

Applied Behavior Analysis and Early Intervention:  
The Extent of Recovery from Autism

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### Abstract

Autism has become an epidemic disorder within society: current statistics state 1 in 150 children are diagnosed as autistic, according to the Centers for Disease Control and Prevention. Autism has three components, which are identifiable to the disorder. These are delays in social ability, communicative behavior, and linguistics. However, Applied Behavior Analysis (ABA), according to recent research, has been successful in improving these delays. To what extent is Applied Behavior Analysis effective in treating the identifying characteristics of autism in children?

The scope of the investigation will identify autism and give data demonstrating recovery rates resulting from ABA. The Diagnostic and Statistical Manual of Mental Disorders will be used in order to define and describe autism. Although many types of therapy exist, ABA will be the focus. The methods of Applied Behavior Analysis will be explored according to various sources. Additionally, the relationship of the brain and early intervention will be established in order to conclude the necessity of early intervention along with the methods of ABA. Two specific case studies, The UCLA Young Autism Project and The Maurice Children, will be referred to in order to demonstrate the success of the therapy. The two case studies showed that recovery is possible in some, but not all cases. The negatives of ABA will be addressed.

The conclusion states that Applied Behavior Analysis in unison with early intervention typically decreases the severity of autistic characteristics. In approximately 90% of cases, intensive behavioral therapy benefits the child and there is a reduction of at least one of the feature autistic characteristics (Maurice, Green, & Luce, 1996). In extremely successful cases, a diagnosis can be removed because full recovery has been achieved. However, Type 2 autistics have a better chance of recovery than Type 1 autistics, and in some cases autism was reversible (Niemann, 1996).

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Autism is an extremely common disorder, affecting 1 child in every 166 (Centers for disease control and prevention [CDC], 2006). According to the American Psychiatric Association, it is defined by impairment in social interaction and communication skills, as well as an occurrence of repetitive behavior (APA, 2000). A child diagnosed with autism can debatably obtain normal functioning through measures of therapy, and thus recover from the disorder. Applied Behavior Analysis (ABA) is a widely known treatment for autism. To what extent is Applied Behavior Analysis effective in treating the identifying characteristics of autism in children? The goal of ABA intervention is to enable an autistic child to best function independently and successfully in various environments (Green, Taylor, Luce, & Krantz, 2005). ABA is most successful in combination with early intervention. At a younger age, the brain is at a more adaptable state. According to research, Applied Behavior Analysis (ABA) in unison with early intervention allows, in most cases, for a decrease in the severity of autistic characteristics.

#### Characterizing Description of Autism

Autism is classified as a pervasive developmental disorder (PDD), due to three common features that appear during early stages of life. These three characteristics are “impaired reciprocal social interaction, impaired communication skills, and restricted, repetitive, and stereotyped patterns of behavior, interests, and activities” (Berkell, 1999, p. 7). The diagnostic features of autism are best described in the *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR*. At least six of the criteria must be present for the diagnosis of autism. Of these six, additional requirements exist in each area. Impairment in social interaction is one key feature of autism. This can be marked by

abnormal nonverbal behaviors, such as eye contact, facial expression, and body gestures or postures. Failure to develop appropriate peer relationships for age and development, and lack of spontaneous sharing of interests or achievements are two additional examples that demonstrate impaired social interaction. Furthermore, a lack of “social or emotional reciprocity” mark this impairment (APA, 2000, p. 70). A child must have at least two of these social criteria in order to socially be considered autistic (APA, 2000).

Impairment in communication is another foundation of autism. A delay in, or total lack of, spoken language development is characteristic. However, if an individual does speak, there may be impairment in initiating or sustaining conversation with other individuals. A “stereotyped, repetitive language or an idiosyncratic language” may be observed, along with little to no varied, spontaneous imaginative or imitative play (APA, 2000, p. 70). If at least one of these conditions is present, then communicatively the child could be described as autistic (APA, 2000).

