Individualized Levels Treatment Packages for Severe Problem Behaviors in Persons With Developmental Disabilities.

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INDIVIDUALIZED LEVELS TREATMENT PACKAGES
FOR SEVERE PROBLEM BEHAVIORS IN PERSONS
WITH DEVELOPMENTAL DISABILITIES

A Dissertation

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in

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Abstract

Levels treatment packages are widely used across many populations and settings. Most packages involve standardized procedures implemented across multiple participants. The current investigation examined the treatment efficacy of individualized levels treatment packages based on the results of functional analyses and systematic preference assessments. Three individuals with developmental disabilities participated in the study. Destructive behaviors for each participant were maintained by positive reinforcement. For one participant, destructive behaviors were maintained by negative reinforcement as well. The levels treatment packages consisted of two or three levels in which the density of attention and access to preferred materials were altered based on the occurrence of destructive behaviors. For all three participants, the functional analysis based levels treatment packages were effective in decreasing destructive behaviors. A component analysis was conducted with one participant to determine the relative contributions of the reinforcement and time-out components. The results suggest that all components of the levels treatment package were necessary for it to be effective.
Introduction

Severe problem behaviors including aggression, self-injurious behavior (SIB), and disruption, are commonly displayed by persons with developmental disabilities. These behaviors significantly interfere with the individual's daily functioning, interfere with the daily functioning of others, cause injury to themselves or others, or cause damage to their environment. Researchers have reported that almost half of institutionalized developmentally disabled individuals exhibited severe problem behaviors within clinically significant levels (Eyman & Call, 1977).

The presence of severe problem behaviors has numerous negative implications for the individual exhibiting the behaviors and those charged with the individual's care. Primarily, severe behaviors displayed by persons with developmental disabilities may result in physical trauma to the individual or persons in close proximity. For example, bruising, sprains, and tissue damage are common results of severe problem behaviors, while extreme examples include permanent injury or death (Griffin, Williams, Stark, Altmeyer, & Mason, 1984; Meador & Osborn, 1992).

Severe problem behaviors also interfere with the person's ability to interact effectively with their environment. For example, when an individual engages in severe behavior they often do not attend to appropriate activities that are taking place concurrently. Within the social environment, the individual's opportunities to interact with others are limited due to risk for violent behavior or fearful reactions from persons in the community.
Finally, severe problem behaviors often lead to more restrictive living, learning, and treatment environments (Hill and Bruininks, 1984; Sherman, 1988). Consequently, severe problem behaviors can have costly effects on care providers. Specifically, severe problem behaviors result in increased staff needs, increased reliance on specialized treatments, and application of specialized equipment (Meador & Osborn, 1992). Given the numerous negative implications of severe problem behaviors in persons with developmental disabilities, attempts to find effective interventions have been at the forefront of research in the field of developmental disabilities. A review of the literature pertaining to severe behavior problems displayed by persons with developmental disabilities as well as a historical perspective of behavioral interventions used to modify these behaviors will be presented next.
Behavior Problems and Developmental Disabilities

Aggression. Aggression is defined as verbal and/or physical responses emitted to harm another individual. Verbal manifestations of aggression include, but are not limited to, threats, cursing, and name-calling. Physical manifestations of aggression often include hitting, kicking, biting, pinching, and hair pulling. Recent estimates indicate that aggressive behaviors occur in 11-31% of persons with developmental disabilities (Schroeder, 1989). Within the analysis of aggressive behavior and developmental disabilities, several studies have been conducted to examine the relationship between aggressive behavior and the individual’s living environment. Sigafoos, Elkins, Kerr, and Attwood (1994) reviewed the prevalence of aggression in persons with developmental disabilities, living in institutions, group homes, and personal residences. The highest percentage of aggressive behavior was found in persons living in institutions (35%), followed by persons living in group homes (17%) and finally, persons living in their personal residence (3%). A study conducted in England also examined the relationship between aggression and developmentally disabled individuals, citing similar results to those found by Sigafoos and colleagues. The highest rate of aggressive behavior was found in persons living in institutional settings (38.2%), followed by persons living in the community and attending school (12.6), and day programs (9.7%) (Harris, 1993). Eyman and Call (1977) reported higher rates of aggressive behavior in community settings than documented in similar studies with 45% of the institutionalized
population, 20% in persons in community facilities and 20% of those living at home exhibiting aggression (Marcus, 1997; Sigaffoos, 1995).

The high rate of aggression reported in the literature is not surprising given that aggression is the primary reason for referral for treatment and institutional placement of persons with developmental disabilities (Meador & Osborn, 1992; Schroeder, 1987). Aggression is also the number one reason for persons with developmental disabilities to receive psychotropic medications (Mulick, Hammer, & Dura, 1991).

Not only do such behaviors lead to more restrictive educational placements, residential placements and treatments (i.e. punishment and medications) they also lead to an increased likelihood of abuse. Researchers suggest that while aggression places both the individual and the caretakers at risk for injury from the behavior, aggressive acts also place the individual at risk for physical and emotional abuse from institutional staff members and/or parents (Rusch, Hall, and Griffin, 1986). For example, aggressive acts often lead to overuse of mechanical restraints, longer periods of isolation, increased verbal abuse and occasionally physical abuse towards the client by staff (Jaudes & Diamond, 1985). These behaviors can be very serious. A second category of problem behaviors equally as problematic are self-injurious behaviors.

Self-injurious behavior. Although there is no single definition of SIB, Johnson and Day (1992) incorporate the major characteristics found in most definitions positing “SIB as behavior directed toward oneself; expected to cause pain
and/or eventual tissue damage; and, should be chronic or persistent in that it occurs repetitiously at some time” (Johnson and Day, 1992). One criticism of this definition is that it captures behaviors typically unrelated to the developmentally disabled population (e.g. suicide attempts and substance abuse). Hence, researchers often use a more restricted definition such as the one provided by Schroeder, Rojahn, Mulick, and Schroeder (1990) defining SIB as “overt acts directed toward oneself that have restricted spatial and temporal topographies, whose rate of occurrence is reliably observable, and whose consequences are actual or threatened physical damage”.

While SIB remains a difficult concept to define, researchers estimate that 8-17% of individuals with developmental disabilities engage in SIB, with higher percentages in lower functioning, institutionalized individuals (Baumeister & Rollings, 1976; Griffin, Williams, Stark, Altmeyer, & Mason, 1984; Maurice & Trudel, 1982; Schroeder, Rojahn, & Oldenquist, 1989).

Not unlike individuals who engage in aggressive behavior, individuals who engage in SIB are less likely to engage in activities that foster learning or socialization. In addition, individuals whom engage in SIB have a greater likelihood that interventions will be in place which restrict their movement or independent functioning (Maurice & Trudel, 1982; Meador & Osborn, 1992).

**Disruption.** Disruptive behaviors are a separate set of maladaptive behaviors commonly exhibited by persons with development disabilities (Meador & Osborn, 1992). Disruptive behaviors include physical violence towards property, tantrums (not directed at another individual), loud vocalizations, excessive or inappropriate
verbalizations, and out of seat behavior (Forehand & Baumeister, 1976). These behaviors significantly interfere with the individual’s ability to optimally interact with his or her environment. In addition, disruptive behaviors are a main reason for community placement failures and reinstitutionalization (Lakin, Hill, Hauber, Bruininks, & Heal, 1983). Thus, in order for persons to successfully function in community settings, disruptive behaviors need to be minimized.

The adverse effects associated with severe problem behaviors emphasize the need for effective interventions. Thus, finding effective interventions for developmentally disabled individuals who exhibit aggression is necessary to ensure the safety of both the individual and those working with him or her. To date, behavioral interventions have been the most effective treatment in reducing inappropriate behaviors and teaching appropriate responses in persons with developmental disabilities (Matson, 1990; Whitman, Scibak, & Reid, 1983).

**Historical Perspectives on Behavioral Assessment**

**Pavlov.** In the early 1900's Pavlov, Thorndike, and Watson conducted basic research on behavior that provided the foundation of behaviorism. Pavlov’s research on classical conditioning suggested one way in which an organism learns (Kazdin, 1994). Pavlov’s precise methods of investigation (e.g. focusing on observation and quantification of behavior) significantly contributed to the scientific study of behavior (Kazdin, 1994).

**Thorndike.** Thorndike extended the emerging field of behaviorism by focusing on instrumental learning. Instrumental learning consists of providing
reinforcement contingent upon an instrumental response. The response is considered instrumental in that it leads to a sought after effect (Gleitman, 1986). Instrumental learning is the basic premise for one of Thorndike's most noteworthy contributions: the law of effect. Thorndike's law of effect states that consequences of a response affect the future occurrence of that response. If the response is reinforced, it is strengthened; if a response is followed by punishment, or a lack of reinforcement, it is weakened.

