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THIS ISSUE IS DEVOTED TO:
Autism, Part 1
Guest Editors: Beth Rosenwasser and Saul Axelrod

Contents

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The Contributions of Applied Behavior Analysis to the Education of People With Autism

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Among the numerous treatments available for helping to educate people with autism, applied behavior analysis (ABA) is the best empirically evaluated, as many articles in this dual-volume special issue document. Unfortunately, the best supported treatments are not always the best disseminated or accepted. Recently, however, ABA has emerged with widespread recognition beyond the limited community of academic and behavioral psychologists and special educators. In fact, ABA has been recognized by the surgeon general of the United States as the treatment of choice for autism in his mental health report for children: "Thirty years of research demonstrated the efficacy of applied behavioral methods in reducing inappropriate behavior and in increasing communication, learning, and appropriate social behavior" (U.S. Department of Health and Human Services, 1999). Corroborating the surgeon general's recommendation are state governments in New York (Department of Health, 1999) and California (Collaborative Work Group on Autistic Spectrum Disorders, 1997), as well as a collaborative group in Maine (MADSEC Autism Taskforce, 1999). New York and Maine reference the unparalleled quantity of outcome research supporting behavior analytic instruction and its best-practice features (see Jacobson, 2000). Beyond governmental organizations, the popular media has begun to recognize and educate the public about ABA treatment for autism. For example, ABC broadcast a *Nightline* episode endorsing ABA early intervention for children with autism

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(Koppel, 2001), accompanied by an extensive ABA resource list on its Web site. The *New York Times* featured an article on the failure of the educational system to meet the needs of autistic students due to the insufficient number schools offering ABA services (Peterson, 2000). *Newsweek* magazine featured autism on its cover and featured ABA as a "godsend" (Cowley, 2000).

With the publication of clear outcome data that support many ABA interventions, more recent coverage of behavior analysis by the media, and the rise of behavior analyst certification, this is an excellent opportunity for behavior analysts to cooperate on many fronts to bring more and improved empirically supported treatment strategies to assist people with autism. The foundation for doing so must continue to be a strategy that utilizes the tactics of those who have been at the forefront of ABA research and dissemination. This two-part special issue covers the span of contemporary ABA offerings and research on autism, looking at how we have moved beyond initial classic research showing its efficacy to identify the current unknowns and areas for organized effort.

Behavior analysis interventions for children with autism began in the 1960s with the work of Ivar Lovaas and his colleagues at the University of California, Los Angeles. Their classic study (Lovaas, 1987), cited in the surgeon general report, demonstrated that with appropriate intervention children with autism could make intellectual and social gains previously seen as impossible. The study included an experimental group of 19 children and two control groups, totaling 40 children. The three groups were similar in relevant preintervention measures. The treatment differed mainly according to the number of hours of educational treatment, with the experimental group receiving at least 40 hours of one-to-one training per week and control group participants receiving 10 hours or less. The differences in outcomes between the groups were profound, with 47% of experimental group participants achieving IQs exceeding 100 as compared to only 2% of the control group students. In addition, several of the experimental group participants were successfully mainstreamed in regular classrooms.

In several respects, the Lovaas (1987) study has led the way for educators and researchers who deal with the education of children with

autism. First, it demonstrated the primacy of language training in the educational process. Next, it showed that intervention must begin early, be intense, and be of sufficient duration that normal functioning can be achieved. Finally, it showed that inclusion of children with autism was an achievable goal.

Undoubtedly, early ABA programs produced impressive language gains for children with autism. Yet, as Sundberg and Michael point out in this issue, there were still many failures, and at times, progress was extremely slow. Sundberg and Michael suggest the possibility that such difficulties emanated from a failure of applied behavior analysts to make use of Skinner's (1957) classic and controversial book on verbal behavior. They observe that many language-training programs began the teaching process with unduly complex language components and with elements of language that were nonmotivational for the learner. For example, early teaching often includes emphasis on a type of language that behavior analysts call *tacts*. This type of language functions to describe characteristics of the environment (e.g., "This crayon is red") for which the reinforcer is often generalized and conditioned (e.g., acknowledgment, praise) and is not inherent to a request by the learner. In contrast, Sundberg and Michael propose that the early portions of language training programs stress *mand* development—a type of language within a behavioral conceptualization that specifies its own reinforcement (e.g., "I want the ball"). Other types of language training, for which the reinforcers are more general, come later in the educational sequence.

Bondy and Frost, who developed the highly recognized Picture Exchange Communication System (PECS), provide an example of a socially based approach to teaching language beginning with mand training. Rather than pointing to a picture of a desired item, students must hand the appropriate picture to a teacher, who then reinforces the request with the actual item. As students develop fluency at each stage of the six-step program, they are exposed to a variety of behavioral procedures that help them to delay reinforcement, become less prompt dependent, make environmental discriminations, and use more complex pictorial mands, such as making the request, "I want an apple." In the final stage of the program, students learn the less motivating form of language that describes elements of their environment (i.e., tacts).

Interestingly, Bondy and Frost report that 59% of children with autism who are properly trained with PECS spontaneously develop independent speech.

In addition to building on earlier language-training strategies, contemporary research has built on Lovaas's demonstration that early, intensive intervention is critical to progress, so today there is increased recognition of the importance of intervening early and intensively and continuing the process into adulthood as necessary. Evidence for this position is found in terms of treatment that is recommended and funded by both the public and private sectors. Nonetheless, the expense of 40 hours of weekly treatment calls for increased interpretation and justification. This issue begins with Pelios and Lund's review of the literature on the problems of the classification of symptoms and early diagnosis; there are subtle questions regarding the accuracy of diagnosis at very young ages as well the lingering question of what is causing the increased number of children diagnosed with autism spectrum disorders—are there more children with this problem, or are we diagnosing better or differently? In addition, Pelios and Lund cover the range of theories concerning neurophysiological causation. Despite disagreement about specifics, most now agree that early intervention is critical based on the greater degree of brain plasticity found in younger children. A quantitative case study of a successful early ABA intervention for a child with autism, begun at age 1 year 2 months, is featured in Part 2 of this special issue (see the article by Green, Brennan, and Fein in the January 2002 issue). Also in Part 2, McClannahan, MacDuff, and Krantz extend the literature to treatment for adults by drawing on the same behavioral principles, including comprehensive, intensive, and individualized curricula, that have been successful with children. A student of Lovaas's, Smith, and his colleagues Eikeseth, Jahr, and Eldevik feature groundbreaking empirical research in a group comparison controlled study that extends his work with Lovaas (also in Part 2). They show that ABA, rather than eclectic treatment, is better, even when the intensity of treatment is held constant.

In a third area of expansion, ABA has mirrored the trend in special education in general, emphasizing the placement and teaching of children with disabilities in integrated environments. Koegel, Koegel, Frea, and Fredeen present a data-based, natural observational study of

five children with autism who are compared with their typically developing peers in an inclusive setting. Focusing on early intervention treatment targets, the authors specifically address the social skills deficits that inhibit children with autism from benefiting from integrated environments. They also help dispel the myth that ABA treatment targets academic and language acquisition but not social-emotional needs, as do the Green et al., Eikeseth et al., and Bondy and Frost articles in this special series. Harrower and Dunlap take this theme further with a comprehensive review of the research support and ABA techniques available for facilitating the progress of children with autism in inclusive settings. Weiss and Harris examine behavioral social and emotional skills training across the life span, many specifically relevant to inclusive settings such as the use of scripts to increase social initiations, self-management strategies, and classwide interventions.

A final area of progress within ABA treatment of autism involves the development of more effective ways to disseminate effective ABA interventions. Meeting the increased demand for services and well-trained practitioners, created by heightened public recognition of ABA's benefits, requires more scalable training programs. ABA is beginning to systematize training and certification of practitioners competent to implement this broader range of interventions. Shook, Ala'i-Rosales, and Glenn (January 2002), in their article on this topic, identify key areas for training practitioners at various levels and discuss the importance of increased professionalization of ABA service provision. Credentialing—and perhaps, in the future, licensing—was initiated in response to parents, organized in groups, who rightfully desire a way to determine if the treatment their children are getting is what has been empirically validated by competent professionals. In Lovaas's early work, he trained all his own staff; now, many treatment programs have the benefit of being able to hire staff with solid training in basic behavioral principles and procedures. This benefits children with autism and their families, as well as the field of ABA.

Unlike other applied branches of psychology, behavior analysis is not lacking in a coherent theoretical basis, nor is it new to the demand for empirical outcome data. ABA is also very strong in individualizing treatment, as many of these articles demonstrate. Following Eikeseth

et al.'s contribution to these two special issues, as well as the surgeon general's report, there is a need for more controlled comparison group studies; continued strong support for the current favorable trend in public policy, including educational and mental health funding and money for research and training, depends on procedures shown to be cost-effective for many people meeting the diagnosis of autism. Additional areas for the future include the need for increased research clarifying the conditions under which inclusion is beneficial to those with special needs, the efficacy of particular types of clinical training procedures and credentialing, and further demonstration of the fruits of theoretically driven verbal behavioral training such as PECS, natural language training, and newer computer-assisted training methods.

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Autism is a behaviorally defined disorder that comprises a controversial diagnostic category due to heterogeneity in symptomatology, causation, and etiology and significant variance in response to intervention. In this article, the authors provide a brief overview of the clinical category and a summary of diagnostic developments with respect to the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders*. Regarding causation and etiology, they briefly discuss selected perspectives from the fields of cognitive neuroscience and neuropsychology. The article concludes with a summary of effective behavioral strategies for the treatment of children with autism. This section highlights the importance of early intensive behavioral intervention and includes a discussion of some important aspects of this approach.

A Selective Overview of Issues on Classification, Causation, and Early Intensive Behavioral Intervention for Autism

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Autism is a behaviorally defined developmental disorder of early childhood characterized by specific, severe delay and dysfunction in communication, language, and social and cognitive development (Volkmar & Cohen, 1988). The condition of autism is generally considered to be the most severe of the childhood neuropsychiatric disorders and is estimated to affect 1 to 2 per 1,000 children, if less severely affected children are included (Gillberg, 1993). The condition typically persists into adulthood and may incapacitate individuals to such a degree that they are often unable to meet even basic personal needs. The disorder is more prevalent in boys (4/5:1 ratio), but girls are typi-

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cally more severely impaired. The apparent onset of the disorder is prior to 36 months, although children are sometimes diagnosed later (Volkmar, 1991).

Autism is a syndrome, not a distinct disease entity, and the neuropsychological causes are largely unknown. However, after the initial psychogenic speculation that cold and emotionally vacant parenting was responsible for causing autism by forcing children to withdraw into their own world (Bettelheim, 1967), there is now consensus that it is a biologically based disorder and a consequence of organic dysfunction (Bauman & Kemper, 1994; Minshew, Sweeney, & Bauman, 1997).