Restricted, repetitive, and stereotyped patterns are another core to autism. These are patterns of behavior, interests, and activities. This can be marked in a “preoccupation with one or more” of these patterns where abnormality extends from an odd intensity or focus (APA, 2000, p. 71). An inflexible observance to a specific, impractical routine or ritual may be observed, in addition to “repetitive motor mannerisms” (APA, 2000, p. 71). Lastly, a “persistent fixation with parts of objects” is an example of these patterns (APA, 2000). At least one of these patterns must be distinguished in order for a child to be considered autistic in behavior. Therefore, a total of six or more of the criteria, along with the respective requirements described above, must be present for a child to be correctly diagnosed as autistic (APA, 2000). These abnormalities must onset before the age of 3

years and must not be better accounted by another Autism Spectrum Disorder, such as Rett's Disorder or Childhood Disintegrative Disorder (APA, 2000).

There are many well known associated features and disorders with autism. Mental retardation, ranging from mild to profound, is prevalent in most cases (APA, 2000). Hyperactivity, short attention span, impulsivity, aggressiveness, self-injurious behavior, and temper tantrums are behavioral symptoms that may accompany autism (APA, 2000). Additionally, EEG abnormalities are common and seizures may develop in up to 25% of cases (APA, 2000). By definition, the onset of autism must be prior to 3 years of age, however it is hard to identify in children under 2 years old. Although mild and subtle, most signs of the disorder are present during infancy and will continuously develop throughout growth. Autism is four to five times more prevalent in males than females, but females with the disorder are more likely to exhibit severe mental retardation (APA, 2000). "The median rate of Autistic Disorder in epidemiological studies is 5 cases per 10,000 individuals, with reported ranges ranging from 2 to 20 cases per 10,000 individuals" (APA, 2000, p. 73). The most recent statistic shows up to 1 in 150 children may be diagnosed with autism (CDC, 2006). Since the direct cause of autism is debatable, the reason for the recent increase is currently unknown.

#### Methods of Applied Behavior Analysis (ABA)

Applied Behavior Analysis (ABA) is a widely recognized treatment based upon more than 50 years of scientific research (Green et al., 2005; as cited in Maurice, Green, and Luce, 1996). ABA has fundamental components, yet the program is specific and tailored to each case of autism (Maurice, Green, & Luce, 1996). First, a Board Certified

Behavior Analyst (B.C.B.A.) should direct the therapy, but a Board Certified Associate Behavior Analyst (B.C.A.B.A) can conduct therapy sessions (Green et al., 2005; Simpson, 2005). An initial assessment is conducted in order to aid in the selection of outcomes (Green et al., 2005). These goals become the focus of the therapy, which are implemented in small steps with continual building until the skill is learned (Green et al., 2005; Sicile-Kira, 2004). Often the progress is tracked, best by means of objective measurement, one example being an Intelligence Quotient (IQ) Test.

Reinforcement becomes key in ABA (Green et al., 2005). Reinforcement increases response rate, while the modifiers positive and negative describe the operation of the stimulus. Positive reinforcement is defined as an increase in occurrence of behavior, which is the result of the presentation of a stimulus, and aids in repetition of the behavior (Cooper, Heron, & Heward, 1987). Therefore the stimulus becomes conditioned because a child would associate the stimulus with performing a specified behavior (Cooper et al., 1987). Negative reinforcement, the removal of an aversive stimulus, which leads to an increase in some behavior, is also used in ABA (Cooper et al., 1987). Positive and negative reinforcement are used simultaneously (Green et al., 2005). Punishment is not typically used in Applied Behavior Analysis because therapists believe it is best to focus on the positive, rather than address the negative (Smith and Lovaas, 1998). Punishment is defined as a stimulus that declines behavior (Cooper et al., 1987). By ignoring a negative behavior, it is believed that the behavior will decrease, since the ignoring is seen as the punisher because the attention the child wants is withheld. If the behavior were addressed, then reinforcement would be used to enforce the desired behavior. Lastly, these techniques must be utilized in various settings and situations, and

the parents must be trained thus allowing the techniques to occur outside of therapy sessions (Green et al., 2005).