Watson. John Watson also focused on the organism's response to its environment. Watson stated that psychology's goal was not to study the mind (the dominant approach of the time), rather it was "to be able, given the stimulus, to predict the response" (Watson, 1925). His theoretical assertions such as "all behavior is controlled by environmental events" and "give me any child, regardless of background, and I will turn him into a doctor, lawyer, engineer..." (Watson, 1925) led American psychology to place greater emphasis on the study of observable behavior. In fact, Watson is considered to be the founder of behaviorism and it is his work that ultimately led to the work of perhaps the most significant figure in the field of behavioral psychology, B.F. Skinner (Miltenberger, 1997).

Skinner. More recently, Skinner focused on operant behavior. He believed that behavior was voluntarily emitted by the individual and that it was strengthened and weakened by its consequences. Skinner's research on operant conditioning led to considerable gains in the field of behaviorism. With his basic animal research, he challenged the paradigms of traditional experimental psychology, bringing to the
field a new approach: the experimental analysis of behavior (EAB). Whereas contemporary psychologists believed that behavior was a reflection of an underlying condition, Skinner focused on observable behaviors rather than attempt to explain what was going on inside the person. Specifically, his studies examined the behavior of a few subjects using controlled manipulations and repeated observations. Contemporary psychology of the time examined the behavior of multiple subjects with restricted opportunities to observe organism-environment interactions. In addition, Skinner recognized the limitation of statistical analyses as practiced with large "n" designs. He therefore, developed a method for analyzing results of small sample, within-subjects designs, and employed the use of rate measures coupled with visual analysis of data. Other contributions include Skinner's early animal research, which provided the foundation for his applied work. It is this initial applied work that is considered to be the foundation of behavior modification (Miltenberger, 1997).

Over the next 30 years, Skinner and other researchers examined the influence of various environmental manipulations on human behavior, thus giving rise to the field of applied behavior analysis. Specifically, researchers examined basic techniques that could be used to decrease maladaptive behaviors and increase adaptive ones. Techniques such as the presentation and removal of reinforcement and the delivery of punishment that were originally applied to animal subjects were attempted with humans. The populations most commonly studied include persons with psychiatric diagnoses, children with behavior disorders, and individuals with developmental disabilities.

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Given the significant behavioral excesses and deficits in persons with developmental disabilities, more behavioral research has been conducted with this population than perhaps any other (Miltenberger, 1997).

**Treatment of Severe Behavior Problems**

The treatment of severe behavior problems in persons with developmental disabilities can be organized into four trends within the history of behavioral interventions: arbitrarily prescribed treatments, treatments based on behavior topography, the least restrictive treatments model, and treatments based on behavior function.

**Arbitrarily prescribed treatments**

In early treatment efficacy studies, treatments that had originally been conducted exclusively in animal laboratories were now being conducted on humans. Initial treatment efficacy studies looked to answer the basic question, "is this an effective intervention?" Thus, various interventions (e.g. time-out, differential reinforcement, token economies, and punishment) were applied to human subjects presenting a variety of problem behaviors (e.g. aggression, disruption, and self-injurious behaviors) with no clear rationale as to why certain procedures were chosen over others. For example, Sachs (1973) examined the efficacy of time-out procedures for a variety of behavior problems. The purpose of this study was to determine behavior problems most effectively treated with time-out. Based on these results, the author concluded that time-out was effective in reducing self-stimulatory behaviors, noncompliance, disruption, and aggression. Bostow and Bailey (1969)
applied both time out and differential reinforcement to the verbal aggression of a 58 year old developmentally disabled female and the physical aggression and disruption of a seven year old institutionalized boy. Every time a target response was emitted, the individual was placed in a two-minute time-out. In addition, DRO schedules were in place in which the individual earned access to reinforcers for not engaging in the behavior for a predetermined amount of time. This treatment was analyzed in an ABAB reversal design and found effective in decreasing verbal and physical aggression and disruption.

As with most studies of these times, neither paper included a discussion of the rational behind why a specific intervention was chosen, nor an explanation of why the intervention was successful in reducing problematic behaviors. Interestingly, even those studies that failed to replicate earlier findings gave limited explanations regarding this issue. When a treatment did not produce the desired effect, it was assumed to be ineffective thus warranting no further analysis.

Rationales for treatment failure. Kazdin (1973) recognized the importance of examining treatment failures and discussed several possible explanations for unresponsiveness to treatments, specifically token economies, exhibited by many individuals.

One possible explanation for unresponsiveness is the use of insufficient reinforcers in treatment (Kazdin, 1973). Given that reinforcers were frequently chosen arbitrarily, it is probable that the items chosen were not reinforcing. Thus, it
may not be surprising to see a lack of change in behavior when an intervention was not in place.

A second explanation for treatment failure is that the behavior to be reinforced is not in the individual’s repertoire (Kazdin, 1973). For example, if the individual is required to communicate an appropriate request in order to obtain reinforcement but the individual has not learned how to communicate such a request, than that individual will not come into contact with the reinforcement contingency.

The manner in which reinforcement is delivered can also contribute to treatment efficacy (Kazdin, 1973). For example, if reinforcement is not delivered immediately following the desired response, the individual may not learn that the reinforcement is a consequence of that behavior. In addition, if there is a delay in reinforcement, another behavior may accidentally be reinforced.

While Kazdin provided some excellent explanations as to why treatments failed, he did not discuss the lack of identifying the variables maintaining the behavior as an additional rationale for lack of treatment efficacy. Thus, the use of arbitrarily prescribed treatments persisted. Perhaps one of the most detrimental effects of the continued use of arbitrarily prescribed treatments was the emerging over reliance on punishment (e.g. Risley, 1968).

**Over reliance on punishment.** Studies examining the effectiveness of punishment procedures generally reported that punishment procedures produced swift and dramatic decreases in problem behaviors (Risley, 1968). Lovaas and colleagues were some of the first advocates for the use of punishment. For example,
Lovaas and Simmons (1969) compared the effectiveness of extinction and punishment procedures in decreasing the SIB of three individuals with developmental disabilities. The authors hypothesized that the problem behaviors were maintained by attention, thus, they first implemented an extinction intervention. Although they found extinction to be effective, the data indicated that the decrease in behaviors occurred slowly following an initial extinction burst. A punishment procedure was then implemented in which every incident of SIB was followed by contingent shock. This produced a rapid reduction in the SIB. Therefore, the authors concluded that punishment was an effective and preferred treatment for decreasing SIB. This study was one of the first studies to examine a hypothesis driven intervention. Unfortunately, the potency of punishment overshadowed the significance of function-based hypothesis development.

Given the consistent effects observed with the use of punishment procedures, punishment treatments for less intensive behaviors increased. In fact, many studies describe the use of spanking, water mist, and contingent shock with milder behaviors such as non-injurious stereotypies and disruption (Forehand & Baumeister, 1976; Risley, 1968). For example, Risley (1968) described the use of contingent shock with dangerous climbing behaviors in a six-year-old autistic girl. The experimenter originally hypothesized that the behavior was maintained by parental attention thus implemented time-out from attention contingent upon climbing and, DRO, in which the child gained access to attention for not climbing. However, when the use of time-out with DRO did not reduce the child’s climbing, contingent shock was
implemented. Following the demonstration of the effectiveness of shock in decreasing climbing behaviors, the experimenters examined the effect shock had in decreasing other problem behaviors including aggression and stereotypies. For each behavior, Risley demonstrated that the use of punishment procedures quickly decreased the maladaptive behaviors to near zero rates. While many continued to use punishment as the treatment of choice for various mild and severe problem behaviors, other researchers attempted to identify effective treatments based on behavior topographies.

**Treatments based on behavior class and topography**

Prescribing treatments based on a specific behavior class such as aggression, self-injury, and tantrums was another trend found in the treatment of severe behavior problems in persons with developmental disabilities. A review written by Forehand and Baumeister (1976) provides an excellent summary of how treatments were matched to behavior based on topography. Forehand and Baumeister's (1976) review of treatments for antisocial behaviors (e.g. "acts which are harmful to others or otherwise have an adverse effect upon the environment") provided examples of studies that examine the effectiveness of differential reinforcement of alternative behavior, removal of contingencies and punishment. The authors discuss how neither differential reinforcement nor removal of contingencies was universally successful. In other words, there were many studies that did not identify these treatments as effective in decreasing antisocial behaviors (Martin, McDonald, & Omichinski, 1971; Risley, 1968). In addition, other studies reviewed demonstrated
that an initial decrease in maladaptive behaviors could be achieved, but when the investigators attempted to fade treatment components, an immediate increase in maladaptive behaviors was observed (Johnson & Baumeister, 1981).

This failure to demonstrate treatment efficacy could be explained by the fact that conditions maintaining aberrant behavior were, for the most part, ignored. (Mace, 1994). Rather than identifying potential maintaining environmental variables, researchers attempted to modify behavior by “superimposing reinforcement and/or punishment contingencies onto environmental contingencies or unknown processes that maintained aberrant behavior” (Mace, 1994). Some would question whether or not an intervention, applied in the absence of determining behavior function, constitutes a treatment at all (Carr, Robinson, & Palumbo, 1991). However, such debates did not appear at the time. Rather, the reliance on default technologies continued with punishment rising as the treatment of choice (Mace, 1994).