The vast amount of research that has been generated has established that individuals diagnosed with autism form a highly heterogeneous group that displays a variety of abnormalities and impairments. According to Waterhouse, Wing, and Fein (1989), the analysis of individuals with autism has revealed no shared, uniquely pathognomonic neural deficit; no shared cognitive functional deficit; no distinct, shared behavioral pattern; no specific life course; and no shared response to pharmacological intervention. These authors reported that studies typically find that only a small percentage (10%-40%) of sampled diagnosed individuals exhibit any particular marker under study, regardless of which diagnostic system is being utilized. In addition, children with autism vary markedly in response to intensive behavioral treatment (Lovaas & Smith, 1989).

Despite the heterogeneous nature of the syndrome, it is the marked impairment in social relatedness that links the population together as a clinical category. In his original study of a group of young children with distinguishing characteristics, Kanner (1943) emphasized the disturbances of affective contact and identified that children with autism from the beginning of life displayed an inability to relate themselves in a typical manner to contexts and other people. Furthermore, Kanner speculated that the children under study "come into the world with an innate disability to form the usual, biologically provided affective contact with people" (p. 250). The marked social disturbance of autism is manifest in impaired verbal and nonverbal communication, impaired ability to imitate, lack of normal affect, poor or absent

attachment, lack of interest in other people, and impairment in imaginative activities such as play.

The constellation of impairments encompassing communication, social interaction, and imagination has been referred to as the "triad of impairments" (Wing & Gould, 1979). This term suggests a unity of symptoms as opposed to the existence of three separate impairments. Whether there is a specific underlying neurological or neuropsychological core that relates these symptoms is a matter of controversy. Frith (1989) proposed that autism constitutes a natural entity with a high plausibility of a single underlying psychological explanation, whereas others argue that social impairment is likely to be caused by a variety of neuropsychological deficits (Fein, Pennington, Markowitz, Braverman, & Waterhouse, 1986). Regardless of theoretical speculation about underlying neuropsychological dysfunctions, the triad of impairments constitutes a core constellation on which the diagnosis of autism is made. The diagnosis of autism is not made if the child has an isolated, single symptom, such as a problem with language, social interaction, or imagination, but only if deficits in these categories co-occur as a consistent pattern.

Approximately half of the autistic population fails to develop speech, and the majority fails to use speech in a functional manner when it does develop (Volkmar, 1991). In cases where communicative speech develops, it is often less advanced than in typical peers and is characterized by short demands, lack of appropriate deixis (e.g., use of *I/you* pronouns, *here/there* constructions, and *now/then* relations), idiosyncratic use of words, and restricted use of grammatical variants. For individuals with more advanced language, the content of speech and conversation is typically very restricted and characterized by perseveration on specific topics such as the weather or automobiles. Although children with autism display profound semantic and pragmatic language deficits, the disorder does not appear to involve a fundamental problem with syntax (Tager-Flusberg, 1989).

Language comprehension is also typically severely impaired (Waterhouse & Fein, 1982), and expressive language is typically more advanced than receptive language. Although children may be able to follow simple directions such as "sit," "come here," and "eat," a high percentage of the population fails to develop an understanding of

more complex instructions and abstract concepts, including the relationship between objects (prepositions), relational adjectives, deictic categories (e.g., personal pronouns), temporal relations (e.g., first/last), and language that transcends the literal.

In addition to the deviance of speech, there is typically an absence of nonverbal gestures, including joint attention behavior such as pointing, nodding, and shaking the head with respect to questions and normative eye contact. Although there is general agreement that language impairment is a core symptom of autism, there is little agreement regarding the nature of the language impairment and whether it constitutes a primary deficit or whether it is a function of other critical aspects of the syndrome (Tager-Flusberg, 1989).

Studies of cognitive skills have documented a great degree of heterogeneity within the autistic population (L. Green, Fein, Joy, & Waterhouse, 1995). However, there appear to be some relatively characteristic patterns. Individuals with autism typically demonstrate islets of abilities such as adequate and often superior rote memory skills, good visual/spatial skills, and remarkable attention to detail. The latter is characterized by selective attention to odd, minor features of the environment to which typically developing children scarcely pay attention. Lovaas, Schreibman, Koegel, and Rehm (1971) used the term *stimulus overselectivity* to describe the fact that children with autism respond to only one of several features of a compound stimulus or to only part of a compound stimulus. Although stimulus overselectivity has proven not to be specific to autism but rather correlated with mental age (Frith, 1989), it is a significant, confounding factor for development and learning. Furthermore, it constitutes a salient component of an abnormal pattern of perception and attention, slowness and difficulty in shifting between attentional sets, and idiosyncratic and stereotypic interactions with the inanimate environment such as spinning objects, lining up objects in neat rows, twirling strings, pouring, and a pattern of behavior that Kanner (1943) referred to as "insistence on the maintenance of sameness." The latter is manifest in marked obsession with the maintenance of or perseveration on specific routines, order of events with respect to specific tasks, configurations of the child's surroundings, and distress over trivial changes in the environment.

There are some data indicating that children with autism have difficulty in prototype formation during category learning (Klinger & Dawson, 1995). Prototype formation (categorization based on "family resemblance") is regarded as an essential feature of human category structure and a critical vehicle for abstract reasoning and imagination (Lakoff, 1987). These data suggest that children with autism instead tend to commit to classical categorization (i.e., categorization by jointly sufficient and necessary properties). When this is the dominant mode of categorization, children with autism will be hampered in the development of flexible and dynamic cognitive skills.

Symptoms such as attention to detail, islets of ability, and obsession (i.e., "nontriad" symptoms) have frequently been attributed to perceptual dysfunction, and perceptual theories of autism have figured prominently in the literature (Frith & Baron-Cohen, 1987; Hermelin & O'Connor, 1970). Although individuals with autism clearly have aberrant responses to a variety of sensory input, data do not suggest any low-level perceptual deficits. In fact, there are no deficits in any perceptual modality that have proven specific to autism (Frith, 1989). To the contrary, studies indicate excellent functioning of basic-level perceptual processes (Frith & Baron-Cohen, 1987); thus, it has been suggested that it is the higher order or central cognitive processes, not the peripheral input processes, that are dysfunctional in autism (Frith, 1989, Frith & Baron-Cohen, 1987; Hermelin & O'Connor, 1970). According to this hypothesis, individuals with autism have difficulty utilizing context and interpreting stimuli as meaningful.

Finally, the social, communicative, and cognitive deficits in autism are commonly accompanied by a high prevalence of behavior such as excessive hand flapping, body rocking, eye gazing, and echolalic speech and serious problematic behavior such as tantrums, aggression, and self-injury. These behavioral patterns can be persistent and difficult to treat, and they often constitute a significant impediment to educational efforts. Furthermore, they tend to have a dramatic impact on the family and on the child's ability to function in typical community settings.

DELINEATION OF BOUNDARIES AND DIAGNOSTIC CRITERIA

The heterogeneity that characterizes the behavioral excesses and deficits that are typical of children with autism and the ensuing difficulty of clearly delineating the boundaries of the syndrome increase the need for an operational definition. By the late 1970s, ample evidence regarding the validity of autism as a clinical syndrome had been compiled so that the disorder was included for the first time in the American Psychiatric Association's (1980) *Diagnostic and Statistical Manual of Mental Disorders*, 3rd edition (*DSM-III*). The *DSM-III* grouped autism within a new class of disorders, the pervasive developmental disorders (PDD). Diagnostic criteria were specified for inclusion in this category (Spitzer, Endicott, & Robbins, 1978), though not highly operationalized (Volkmar, Cicchetti, Bregman, & Cohen, 1992). Although progress was made in attempting to specify and operationalize the essential characteristics necessary for a diagnosis according to the *DSM-III*, numerous problems arose from the definition adopted by this classification system. For instance, many children with autistic symptoms did not meet the arbitrarily determined number of criteria for a diagnosis of autism and were given the diagnosis of PDD (Eaves, Ho, & Eaves, 1994). In addition, the added requirement that the diagnosis be made early in childhood (before 30 months of age) was problematic because of the difficulty to determine onset. Research has demonstrated that different kinds of behavioral manifestations are found at different ages. In addition, characteristics such as poverty of babbling and other forms of nonverbal communication may not be detected by parents without prior knowledge of the symptoms of autism (Wing, 1980). Furthermore, in their efforts to prescribe effective intervention, clinicians used terms such as *autistic-like* or *language-disordered with autistic features* to describe children with a variety of symptoms who did not meet the necessary criteria for a diagnosis of infantile autism.

Ultimately, the *DSM-III* definition proved to be problematic in its failure to address developmental issues. To rectify these problems, adjustments were made in the *DSM-III-R* (American Psychiatric Association, 1987). This resulted in an increase in the number of criteria and the developmental orientation of the criteria necessary to make

a diagnosis. In addition, the requirement that onset of autism occur in the first 3 years of life as a major diagnostic criterion was no longer included. In summary, the changes were an attempt to de-emphasize historical information and focus on current examination (Volkmar, 1996). Despite these improvements, however, problems persisted. The *DSM III-R*, which allowed three diagnostic options—pervasive developmental disorder not otherwise specified (PDD-NOS), PDD, and autism classified under PDD—broadened the criteria to include more children, thereby resulting in approximately a one-third increase in children being diagnosed with infantile autism (Hertzig, Snow, New, & Shapiro, 1990). Furthermore, the three diagnostic categories identified in the *DSM-III-R* did not account for additional categories, such as Rett's syndrome, childhood disintegrative disorder, and Asperger's syndrome, as distinct categories from autism, distinctions supported by research. These discrepancies were problematic for two major reasons: (a) a diagnosis of PDD or PDD-NOS, which was often used in those cases in which the type of symptoms exhibited did not fulfill the requirements for infantile autism, did not guarantee the intensive intervention similar to that typically offered to children with a diagnosis of autism, and (b) the discrepancy with respect to the range of children receiving a diagnosis of autism, depending on which edition of the *DSM* was utilized, obscured empirical findings in the field. Consequently, several researchers concluded that neither the *DSM-III* nor the *DSM-III-R* was adequate in diagnosing autism and that the definitions used should be viewed as evolving and subject to change (Factor, Freeman, & Kardach, 1989). To resolve these issues, the *DSM-IV* (American Psychiatric Association, 1994) revision process focused on the compatibility between diagnostic systems; the nature of the apparent high rates of false-positive cases based on *DSM-III-R* criteria; the justification for inclusion of other diagnostic categories in the *DSM-IV*, such as childhood disintegrative disorder, Asperger's syndrome, and Rett's syndrome; and alternatives for the *DSM-IV* definition of autism (Volkmar, 1996).

