setting of findings related to early intervention in home based programs.

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- A set of mixed findings were obtained at the Douglass Developmental Disabilities Center by Harris et al. 1991
- Home based programming seemed to improve cognitive functioning in some areas and less dramatic results were obtained in the area of language.
- However, the results did indicate the benefit of the treatment with young children.
- An earlier report by Fenske et al. 1985, at the Princeton Child Development Center, showed much improvement in younger children with less improvement for the older group.

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- At around the same time as the surgeon general's declaration the NYS Department of Health developed a Clinical Practice Guideline (1999) for the education and treatment of children with autism.
- In NY the Department of Health is responsible for early intervention services to children with autism.
- Consequently, the department organized an expert panel to make recommendations regarding the most effective forms of treatment for young children with autism/pervasive developmental disorders.
- Overall applied behavior analysis received the highest ranking among treatment methods and was therefore designated as the treatment of choice for young children with autism in NYS.
- An entire cottage industry of ABA providers has emerged as a result of the NYS guidelines.

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- The Maine Administrators of Services for Children with Disabilities Autism Task Force in 2000 published a paper outlining the most effective methods of treatment for children with autism.
- It is clear the publication of "Let Me Hear Your Voice" in 1993 by Catherine Maurice had a major impact on the popular dissemination of behavior analysis as a treatment for children with autism.
- Her compelling story of her search for effective treatments for her two children informed the population of parents about the benefits of ABA forms of treatment.
- In fact, the demand grew internationally beyond the supply of competent and well trained providers of ABA services (Foxx, 2000)
- As a result of the demand for information on effective treatment manuals began to emerge that outlined the most effective forms of treatments.

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- Following the publication of ME Book in 1981 by Lovaas a comprehensive program manual edited by Maurice, Green and Luce (1996) appeared several years later.
- Chapters covering problem behavior, language instruction, teaching methods, how to set up home programs, behavioral assessment, etc. were included
- The next year, 1997, McEachin and Leaf published their manual, "A Work in Progress". This manual contained similar chapter headings and information.
- Two more manuals have been published, they are the updated version of Maurice, et al book called "Making a Difference" (2001) by Maurice, Green and Fox, and a Lovaas revision and update of the ME Book called "Teaching Persons with Developmental Disabilities" (2003)
- Additional topics related to incidental teaching, how to teach feeding and peer social skills training were included in these subsequent manuals.

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- The manuals have been used as overviews of effective practices to guide mainly school and home based programs of intervention.
- They have included descriptions of procedures in core areas of autism, e.g. language, social, academic, cognitive, play, disruptive behavior, etc.
- Moreover, the manuals have provided descriptions of the educational curriculum in the important instructional domains.

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- The work of Lovaas has not been without its critics.
- The results of his 1987 study were so unusual and inconsistent with previous work it drew close scrutiny.
- The majority of criticism has focused on the experimental design and have questioned whether the claims made of effective outcome can be related to the treatment method given the design flaws.
- Moreover, the results were so dramatic and discrepant with previous findings that the outcomes seem almost “too good to be true”.
- For a more complete discussion of the criticism see Eikeseth, 2001; and Gresham and MacMillan, 1998; Schopler, Short & Mesibov, 1989.

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OUTCOME STUDIES

- There have been several outcome studies that served as at least partial replications of the methods used by Lovaas in the UCLA Young Autism Project of 1987. Anderson, et al. 1987; Bibby, et al., 2002; Fenske et al. 1985; Handelman, et al. 1991; Harris, et al. 1990; Harris, et al. 1991; Hoyson, et al. 1984; Luiselli, et al., 2000, Weiss, 1999.
- These studies all included children with autism who were treated with behavior analytic methods over many months.
- None of these studies used comparison groups to verify the effects of the treatment.
- The results from these studies however, all supported the benefit of EIBI with children with autism
- Notwithstanding these results Eikseith, 2009, ranked these studies as having insufficient scientific value (ISV) and therefore providing no additional scientific evidence to support the methods.

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GROUP DESIGN OUTCOME STUDIES

- Studies indicating the benefits of intensive behavioral intervention have been presented in a previous section of the paper (Harris, et al, 1991, Fenske, et al., 1985, Anderson, et al, 1987, etc.)
- In addition to these studies there now exist at least 13 control/comparison group design studies demonstrating the effectiveness of behavior analytic methods for children autism.
- All of the studies are either replications or modified versions of Lovaas' 1987 study with young children with autism as part of the UCLA Young Autism Project (YAP).
- What follows is a brief discussion of each study and the results.