Applied Behavior Analysis uses the A-B-A design. “A” denotes a baseline period in which the target behavior is observed in its freely occurring state. “B” symbolizes the period introducing an independent variable in order to alter the targeted behavior. And “A” continues observation, but the treatment is removed to see if the child returns to the baseline. This observation is to determine whether a specific behavior is dependent on the independent variable (Cooper et al., 1987). If so, “the experimental variable then is applied again, to see if the behavioral change can be recovered... the experimenter is attempting to show that an analysis is at hand: that whenever he applies a certain variable, the behavior is produced, and whenever he removes this variable, the behavior is lost” (as cited in Cooper, Heron, & Heward, 1987, p. 164). By re-instilling the variable, another “B” phase is added; therefore the therapy becomes an A-B-A-B design. This design strengthens the analysis, and has become more widely used than the A-B-A design (Cooper et al., 1987).

### Early Intervention

According to multiple carefully conducted studies, it is suggested that a disruption in brain development before the thirtieth week of gestation may cause autism. Primary abnormalities occur in the limbic system and cerebellar circuits (Niemann, 1996). The limbic system’s structure controls emotion, memory, learning, and motivation. It influences memory formation by incorporating emotional states with stored memories of physical sensations (Niemann, 1996). In an autistic child, there is a lack of Purkinje cells,

neurons located in the cerebellar cortex, that are responsible for the input and output of information and that also communicate with various part of the brain. These abnormal systems of the brain are associated with autism (Niemann, 1996).

Children learn through two types of memory systems, the “habit, rote, or procedural” memory and the “representational or associative” memory (Niemann, 1996). The “habit, rote, or procedural” memory develops in the first few months of life, and assists in skill learning. Skill “is acquired by repeated presentation of the same stimulus until the task is correctly stored and accessed in memory and thereby learned” (Niemann, 1996). The striatum and neocortex control this kind of memory, and in autistic children without the diagnosis of mental retardation these would be anatomically intact and would have normalcy (Niemann, 1996). The “representational” system coordinates sensory, particularly the processing of experience and events, generalization, and high-order cognition and learning (Niemann, 1996). It is dependent upon the limbic system, which is abnormal in association with autism. Disruption of the “representational” system would result in disorganized cognition, sensory problems, inappropriate social interaction, and abnormal development of language (Niemann, 1996).

Due to these neurological findings, it can be said that normal functioning can best be obtained if early intervention occurs. It would allow an autistic child to fully develop rote-learning capabilities, and then extend to associative learning. The ability to transfer skills from the rote to the associative stage is dependent upon the relationship of brain maturation and stimulation (Niemann, 1996). Therefore, early intervention is crucial so that this interaction is developed. Additionally, lasting changes may take years because neuronal networks develop and mature slowly over time. Early, intensive therapy cases

conducted over several years have reported varying levels of recovery from autistic behaviors (Niemann, 1996). Hence, early intervention aids in the initial acquirement of rote skills, which in time progressed to higher-order associative skills, and eventually to adaptive behaviors necessary for independent functioning (Niemann, 1996). Since these skills are more adaptive at a young age, early intervention is necessary to develop the neural connections to conduct these skills.

Based on this research, two subclasses of autism have been described. Type 1 describes distinct neurological complications and the presence of mental retardation. This subclass accounts for 60 to 70% of the autistic population (Niemann, 1996). An earlier disruption of brain development likely occurred in the womb, which describes the diagnosis of mental retardation (MR). These children would have difficulty with tasks that involve the rote memory. Therefore, they typically have no high-order cognition and struggle to process experiences, since these actions are coordinated by the “representational memory” (Niemann, 1996). Early intervention would first need to address the development of “rote” memory, and therefore the focus would not extend far beyond the basics because of MR, so early intervention may not result in full recovery (Niemann, 1996). Type 2 describes an anatomically intact central nervous system, and hence no mental retardation is present. This subclass encompasses approximately 30 to 40% of the autistic population (Niemann, 1996). These children would have intact cortices, and consequently intact rote memory systems. However, delays of language and social skills would indicate a disturbance in the limbic system and cerebellum, affecting the “representational” memory (Niemann, 1996). Since the rote system is already developed, therapy could activate the limbic system and cerebellar circuit, and allow the

“representational” system to be utilized (Niemann, 1996). Early intervention, in general, can be profitable for an autistic child, but Type 2 autistics have a better chance of recovery. According to the data presented above, it can be argued that early intervention aids in better functioning of the representational memory. Therefore, autism should be reversible, at least in 40 to 50% of cases in which early intervention is implemented (Niemann, 1996).