CAUSATION

The concept of causation is multifaceted, perplexing, and laden with conceptual problems. Efforts to attribute the condition of autism to an essential or specific cause are confounded by the complexity of the human neuropsychological system. Many neural structures participate in the system that underlies behavior, cognition, and emotion, and science is only approaching an understanding of the complexity and nature of higher order processes (e.g., concepts) and how they emerge from lower, subservient structures and processes (e.g., neural activity and circuitry) (Edelman, 1992). As discussed by Rapin (1997), we might distinguish between several levels of causation: (a) the behavioral/neuropsychologic level, (b) the neural/pathophysiologic level, and (c) the etiological level. What constitutes causal explanation at one level might not enlighten causality on other levels. Another confounding factor in elucidating causality is the persistent difficulty in delineating the primary and secondary deficits of the syndrome.

Etiology and brain abnormalities. Autism has many etiologies, including genetic conditions such as Fragile X syndrome, viral infections such as congenital rubella, metabolic conditions such as abnormalities of purine synthesis, and congenital anomaly syndromes such as William's syndrome (Gillberg, 1992). However, none of the identified etiologies are invariably associated with autism, and knowledge of etiological causes has clarified little regarding the neuropsychological basis of the disorder (Ungerer, 1989).

It is estimated that approximately 60% to 70% of the population manifests distinct neurological abnormalities and various ranges of mental retardation (Niemann, 1996). Several brain anomalies have been identified in individuals with autism (Gillberg, 1989), but exactly which of the identified anomalies is universal in autism, but also specific only to autism, is still unclear. The most consistent findings include disruption in the limbic system and the cerebellum and its circuits (Bauman & Kemper, 1994). Although distinct brain abnormalities exist in the great majority of individuals diagnosed, approximately 30% to 40% of the population possesses an anatomically intact central nervous system with no indication of mental retardation

(Niemann, 1996). Although substantial progress has been made in describing the neurobiological features of autism, there currently exists no clear framework with which to fully understand the implications of the data (Bauman & Kemper, 1994).

Primary versus secondary deficits. Difficulties in clarifying causes of autism are related to the problem of differentiating between the primary and secondary deficits of the disorder (Ungerer, 1989). Criteria to examine the primacy of a deficit include (a) universality of the deficit within the group, (b) specificity of the deficit to the disorder, and (c) persistence or stability of the deficit throughout development (Ozonoff, Pennington, & Rogers, 1990).

After the initial psychogenic theories of autism, the cognitive, perceptual, and linguistic dysfunction associated with the disorder was emphasized (Mundy & Sigman, 1989). This lack of attention to the social and communicative aspect underscored that these symptoms were considered to be a function of a more primary cognitive deficit.

Currently, there is a strong emphasis on the social and affective features of autism (Mundy & Sigman, 1989), and as such, the trend represents a return to the disturbance of "affective contact" that Kanner (1943) originally emphasized. There are, however, divergent perspectives regarding the source of the social and affective dysfunction. The question centers on whether autism is a neurological disorder that primarily affects social and affective development (Fein et al., 1986) or whether the social/affective disturbances are epiphenomenona of a more primary deficit. For instance, Dawson and Lewy (1989) argued that the affective and perceptual-cognitive impairments are secondary and influenced by deficiencies in arousal modulation. This primary and more general deficiency is hypothesized to influence attention to and processing of both social and nonsocial information as well as affective expression. A second group argued that the social and affective dysfunctions are primary and domain specific and not derived from some other general dysfunction, such as perceptual or general cognitive impairment (Baron-Cohen, 1995; Fein et. al., 1986; Hobson, 1989; Leslie, 1987).

A prominent theory that has focused more directly on the social and pragmatic deficits of the disorder is the "theory of mind" hypothesis.

Theory of mind is a term first used by Premack and Woodruff (1978) that refers to our ability to explain, predict, and interpret behavior in terms of mental states (e.g., intention, belief, and desire). Baron-Cohen (1995) has proposed that autism is a case of selective impairment in the ability to infer mental states of others due to defects in various hypothesized innate "social-perception mechanisms" or an attentional bias to relevant social information that give input to the construction of a theory of mind. Leslie (1987) held the position that the child is innately endowed with a representational system or a module, termed a "Theory of Mind Mechanism" (ToMM). He argued further that such a module is designed to represent and compute information in a data structure in the form of "agent-attitude-proposition" (e.g., "Mary thinks that it is raining") and that this kind of data structure and representational and computational complexity is congruent with what is needed to engage in pretense and imaginative activities. Defects in this postulated cognitive system are considered to comprise the primary deficit in autism and are hypothesized to account for both social impairment and lack of imagination.

In contrast to the theory-of-mind hypothesis, Hobson (1989) proposed that the social/affective impairments in autism are not of a cognitive nature but are derived from a basic failure to develop affective relationships with others. While the theory-of-mind hypothesis holds that the ability to infer mental states requires complex cognitive structures and mechanisms, Hobson attributed social and cognitive deficits to defects in the human's prewired sensitivity to comprehend other people's emotion and the ability to interact emotionally with others. The failure to develop the ability to abstract, symbolize, and engage in pretense is assumed to be a function of these basic emotional disturbances that is causally related to dysfunctional subcortical structures, especially in the limbic system.

A more general account for the behavioral symptoms of autism is put forward in the "executive dysfunction" hypothesis (Ozonoff et al., 1990). Executive function is a postulated mechanism mediated by the frontal lobe that is responsible for the flexible shift in attention, inhibition of prepotent responding, generating goal-directed behavior, strategic problem solving, and flexibility of thought and action. Executive dysfunction has been proposed as a primary deficit and is assumed to

encompass several impairments, including theory of mind, emotion perception, imitation, spatial reasoning, and pretend play. Furthermore, it is assumed to account for the perseverative, narrow interests, stereotypic behavior, and insistence of sameness characteristic of the autism syndrome. The executive dysfunction hypothesis has been criticized on the basis that frontal lobe damage occurs in a large number of clinical disorders and is therefore not specific to autism and that it encompasses too broad a level of analysis (Baron-Cohen & Swettenham, 1997).

This brief and highly selective discourse regarding primary versus secondary deficits in autism illustrates the difficulties in elucidating causation. Although the current trend appears to favor the perspective that a disruption in social/affective development is a primary deficit in autism, its neuropsychological nature is unclear. Presently, there appears to be no consensus with respect to the basic tenets necessary for the development of a neuropsychological model of autism. In the absence of a consistent framework, causation remains an elusive issue.

TREATMENT: EARLY INTENSIVE BEHAVIORAL INTERVENTION

Theories of autism have by far surpassed the facts (Rapin, 1997), and many prescribed types of therapies do not meet the criteria of scientific validation but are instead rooted in flawed theories and assumptions concerning the causes and nature of the disorder (G. Green, 1999). Currently, no neuropsychological model exists, and furthermore, there is no scientific consensus with respect to a primary deficit. Therefore, there appears to be no point of departure for an intervention aimed at treating autism.

Rather than attempt to remediate upon a primary deficit or hypothesized dysfunctional core, behavior analysts take as a basic tenet that children with autism have many difficulties that need to be addressed individually (Lovaas & Smith, 1989). In behavior analytic intervention, the manifestation of autism is deconstructed and organized to define specific behavior or skill domains. Presently, behavior analytic

intervention is the only approach that is established as effective in producing significant and long-lasting improvements for children with autism (Smith, 1996). The effectiveness of behavior analytic methods in reducing problematic behavior is documented in more than 30 years of empirical research (cf. *Journal of Applied Behavior Analysis*). Behavior analytic intervention has proven effective not merely in reducing aberrant and problematic behavior but also in building a multitude of repertoires of complex and functional skills in individuals with autism (Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996). In recent years, several studies have demonstrated the effectiveness of early intensive behavioral intervention (EIBI) in significantly improving intellectual functioning in young children with autism (for a summary and discussion of this research, see G. Green, 1999). Some of these long-term studies have demonstrated remarkable outcomes and revealed the accomplishment of normal functioning in a subgroup of children diagnosed with autism.

The importance of EIBI. It has been established that in the first few years of life the brain exhibits a great degree of plasticity (Edelman, 1992). During the early developmental phases, the brain is most susceptible to change; this potential diminishes as the child grows older. This "post-natal design fixing" is critically dependent on our interaction with the environment. Thus, the selective mechanisms that produce the fundamental neurological structures and circuits must be exposed to the right input at the right time. Bateson (1979) conceptualized these critical periods as "a window of opportunity."

As discussed, in a subgroup of children with autism there are no identified abnormalities in the central nervous system. According to Niemann (1996), activation of correct pathways to produce normative brain development in this subgroup would be possible if intervention starts early. Waiting to implement remedial techniques until the child is 5 or 6 years old may be too late. Niemann argued that behavioral intervention with a focus on an ideal format of repeated, carefully modulated presentation of stimuli and initial emphasis on rote learning is imperative to remediate and guide brain development in the critical, first few years of life of the child with autism. Furthermore, to affect lasting changes in brain functioning, it is imperative to consis-

tently and repeatedly provide optimal learning contingencies "over most of the time the child is awake and functioning, and for several years in duration" (p. 11). Niemann's prescription of modality, intensity, and duration of treatment is consistent with that of Lovaas (1987).

Aspects of EIBI. Lovaas and colleagues were the first to develop systematic and comprehensive behavioral intervention programs for children with autism (Lovaas, 1993), resulting in a comprehensive and detailed treatment protocol (Lovaas, 1981, 1987) that has produced encouraging long-term outcomes (McEachin, Smith, & Lovaas, 1993). A significant broadening and sophistication of behavioral technology and intervention characterize the past two decades. Contrary to popular perceptions, behavior analysts have substantial interest in language, cognition, and complex behavior (Donahoe & Palmer, 1994; Epstein, 1996; Hayes, 1989; Hayes, Hayes, Sato, & Ono, 1994; Sidman, 1994; Skinner, 1957). The conceptual system of behavior analysis extends beyond the three-term contingency and encompasses accounts for complex stimulus-stimulus relations (Sidman, 1994), motivational variables or establishing operations (Michael, 1993), relational frames (Hayes, 1994), principles of behavioral fluency with a focus on component-composite relations and generative learning (Binder, 1996; Johnson & Layng, 1992), and a comprehensive functional taxonomy of verbal behavior (Sundberg & Partington, 1998). Behavior analysts have developed comprehensive language intervention programs for individuals with autism, focusing on a vast range of language functions and cognitive skills (Leaf & McEachin, 1999; Lovaas, 1981; Sundberg & Partington, 1998).