**Least restrictive treatment model**

The increasing over reliance on punishment procedures led to the development of the least restrictive treatment model in an attempt to protect the civil rights of persons with developmental disabilities (Foxx, 1982). The least restrictive treatment model dictated that techniques be ranked from least to most intrusive or aversive, and that the least restrictive treatments be attempted prior to more aversive interventions. Thus, as minimally restrictive treatments failed, one could move to a more restrictive intervention.
Foxx (1982) provides one example of a treatment hierarchy listing the following interventions from least to most restrictive as a guideline for clinicians:

Least restrictive interventions may include reinforcement-based interventions such as DRO, DRA, DRI and NCR. Moderately restrictive interventions may include negative practice, extinction, and nonexclusionary time-out. Most restrictive interventions may include negative practice with manual guidance, physical restraint, exclusionary time-out, and overcorrection. Others include medication and other types of therapies in their definition of restrictive interventions and describe the placement of various behavioral interventions in a manner different from above (Matson & Taras, 1989).

Having conflicting ideas regarding the restrictiveness and aversiveness of procedures makes it difficult to follow this model. Even if an agreed upon definition were identified, an arbitrarily prescribed treatment would again be recommended in the absence of understanding the cause of the behavior. To resolve this dilemma, when identifying the least restrictive treatment, the function of behavior should also be considered. Specifically, the goal should be to implement the least restrictive/aversive intervention that is likely to be effective based on the function of the problem behavior (Iwata et al., 1990). For example, when recommending the use of extinction, if one looked at aversiveness alone, escape extinction would probably be considered more aversive than attention extinction. However, it would be counter-therapeutic to use attention-extinction with a person whose behavior is maintained by negative reinforcement (Iwata et al., 1990).
The development of a hypothesis driven methodology

As early as the 1960's, some researchers described the importance of identifying the function of maladaptive behaviors to develop an appropriate treatment. For example, Lovaas, Freitag, Gold, and Kassorla (1965) conducted an assessment examining the hypothesis that the SIB of a nine-year-old schizophrenic girl was maintained by social attention. To test this, Lovaas et al. (1965) assessed three possible conditions: social attention contingent upon SIB, no attention for SIB (ignoring), and a condition in which discrimination stimuli for incompatible behaviors with SIB were present. Outcomes of the analysis indicated an increase in SIB during the attention condition, a stable rate of SIB in the ignore condition, and a decreased rate in the incompatible behaviors condition. The Risley (1968) study previously described also examined an attention hypothesis. Specifically, Risley hypothesized that the problem behaviors were maintained by parental attention. However, when extinction was applied, the observed decrease in maladaptive behaviors was minimal. Rather than further explore possible maintaining variables, the researchers concluded that the behavior may not have been under environmental control.

Other researchers examined the hypothesis that maladaptive behaviors could be maintained by escape. For example, Frankel and Simmons (1976) describe the ineffectiveness of time-out for problem behaviors. They found the use of time-out actually increased problem behavior thus concluding that the behaviors may have been maintained by avoidance or escape contingencies. In a second study, Frankel,
Moss, Schofield, and Simmons (1976) attempted to use time-out to decrease aggressive and self-injurious behaviors that appeared to be maintained by escape or avoidance contingencies. Frankel et al. (1976) found that time-out failed to decrease these behaviors. A differential reinforcement procedure was then implemented resulting in a rapid decrease in the maladaptive behaviors.

Few other hypothesis-driven intervention studies were published during the 1960's and 1970's, but not on a consistent basis. It was not until Carr (1977) wrote an article focusing on the “motivation”, rather than treatment, of SIB that hypothesis driven interventions began to gain recognition.

The motivation of SIB. In summarizing the literature, Carr identified five major hypotheses regarding the motivation of SIB: the positive reinforcement hypothesis which suggested that SIB was maintained by positive social reinforcement; the negative reinforcement hypothesis which suggested that SIB was maintained by termination/avoidance of an aversive stimulus; the self-stimulation hypothesis which suggested that SIB provided sensory stimulation; the organic hypothesis which stated that SIB was due to aberrant physiological processes; and the psychodynamic hypothesis which suggested that the occurrence of SIB was an attempt to establish ego boundaries.

One important development from this paper was the suggestion that SIB is multiply determined and can serve different functions for different individuals. This study prompted others to search for assessment methodologies for identifying maintaining variables of SIB.
Functional analysis. In 1982, an operant methodology useful in identifying the motivational properties of self-injurious behaviors was developed at the Kennedy Institute. Iwata, Dorsey, Slifer, Bauman, and Richman (1982) described a series of analogue conditions developed to assess whether SIB was maintained by positive reinforcement (the social disapproval condition), negative reinforcement (the academic demand condition), or automatic reinforcement (the alone condition).

The social disapproval condition examined whether or not SIB was maintained by positive reinforcement in the form of brief verbal reprimands (e.g. “Don’t do that, you’re going to hurt yourself”). Within this condition, every occurrence of SIB was paired with physical contact and a verbal reprimand.

The academic demand condition examined whether or not SIB was maintained by negative reinforcement in the form of escape from demand situations. In this condition, every occurrence of SIB was paired with a 30-second termination of the academic demand.

The alone condition assessed whether or not SIB served a self-stimulatory function. The child was placed in the room alone, without access to any materials that could potentially serve as external sources of stimulation. There were no programmed consequences for SIB.

The unstructured play condition was developed as a control condition. The condition was designed to replicate an enriched environment in which the child had access to toys and adult attention. During this condition, the child had unlimited...
access to the toys in the room. In addition, the examiner provided physical and social attention every 30 seconds. SIB was ignored.

The variability observed in the occurrence of SIB between and within individuals was not random. Rather, self-injury may be a function of different sources of reinforcement. Theoretically, by identifying the reinforcement variables, one could identify potentially effective interventions (Iwata et al., 1982; Carr, 1977).

**Treatments based on behavior function**

Following the development of a functional analysis methodology a shift in treatment philosophy came about in which treatments were selected based on the identified function of the aberrant behavior (i.e. positive reinforcement, negative reinforcement, or automatic reinforcement). This increase in hypothesis-driven studies led to an increase in consistency within the literature as to which treatments were effective for specific behavior functions. In addition, as ongoing research identified effective reinforcement based interventions, the use of aversive punishment procedures decreased.

Overall, reinforcement based treatments were developed to weaken or absolve the response-reinforcement contingencies in a combination of three ways: by manipulating the establishing operations (Carr, Bailey, Ecott, Lucker, & Weil, 1998; Hagopian, Fisher, & Legacy, 1994; Piazza, Contrucci, Hanley & Fisher, 1997; Roscoe, Iwata, & Han-Leong Goh, 1998); by eliminating the source of reinforcement for behavior problems through the use of extinction (Kuhn, DeLeon, Fisher & Weil, 1999; Richman, Wacker, Asmus, & Casey, 1998; Thompson, Fisher, Piazza, &
Kuhn, 1998); or by providing differential reinforcement (DRO, DRA) (Fisher, Kuhn, & Thompson, 1998; Iwata, Vollmer, & Zarcone, 1990; Vollmer, Roane, Ringdahl, & Marcus, 1999).

Establishing operations. An establishing operation is "any change in the environment which alters the effectiveness of some object or event as reinforcement and simultaneously alters the momentary frequency of the behavior that has been followed by that reinforcement" (Michael, 1982). When developing a treatment for a problem behavior maintained by positive reinforcement, one can alter the establishing operation by providing noncontingent reinforcement or satiation (Carr et al., 1998; Fisher et al., in press; Hagopian, Fisher, & Legacy, 1994; Piazza et al., 1997, Iwata et al., 1990, Allyon & Michael, 1959; Lovaas & Simmons, 1969). For example, Hagopian et al. (1994) compared the effectiveness of dense and lean schedules of NCR in decreasing destructive behaviors maintained by social attention of five-year-old quadruplets diagnosed with mental retardation and pervasive developmental disorders. They found that a dense schedule of NCR resulted in immediate and dramatic reductions in destructive behavior. The lean schedule was equally effective only after a systematic fading schedule was implemented.

When a problem behavior is maintained by negative reinforcement, one could alter the establishing operation by reducing the level of aversive stimulation (Iwata et al., 1990). For example, if the aversive stimulus is the number of demands presented, then the number of demands could initially be decreased and eventually faded up to the criterion level.
When a behavior is maintained by automatic reinforcement, one can manipulate the establishing operation using satiation, enriched environments, providing alternative forms of stimulation, and/or noncontingent stimulation (NCR) (Hagopian, et al., 1994; Carr, Bailey, Ecott, Lucker & Weil, 1998; Fisher et al., in press). For example, Thompson et al. (1998) effectively treated chin grinding by providing the individual with an alternative source of chin stimulation.