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- **Lovaas, 1987**- a thorough description of this study occurred in earlier section of this paper.
- **McEachin, Smith & Lovaas, 1993**- this study was a follow up on the 19 participants in the experimental group and 19 participants in the control group from the 1987 study.
- These children were now 13 years old in the experimental group and about 10 years old in the control group.
- The participants were tested for IQ scores, Adaptive and maladaptive behavior, personality measures and school placement.
- The results indicated that the participants remained in the same groups and IQ and other gains had been maintained over time.
- Only one student in the best outcome group received lower scores and was placed in a special education classroom.
- The results suggest the durability of the results.

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Birnbrauer & Leach, 1993- An experimental group of 9 children was compared a control group of five children. The experimental group received about 18 hours per week of 1:1 ABA services for 2 years. The children were all about 3 years old and the program was carried out in the homes. Measures of intellect, Adaptive behavior, language, personality and behavioral observations were conducted.

- The results indicated that about half of the experimental group had approached normal functioning while only 1 child in the control group made substantial progress. Overall the gains were moderate to minimal for the other children.

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- **Smith, Eikeseth, Klevstrand, Lovaas, 1997-** Using an archival analysis a comparison between experimental and controlled participants was conducted.
- There were 11 pre-schoolers with mental retardation and PDD in the experimental group and 10 in the control group. Checklists of skills, Bayley Scales and intellectual functioning was assessed at least 2 years after entering the program or comparison group.
- The treatment was carried about by university trained therapists in a clinical setting.
- The groups received about 30 hours per week of treatment.
- Overall the results showed greater gains for the experimental group although the gains were modest.

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- **Smith, Groen & Wynn, 2000-** 15 children in an experimental group that received about 25 hours of ABA therapy was compared to a randomly assigned control group of 13 children who received parent training. Children were about 3 years old
- The children were assessed for intellectual functioning, adaptive behavior, academic achievement, social functioning, school placement, etc.
- Results indicate substantial gains for the experimental group children however gains in most areas except adaptive functioning and socio-emotional functioning.
- About 27 percent of experimental group children achieved average post treatment scores and were functioning in regular education classrooms

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- **Eikseth, Smith, Jahr & Eldevik, 2002-** School aged children were assigned randomly to a behavioral treatment group (13) or an eclectic treatment control group (12).
- Both groups received a minimum of 20 hours of treatment per week.
- Behavioral treatment was based upon the treatments outlined in the 1981 ME Book by Lovaas.
- Measures of intellectual function, language, visual spatial skills, adaptive behavior were assessed pre and post.
- The results indicated that the treatment group after one year showed substantial improvements and larger improvements compared to the control group. However, only the Vineland scores difference were statistically significant.
- Moreover, the older children actually may do quite well which is in conflict with earlier reports that below 4 year old children do the best.
- The results indicate that some children with autism may do well in school based ABA programs.

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- **Howard, Sparkman, Cohen, Green & Stanislaw, 2005-** Compared three treatment approaches with children with autism and PDD-NOS.
- 29 children received 1-1 ABA services, 25-40 hours per week.
- A second group of 16 children received 3- hours per week of 1-1 services in an eclectic special education classroom.
- A third group of 16 children received early intervention services in small groups.
- The children were all about three years old.
- Measures of IQ, adaptive behavior and language were obtained.
- After 14 months the ABA group should greater gains in comparison to the other two groups in all areas.

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- **Sallows & Graupner, 2005-** 13 children were randomly assigned to an ABA treatment group and 10 to a parent managed ABA group.
- Both groups received over 30 hours per week for two years.
- Measurements of language, IQ, social functioning, autistic symptoms, visual-spatial skills, language and adaptive functioning were conducted.
- Children in both groups made substantial gains with 48 percent of all children showed rapid gains achieved average scores and were successful in regular education programs.
- This study is considered the closest replication of Lovaas' early research.