There are several important characteristics of EIBI. The overarching goal is concerned with guiding behavioral and brain development through the systematic and modulated sequencing of environmental events. This approach strives to affect change in all fundamental areas of cognitive, language, and behavioral functioning. Several skill domains must be addressed simultaneously, including functional communication, imitation, matching-to-sample, affiliative behavior, and basic receptive and expressive language, with a gradual progression to more complex domains. Teaching within these domains must be highly coordinated and integrated. As emphasized by Lovaas and

Smith (1989), children with autism "need to be taught virtually everything, and the teaching needs to proceed piece by piece rather than in major steps" (p. 23). The intervention protocol (i.e., curriculum) must be highly detailed and include (a) incremental steps in a simple-to-complex continuum in which the internal structure of each component skill (i.e., constitution of microskills) is sufficiently described according to operational criteria; (b) a high degree of coherence between each step or component skill in such a way that individual components (i.e., programs) are designed to eventually merge with each other (synthesis); and (c) the merging of programs or components, which must yield more complex skills that can be maintained by natural environmental contingencies, whereas basic components are maintained by virtue of their participation within composite or higher level skill units. The training manuals developed by Lovaas (1987), which consist of several hundred individual programs or steps, reflect a significant degree of such internal coherence and constitute a sound foundation for further elaboration and refinement.

Although establishment of functional skills is imperative, it is often necessary to focus on a multitude of microskills. As Moerk (1992) has emphasized, "Acquisition of any complex skill takes a long time and requires many levels of accomplishment" (p. 7). Some of these levels may not be functional per se. Research in behavioral fluency appears to validate the position that practice of component skills may support development of higher order problem-solving repertoires and generative learning (Johnson & Layng, 1992). Application of the principles of behavioral fluency to EIBI is an important development. Nevertheless, treatment must include a substantial emphasis on establishing skills with immediate functionality, such as communication and social skills, and a vast variety of other skills that enable the child to successfully and appropriately relate to the environment. Treatment must strive for a careful and balanced combination of child-driven and teacher-driven interactions. These requirements demand the utilization of several instructional strategies, including discrete-trial instruction, principles of fluency building, and strategies that systematically capture and contrive motivational variables (i.e., establishing operations). Consequently, EIBI is synonymous neither with discrete-trial instruction nor with contrived training.

EIBI cannot merely focus on establishing specific content. Rather, it must strive to establish skills that have the potential to produce widespread and generalized effects on learning, such as generalized conditional discrimination (within and across modalities), sufficient basic-level categorization (i.e., stimulus generalization), flexible shifts between part/whole perceptions of stimuli, inferential capacity, and generative learning. Inferential capacity and generative learning are concepts that are difficult to define behaviorally. However, the work in behavioral fluency, stimulus equivalence, and relational frame theory explores these concepts. Hayes (1994) has proposed an empirically based theory that includes frames of relations in which relational responding is contextually controlled. According to Hayes, overarching frames of relations are forms of behavior and appear to be important in the development of verbal behavior. As with imitation, relational frames (e.g., "opposite," "different," and "same") are general behavioral classes in which response topographies can be substituted for those used in the initial training. This proposal is consistent with Moerk's (1992) recognition that skill learning entails learning of abstract patterns that are flexible to changing situational demands.

Although establishing social skills must entail in vivo training, there should be a focus on the basic elements of social cognition or theory of mind (Ozonoff & Miller, 1995). Research inspired by the theory-of-mind hypothesis has produced detailed information regarding subcomponents and the structure and dynamics of social cognition. Although there are apparent constraints on generalization, there is evidence that children with autism can learn skills necessary to pass the litmus tests for a theory of mind (Ozonoff & Miller, 1995). Theory of mind might be a focus of future research within behavior analysis, and a behavior analytic interpretation might prove to be of great significance for intervention.

Finally, there must be a significant focus on generalization. Generalization is not an ad hoc element to be inserted at a later phase of the intervention but must be programmed from the outset. Skill acquisition per se is insufficient unless it can produce further changes in the child's behavioral repertoire. The concept of behavioral cusps (Rosales-Ruiz & Baer, 1997) captures this point. A cusp is a behavioral change that has consequences beyond the change itself because it

"exposes the individual's repertoire to new environments, especially new reinforcers and punishers, new responses, new stimulus control, and new communities of maintaining or destructive contingencies" (Rosales-Ruiz & Baer, 1997, p. 534). For instance, imitation is a cusp if and only if it enhances further learning. A mere collection of unrelated skill units that only occur under specific contingencies is neither a cusp nor a hallmark of effective treatment. It is often assumed that because children with autism struggle with skill generalization, the training should be as natural or functional as possible. Although this suggestion is important, it appears to be incomplete. Within applied behavior analysis, the concept of generalization is used in a variety of ways, and as such, it appears to lack a coherent meaning (Johnston, 1979). Generalization may best be regarded as a broad conceptual category containing several different behavioral processes, including spontaneity, recombinative behavior, stimulus generalization, fluency, and various forms of inference, each of which requires different kinds of contingency arrangements. "A flight" to the natural environment may not solve all the problems that are at issue when we speak of problems of generalization. EIBI must carefully identify the specific processes and skills that need to be in place to promote flexible and dynamic behavior that exhibits the relevant properties of generalization. The establishment of skills with an emphasis on integrating different repertoires and the transfer to extratraining contexts by systematic sequencing of environmental events are imperative and often require an element of intensive and contrived training.

Considering the significant heterogeneity of autism, response to intervention has been idiosyncratic—what works for one child may not work for another child or may even be counterproductive. Therefore, it is imperative to individualize curricula so that the facts of the child's behavior always guide intervention. As Rosales-Ruiz and Baer (1997) stated, "One child's cusp may be another child's waste of time." Replacement of normative skill building with approaches that focus on accommodating children's existing strengths must be made in accordance with the data. Thus, there is a great need for empirically based guidelines in making such decisions and research that compares the effectiveness of various behavioral intervention packages (G. Green, 1999; McIlvane, 1996).

At several levels of explanation, autism remains unresolved. However, the science of behavior analysis has generated an effective technology and intervention paradigm that continues to develop. It constitutes the only reliable form of intervention to improve the lives of children with autism and their families.

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Behavior analysis has already contributed substantially to the treatment of children with autism, and further gains can result from more use of Skinner's analysis of language in *Verbal Behavior* (1957) and in the resulting conceptual and experimental work. The approach emphasizes a unit of analysis consisting of the relations between behavior, motivative and discriminative variables, and consequences. Skinner identifies seven types of verbal operants—echoic, mand, tact, intraverbal, textual, transcriptive, and copying a text—which function as components of more advanced forms of language. This approach focuses on the development of each verbal operant (rather than on words and their meanings) and on the independent training of speaker and listener repertoires. Five more specific contributions are described that relate to the importance of (a) an effective language assessment, (b) mand training in early intervention, (c) establishing operations, (d) an intraverbal repertoire, and (e) automatic reinforcement.

The Benefits of Skinner's Analysis of Verbal Behavior for Children With Autism

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There have been several major advances in the behavioral treatment of children with autism since the publication of the initial study by Wolf, Risley, and Mees (1964). The majority of these advances are attributable to the development and maturing of the field of applied behavior analysis and to the extensive work of Ivar Lovaas and his students (e.g., Koegel, Russo, & Rincover, 1977; Leaf & McEachin, 1998; Lovaas, 1977, 1981; Lovaas, Koegel, & Schreibman, 1979; Lovaas & Smith, 1989; Schreibman & Carr, 1978). Much has been learned about the disorder from behavior analysis and this exceptional line of research. For example, early and intensive intervention is essential, behavioral techniques can be quite effective, and the pri-

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mary focus of the treatment plan needs to be on the development of language skills.

APPLIED BEHAVIOR ANALYSIS

The basic intervention program, now quite common in the behavioral treatment of autism (e.g., Maurice, Green, & Luce, 1996), consists largely in identifying goals in terms of specific behaviors to be altered in frequency; recording target behaviors; identifying effective forms of reinforcement; the use of extinction, shaping, and intermittent reinforcement; the development of operant stimulus control, stimulus prompting, and the fading of prompts; and the development of chaining, generalization, rules, imitation, modeling, and other now well-known behavioral procedures. With respect to research, there is an emphasis on within-subject (also called single-subject) experimental comparisons, direct observation (as opposed to the use of mental tests and self-report), ensuring the reliability of observations, and other methodological refinements. Any one of several current texts will suffice as a source of the scientific background, technical concepts, procedures, and methodology of applied behavior analysis (e.g., Cooper, Heron, & Heward, 1987; Kazdin, 2001; Martin & Pear, 1999; Miltenberger, 2001; Sulzer-Azaroff & Mayer, 1991).

LANGUAGE TRAINING

Because language underlies most learning in the typical child and is so conspicuously defective in children with autism, developing language skills is seen as a major goal of any training program. In most such programs, the training consists of the application of the behavioral technology described above to what is usually called communicative behavior. With deliberate use of reinforcement, the children are taught to look at an instructor, react appropriately to verbal stimuli by following simple instructions (“Stand up”), and identify stimuli by pointing or touching (“Touch nose”). They are taught to imitate the movements of the instructor (“Do this”), obtain one of several possible reinforcers by pointing at it (“What do you want?”), imitate the instructor’s vocal responses (“Say *cat*”), name objects and pictures of

objects ("What is this?"), name actions performed by the instructor ("What am I doing?"), and so on, with the tasks becoming increasingly complex as the child learns to perform the simpler ones. The training eventually requires correct pronunciation, correct grammar, appropriate tone of voice, appropriate use of *please*, and so on, with the goal that the child's language should ultimately be like that of typically developing peers. There are several versions of this general approach to language training (e.g., Guess, Sailor, & Baer, 1976; Kent, 1974; Lovaas, 1977; Maurice, 1993; Taylor & McDonough, 1996); however, they share most of the basic behavioral features identified above.

The behavioral approach in general has been much more effective than those based on psychoanalysis, holding therapy, auditory training, sensory integration, swimming with dolphins, weighted jackets, facilitated communication, vitamin therapy, and others (Green, 1996; T. Smith, 1996). Some children, after early and intensive intervention, have entered regular education classes at their appropriate age level (e.g., Fenske, Zalenski, Krantz, & McClannahan, 1985; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993), and most children at least acquire more effective social and language repertoires. However, even intensive intervention may be considerably less successful with some children than might be hoped (e.g., Lovaas, 1987, 1993; Maurice, 1996), perhaps due in part to the wide variability seen in children diagnosed with autism, the age at intervention, and the nature of the intervention program received.