**Extinction.** Extinction is withholding reinforcement previously delivered in response to the occurrence of a target behavior. When applying extinction to a behavior maintained by positive reinforcement, previously delivered positive reinforcement for the problem behavior is withheld. For example, if a child was previously given attention for tantruming, the tantrum during extinction would be ignored.

Extinction for an escape maintained behavior involves preventing the individual from escaping the demand situation. Thus, the target behavior is ignored and demands are continued to completion.

When behavior is maintained by automatic reinforcement, extinction can be implemented through the attenuation of the response produced stimulation. For example, if head banging is thought to produce reinforcing stimulation, the stimulation could be attenuated by padding the surface that the head contacts or placing a padded helmet on the individual.

**Differential reinforcement.** Differential reinforcement of incompatible behavior (DRI), differential reinforcement of alternative behavior (DRA), differential
reinforcement of the absence of the behavior (DRO), and differential reinforcement of low rates of responding (DRL) are four types of differential reinforcement procedures used to decrease or eliminate inappropriate behavior maintained by positive, negative, and/or automatic reinforcement (Cooper, Heron, & Heward, 1987). One commonly used form of differential reinforcement is functional communication training (FCT). FCT is a procedure in which individuals are taught appropriate communicative responses that result in access to the reinforcer maintaining the aberrant behavior (Carr & Durand, 1985; Hagopian et al., 1998). The effectiveness of this technique with behaviors maintained by positive and negative reinforcement has been widely examined elsewhere (Fisher, Kuhn, & Thompson, 1998; Hagopian et al., 1998). FCT can be a highly effective intervention particularly when used in combination with other interventions such as extinction and/or punishment (Fisher et al., 1998; Hagopian et al., 1998).

Treatment packages are often developed which combine multiple components (Hagopian et al., 1998). This approach can be used in an attempt to strengthen a treatment for a specific behavior or to treat multiply maintained behaviors. Most often such treatment packages are developed systematically. However, some treatment packages are still developed in a more technologically based manner. That is, the treatments are chosen arbitrarily with the goal of managing rather than treating problem behaviors. One example of such a treatment package is the levels system treatment.
Levels Treatments

Levels treatments have been defined as an organizational framework in which various behavioral techniques are implemented in an attempt to shape appropriate behaviors while managing problem behaviors (Bauer et al., 1986). Levels treatments are designed to deliver and withdrawal reinforcement contingent upon the individual’s behavior using techniques such as DRA, response cost, and time-out. For example, a child may earn points or tokens for appropriate behaviors. Once they have reached the defined criteria, they move to a higher level gaining access to more privileges. When the child exhibits an inappropriate behavior, they may lose tokens/points and, consequently, move to a lower level, losing privileges available in higher levels. In addition to accessing a greater variety of reinforcers at higher levels, most levels systems also increase the behavioral expectations at each level with the end goal being self-management. Thus, most programs require the individual to start in the lowest level, earning their way up to higher levels.

Levels treatments have been applied in a variety of settings (e.g. psychiatric hospitals, schools, residential facilities, and institutions) with a variety of populations (psychiatric patients, children with behavior disorders, alcoholics, and individuals with developmental disabilities) (Barbetta, 1990; Bauer, Shea, & Keppler, 1986; Hewett, 1967; Grace, Thompson, & Fisher, 1996; Jones, Downing, Latkowski, Ferre & McMahon, 1992; Klotz, 1987; Mastropieri, Jenne, & Scruggs, 1988; Titus, Savage, Krebs, Aquino, Simonet, & Sachs, 1990).
Most levels systems include a set of criteria for inclusion at each level, as well as for upward and downward mobility within the levels system (Mastropieri et al., 1988). Typically, a list of appropriate and inappropriate behaviors that effect level placement is provided. The list of behaviors is usually developed based on the general rules of the institution and is universal across all participants. In addition, a list of privileges is provided. The privileges, including generic activities such as access to phone calls, TV, using the pencil sharpener, and special outings, are presumed to be universally reinforcing. Likewise, the reductive procedures (e.g. time-out and response cost) are presumed to be universally punishing. Thus, the same treatment is applied to the entire group, with all participants moving up and down within the level system based on the same contingencies. The following is a review of the current literature on levels treatments.

Current research on levels systems

Jones et al., (1992) describe the effectiveness of a token and levels system implemented in an inpatient psychiatric program. The levels treatment had six levels ranging from Level 0 (room time-out) to Level Super 4 (maximum access to reinforcers such as phone calls, off unit privileges, and trips to the cafeteria). The investigators identified the need to individualize treatment placement by offering various levels of treatments, ranging from a token economy with a dense schedule of reinforcement to a levels treatment with variable reinforcement from the natural environment. However, they did not individualize the child’s treatment package. That is, the behaviors that determine level placement (i.e. the absence of hitting,
kicking, smoking, etc.) and the reinforcement available, were the same for all of the participating individuals. Based on the presentation of the results, it is difficult to review individual responsiveness to the intervention. However, the authors report that the treatment was generally effective for most participants, especially for older children.

Levels treatments have also been implemented in the school setting with children with behavior disorders (Barbetta, 1990a; Barbetta, 1990b). Barbetta (1990a) described the use of a group oriented levels system (Group Oriented Adapted Levels System- GOALS) which was designed to teach children new skills while also managing their behavior problems. As with the previously described levels treatment, the expectations were applied to the entire class. The class was divided into groups and each child earned or lost daily points based on the same classroom rules. The children’s individual points were combined to make a group total. Based on the number of points each group earned, they were placed in one of three levels with specific privileges and restrictions present at each level. Although Barbetta suggested that this was an effective intervention, there were no data presented, making it difficult to identify what criteria were used to determine the effectiveness of the program.

In a second study, Barbetta (1990b) described a levels intervention designed for younger students. Barbetta stated that the delay in consequating behavior is a major limitation of current levels systems for use with young behavior disordered students. Specifically, when the child engages in an appropriate or inappropriate
behavior, an entire day or week may go by before the child gains access to or loses reinforcement. Thus, a Red Light-Green Light levels system was developed where a child’s behavior is consequated every 30 minutes. Within the course of one day, a child may move up and down between levels multiple times. Barbetta reports that more immediate consequences for behavior results in more opportunities to learn the behavior-consequence contingencies. Barbetta also reported that this was an effective intervention, however, no data were presented, again making it difficult to draw empirically based conclusions.

Mastropieri, Jenne, and Scruggs (1988) applied a levels system intervention to decrease talking out and out-of-seat behavior, and increase work completion in high school students placed in a resource program. Students earned points for remaining in their seat, not talking out, and for completing work. Students remained in each level for one week. At the end of the week, they could request a level change. The class would vote on each request. If the class made a majority vote in favor of the level change, and the student met an 85% accuracy criterion on assignments, the level change was made. The students wore colored nametags to indicate their current level status. Each level was associated with specific rules and privileges. As students moved to higher levels, there was a greater degree of autonomy (i.e. self monitoring target behaviors) and an increase in privileges (e.g. leaving seat without teacher permission to solicit teacher assistance, reading at their desk, use of pencil sharpener, and use of water fountain during study times and studying independently in an adjacent room). Using a reversal design applied to the
group as a whole, the authors report that the intervention was effective in increasing work completion while decreasing talking out and out-of-seat behavior for the group.

Klotz (1987) also applied a levels system to emotionally disturbed adolescents. The Behavior Management Level System (BMLS) consisted of six levels. At each successive level, the student was required to assume more responsibility for his/her behavior while also accessing a larger variety of reinforcers. Klotz (1987) operationally defined 10 "class rules" which were applied to all students (e.g. on time, on task, appropriate language, homework completion, required materials present). In addition, the author allowed for inappropriate behaviors specific to the individual to be targeted. The author evaluated the effectiveness of the intervention on the group as a whole. The results suggest that the treatment was effective in that 71% of the students progressed to one or more levels during the evaluation. In addition, Klotz examined the relationship between specific student variables (i.e. IQ, sex, developmental level, level of achievement, and length of time in program) and success in the levels program. No significant effects were found. Thus, the author concluded that the BMLS could effectively serve a broad range of students.

Using an approach similar to Klotz (1987), Brennock and colleagues (1989) described the effectiveness of a level system designed to increase successful mainstreaming of BD students. Within a five level program, level five provided the most amount of structure while level one mainstreamed the individual entirely into the
regular classroom. Thus, the goal of the program was more of mainstream readiness than behavior management.

Limitations of levels system interventions

In reviewing the literature on level systems from the past 20 years, the majority of the articles are descriptive in nature with very little research on the efficacy of the levels systems (Smith & Farrell, 1993). Thus, the primary limitation of the levels systems literature is the lack of empirically based studies. In addition, most studies that examined the efficacy of levels systems implemented weak or non-experimental designs. Specifically, most of the studies utilized a small sample, one-group design with pre-post comparisons lacking control groups and randomization (Smith & Farrell, 1993). Thus, the wide use of levels systems in schools and residential settings remains largely untested using experimental research paradigms. Hence, the efficacy of such interventions remains suspect.