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- **Cohen, Amerine-Dickens, Smith, 2006-**
- Comparison of ABA programming to special education services for children with autism or PDD-NOS.
- All children were younger than four years old.
- There were 21 children in the treatment group and 21 in the eclectic group.
- The ABA group received 35-40 hours per week in a community setting through 1-1 services.
- The eclectic group received about 15 hours of service with a ratio of 1-1 and sometimes 1-3.
- Measures of IQ, visual IQ, language and adaptive behavior were conducted.
- Overall the ABA group scored higher in most areas and on follow up 6 of the 21 treatment group members were in general ed and 11 others were there with support.
- Only 1 of the comparison group members was placed in a regular education program.
-

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- **Eldevik, Eikseth, Jahr & Smith, 2006-**
- In this study low intensity ABA was compared to low intensity eclectic approaches.
- The study was retrospective in design.
- There were 13 children in the ABA group and 15 in the comparison group.
- Files of the children were reviewed for measures of IQ, language, adaptive functioning, psychopathology.
- After 21 months of intervention the ABA group scored substantially higher on all measures except adaptive functioning.
- Clearly gains were higher in studies where children received more intense services and is unclear if any of the gains were clinically significant.

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- **Eikeseth, Smith, Jahr & Eldevik, 2007-**
- Children between 4 and 7 years old were participants in the study.
- An ABA group was compared to an eclectic treatment group.
- Both groups received about 29 hours of treatment per week.
- Measures of IQ, language, adaptive behavior, maladaptive behavior and socio-emotional responding were measured.
- After 2 years the ABA group showed gains in IQ and adaptive functioning.
- Several more children scored in the normal range of intelligence in the ABA group compared to the eclectic group at follow up.

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- **Remington, Hastings, Kovshoff, degli Espinosa, Jahr, Brown, Alsford, Lemaic, & Ward, 2007-**
- Parents chose the groups children were placed in, either ABA or treatment as usual group.
- The ABA group received about 25 hours per week of 1-1 ABA services while the comparison group received their educational provision from their local authority.
- Measures included, IQ, adaptive behavior, language, rating scales and observations of child behavior and self reports of parent well being.
- Follow up assessment showed gains in IQ but not adaptive behavior or language.

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- **Zachor, Ben-Itzhak, Rabinovich, Lahat, 2007**
- An ABA treatment group was compared to a developmental eclectic group.
- There were 21 very young children in the ABA group and 19 in the eclectic group.
- The eclectic group received services during a normal school day in groups while the ABA group received 35 hours of services in 1-1 therapy.
- After one year of service the ABA group showed gains in language and communication and both showed improvement in social development.
- 20 percent of the ABA group children were no longer diagnosed with autism indicating a change in core symptoms of autism through effective treatment.

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- Not all of the group outcome studies have sufficient methodological rigor that would allow strong statements about the findings.
- For a complete review of these issues see, Eikseth, 2008.
- Notwithstanding the design issues, it appears that not all early intensive behavioral intervention programs produce the same effective outcomes.
- It appears that there are a core of treatment methods that bring about the best outcome in the participants (Hayward, Gale, & Eikseth, 2009)

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- These authors suggest that the programs that produce the best outcome include the following components:
 1. Treatment occurs in the child's natural environment, home, school, etc.
 2. Parents are actively involved in the treatment
 3. Treatment is intensive and comprehensive. Many hours and targets core deficits.
 4. Treatment providers are skill in the application of behavioral methods to the learning needs of children with autism
 5. Supervision is intense and carried out by well trained behavior analysts.
 6. Services are research based and are controlled for quality.

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- Matson & Smith (2008) provide an excellent status report on the data that support the effectiveness of behavioral interventions for children with autism.
- They make several suggestions for improving the research based for behavioral treatments and encourage the examination of issues that may impact the treatments, e.g. co-morbid conditions.
- In their review of the currently available studies of early intensive behavioral intervention (EIBI), Matson & Smith conclude "To date, enough behaviorally oriented EIBI studies have been conducted to suggest that not only is the approach effective, but as a congregate group of learning based methods, it stands alone as the only effective treatment(s) for young children with ASD" p.69.
- A recently published examination of the outcome studies suggest that EIBI is effective in bring about changes in intellectual scores it is not effective for all children.
- They point out that some children fail to make any progress with the treatment and some even regress.(Reichow & Wolery, 2009)
- All of this suggests continued research into the match ¹⁶⁰ between child characteristics and effective treatments.

- In conclusion , a recent report out of Canada by Perry et al. (2008) found that a group of 332 children age 2-7, showed substantial improvements in cognitive and adaptive scores and reduction in autism severity and doubling of rate of development through intensive behavioral intervention.
- The study lacks methodological rigor given its retrospective design and failure to report on a comparable comparison group.
- Nevertheless, the data are impressive given the sheer numbers and the “real world” nature of the treatment.