Craig and Sharon Landesman Ramey stated that there are six principles to early intervention. Although they were not speaking specifically of early intervention in combination with Applied Behavior Analysis, these six principles can be applied to ABA. The first is developmental timing. Interventions that begin earlier and continue for a long period of time yield the best results (Ramey and Landesman, 1998). The optimal age to begin intensive behavioral intervention is prior to age five, but best results came from children who started between the ages of two and three (Maurice et al., 1996). Best outcomes have also been reported from intervention that occurred for at least two consecutive years (Maurice et al., 1996). The second principle is intensity. Intensity is measured by the amount of time intervention is conducted, and a more intense program results in larger positive effects and greater developmental progress (Ramey and Landesman, 1998). At least 30 hours per week of active intervention is recommended (Maurice et al., 1996). The third principle is based on the direct application of learning experiences. The intervention should focus on providing direct educational experiences, in essence a high quality program, because it has been found that these have more lasting effects (Ramey and Landesman, 1998). The fourth principle deals with the flexibility of the program. A varying intervention in settings additional to the home and the use of

multiple routes allow for a well-rounded therapeutic program (Ramey and Landesman, 1998; Maurice, Green, & Luce, 1996). An individualized program is key to ABA, and this is the fifth principle of intervention. It allows for each child's specific problems to be addressed (Ramey and Landesman, 1998; Maurice, Green, & Luce, 1996). The last principle states "Over time, the initial positive effects of early interventions will diminish to the extent that there are not adequate environmental supports to maintain children's positive attitudes and behavior and to encourage continued learning related to school" (Ramey and Landesman, 1998, p. 117).

#### Case Studies: The UCLA Young Autism Project and The Maurice Children

"Early intervention based on the principles and practices of Applied Behavior Analysis can produce large, comprehensive, lasting, and meaningful improvements in many important domains for a large proportion of children with autism" (Maurice et al., 1996, p. 38). An autistic child can achieve complete normalcy in intellect, social, academic, communicative, and adaptive functioning if ABA is successful. According to many professionals, only a small proportion, approximately 10%, has had little to no improvement from intense therapy (as cited in Maurice, Green, & Luce, 1996). A majority made some improvement in Intelligence Quotient (IQ) scores during the 1-6 years of behavioral treatment, and almost half made large gains. Large gains were typically from levels of moderate to severe mental retardation to a normal range. However, a small percentage had little to no change in IQ level, which was consistent in many studies (as cited in Maurice, Green, & Luce, 1996). Additionally, large improvements in language, social skills, play, self-help, and problematic behavior occurred in some, but not all cases. These children became indistinguishable from non-

autistic children in all dimensions (as cited in Maurice, Green, & Luce, 1996). Successful integration into regular classrooms is often attainable after two years of intensive behavioral therapy that began at a young age (Maurice et al., 1996). These statements can be reinforced by case studies, and Applied Behavior Analysis will be referred to most often as intensive behavioral therapy.

Ivar Lovaas has been a pioneer in Applied Behavior Analysis. He and his colleagues conducted behavioral intervention research at the University of California-Los Angeles (UCLA). The first report dates to 1987, and has critical data to reinforce the ideas behind ABA (Maurice et al., 1996). Nineteen autistic children were involved in the study, each receiving 40 hours per week of one-on-one behavioral treatment from qualified therapists. All treatment started prior to age four, and they participated in the program for at least two years (Maurice et al., 1996). The focus of the treatment was to increase “language, attending, imitation, social behavior, appropriate independent play, cooperative peer play, and self-care skills, as well as decrease aggressive, stereotypic, and ritualistic behavior and tantrums” (Maurice et al., 1996). Two control groups were also a component of the study, one group of children receiving less than ten hours per week of behavioral treatment and the other receiving treatment outside of the UCLA project. All children participating in the research were diagnosed autistic independently of the study (Maurice et al., 1996). After two years, the children who gained enough skills to function in a regular classroom began to attend kindergarten and received only ten hours of intensive behavioral therapy each week. During first grade, they received minimal guidance from trained therapists. Those children that did not have the skills to enroll in school continued to receive 40 hours per week (Maurice et al., 1996). The children were