A second limitation of the levels system literature is that all of the empirically based studies reported composite results for groups of students. The inherent limitation was the difficulty in assessing individual success within the program. In addition, the researchers only examined whether or not a program was effective, most did not examine which, if any, participant or treatment variables were associated with treatment success or failure. For example, it would have been informative to examine the characteristics of the individuals for whom the levels treatment was unsuccessful in producing behavior change to determine if any variables could predict treatment failure.
Third, the goal of most levels interventions is to manage behavior within the specific environment in which the treatment is implemented. Generalization to other settings is typically not at the forefront of levels program development. Consequently, many components of the intervention do not lend themselves to generalization. For example, many of the reinforcers used would not serve as reinforcers outside of a highly controlled environment (i.e. using a pencil sharpener, phone privileges, taking walks outside of the facility).

Fourth, the majority of the levels systems studies described above do not take into account individual differences of the participants. Titus et al. (1990) identified two major shortcomings of levels systems regarding the group intervention approach. First, the typical levels intervention requires the child to sustain specific behaviors over a period of time in order to receive access to reinforcement. The time period is usually the same for all individuals. Thus, children unable to initially engage in the target behavior for the identified time period never come into contact with reinforcement. Second, the behaviors targeted are the same for all participants, even though the children enter treatment with a broad range of skills and inappropriate behaviors. Thus, many children may not have prerequisite skills needed to succeed in the levels program. The authors concluded that for levels system interventions to be successful (for all participants), there may need to be a separate levels system for each individual.

Scheuermann, Webber, Partin, & Knies (1994) provided an additional concern with group-based-levels-interventions. They propose that such
interventions not only limit chances of individual effectiveness, but may also be in violation with the Individuals with Disabilities Education Act (IDEA). First, given that group based levels programs are designed based on global criteria, they may be in violation of the students’ right to an individualized educational program (IEP). Specifically, based on IDEA, decisions regarding access to general education environments, target behaviors, entry to a levels system and criteria for promotion and demotion within a levels system need to be individualized for each participating student, based on recommendations from the IEP. In addition, many levels programs require the student to start in the most restrictive level and earn their way up to less restrictive levels. The authors report that this may be in violation of the law in two ways. First, the law requires schools to start students in the least restrictive environment and move to more restrictive environments as needed. Second, defining general education (the final goal for many levels programs) as a privilege may violate the students’ rights to an appropriate education. Thus, given the multiple ways in which group-based levels systems may violate students’ rights, the authors advocate for the use of individualized levels programs.

Finally, all of the examples described above applied a universal nonfunctional analysis-based-treatment to a group of individuals. In other words, rather than identify the variables maintaining each child’s problem behaviors, a generic treatment was applied across individuals. For a treatment to be effective in reducing a problem behavior, the maintaining variables need to be identified and diminished. To do this within a levels treatment framework, the treatment packages must be
individualized. Thus, a functional assessment would need to be conducted to identify the variables maintaining the problem behavior for each individual. Based on this assessment, a treatment manipulating the access to and withdrawal of reinforcement should be developed targeting the variables maintaining the problem behavior. In addition, preference assessments would need to be conducted to identify potential reinforcers for each individual. These reinforcers should then be incorporated into the treatment package. Finally, the criteria for progression and regression into levels would need to be individualized. Specifically, one would need to identify the target behaviors for each individual, and, based on the functional assessment, determine which treatment components would best target the response-reinforcement contingency.

There is one published study employing such a technique. In this study, a levels treatment was used in an inpatient setting with an individual with developmental disabilities (Grace, Thompson, & Fisher, 1996). The treatment was developed based on the results of a functional analysis. Reinforcers were identified using a stimulus choice assessment. The target behavior was low frequency, high intensity SIB (skin and nail picking, head banging, self biting, inserting objects into nose, ears, and eyes, and pulling eyelids). A levels treatment was developed in which level progression and regression was contingent upon the presence or absence of tissue damage from self-injury or the occurrence of destructive behavior. This intervention was effective in decreasing tissue damage resulting from SIB. This was the first study to demonstrate the potential effectiveness of a functional analysis.
based levels treatment with the developmentally disabled population. Given that the Grace et al. study included just one participant with a low frequency behavior, more research is needed. Future studies should also examine the effectiveness of levels treatments with high frequency high intensity problem behaviors.
Purpose

A review of the literature of individuals with developmental disabilities who exhibit severe problem behaviors suggests that numerous negative implications are associated with such behaviors. For example, severe problem behaviors can result in physical trauma to the individual or others in close proximity, interference with the individual’s ability to interact optimally with their environment, and the use of more restrictive treatments and living environments (Meador & Osborn, 1982; Griffin et al., 1994). Given the serious consequences of these behaviors, there is a need to identify effective interventions for decreasing or eliminating them.

Researchers indicate that the most effective interventions for decreasing severe problem behaviors in persons with developmental disabilities are interventions that are based on behavior function (Carr, 1977; Iwata et al., 1982). Function-based interventions usually target the maintaining variable in one of three ways: manipulating the establishing operations, implementing extinction, or by providing differential reinforcement. Another possibility is to implement a treatment package that incorporates more than one of these components. Such treatment packages, when based on behavior function, often produce swifter and more dramatic reductions in problem behaviors than when treatment components are used in isolation (Hagopian et al., 1998). Thus, treatment packages offer an alternative when single interventions produce minimal or slow progressing changes in behavior.

Although the literature supports the use of interventions based on behavior function, nonfunctional treatment packages continue to be widely used. One
example of a commonly used nonfunctional treatment package is the levels system
treatment package. Levels system treatment packages are frequently used in
inpatient, residential, and classroom settings. The most commonly implemented
levels treatments are applied universally and nonfunctionally to all participants. In
addition, in most cases the participants have average cognitive abilities.

To date, only one study has examined the effectiveness of an individualized
functional analysis based levels treatment (Grace et al., 1996). The authors reported
that the intervention produced a reduction in the number of injuries caused by covert
SIB in an individual with mild mental retardation. However, the generalizability of
these results is limited in that only one subject participated. In addition, the behavior
examined was low frequency.

The purpose of this study was to examine the effectiveness of a functional-
analysis-based-levels-treatment-package in decreasing high frequency and high
intensity severe problem behaviors in three adolescents with developmental
disabilities. This study will extend the literature on levels treatment packages in
three ways. First, the interventions were individualized and based on the results of
functional analyses and preference assessments. Second, the participants consist of
adolescents with developmental disabilities. Third, the target behaviors were high
frequency and high intensity severe problem behaviors.
General Method

Participants

Three individuals with developmental disabilities were admitted to an inpatient unit specializing in the assessment and treatment of severe behavior problems. All three participants were able to follow complex instructions (e.g., multiply 5 times 6), communicate in complex sentences, and ambulate without assistance.

Karl was a 14 year old boy diagnosed with mild mental retardation, attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD) and depressive disorder (NOS). Karl displayed a number of destructive behaviors including severe aggression, disruption, and inappropriate social behaviors. On one occasion, he physically assaulted a woman in a public restroom, which led to his arrest.

Lori was a 16 year old female diagnosed with moderate mental retardation, bipolar disorder, ODD and a seizure disorder. She exhibited a variety of problem behaviors including severe aggression and property destruction. She reportedly caused serious injury to others on a number of occasions, including stabbing her sister with a knife. As a result of these incidents, Lori had four emergency admissions to inpatient psychiatric units prior to this admission.

Kristi was a 12 year old female diagnosed with mild mental retardation, ADHD and ODD. Kristi exhibited aggression, socially offensive behaviors and
property destruction. On one occasion, Kristi physically assaulted the principal of her school, which led to her permanent dismissal from school.
Phase 1: Functional Analysis

Data Collection and Interobserver Agreement

During sessions, data were collected by trained observers using laptop computers. Two independent observers scored the frequency of target responses simultaneously but independently during 36%, 55%, and 60% of functional analysis sessions for Karl, Lori, and Kristi, respectively. Exact agreement for problem behavior was automatically calculated by the computer by partitioning each session into 10-second intervals and dividing the number of exact agreements on the frequency of behavior by the sum of agreements plus disagreements and multiplying by 100%. Mean exact agreement for combined target behaviors during the functional analysis was 99.7%, 91.4%, 95.4% for Karl, Lori, and Kristi, respectively.

Response Definitions

Karl. Karl’s problem behaviors were defined as aggression (hitting, pinching, scratching, kicking, grabbing, throwing objects at people, cursing, and threatening language), severe aggression (biting, hairpulling, hitting other’s in the face, and aggression towards children), inappropriate social interaction (touching others - except in areas specified as severe inappropriate social interaction), severe inappropriate social interaction (touching other’s on their buttocks, breasts, or genitalia and attempts to kiss other’s and blow in people’s ears), inappropriate sexual behavior (exposing his genitals and touching his genital area under or over his clothes), disruption (throwing objects, property destruction, and kicking objects), and
elopement (going through doors without staff and running away from staff in an open area).