In most of the current programs, the technical vocabulary of the instructor with respect to language is essentially that found in general language instruction as it occurs in elementary education, special education, speech and language instruction, and, to some extent, linguistics. Language is seen as receptive (understanding the language of others) and expressive (using language to interact with others), with the two referred to as communicative behavior. The descriptive terms for different kinds of language behavior are those of ordinary language such as *labels*, *requests*, *nouns*, *verbs*, *prepositions*, responding to and using "Wh" questions, responding to yes-no questions, and so on. This general approach seems quite reasonable, but the failure to make much use of the technical concepts and principles that appear in B. F.

Skinner's (1957) *Verbal Behavior* seems inconsistent with the stated behavioral focus of many intervention programs.

In 1984, the *Journal of the Experimental Analysis of Behavior* devoted an entire issue to "present trends and directions for the future." Jack Michael (1984), one of the authors of the current article, contributed an article titled "Verbal Behavior," and among the current trends he covered was behavioral theory and research on "learning to be an effective speaker and listener" (pp. 367-369). After describing the theoretical and practical importance of the existing behavioral work on teaching language, Michael commented as follows:

> Interestingly, this extensive body of research makes almost no use of the concepts, terms, and analyses that appear in Skinner's (1957) *Verbal Behavior.* Although the term verbal behavior had become widespread, the recent trend is toward increased use of the traditional term, language, in spite of its implication of a common process underlying kinds of behavior that differ considerably from one another, such as speaking and listening. The terms for elementary verbal relations—mand, tact, echoic, etc.—are used occasionally, but not to any important purpose; the research could easily have been conceived without the benefit of the distinctions Skinner makes. (pp. 368-369)

This comment still seems accurate today with respect to the relevance of *Verbal Behavior* to current work with children with autism. In the present article, we will consider some possible benefits of a closer look at Skinner's behavioral interpretation of language and suggest some applications based on that approach.

SKINNER'S GENERAL APPROACH TO VERBAL BEHAVIOR

THE UNIT OF ANALYSIS

First, Skinner (1957) defined verbal behavior as behavior that is reinforced through the mediation of another person's behavior (whereas nonverbal behavior is reinforced directly through contact with the physical environment) (pp. 1-2). He was concerned with the verbal behavior of the individual speaker rather than with the verbal

practices of a verbal community (e.g., as they are represented in a dictionary or a grammar text). The unit of analysis is the functional relation between a type of responding and the same independent variables that control nonverbal behavior, namely, motivative variables, discriminative stimuli, and the consequences that have followed that type of responding. Skinner refered to this unit as a verbal operant, with *operant* implying a type or class of behavior as distinct from a particular response instance; he refered to a set of such units in a particular individual as a verbal repertoire (pp. 19-22).

THE ELEMENTARY VERBAL RELATIONS

In chapters 3 through 7 of *Verbal Behavior*, Skinner (1957) distinguished between several different types of verbal operants (see Table 1). In addition to the audience relation, the following elementary verbal relations are described: mand, tact, echoic (and imitation), intraverbal, textual, transcriptive, and copying a text. The mand is a type of verbal behavior where the response form is controlled by a motivative variable (deprivation, satiation, or aversive stimulation, currently termed *establishing operation*, or EO); the echoic, intraverbal, textual, copying a text, and transcriptive relations are types of verbal behavior whose response forms are controlled by verbal stimuli; and the tact is a type of verbal behavior whose response form is controlled by a nonverbal stimulus. These are the elements of which all more complex forms of verbal behavior are composed; all consist of relations between motivative variables, discriminative stimuli, and response forms; and all are developed through the occurrence of response-contingent consequences.

THE VERBAL OPERANT VERSUS WORDS AND THEIR MEANINGS

At the beginning of chapter 8 of *Verbal Behavior*, "The Verbal Operant as the Unit of Analysis," Skinner (1957) elaborated on the difference between a traditional or commonsense understanding of language and his behavioral analysis. The first subsection heading is "The Same Form of Response in Different Types of Operants" (pp. 187-188), and its main point is that it may be the same word, but it

TABLE 1
Technical Definitions of Skinner's (1957) Elementary Verbal Operants

Controlling Variable	*Response*	*Consequence*
Verbal stimulus with point-to-point correspondence and formal similarity	Echoic Imitation Copying a text	Nonspecific reinforcement
Establishing operations	Mand	Specific reinforcement
Nonverbal stimulus	Tact	Nonspecific reinforcement
Verbal stimulus without point-to-point correspondence or formal similarity	Intraverbal	Nonspecific reinforcement
Verbal stimulus with point-to-point correspondence but without formal similarity	Textual Transcriptive	Nonspecific reinforcement
Verbal stimulus	Nonverbal behavior (receptive language)	Nonspecific reinforcement

is not the same functional unit for the individual verbal behaver. Or, said differently, the word is not a functional unit of the verbal behavior of the individual speaker or listener, even though it may be a unit of traditional grammar.

> In the terminology of meaning, we say that the word *doll* is used at one time "to ask for a doll" and at another "to describe or refer to a doll." When the response *Doll!* has been acquired as a mand, however, we do not expect that the child then spontaneously possesses a corresponding tact of similar form. If we find both types of operants in the repertoire of the child, we must account for them separately. This appears to make the task of explaining verbal behavior more difficult, but the advantage which appears to be gained by the traditional concept of the "word *doll*" is offset by the problem which remains of explaining how a child may learn to use a word both to "express a desire" and also to "describe an object." The total formulation has not been simplified; part of the task has merely been postponed. If we are to accept the full responsibility of giving an account of verbal behavior, we must face the fact that the mand *doll* and the tact *doll* involve separate functional relations which can be explained only by discovering all relevant variables. (pp. 187-188)

Skinner similarly criticized the notion that it is the same word whether written or spoken, the same word spoken or heard, or that we can "say the same thing" in different languages (e.g., in French or English, in technical and nontechnical jargons, etc.). Evidence is presented to the effect that because it is in some sense the same word, this does not in any way imply that it is the same behavioral functional relation. Various reasons why we might think so are considered, and in each case it is concluded that we are dealing with different verbal operants with independent functional control. Respect for this independent functional control is especially important for language training with children who have very little language. Skinner, of course, recognized that a sophisticated speaker can acquire a functional relation of one form, for example, as a tact, and then have it available without further training as a mand, but this seemingly spontaneous transfer from one verbal operant to another also needs analysis in terms of basic behavioral concepts and principles and in some cases turns out to be quite complex. This section of *Verbal Behavior* is only 12 pages long (pp. 187-198) but is filled with points that seem very relevant to much of the current efforts to develop verbal behavior in children with autism.

A major manifestation of the theme of the verbal operant as a unit is Skinner's clear distinction between the behavior of speaker and listener. In contrast with most traditional approaches, Skinner was primarily concerned with the behavior of the speaker. He avoided use of the terms *expressive language* and *receptive language* because of the implication that these are merely different manifestations of the same underlying processes. It is important to teach a child to react appropriately to the verbal stimuli provided by speakers, as well as to behave verbally as a speaker, but these are separate and different functional relations. In some cases, learning one type of behavior facilitates learning another, but this must also be understood in behavioral terms (in terms of motivative variables, stimuli, responses, and consequences) rather than in terms of learning the meanings of words as a listener and then using the words in various ways as a speaker.

This emphasis on a behavioral functional unit for the individual speaker and listener is especially important for training children with

autism who may not have had the massive exposure to verbal stimuli and related environmental events in the same manner as a typical child. Thinking in terms of the traditional linguistic unit consisting of words and meanings, it is easy to underestimate the complexity of some particular verbal relation and attribute a failure to the child's autism rather than to an incomplete behavioral analysis of the task. Skinner's verbal operants are fairly simple and readily understood in terms of basic behavioral principles—reinforcement, motivative variables, discriminative stimuli, and response forms—but some programs attempt to develop behavior that involves multiple and interacting repertoires before the relevant components are even in early stages of effectiveness. Skinner's general approach can help prevent these mistakes and avoid some of the discouragement on the part of trainers working at a very difficult task.

TEACHING CHILDREN WITH AUTISM

An important contribution of this approach is a training focus on the elementary verbal operants as separate functional units. These units are then seen as the bases for building more advanced language behavior. The emphasis on speaker and listener behaviors as independent repertoires is a closely related and equally important general contribution. In addition to these general themes, five more specific contributions will be described in some detail: the nature of an effective language assessment, the importance of mand training in early intervention, the relevance of EOs in language training, the importance of teaching an intraverbal repertoire, and the role of automatic reinforcement in language acquisition.

LANGUAGE ASSESSMENT

Viewing language as an interaction between speakers and listeners with the verbal operants as the basic units implies the relevance of these units for an assessment of defective or delayed language. For example, if a child with autism is referred for a language assessment, rather than administer a standardized test or search for an age-

equivalent score, one might examine the current effectiveness of each verbal operant. The behavior analyst would start by obtaining information about the child's mand repertoire. When known EOs are at strength, what behavior does the child engage in to obtain relevant reinforcement? When the reinforcement is provided, does the behavior cease? What is the frequency of the various mand units? Information regarding the quality and strength of the echoic repertoire can reveal potential problems in producing response topographies that are essential for other verbal interactions. If the child cannot echo specific sounds, then the probability of those responses occurring in other functional units of verbal behavior is quite low. A thorough examination of the tact repertoire will show the nature and extent of nonverbal stimulus control over verbal responses, and a systematic examination of the receptive and intraverbal repertoires will show the control by verbal stimuli. Finally, although not relevant for many early learners, the tendency for textual stimuli to evoke verbal behavior should be examined (although a surprising number of children with autism are hyperlexic). Each of these functional units can be examined briefly (M. L. Sundberg & Partington, 1998) or in extensive detail (Partington & Sundberg, 1998).

THE IMPORTANCE OF THE MAND IN INITIAL LANGUAGE TRAINING

The mand (Skinner, 1957, pp. 35-51) is a type of language in which the form of the child's verbal response (what the child says) is controlled by what the child wants (by what is currently effective as an EO—see below). Mands receive reinforcement specific to the particular mand—the mand *milk* is reinforced by receiving milk, *out* is reinforced by an adult's opening a door, *up* is reinforced by being picked up, and so on. The other verbal operants (echoic, tact, intraverbal) typically receive nonspecific reinforcement—some form of generalized conditioned reinforcement such as social attention, approval, or termination of a demand of some sort. Said another way, mands directly benefit the speaker by producing access to desired (often unconditioned) reinforcers. The other verbal operants, while certainly important, do not have this type of immediate benefit. They produce social

approval, possibly immediately after the response, but the reinforcing effectiveness of social approval may itself be dependent on more remote events. It is not surprising, then, that mands are typically the first type of verbal behavior that humans acquire (Bijou & Baer, 1965; Skinner, 1957). Much of a typical infant's early language consists in mands for unconditioned reinforcers or for strong conditioned reinforcers.