reevaluated around the age of six or seven by examiners unrelated to the study. Of the 19 children, nine (47%) completed regular first grade and achieved a range of IQ of 94 to 120, which are average to above average, since average is 100. There was an average gain of 37 points compared to the initial evaluation (Maurice et al., 1996). Eight children (42%) completed first grade in classes specified for language delay or learning disabilities, and obtained IQ levels that classified them as having mild mental retardation (Maurice et al., 1996). The other two children (11%) were placed in classes for autistic and mentally retarded children and had IQ scores characterizing them as profoundly mentally retarded (Maurice et al., 1996). In comparison, only one child from both control groups successfully integrated into a regular classroom and achieved an average IQ. Of the control group, 45% were in classes with other language-delay and learning-disabled children, and 53% were placed in classrooms for autistic/mentally retarded children. However these children had no change in IQ (Maurice et al., 1996).

The nine children that completed regular first grade participated in a long-term follow-up study. Eight of the nine continued to succeed in a regular classroom and another child moved up to a regular classroom, therefore 47% of the former experimental group obtained normal functioning (Maurice et al., 1996). Additionally, IQ scores remained an average of 30 points higher than those of the control group (Maurice et al., 1996). Most importantly, blind examiners could not determine former autistic children from average developing children (Maurice et al., 1996). Only those that participated in intensive behavioral therapy for 40 hours a week and 50 weeks per year for at least two years achieved normal functioning (Maurice et al., 1996).

These results of the 19 children receiving treatment were obtained through a specialized, controlled therapy. Forty hours of therapy, during a two to three year program, was the direct origin of success (Smith and Lovaas, 1998). During sessions, reinforcement and prompting were key. Reinforcers, such as food, play, and verbal praise, were used for the intent of increasing good behavior (Smith and Lovaas, 1998). As intervention continued, these reinforcers were replaced by more natural reinforcers (Smith and Lovaas, 1998). The intervention is structured so “that positive behaviors are maximized through prompting and positive reinforcement. High rates of aggressive or self-stimulatory behaviors reduced by being ignored and by shaping alternative, more socially acceptable forms of behavior” (Smith and Lovaas, 1998, p. 70). The aim of the therapy was successful integration into preschool by eventually generalizing training procedures to be applicable to everyday environments (Smith and Lovaas, 1998).

The first year of treatment was focused on nonverbal and verbal imitation, necessary receptive language skills, and appropriate toy play (Smith and Lovaas, 1998). After these tasks were mastered, the second stage of intervention began, with a concentration on expressive language, interactive play, and an introduction to preschool activities in a home atmosphere (Smith and Lovaas, 1998). Again, once accomplished, the child attended school for a 30 minute interval, and eventually reached a full session (Smith and Lovaas, 1998).

The Maurice children are another prime example of effective early intensive behavioral intervention. These two siblings were diagnosed autistic individually from one another by the age of two. Each child received one-on-one formal sessions conducted 10 to 35 hours per week, but the parents continued instruction outside of the sessions

(Maurice et al., 1996). Treatment occurred for approximately two years, and each child made rapid improvement. At 53 months, the girl, and at 39 months, the boy, no longer met the criteria for the diagnosis of autistic, and so treatment was ceased (Maurice et al., 1996). Independent professionals had determined that both children fully recovered from autism. This case study is critical because it possesses a high level of credibility (Maurice et al., 1996). In comparison, the goal of the Maurice children was to give them skills to help cope with their autism, where as the goal of the UCLA project was to see the effect of intervention. Additionally, the Maurice children received highly individualized programs since the focus was on each individual, where as the focus of the UCLA Project was more on the group, although intervention was still successful. These two case studies come to show that although Applied Behavior Analysis has particular methods, the program itself can vary, thus leading to various results.