Lori. Lori’s target behaviors were defined as aggression (hitting, kicking, scratching, pinching, hair pulling, bending other’s fingers back, pushing, grabbing, elbowing others and throwing objects at people), disruption (throwing objects, knocking objects off of surfaces, slamming objects on surfaces, and property destruction), cursing (profane language or gestures), verbal aggression (threatening other’s), and biting.

Kristi. Kristi’s target behaviors were defined as aggression (hitting, kicking, pushing, pinching, and hair pulling), disruption (throwing objects, knocking over objects, hitting/kicking surfaces, and property destruction), socially offensive behaviors (cursing, threatening others, insults, racial slurs, and short high pitched screams), and biting.

Procedure

Functional analyses, using procedures similar to those described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) were conducted for all participants. Sessions were 10 minutes in duration. For Lori and Karl, sessions were conducted in a padded room (3 m by 3 m) with a one-way observation mirror. For Kristi, sessions were conducted in a larger nonpadded room (6 m by 4 m) with a one-way observation mirror. Protective gear was worn by all staff during all sessions with Kristi and as needed with Karl and Lori. Protective gear included arm pads, shin pads, chest pads, and padded helmets.
Criteria for session termination was established as any time injury was incurred by the participant or staff member, and any time a staff member felt that they could not control the participant. If an injury was incurred, a nurse would be called to examine the injury and determine whether or not sessions could continue. None of the sessions, for any of the participants, were terminated.

The experimental conditions consisted of toy play, demand, social attention, and divided attention for Karl; toy play, demand, divided attention, and tangible for Lori, and toy play, demand, social attention, and tangible for Kristi. Because descriptive data suggested that Karl and Lori frequently engaged in problem behaviors when two adults were interacting with one another, Divided Attention sessions were conducted for both participants. The tangible condition was only conducted during Lori and Kristi's functional analyses because interview information provided by parents suggested that problem behaviors for both of these participants were likely to occur to gain access to preferred items. Karl's parents did not report problem behaviors occurring to access preferred items, thus the tangible condition was not conducted during Karl's functional analysis. Alone sessions were not conducted with any of the clients because aggression was the primary behavior of concern and an automatic function was not suspected in any of the cases.

The toy play sessions consisted of the therapist interacting with the client, allowing access to preferred items and providing praise every 30 seconds. During the demand sessions, the therapist used sequential verbal, gestural, and physical prompts every 10 seconds until the participant either complied or engaged in
destructive behavior. If the participant complied following the verbal or gestural prompt, he/she received praise from the therapist. If the participant displayed problem behavior, a 30 second escape was permitted in which the task was terminated and the task materials were removed. Lori and Kristi were prompted to complete academic tasks consistent with their individual education plan while Karl was prompted to complete a variety of both academic and daily living demands. In the social attention condition, Karl and Kristi were given toys and asked to play quietly while the therapist sat in the room reading a magazine. Attention in the form of a brief statement of concern (e.g., “Don’t do that, I am trying to read.”) was provided contingent on each occurrence of problem behavior. The divided attention condition (conducted with Karl and Kristi) was similar to the attention condition described above, with the exception that two therapists were present in the room interacting with each other, but not with the client. The therapist provided a brief verbal reprimand contingent on problem behavior. During tangible sessions, for Lori and Kristi, the client was allowed to play with a preferred item (e.g. electronic game, TV) for 2 minutes prior to the start of session. The item was selected based on parental report that removal of that item resulted in problem behavior. At the start of the session, the therapist removed the item. Following each occurrence of problem behavior, the therapist returned the item to the client for a 30-second period.

During initial functional analysis probes, Kristi displayed intense negative emotional responses to the contingencies in place and requested the opportunity to use appropriate communication during the sessions. Thus, Kristi’s functional
analysis sessions were modified so that she could gain access to reinforcement for both inappropriate behaviors and appropriate communication.

**Experimental Design**

A multi-element design was used with conditions presented in semi-random order. Following procedures described by Iwata et al. (1982), the sequence in which the conditions were presented were randomized, however, no condition was run more than twice consecutively.

**Results and Discussion**

Results of the functional analyses for each participant appear in Figure 1. For each participant, target responses scored within the ten-minute session were converted into responses per minute for each session. For Karl (top panel), target behaviors were highest in the divided attention condition ($M = 0.4$ rpm), followed by the social attention condition ($M = 0.24$ rpm). Target behavior rarely occurred in the demand or toy play conditions ($M = 0.07$ rpm, and $M = 0.04$ rpm, respectively). These results suggested that Karl’s target behaviors were maintained by positive reinforcement in the form of attention.

During Lori’s functional analysis (middle panel), target behaviors were stable and efficient in the tangible condition ($M = 2.2$ rpm), and high and variable in the divided attention condition ($M = 23.7$ rpm). Low rates of responding were observed in the demand condition ($M = 0.26$ rpm), and no target behaviors were observed in the toy play condition. These results suggested that Lori’s target behaviors were maintained by positive reinforcement in the form of access to tangibles and attention.
During Kristi's functional analysis (bottom panel), target behaviors were high and variable in the tangible condition ($M = 10.0$ rpm), high in the social attention condition ($M = 19.3$), and efficient in the demand condition ($M = 1.6$ rpm). No problem behaviors were observed in the toy play condition. In addition, appropriate communication remained low across all conditions (demand, $M = 0$ rpm; toy play, $M = 0.55$ rpm; social attention, $M = 0.45$ rpm; and tangible, $M = 0.1$ rpm). These results suggested that Kristi's target behaviors were maintained by positive reinforcement in the form of access to tangibles and attention, and negative reinforcement in the form of escape from demands.

Kristi's and Lori's functional analyses were terminated with only 3-5 data points per condition due to the severity of aggression exhibited towards staff members during session. However, early termination did not influence the data interpretation, as clear patterns of responding emerged for both participants.
Figure 1: Functional Analyses
Phase 2: Stimulus Choice Assessment

Data Collection and Interobserver Agreement

During all stimulus choice assessments, trained observers recorded the clients' behavior towards the items (approach, consume, avoid, or no choice). Approach was defined as reaching for the item but not interacting with it. Consume was defined as interacting with the item. Avoid was defined as turning away from the item or pushing it away. No choice was defined as not engaging in any behavior towards the items. Interrater agreement was assessed during 100%, 100%, and 48% of the stimulus choice trials for Karl, Lori, and Kristi, respectively. Mean exact agreement during the stimulus choice assessment was 99% for Karl, 100% for Lori, and 98% for Kristi.

Procedure

Stimulus choice assessments were conducted following the procedures described by Fisher, Piazza, Bowman, Hagopian, Owens, and Slevin (1992). Up to sixteen items were randomly presented in pairs with each stimulus paired once with every other stimulus. The stimuli were presented in front of the client. When the client approached one of the stimuli, they received 30 seconds access to that stimulus and the other one was removed. If the client did not approach either stimulus, they were both removed and the client was prompted to interact with each item for 30 seconds (item sampling). Following the item sampling, the two items were represented following the above procedure. If they did not approach the items following the second presentation, both items were removed and the next two items were presented. Following the assessment, the percentage of consume responses to...
each of the stimuli was calculated. These percentages were used to identify highly preferred items for each client.

Results

The results of the stimulus choice assessments are depicted in Figure 2. Items identified as highly preferred for Karl include a walkman, Beetle Borg, Mortal Combat game, and game boy. Items identified as highly preferred for Lori include potato salad, Uno card game, chips and dip, and Mountain Dew. Items identified as highly preferred for Kristi included nail polish, cassettes, Barbie books, and Doritos chips.

Figure 2: Stimulus Choice Assessments

(Figure continued)
Phase 3: Levels Treatment Analysis

Data Collection and Interobserver Agreement

Target behaviors were defined as described in Phase 1. Data were collected as described in Phase 1 for Lori. For Karl and Kristi, paper and pencil data were collected in five minute intervals on the frequency of each target behavior. Interrater agreement was assessed during 100% of the levels treatment analysis sessions for Lori, an average of 81.7% of 5-minute intervals for all treatment sessions for Karl, and an average of 87.6% of 5-minute intervals for all treatment sessions for Kristi. Agreement coefficients were calculated by partitioning each session into 5-minute intervals and dividing the number of exact agreements on the frequency of behavior by the sum of agreements plus disagreements and multiplying by 100%. During the levels treatment analysis, mean exact agreement for problem behavior was 95.4%, 96.4%, 97.8% for Karl, Lori, and Kristi, respectively.

Experimental Design

Experimental control of the effects of the treatment package on problem behavior was demonstrated via an ABAB reversal design for Karl and Lori and an ABABCBC reversal design for Kristi. Kristi’s analysis was extended in order to evaluate the Levels treatment sequentially. That is, Level-3 was evaluated in isolation and then, in combination with Level-2. Level 1 was never evaluated because following the Level-2 and 3 combined analysis, a seclusionary time out was not deemed warranted. The reversal design was utilized as it “is the most powerful
single subject design for demonstrating a functional relationship between an environmental manipulation and behavior” (Cooper, Heron, & Heward, 1987; p 165).