From the perspective of Skinner's analysis, it would be quite reasonable for mand training to be the major focus of early language training. The other types of verbal behavior should not be neglected, but it is the mand that gives the child some control over the social and, indirectly, the nonsocial environment. This control should increase the value (to the child) of language training in general, which in turn should make the task of the language trainer an easier one. Until recently, however, the mand has been somewhat neglected in training programs for children with autism in favor of receptive language training and training in the tact relation. This neglect is quite reasonable if one believes that the acquisition of language consists largely in learning the meanings of words that can then be used in various ways with no further training. From this traditional language perspective, receptive language training is clearly one of the easiest ways to teach such meanings, and tact training is probably next. Based on experience with typical children and adults, once a person has learned what an object is called (by learning to point to it when given its name or to say the name when the object is shown), it is reasonable to assume that when the object becomes important, the learner will be able to ask for it without further training. However, it is clear that this does not happen with children who have very little language, many of whom have had a good deal of receptive language and tact training but are said to lack a functional language repertoire, which is then explained in terms of their intellectual deficit. Such children can often point to several kinds of objects when the name is spoken, and they can sometimes even say the name when the object is shown, but they have no tendency to request the object when it is clear from other evidence that it would be an effective form of reinforcement for them. Or, in more general terms, they have no tendency to use language to control their environment for their own benefit.

Another reason for the neglect of mand training, even by those who might well appreciate its significance, is that the trainer must contrive appropriate motivative variables (EOs) or take advantage of those that develop naturally. Contriving a variety of effective EOs for the learner seems at first glance much more difficult than providing a variety of objects (usually pictures of objects) to be named or pointed at. And relying on naturally occurring EOs in a language-training setting will not usually result in sufficient variety, although the variety can be increased by providing language training under other circumstances not instituted for that purpose. The procedure called incidental teaching (Hart & Risley, 1975) makes some use of this latter approach in that verbal prompts for mands are provided whenever the learner needs help in obtaining some kind of reinforcement during ordinary training or care-giving activities.

Mands are very important to early language learners. Not only do they allow a child to control the delivery of conditioned and unconditioned reinforcers, but they begin to establish the speaker and listener roles that are essential to further verbal development. Mands are also the most likely type of verbal behavior to be emitted spontaneously, and generalization may occur quickly because of the unique effects of the EO (see below). The data are quite clear that manding does not emerge from tact and receptive training for severely language-delayed children (for a review, see Shafer, 1994). Controlling and manipulating EOs is slightly more complex than presenting discriminative stimuli, but if one is familiar with learned EO (Michael, 1993) methods of contriving and capturing, EOs are relatively straightforward (e.g., Shafer, 1994; M. L. Sundberg & Partington, 1998). Finally, it is frequently reported by parents and trainers that mand training is more enjoyable for both parties, that inappropriate behavior occurs less, and that children are more willing to participate in language-training activities.

THE ESTABLISHING OPERATION AS AN INDEPENDENT VARIABLE IN LANGUAGE TRAINING

In chapter 3 of *Verbal Behavior*, Skinner (1957) described several different types of mands and discussed in detail how deprivation, sati-

ation, and aversive stimulation control these mands as well as other types of behavior. In short, Skinner carried on a theme introduced in *Behavior of Organisms* (1938) and elaborated on in *Science and Human Behavior* (1953) that deprivation, satiation, and aversive stimulation are basic independent variables in the analysis of behavior. *Establishing operation* (Keller & Schoenfeld, 1950; Michael, 1982, 1988, 1993) is a general term for any environmental change that functions like deprivation, satiation, and aversive stimulation in momentarily altering the reinforcing effectiveness of other events and in altering the frequency of occurrence of the type of behavior that is a consequence of those other events. For example, food deprivation increases the momentary effectiveness of food as a reinforcer (when or if the organism encounters food) and increases the frequency of any behavior that has been followed by food. For a child, food deprivation will make any kind of food effective as reinforcement and evoke going to the place where food has been found or possibly evoke the mand, saying "eat" or "food," if this behavior has been followed by the receipt of food in the past.

Michael (1993) distinguished between two main types of EOs: (a) unconditioned establishing operations (UEOs) related to unlearned forms of motivation and (b) conditioned establishing operations (CEOs) related to learned forms of motivation. Examples of UEOs are food deprivation, water deprivation, sleep deprivation, painful stimulation, and being uncomfortably cod. He identified several kinds of CEOs, two of which (transitive and reflexive) are quite relevant to training children with autism, but a description of their function would take us somewhat beyond the purpose of this article (see McGill, 1999; Michael, 1993, in press; M. L. Sundberg, 1993a).

EOs play a significant role in the development of mands during early training, as suggested previously, but they are also relevant to a wide variety of more complex mands in later training, and they also share control with verbal and nonverbal discriminative stimuli in other verbal operants. However, the controlling variable for the mand, the EO, is not as conspicuous as a discriminative stimulus and may be overlooked as an essential part of the verbal functional relation. Several versions of this kind of problem are given below.

An EO for a mand cannot be assumed from discriminative stimulus control. As discussed in the section "The Verbal Operant Versus Words and Their Meanings," providing a tact when shown an object (naming the object) or identifying that object among several when a verbal stimulus is provided (receptive language) does not constitute evidence that the same response form will function as a mand when the object is wanted (i.e., would be effective as reinforcement if obtained). In the early stages of training a child to say "cup" as a mand, an EO that makes the receipt of a cup effective as reinforcement should be in effect, and the cup (not social approval) should then be provided contingent on the child's saying "cup." The manipulation of an EO followed by specific reinforcement relevant to that EO is essential for the development of effective mands, yet this procedure seems not to be a prominent part of many of the current training programs. This issue is closely related to the next problem.

Mands for missing items. The ultimate value of the mand to the speaker is to obtain objects or to bring about conditions that are not present. This means that to be optimally useful a mand should occur in the absence of the object or condition that is the reinforcement for the mand; it should occur primarily under the control of the EO. A common problem faced by many children with autism is that they are unable to mand for items that are not physically present. For example, a child may be able to ask for a specific toy when that toy is present and being offered to the child, but if the toy is missing, the child may be unable to tell anyone what is desired and just engages in generalized mand behavior such as pulling at the adult, crying, and so on. Thus, many parents find themselves playing a guessing game by presenting several toys or objects or actions.

Mand training, to the extent that it is given at all, may consist largely in presenting an object that is assumed to be effective as a reinforcer and asking, "What do you want?" The "correct" answer to the question is then the same response form that has been appropriate as a tact, and the social reinforcement for making the response as a tact may be as important to the child as receiving the object. This procedure results in a functional relation that is part tact and part mand, and the mand relation may be the smaller part, with the result that there

will be no strong tendency to make the same response in the absence of the object (when the tact stimulus is not present) even when it would be effective as a form of reinforcement. The target repertoire for mand training is a pure mand, that is, a response that is free from nonverbal stimulus control and under the exclusive control of an EO. Specific training on these verbal skills is typically necessary and must occur when the EO is strong by either capturing an existing EO or contriving a new EO (Hall & Sundberg, 1987; M. L. Sundberg, 1993a; M. L. Sundberg & Partington, 1998).

Mands for information. Questions are mands that are reinforced by verbal behavior on the part of the listener, who typically supplies what can be considered information about the environment. Questions are thus under the control of EOs that make such information valuable to the asker. Questions are important for verbal development because they allow a speaker to react more precisely to the environment and to acquire additional verbal behavior. Training a child with autism to ask questions, however, is difficult in part because there must be an EO for information at strength during the training, and many children with autism are not strongly reinforced by such verbal information. Training may fail because the role of the relevant EO as the primary source of control for asking questions is not appreciated. Teaching a child to say "Where is the cup?" as an echoic response and then providing the information ("On the table") along with social reinforcement for the echoic response will not generate a functional verbal relation unless there is a current EO at strength responsible for the value of the information. The relevant EO must either be captured or contrived to conduct the necessary training. Other mands for information, such as those involving the response forms "who," "what," "when," "which," "how," and "why," also involve specific EOs that must be present during training.

Mands to remove aversive stimuli. There are several different mands that can be evoked by learned aversive stimuli (a type of learned EO or CEO), and children with autism need to be specifically taught each of them (e.g., "go away," "don't," "stop," "give that back," "leave me alone"). It is important that these responses be under EO

control rather than control by a discriminative stimulus, which means that the aversive stimulus must be present during training, and terminating the aversive stimulus must be the main form of reinforcement for the correct response, otherwise the mand will not occur in the natural environment under appropriate conditions.

The use of the EO to teach other verbal behaviors. It also appears that mand training, and the specific use of the EO as an independent variable, can facilitate the later development of echoic, tact, and intraverbal training in at least two ways. First, a successful mand training program with a previously nonverbal child often changes the child's willingness to participate in training sessions. The child is now successful where only failure had occurred in the past, and trainers are paired with this kind of reinforcement rather than with punishment consisting of demanding further efforts and possibly other social behaviors that function negatively. Second, the EO can be used as an additional independent variable in teaching echoics, tacts, and intraverbals (multiple control). Once a specific response form is acquired as a mand, then procedures to break free from EO control and bring the response solely under discriminative stimulus control can be implemented (Carroll & Hesse, 1987; Drash, High, & Tutor, 1999; Skinner, 1957; M. L. Sundberg & Partington, 1998).

THE INTRAVERBAL REPERTOIRE

Skinner (1957, pp. 71-78) identified the intraverbal relation as a type of verbal behavior where a verbal response is controlled by an antecedent verbal stimulus that lacks point-to-point correspondence between the stimulus and the response. That is, the verbal stimulus and the verbal response are not composed of the same verbal units (letters, sounds, etc.). A tendency to say "dog" as a result of hearing someone else say "animal" or seeing the word *animal* on a chalkboard is an example of an intraverbal relation. By contrast, a tendency to say "dog" as a result of hearing someone else say "dog" is echoic behavior, a tendency to say "dog" as a result of seeing the word *dog* on a chalkboard is textual behavior, and a tendency to say "dog" as a result of seeing an actual dog or a picture of a dog is a tact. The first three

examples illustrate control by a verbal stimulus and the fourth by a nonverbal stimulus. In the educational context, the reinforcement for all four of these relations usually involves some form of social conditioned reinforcement (see Table 1) such as "good job" or "right."