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Development of Standards

- The first major attempt for the professional community to develop standards of care for persons with autism was initiated by the National Academy of Sciences through the National Research Council (2001).
- A commission of experts were gathered to develop a set of guidelines for most effective treatment practices for persons with autism.
- Behavior analytic researchers and practitioners played an important role on the commission that was chaired by Lord and McGee.
- The final report took the form of a book titled “Educating Children with Autism”, 2001.
- It provides a comprehensive review and analysis of evidence based practices related to the treatment of children with autism.
- Given the evidence based focus of the group there was heavy reliance on behavior analytic treatments within the recommendations of most effective practices.

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- The recommendations were that the most effective programs included at least 25 hours per week of treatment focused on developing skills in the following areas:
 1. Functional spontaneous communication
 2. Social instruction throughout the day in various environments
 3. Cognitive development
 4. Play skills
 5. Proactive responses to problem behavior.

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- Recently the National Autism Center has commissioned a National Standards Project (Wilczynski & Christian, 2008)
- The purpose of the project is to provide the most up to date information on effective and evidence based treatments for persons with autism up to age 22.
- It is assumed a report a set of standards will be published in the near future.

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Etiology of Autism

- It is generally recognized at this point in time that autism is “....considered a neurodevelopmental disorder that is biologically mediated” (Hixson, 2008).
- Notwithstanding this agreement it is clear that the behavioral repertoire of these individuals can be rather dramatically altered through the application of environmentally based treatment methods and specifically the methods of applied behavior analysis. (Lovaas & Smith, 1989)
- Consequently, a number of researchers have suggested that the etiology of autism may have a predominantly behavioral basis.
- While Lovaas and Smith clearly acknowledge the neurological differences of children with autism they suggest the ultimate display of behavioral manifestations is a result of the interaction between biology and environment.

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- Beginning with Ferster, 1961, it was suggested that autism was purely a behavioral phenomenon resulting from the interactions of the child with parents who failed to reinforce behavior and who relied on extinction at a very high rate.
- Since that time it has been established that parents of children with autism do not possess characteristics that would suggest they are so disparate from other parents that their actions could account for the behaviors of children with autism (See Hixson, 2008)
- That does not mean that changes in parent behavior will not effect the ultimate outcome but the finding suggest the parents do not cause the disorder.
- In a recent issue of *The Analysis of Verbal Behavior* Drash and Tudor, (2004), made a claim similar to Ferster’s regarding the environmental conditions that may lead to autistic behavior.

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- Their hypothesis is that failure to develop verbal behavior leads to the behavior patterns display by children with autism.
- The logical extension of their remarks is that autism can therefore be prevented and certainly cured through the application of behavior analytic methods.
- The comments on this paper drew mainly opposing views with issues related to the concordant twin studies and placement of children with Asperger syndrome appearing on the autism spectrum suggesting an alternative etiology. (Hixson, 2004)
- Other behavior analytic explanations of the disorder have included issues related to stimulus control (Spradlin and Brady, 1999) and the interfering effects of automatically reinforced behavior (Bijou and Ghezzi, 1999).

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FUTURE DIRECTIONS

- In the last 50 years the field of behavior analysis has developed a broad data base of effective methods for addressing the core deficits of children with autism.
- However, there is still much to be done to help this growing and very need population of children and adults.
- The results of the National Research Council Reported point out the limited about of well designed control studies exist upon which to develop treatment programs.
- As a result of these findings the National Institutes of Health convened a meeting in 2002 to discuss ways of developing and encouraging more and better research on the treatment of person with autism. (Lord, 2005)
- Based upon their findings and other sources what follows is a non-exhaustive list of the issues that future researchers and practitioners may pursue.

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- More and better designed outcome studies.
- Long term studies, that show the durability and sustainability of the change methods over decades.
- Research that informs practitioners about the match between child characteristics and effective practices.
- Some clear conclusion on the number of hours of instruction that provide maximal benefit.
- Information on how to maintain the benefits of adolescents who have received early intensive behavioral intervention.
- Which environments or which combination of environments produce the best outcome.
- What types of alternative augmentative communication methods work best and for which children.
- Increase in university training programs that prepare behavior analysts and educators to provide services to the growing number of children with autism.
- What does behavior analysis have to offer to families to improve their ability to manage their children and improve their quality of life.

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- Development of a set of standards or practice guidelines for persons who provide services to children with autism.
- How to improve the delivery of services in publically funded programs and schools.
- Methods to include persons with autism in community activities, independent living and vocational opportunities.

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