For Karl and Kristi, treatment analysis sessions were 1.5 to 2 hours in duration. Because Lori’s problem behavior was highly intense and dangerous to staff, treatment analysis sessions were only 25 minutes in length. All sessions for each participant were conducted on the living unit. Protective gear was worn if needed. Termination criteria were the same as described in Phase 1. No sessions were terminated for any of the participants.

Procedure

Baseline. For Karl and Lori, baseline sessions were identical to the divided attention condition of the functional analysis in which two therapists were present, engaged in conversation, and only interacted with the client contingent on target behaviors. For Kristi, baseline sessions included social attention contingencies in which Kristi was given attention contingent upon target behaviors and demand contingencies in which Kristi received a 30-second break from work contingent upon target behaviors.

Treatment. Based on the results of the functional analyses and stimulus choice assessments, individualized levels treatment packages were developed for each client. The behavioral contingencies were described to each participant prior to the implementation of the treatment.
The levels treatment packages for Karl and Lori consisted of three levels in which the density of attention and access to preferred items were manipulated. That is, the level in place was a function of the client’s behavior. Kristi’s treatment package consisted of two levels (Levels 3 & 2). “Level-3” consisted of dense schedules of attention and interaction, access to preferred items, and frequent praise (i.e., “You are doing a nice job staying in Level-3”). “Level-2” was a non-exclusionary timeout. This involved providing the client minimal attention and limiting interaction to prompting him/her to complete necessary tasks. “Level-1” consisted of a seclusionary room timeout for dangerous behaviors.

During treatment, the client started each session in Level-3. For all participants, Level 3 consisted of a dense schedule of noncontingent reinforcement (NCR) in the form of attention. (Each client received NCR on an individualized schedule. Lori and Karl received NCR on a fixed time (FT) schedule of 5 minutes throughout treatment. Kristi’s NCR schedule was faded from FT-5 minutes to variable time (VT) schedule of 30 minutes.). In addition, Lori and Karl had individualized DRO (differential reinforcement of other behavior) schedules in which they earned tokens for the absence of inappropriate behaviors during academic demands (Karl received one token for every task completed without any occurrences of inappropriate behavior. Lori received one token every 20 minutes during academic demands in which there were no occurrences of inappropriate behavior). Kristi had a DRA (differential reinforcement of an alternative behavior) schedule during academic demands in which she earned tokens for the absence of
inappropriate behavior and compliance with a set number of tasks (faded from one
token every six tasks to two tokens per worksheet to one star for compliance and no
inappropriate behaviors during the entire academic period) and a DRO schedule
during nonacademic periods in which she earned tokens for the absence of
inappropriate behavior (faded from an FT-10 minute schedule to a variable DRO
schedule developed to match the natural environment in which she earned a star for
the absence of behavior on an average of every 1.8 hours). A response cost
component was also included in Kristi’s Level-3 in which she lost a set amount of
tokens for each occurrence of aggression, socially offensive behaviors, disruption,
and biting. All three individuals had multiple opportunities daily to trade in their
tokens for reinforcers identified in the stimulus choice assessments.

Each client was moved to Level-2 contingent upon problem behaviors. Karl
was moved to Level-2 contingent on aggression, disruption, elopement, inappropriate
sexual behavior, and inappropriate social interaction. Lori was moved to Level-2 for
disruption, cursing, and verbal aggression (these behaviors were problematic, but did
not pose an immediate risk to staff and other clients); and Kristi was moved to Level-
2 contingent upon the loss of all of her tokens due to aggression, socially offensive
behaviors, disruption, and biting. The client remained in Level-2 until he/she did not
display any targeted inappropriate behavior for 15 consecutive minutes (i.e., 15-
minute resetting DRO) (See Table 1).
Table 1: Levels System Flow Chart

Karl and Lori were moved to Level-1 for severe behaviors. Karl was moved to Level-1 contingent on severe aggression and severe inappropriate social interaction; and Lori was moved to Level-1 contingent on aggression and biting (these behaviors were determined to be unacceptably dangerous to staff or clients).

There was no Level-1 in place for Kristi. The client remained in Level-1 until he/she did not display any targeted inappropriate behavior for 10 consecutive minutes (i.e.,
10-minute resetting DRO). After exiting Level-1, the client was moved to Level-2 until he/she met criteria to move up to Level-3 (i.e., 15 minute resetting DRO) (See Table 1).

Generalization. Following demonstration of effectiveness of the levels treatments, the individualized treatments were implemented in the living area of the inpatient unit for a six-hour period, and eventually a 24-hour period. During 6 hour generalization analyses, computer data were taken for Lori, while paper and pencil data were taken for Karl and Kristi. Both data collection procedures were implemented as previously described. During the 24 hour generalization analyses, paper and pencil data were collected in 30 minute intervals as previously described for all three participants. Reliability data were collected during 23%, 11 %, and 21% of intervals for Karl, Lori, and Kristi, respectively. Agreement coefficients were calculated by dividing the number of exact agreements on the frequency of behavior by the sum of agreements plus disagreements and multiplying by 100% for each interval. During the levels treatment analysis, mean exact agreement for problem behavior was 92%, 98.5%, 98% for Karl, Lori, and Kristi, respectively. It should be noted that all of Karl's generalization data were collected during the 6-hour generalization phase. Prior to discharge, parents or caregivers were trained on the implementation of the levels treatment. Parent training consisted of: 1) an explanation of the treatment, 2) modeling each treatment component for the caregiver, 3) rehearsal in which the caregiver practiced each treatment component, and 4) direct and immediate feedback. Caregivers were trained until they could
implement the treatment with 90% accuracy across three consecutive sessions.

Reliability data were collected during 100% of all intervals for each participant.

Agreement coefficients were calculated as described above. During parent/caregiver training, mean exact agreement was 100% for all three participant’s analyses.

Results and Discussion

The results of the treatment analyses are depicted in Figures 3-5. When baseline contingencies were in place (i.e., contingent attention for problem behavior), all participants displayed high and variable rates of problem behavior (Karl, \( M = 13.3 \); Lori, \( M = 9.6 \); and Kristi, \( M = 2.1 \) responses per minute). When the levels treatment packages were implemented (all three levels for Karl and Lori, and Level 3 in isolation for Kristi), problem behaviors were reduced to near zero levels for all clients (Karl, \( M = 0.02 \); Lori, \( M = 0.01 \); and Kristi, \( M = 0.02 \) responses per minute). High rates of problem behavior were recovered when baseline contingencies were again in place (Karl, \( M = 12.2 \); Lori, \( M = 14.2 \); and Kristi, \( M = 8.5 \) responses per minute). Problem behaviors were once again reduced to near zero rates when the levels treatment packages were re-implemented (Karl, \( M = 0.17 \); Lori, \( M = 0 \); and Kristi, \( M = 0.11 \) responses per minute). For Kristi, the analysis was extended following an escalation observed in inappropriate behavior (\( M = 0.5 \)) during demand fading (increasing the duration and number of tasks during the academic demand period). Thus, Levels 2 and 3 were implemented together. With the addition of the Level 2 component, Kristi’s inappropriate behavior decreased to 0 (\( M = 0.006 \) rpm). High rates of inappropriate behavior were recovered when Level 3
was again implemented in isolation ($M=1.14$ rpm). Inappropriate behaviors were once again reduced to 0 rates when the Level 2 component was re-implemented ($M=0.003$ rpm).

After demonstrating the intervention's effectiveness for each client, the levels treatment package was later generalized across the entire day on the living area of the inpatient unit. Over the course of 30 days for Karl, 91 days for Lori, and 30 days for Kristi problem behavior remained at acceptably low levels (Karl, $M = .05$; Lori, $M = .02$; and Kristi, $M = 0.04$ rpm). A 99.8% reduction from baseline was obtained for Karl, a 99.9% reduction was obtained for Lori and a 98.1% reduction for Kristi.

Prior to discharge, caregivers were trained on the implementation of the levels treatment. Karl's mother, Lori's mother, and Kristi's grandmother all implemented the treatment with 100% accuracy across three consecutive sessions. Kristi’s mother implemented the treatment with 97% accuracy across the three consecutive sessions.

![Figure 3: Karl's Treatment Analysis](image)

Figure 3: Karl's Treatment Analysis

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Figure 4: Lori's Treatment Analysis

Figure 5: Kristi's Treatment Analysis

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Phase 4: Component Analysis

A component analysis of the levels treatment package was conducted for one participant (Lori), to examine the relative contribution of each component of the levels treatment. The effects of Level-3 in isolation were examined to determine whether reinforcement alone (NCR & DRO) would be effective in maintaining low rates of target behavior. In addition, because seclusionary time out is a restrictive procedure, the effects of Levels 2 and 3 in combination were evaluated to determine whether the seclusionary time out component (Level 1) was needed to maintain low rates of behavior.