An intraverbal repertoire facilitates other verbal and nonverbal behavior. It prepares a speaker to behave rapidly and accurately with respect to further stimulation and, at a more advanced level, plays an important role in continuing a conversation. For example, a child hears an adult speaker say "animal" in some context. If this stimulus functions to evoke several relevant intraverbal responses, such as "elephant," "lion," "camel," "bear," and so on, the child is then better able to react to other parts of the adult's verbal stimulus that may be related to a recent trip to a zoo. One might say that the child is now thinking about animals and now has relevant verbal responses at strength for further responses to the adult's verbal behavior. An intraverbal stimulus probes the listener's repertoire and gets it ready for further stimulation.

Intraverbal chains are important components of many normal intellectual repertoires, such as a tendency to say "three" as a result of hearing "one, two . . . "; a tendency to say "blue" as a result of hearing "red, white, and . . . "; reciting the alphabet; providing addresses and phone numbers; and so on. Typical adult speakers have hundreds of thousands of such relations as a part of their intraverbal repertoires. In terms of conversation, a tact repertoire permits verbal behavior about an object or event that is actually present, whereas an intraverbal repertoire allows a speaker to talk about (and to think about) objects and events that are not physically present.

Many children with autism have delayed, defective, or nonexistent intraverbal repertoires, even though they can emit hundreds of words for objects and actions (tacts) and can point to those objects under the control of appropriate verbal stimuli (receptive language). For example, a child may be able to identify a picture of a bed when hearing "bed" spoken by another person, tact a bed, and even mand for bed, but may not have any tendency to say "bed" when hearing someone say "sleep" or, more formally, when hearing "You sleep in a . . . . " In traditional terms, this type of language disorder may be described as a child's failure to auditorily process the verbal stimulus or in terms of

other hypothesized internal processes. Conceptualizing the deficit this way can easily hinder acquiring intraverbal behavior because it distracts us from an analysis of the appropriate environmental controlling variables. Rarely is the problem identified as a failure to teach intraverbal behavior along with the other types of verbal behavior, a characterization that more clearly implies the necessary remedial training.

Typical children acquire much of their intraverbal repertoire as a result of massive exposure to a complex and valuable verbal environment. For example, they can be heard reciting television commercials with no special instruction or encouragement—even in spite of some discouragement. However, with a beginning learner who is not strongly reinforced by stimuli that make up the typical social environment, it may be necessary to directly teach some intraverbal behavior that the more typically developing child acquires indirectly. Due to the independence of the various functional verbal units in the early stages of language training, one cannot assume the development of an intraverbal repertoire from the availability of an extensive echoic, tact, and mand repertoire. Empirical research has shown that some children with mands and tacts may not be able to emit those same response forms under intraverbal control (e.g., Braam & Poling, 1983; Luciano, 1986; Partington & Bailey, 1993; Watkins, Pack-Texteria, & Howard, 1989).

AUTOMATIC REINFORCEMENT

Skinner used the term *automatic reinforcement* in a number of his writings simply to indicate that the reinforcement occurred without someone providing it (Vaughan & Michael, 1982). In other words, the reinforcement was the automatic result of the response. For example,

> the young child alone in the nursery may automatically reinforce his own exploratory vocal behavior when he produces sounds which he has heard in the speech of others. . . . The adult acquires intonational patterns which are automatically reinforcing because they are characteristic of, say, a person of prestige. (Skinner, 1957, p. 58)

Others have made use of a similar analysis or have elaborated on Skinner's (e.g., Bijou & Baer, 1965; Braine, 1963; Mowrer, 1950; Osgood,

1953; Spradlin, 1966). A two-stage conditioning history is involved in this process. In Stage 1, a neutral stimulus (e.g., a mother's voice) is paired with an existing form of conditioned or unconditioned reinforcement (food, warmth, removal of aversive stimuli). As a result, the previously neutral stimulus becomes a form of conditioned reinforcement (hearing mother's voice or any similar stimulus will now strengthen whatever behavior precedes that stimulation). In Stage 2, a vocal response by the child (either as random muscle movement of the vocal cords or as reflexive behavior) produces an auditory stimulus that sounds somewhat like the mother's voice (words, intonation, pitch), which then functions as reinforcement in automatically increasing the frequency of that type of vocal behavior. The concept of automatic reinforcement may help to explain why a typical infant engages in such extensive babbling without the apparent delivery of reinforcement. In their analysis of child language development, Bijou and Baer (1965) also concluded that automatic reinforcement, along with direct reinforcement, is a major independent variable responsible for an infant's tendency to babble.

A problem faced by many language-delayed children is that their vocalization rate is too low to acquire the muscle control necessary for the later training of echoic responses. There is some evidence that the application of an automatic reinforcement procedure (pairing sounds made by a trainer with various reinforcers) can increase vocal behavior, which should facilitate the development of echoic and mand behaviors (R. Smith, Michael, & Sundberg, 1996; M. L. Sundberg, Michael, Partington, & Sundberg, 1996; Yoon, 1998; Yoon & Bennett, 2000). A significant aspect of these studies is that the procedure not only results in an increase in the rate of babbling the sounds that were paired with reinforcement but that new vocal responses have sometimes been acquired without the use of direct reinforcement or prompts to respond. Thus, the procedure can provide parents and clinicians with a new way to increase a child's vocal repertoire, and it is an especially easy procedure to carry out (just make simple sounds like those the child can or could also make and provide reinforcement of any kind at the same time).

It seems quite likely that automatic reinforcement continues to play an important role in the development of the more complex aspects of

verbal behavior, such as the acquisition of grammatical conventions. Donahoe and Palmer (1994, pp. 317-319) and Palmer (1996, pp. 289-290; 1998, p. 14) have suggested that much grammar is acquired as children hear their own vocal behavior and are automatically reinforced when it sounds like that of other people in their environment and automatically punished when it sounds odd or unusual. Palmer (1996) refered to this as the child's "achieving parity." If this interpretation is correct, we should expect that the use of explicit reinforcement to teach many subtle grammatical conventions (e.g., those relating to the use of "the" and "a") without the support of massive automatic reinforcement and punishment may be relatively unsuccessful. One implication is that the focus on developing verbal behavior in children with autism should be on communicative effectiveness and not impaired by a focus on grammatical correctness that can be expected to develop without instruction as the child's functional verbal repertoire increases. Another implication is that language training should be fun for the child and paired with reinforcement as much as possible rather than with the aversive stimuli often associated with demands.

IMPLICATIONS FOR MORE COMPLEX VERBAL BEHAVIOR

In many cases, the task of the program designer is to directly teach most of the elements of a language repertoire to an individual child. This task may be quite straightforward at the early steps of nonverbal imitation, echoic, tact, mand, and intraverbal training because the components of the basic operants are quite clear (i.e., EOs, discriminative stimuli, consequences, etc.) and it is known what to expect from the child who starts with nothing. However, more advanced targeted repertoires may depend on verbal relations that are considerably more complex than is realized. This is especially likely if the training tasks and goals are taken from a commonsense understanding of the verbal behavior a typical child engages in, rather than starting with the elementary verbal operants and building from those elements.

Many more advanced verbal relations involve multiple sources of control and interacting repertoires that cannot be developed before the

relevant components are firmly established. Verbal behavior involving possession ("Point to Mary's book"), yes-no questions ("Is this a cup?"), emotional states ("How do you feel?"), subject-verb-object combinations ("Boy touching dog"), and so on may be one kind of behavior when exhibited by a typical child who already has a large repertoire of mands, tacts, and intraverbals but a very different kind of behavior for the child with autism. Even what is ordinarily viewed as relatively simple behavior may be more complicated than it seems. For example, some beginning receptive language involves joint control (see below) and conditional discriminations. When asked to point to an object when there are several objects present, the child must have a reasonable scanning repertoire—looking at the first object, then looking at the next object, and so on, without skipping any objects—and the pointing response must then be controlled by both the verbal stimulus (the instruction) and nonverbal stimulus (the object), clearly a type of multiple control or conditional discrimination. The typically developing child may make echoic responses to the verbal instruction and then further self-echoic responses as the objects are being scanned. When it is possible to tact an object with the same response form as the echoic or self-echoic response, that object is then selected. This is the joint control discussed at length and specifically trained in a number of experiments by Lowenkron (e.g., 1984, 1991) in connection with generalized matching to sample. Pointing at the correct object would involve a different kind of verbal control for a child with no systematic scanning repertoire and no relevant echoic and tact responses, if it were possible at all for such a child.

It is also common in some training programs to attempt early to bring verbal behavior under the control of private stimuli, such as those involved in emotional states (sad, happy, afraid), pains, itches, a full bladder, hunger pangs, nausea, and so on. Such verbal behavior is an important part of any person's repertoire, but because the controlling variables that are affecting the learner cannot be directly contacted by the teacher or parent, accurate tact relations are difficult to develop. An instructor cannot present the relevant private stimulus that is inside a person's body and therefore cannot differentially reinforce correct tact responses in the same way that correct tacts to objects and actions can be reinforced. Teaching a child to correctly say

"itch" with respect to a stimulus coming from a portion of the child's arm is trained indirectly as the teacher reacts to common public accompaniments of such stimuli (observing a skin rash) and collateral responses by the learner (observing the child's scratching), but this method is fraught with difficulties (the rash may not itch, the scratching may be imitated), and such repertoires even in typical adults are often quite imprecise. Verbal behavior under the control of private stimuli is an issue that has been at the core of much of the theoretical and philosophical analyses of behavior ever since Skinner (1945) first described his radical behaviorism and contrasted it with methodological behaviorism. It goes considerably beyond the scope of this article to deal with this issue, but its understanding is critical for teaching this most subtle and personal type of language. (For more on this topic, see chap. 17 of Skinner's *Science and Human Behavior* [1953] and pp. 130-146 of *Verbal Behavior* [1957].)

There are a number of complex types of verbal behavior that raise special problems when language is being deliberately generated in those who have very little language. Some examples are verbal behavior under the control of relative concepts, such as large and small (a large dog is much smaller than even a tiny mountain), under, over, to the right of, and so on, and teaching children to talk about the past ("What did you see at the zoo yesterday?"). Such verbal relations are difficult to train from any theoretical or conceptual approach, but Skinner's detailed analysis, as in *Verbal Behavior* (1957), may offer some additional techniques and concepts in our effort to develop this type of language in children with autism.