#### Debatable Issues with ABA

Recovery from autism is debatable because it implies normalcy. Most professionals believe that autism is a lifelong disorder, but claims have been made that it is possible to overcome autism and achieve normal functioning. This claim has been supported by data such as that coming from The UCLA Young Autism Project and the Maurice children (Cohen, 2002). Normal functioning is defined by Lovaas as having at least an average IQ, being integrated into regular school, and being promoted to the next grade repeatedly (qtd. in Cohen, 2002). However, it is possible to have these characteristics, but still have residual deficits that will possibly become obvious later in life (Cohen, 2002). In addition, recovery does not claim to eliminate neurological factors

that may give way to autism, but it is plausible that early intervention may cause alterations in the neurological systems (Cohen, 2002). Recovery may be conceivable in some cases, but these are exceptional circumstances. Nevertheless, Applied Behavior Analysis can never be referred to as a cure (Cohen, 2002).

Applied Behavior Analysis is a highly regarded treatment, however some flaws exist. ABA is extremely expensive, costing anywhere from \$16,000 to \$50,000 per year (Simpson et al., 2005). The actual cost is dependent upon circumstances, such as number of hours, location of instruction, and the qualification of each therapist (Simpson et al., 2005). This high financial cost may be a burden for parents, and in some cases may be a deciding factor not to participate in the ABA program. Another issue is focused on the methodology of determining improvement. Although ABA is considered credible because it is data driven, the actual tests have slight flaws (Simpson et al., 2005). IQ tests are not always objective because results can depend on a person's ability to take tests. Also, a person may be incorrectly considered mentally retarded according to IQ. Lastly, there are many common myths about ABA, but none of great concern. It is beneficial to recognize the weakness of ABA, however the positives of the therapy heavily outweigh the negatives.

### Conclusion

The DSM-IV characterizes autism as a disorder in which behavioral, social, and linguistic delays existed comprehensively. The most renowned feature in association with autism is mental retardation (APA, 2000). By definition, the onset of autism must be prior to 3 years of age, however it is difficult to identify under 2 years old (APA, 2000).

Since most signs of autism are present during infancy and will develop with growth, early detection of the disorder can occur, thus allowing treatment to begin.

Applied Behavior Analysis (ABA) is extremely successful, a result of highly personalized programs conducted by specialists (Maurice et al., 1996). Reinforcement is prominently used in order to achieve an acceptable behavior (Cooper et al., 1987; Green, Taylor, Luce, & Krantz, 2005). Applied Behavior Analysis instills the A-B-A-B design, to show that a specified independent variable precisely affects a specific behavior (Cooper et al., 1987).

Early intervention is important in successful intervention. From current studies, it is believed autism is related to abnormal brain development prior to the thirtieth gestation week (Niemann, 1996). With the identification of the problematic brain sections, two subclasses of autism were recognized, and the effects of early intervention could be explained (Niemann, 1996). The optimal age to begin intensive behavioral intervention is prior to age five, but best results came from children started between the ages of two and three (Maurice et al., 1996). Best outcomes have also been reported from intervention that occurs for at least two consecutive years (Maurice et al., 1996). Additionally, at least 30 hours per week of intensive behavioral intervention is necessary to achieve recovery (Maurice et al., 1996). Both Lovaas' 1987 research project and the Maurice children showed that with these conditions, recovery is possible, although not in all cases. Therefore, when Applied Behavior Analysis is in unison with early intervention, there is typically a decrease in the severity of autistic characteristics. In extremely successful cases, a diagnosis can be removed because full recovery has been achieved. In approximately 90% of cases, intensive behavioral therapy has some positive impact on

the child and there is a reduction in at least one of the autistic characteristics (Maurice et al., 1996). While Type 2 autistics have a better chance of recovery than Type 1 autistics, in 40 to 50% of cases applying intervention, autism was reversible (Niemann, 1996).

Applied Behavior Analysis appears to be a therapy that works well with the diagnosis of autism. Awareness of case studies, along with personal success stories, can give hope to parents and doctors. Although ABA should never be viewed as a cure, it can help to alleviate characteristics of autism. Therapists and parents must be dedicated to the case at hand, and if so, some improvement can be made. ABA is a recommendable therapy because of the chance of recovery, which is every parent's dream.

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