Procedure and Design

Sessions were conducted on the living unit and were 25 minutes in length. Frequency of destructive behavior was measured during the following four conditions: (a) Levels-1, -2, and -3 which was the same as the complete levels treatment package previously described in Study 2; (b) Levels-2 and -3, which was identical to the complete levels package, except that Level-1 (seclusionary timeout) was not in place (i.e., Lori was moved to Level-2 for all destructive behaviors); (c) Level -3 only, during which Lori was in Level-3 continuously throughout the session, and problem behaviors were ignored; and (d) baseline, which consisted of contingent attention for problem behavior (described in Phase 2). A multi-element design was used to evaluate the effects of three different combinations of the levels treatment components on the rate of Lori's destructive behavior.
Interobserver Agreement

Problem behaviors were defined and data were collected as described previously. Two observers scored destructive behavior simultaneously but independently during 68% of the sessions. Mean exact agreement for destructive behavior was 92%.

Results

The results of the component analysis are depicted in Figure 6. The highest rates of responding were observed during the baseline condition (M = 5.1 responses per hour). The average hourly rate of problem behavior in the Level-2 and -3 condition was 2.3, and a similar rate of responding was observed in the Level-3 only condition (M = 2.6). Thus, neither Level-3 alone or Level-3 in combination with Level-2 were effective in maintaining acceptably low levels of problem behavior. Lori did not exhibit any problem behaviors in four of the five sessions in which the full levels treatment package (Levels 3, 2 +1) was in place (M = 0.008). This data demonstrated the necessity of the seclusionary time-out component (Level-1) for this particular client.
Figure 6: Component Analysis
General Discussion

Levels system interventions are commonly used in a number of settings with a variety of populations. Typically, the individuals participating in a levels system have emotional or behavioral difficulties but display average cognitive abilities.

Levels system treatment packages are usually applied universally across all participants without regard to the variables maintaining the individuals’ problem behaviors or the individuals’ current skill level (Titus et al., 1990). This lack of individualization has been identified as a potential violation of a student’s rights based on the Individuals with Disabilities Education Act (Scheuermann et al., 1994). In addition, the goal of the intervention is typically to “manage” the individuals’ behavior while at the facility. Thus, levels treatments, even if proven effective, are rarely prescribed upon discharge. Given the goal of the intervention, components of the levels systems are often set up in a manner that is highly unlikely to generalize to the community. For example, the privileges often used as reinforcers can be manipulated in a highly controlled setting but would not serve as reinforcers in a community setting (i.e. phone privileges, use of pencil sharpener, access to outings).

Despite the limited generalizability, many studies report favorable outcomes of level systems within the prescribed settings. However, the majority of the literature on level systems is descriptive, and those studies that were experimental in design had methodological shortcomings. Thus, given the paucity of experimentally sound research on level systems, conclusions on effectiveness remain suspect at this time.
The current study was designed to address many of the above shortcomings. First, the intervention was implemented with a population that has received little attention in the level system literature: adolescents with developmental disabilities. Second, the treatments were individualized based on the results of stimulus choice assessments and functional analyses. That is, the stimuli and activities available within each level, the criteria for moving between levels, and the selection of target behaviors were different for each individual. Third, the individualized systems were used as therapeutic interventions to decrease or eliminate severe problem behaviors rather than as a "management" technique. Fourth, the reinforcers chosen were those that would also serve as reinforcers outside of the inpatient hospital setting, thus promoting generalization. Finally, a single case reversal design was used to systematically evaluate the effectiveness of the intervention for each participant.

Successful treatment outcomes were achieved with three adolescents with mental retardation and severe behavior problems. Target behaviors for all three individuals were decreased by more than 98% from baseline levels using individualized levels treatment packages. In addition, a 91% reduction in occurrence reports documenting Lori causing injuries to staff and incidents with other clients was obtained with the introduction of the levels treatment. These results add additional support to the results reported by Grace et al. (1996). Specifically, researchers in both studies found that function based individualized levels treatments can be highly effective in decreasing severe problem behaviors in individuals with developmental disabilities. In addition, the results from the present study extend the
literature in that the participants displayed high frequency and intensity target
target behaviors.

The present study also addressed the legal concerns presented by
Scheuermann et al. (1994). That is, in compliance with the guidelines specified in
IDEA, the present levels interventions moved from the least restrictive to most
restrictive intervention rather than from the most restrictive to least restrictive as
most commonly done in levels systems. All three participants started each day in
Level 3, the least restrictive level, and, contingent upon the severity of the behavior
displayed, moved to more restrictive levels as needed. In addition, as noted above,
each levels system was individualized, targeting behaviors specific to each
participant. This not only allowed for compliance with IDEA, but also for individual
skills levels to be taken into account. Thus, schedules of reinforcement were
developed so that each adolescent had contact with the reinforcement contingencies
and these schedules were faded as needed.

Furthermore, as recommended by Barbetta (1990b), there were multiple
opportunities daily to move up and down within the levels and behaviors met with
immediate contingencies.

Limitations of the present study

Although the current study provides systematic evidence on effectiveness of
the levels system treatment package, only three individuals participated. All three
individuals had mild to moderate mental retardation and behaviors maintained by
positive reinforcement. Future studies should be designed to identify what client
variables predict levels treatment success. For example, the effectiveness of the functioned-based individualized levels treatment packages with other populations (such as individuals with severe or profound mental retardation) should be examined. In addition, the effectiveness of the levels treatment package with behaviors maintained by variables other than positive reinforcement should also be investigated.

A second limitation of the study was that generalization data were not collected outside the inpatient environment. The levels treatment was generalized across a 24 hour period for multiple days. Prior to discharge, the parents, caregivers and/or teachers of each participant were trained in the home and/or school environment on implementing the levels treatment. Each caregiver was trained until they could implement treatment with 90% or higher accuracy. The average percentage of correct implementation of treatment components for all caregivers was 99.4% (ranging from 97% to 100%). In addition, parents and teachers informally report that low rates of target behaviors persisted when the levels interventions were implemented. However, no data were collected in the home and school environments to support these reports. Thus, future studies should be designed to collect such data as well as data that would identify variables that promote or inhibit generalization outside a highly controlled environment.

A third limitation of the study is the lack of data on adaptive skills, specifically communication. Given that each individual used their target behaviors to gain access to preferred activities or objects, it is important that the individual
have other means to communicate their requests as target behaviors diminish. All three individuals in this study were verbal and, based on multiple observations on the inpatient unit and during schoolwork, used their verbal skills to communicate their requests frequently, however, no formal skills assessments were conducted. As levels treatments are investigated with other populations, especially lower functioning individuals, it would be important to conduct a systematic skills assessment to identify if the individual has appropriate communication skills (verbal, gestural, or picture format) to communicate their requests. If the individual does not have the ability to communicate his or her needs it would be necessary to teach functional communication as well so that the individual has an appropriate response to replace the targeted response.

Finally, for one individual, each level was examined sequentially to determine which levels were necessary for treatment success. Based on this analysis, it was determined that Level 1 was not necessary in maintaining low rates of target behaviors for this individual. For a second participant, a component analysis was conducted. Based on the results from this analysis it was concluded that all three levels were necessary to maintain low rates of target behaviors for this individual. This type of analysis was not conducted with the third participant. However, given that such analyses produced different conclusions for two individuals, it is evident that component analyses should be conducted with each participant. Thus, future studies might conduct component analyses with each participant to identify which levels are necessary for treatment efficacy.
Conclusion

Given the multiple negative implications associated with severe problem behaviors exhibited by individuals with developmental disabilities, attempts to find effective interventions have been at the forefront of research with this population. Individualized function based behavioral interventions have been associated with dramatic reductions in severe problem behaviors in individuals with developmental disabilities. Often such interventions are a combination of components rather than one component in isolation. One treatment package that is widely used in schools and residential facilities is the levels system. However, there is very little empirical literature on treatment efficacy. The current study provided evidence that individualized function based levels systems can be highly effective in decreasing severe problem behaviors in adolescents with developmental disabilities. As stated before, this study systematically evaluated the behavior of only three individuals with similar characteristics, thus more research on individualized function based levels system needs to be conducted before conclusions on it’s generalizability are made.
References


Vita

Karena Rush received her master of arts degree from the Department of Psychology at Louisiana State University in Baton Rouge, Louisiana, in 1997. Prior to this, she completed a bachelor of arts degree in Psychology at Bryn Mawr College and the degree of Master of Education with a specialization in Risk and Prevention from Harvard University. Karena is currently starting a post-doctoral fellowship position at the Kennedy Krieger Institute with the department of Behavioral Psychology at the Johns Hopkins School of Medicine in Baltimore, Maryland. Her professional interests include the assessment and treatment of severe behavior disorders, teaching strategies for autistic individuals, staff training, and teaching. The degree of Doctor of Philosophy will be conferred in May, 2000.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Karena Suzanne Rush

Major Field: Psychology

Title of Dissertation: Individualized Levels Treatment Packages for Severe Problem Behaviors in Persons with Developmental Disabilities

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

October 22, 1999

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