MORE GENERAL ISSUES

Skinner's analysis of verbal behavior may also help parents and professionals make decisions regarding general instructional approaches for a child. Three such issues will be considered: augmentative communication, discrete-trial training (DTT) versus natural environment training (NET), and inclusion. Selecting a form of augmentative communication often involves a decision between a selection-based form of verbal behavior (e.g., the picture exchange communication system) (Frost & Bondy, 1994) and a topography-

based form of verbal behavior (e.g., sign language). Conceptual analyses and research based on Skinner's *Verbal Behavior* suggest that selection-based systems involve multiple response forms (e.g., scanning, selecting, handing over) and conditional discriminations that are more complex than they first appear (e.g., Lowenkron, 1991; Michael, 1985; Potter & Brown, 1997; Potter, Huber, & Michael, 1997; Shafer, 1993; C. T. Sundberg & Sundberg, 1990; M. L. Sundberg, 1993b; Wraikat, Sundberg, & Michael, 1991), yet selection-based systems remain the most popular choice by augmentative communication specialists but not necessarily because of more effective short- and long-range performance by the learner (Shafer, 1993).

DTT is often contrasted with NET in the behavioral literature, with studies attempting to show that one approach is more beneficial than the other (e.g., Elliott, Hall, & Soper, 1991; Koegel, Koegel, & Surratt, 1992). However, a verbal behavior analysis suggests that the two focus on different verbal operants. Both teach receptive and expressive language, but NET is primarily based on mand training by using the child's current EOs and delivering specific reinforcement, whereas DTT is primarily based on tact and receptive training with nonverbal and verbal stimuli and delivering nonspecific reinforcement. From a verbal behavior perspective, a more complete language repertoire would be acquired from a combination of DTT and NET procedures (M. L. Sundberg & Partington, 1999).

Inclusion is also an issue that is frequently discussed by parents and professionals. Probably a major advantage of including a child with autism in a regular education classroom is the presence of verbal peers who can model typical verbal interactions, present a wide variety of verbal stimuli, and produce consequence verbal behavior through social interaction and specific reinforcement. However, the decision to place a child with autism in a regular education class should be based, in part, on whether the child has the basic verbal repertoires necessary to acquire new behaviors in that learning environment. The child needs functional mand, tact, and intraverbal repertoires, as well as effective listener skills, in order to acquire new verbal behaviors from peers. If the child does not have a strong intraverbal repertoire, for example, the verbal stimuli presented by peers will not evoke appropriate verbal responses and may produce a form of punishment

rather than reinforcement. If the child does have the prerequisite verbal skills, then an inclusion environment is essential for further verbal development (M. L. Sundberg & Partington, 1998). Skinner's analysis of verbal behavior as a conceptual basis for examining these issues could result in a more effective individualized intervention program.

CONCLUSION

Children with autism have benefited greatly from the procedures and techniques of applied behavior analysis. It is suggested in this article that it may be possible to make further gains by using some aspects of Skinner's analysis of verbal behavior as a basis for assessment and intervention programs with these children. The emphasis on the verbal operant as an appropriate unit of analysis has implications for several elements of an intervention program: a focus on the separate training of each verbal operant and with greater emphasis on mand and intraverbal relations than is currently practiced; consideration of speaker and listener repertoires as requiring separate and independent training; and consideration of EOs and automatic reinforcement as important factors in the analysis and training of verbal skills. Another implication is that with the more traditional emphasis on words and meanings it may be easy to underestimate the complexity of some verbal relations and attribute failure to the child's autism rather than to an incomplete behavioral analysis of the language task. Skinner's approach may help prevent some errors of this type and hasten the acquisition of language by children with autism.

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The Picture Exchange Communication System (PECS) is an alternative/augmentative communication system that was developed to teach functional communication to children with limited speech. The approach is unique in that it teaches children to initiate communicative interactions within a social framework. This article describes the advantages to implementing PECS over traditional approaches. The PECS training protocol is described wherein children are taught to exchange a single picture for a desired item and eventually to construct picture-based sentences and use a variety of attributes in their requests. The relationship of PECS's implementation to the development of speech in previously nonvocal students is reviewed.

The Picture Exchange Communication System

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Communication is a complex behavior (see Skinner, 1957). For an act to be defined as communicative (or "verbal," within Skinner's analysis), it must be under the stimulus control of the listener, and the subsequent reinforcement must be mediated by the listener. In more lay terms, we have defined functional communication as "behavior (defined in form by the community) directed to another person who in turn provides related direct or social rewards" (Bondy & Sulzer-Azaroff, 2001).

Historically, therapists working with children with autism spectrum disorder (ASD) have used a broad array of training protocols to teach communication skills. When speech production is viewed as the goal of intervention, speech imitation protocols are used. The basic premise of these approaches is that children can be taught to speak by imitating the various sound and word productions of the therapist. If, however, a program is to rely on a child imitating the therapist, then what must first be taught are basic attending skills such as sitting appropriately and looking at the therapist (e.g., Anderson, Taras, &

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Cannon, 1996; Lovaas, 1987). When speech imitation is initially difficult for children, the task may be simplified by teaching the child to first imitate specific nonspeech actions of the therapist. Some children spend many months in this type of training before the first words are spoken, and a fair proportion of children fail to develop speech within a reasonable period of time (i.e., 3 to 6 months). Furthermore, some approaches to vocal imitation may result in skill acquisition but yet fail to generalize to spontaneous communication. That is, modeling by the therapist may lead to prompt dependency by the learner.

Therapists recognizing the limitations of speech imitation training programs or looking for alternative communication modalities to teach while speech is developing have tried various alternative or augmentative communication systems. These have included both sign language and picture- or symbol-based communication systems that require a user to point to or touch pictures or symbols in order to encode a specific message. If the goal of intervention is the use of communication in a variety of natural settings, then sign language presents limitations merely because of the limited number of communicative partners available to the user. Although there is a distinct signing culture within the deaf community, we are aware of no reports of a child with autism successfully participating as a full member of this group. Furthermore, traditional approaches to sign training have focused on a child's imitation skills with concomitant concerns over developing prompt dependency, poor generalization, limited total vocabulary, or limited complexity. Recent efforts by some have lead to training programs that minimize modeling while promoting greater use of direct physical prompts (Sundberg & Partington, 1998).

Many children using picture-point systems are inaccurate pointers or have difficulty isolating a single finger to point, related either to age or specific motor difficulties. A child may touch the communication board with his or her whole hand, covering many pictures. This lack of precision in pointing requires that the listener interpret these imprecise messages. Picture-point systems often limit the user to communicating only in situations where a "listener" is near enough to see the pictures or the action of the user. Therefore, many children wait for a teacher to approach them (usually with a question such as "What do you want?" or "What is it?") before using the communication display.

The use of such prompts also may result in prompt dependency, again limiting generalization to spontaneous use. Furthermore, keeping our definition of communication in mind, teaching someone to point to pictures (or other visual symbols) does not necessarily bring them in direct contact with their communicative partners (even if the device involves a voice-output component). In fact, we have observed many children with autism sit and point to pictures without ever approaching the potential communicative partner.

In addition, many traditional programs fail to consider the importance, from the child's perspective, of the potential outcomes of engaging in a communicative exchange. For example, typically developing children's first words are as likely to be associated with concrete outcomes ("Airplane!" to get mom to hand the child his favorite toy airplane) as with more social outcomes ("Airplane!" to receive some social reaction from mom such as "Yes, I hear one, too") (Wetherby, Cain, Yonclas, & Walker, 1988). These two communicative functions are identified as *mands* and *tacts* by Skinner (1957). Many traditional programs begin by teaching children to name or label objects or pictures with the assumption that once the child knows the word he or she will be able to use it in all contexts. Because children with autism are much more likely to engage in behaviors that lead to tangible outcomes (Mundy, Sigman, & Kasari, 1990), they often fail at traditional labeling lessons.

The Picture Exchange Communication System (PECS) is a training system that was developed to teach children with ASD a rapidly acquired, self-initiated functional communication system (Bondy & Frost, 1994, 1998). Because tangible outcomes initially are more motivating to children with autism than are social outcomes, PECS begins by teaching requesting. The overall protocol is divided into six phases that progress from teaching children how to communicate using the pictures in a manner that is important to the child, to the use of multipicture sentences, and then to the use of a variety of communicative functions. The protocol combines the theory and practices of both behavioral and developmental, or interactional, perspectives. Typical language development initially is paralleled so that children functioning as young as 10 to 12 months can learn the initial phases (Scott Helsinger, personal communication, 2000). PECS relies on the

principles of applied behavior analysis so that distinct prompting, reinforcement, and error correction strategies are specified at each training phase in order to teach spontaneous, functional communication. Specifically, no verbal prompts are used (although responding to natural verbal cues is taught later in the sequence). When teaching communicative initiation, two trainers are used: one who acts as the communicative partner (the listener) to interact socially with the child and one who provides physical prompting from behind the child and who will not interact with the child in any social manner. This type of prompting strategy reduces the likelihood of developing prompt dependency on cues provided by the communicative partner and can be faded easily so that spontaneity is achieved very early in training.

TRAINING SEQUENCE

REINFORCER INVENTORY

PECS begins by teaching spontaneous requests. In order to do so, though, the trainer first must know what the child wants. The initial step in implementing PECS, therefore, is to determine which items the child persistently wants. This entire process can be conducted without any verbal prompts such as "Show me what you want," "What do you want?" or "Do you want this?" Rather, the trainer merely offers items and then observes the student's subsequent actions. Specific, observable actions such as reaching toward, looking toward, taking, and so on indicate that an item is preferred. Once the trainer has identified a variety of items the child seems to like, he or she systematically offers a few items at a time in order to determine a hierarchy of preferences.

Phase 1: How to Communicate

Typically developing children learn the nature of communication as early as 6 to 9 months of age when they begin to develop interactive routines with mom or dad. These interactions may or may not involve babbling, but they certainly precede the development of spoken words. Instead, they involve an *approach* (or orienting response) via

looking at their parents, physically getting closer, pointing to them, or some similar action; a *behavior* that draws attention to some event or item (such as the movement of an object, a sudden noise, etc.); and a *consequence* by which the parents reinforce the behavior via laughing, smiling, repeating the vocalizations or gestures, or providing a tangible outcome. Thus, even though no words are spoken, a communicative episode can be identified. In Phase 1 of PECS, students are taught to similarly communicate without using spoken words—they learn to approach another person (reach toward), engage in a specific behavior (give a picture), and receive a desired outcome (the item asked for).

Just as typical children do not use actual words during this early learning period, students using PECS also do not yet choose a specific picture. Instead, they use the single picture prepared by the teacher. A child does not need to have mastered discrimination between symbols or pictures before learning the basic elements of communication (just as typical children do not demonstrate the use of spoken words prior to learning to communicate). As with typically developing children, learning to use a specific word or symbol comes later.

Phase 1 is designed to teach a physical behavior that will be considered communicative. The student learns to pick up a picture of a desired item, reach to a communicative partner, and release the picture into the communicative partner's open hand. Spontaneity is ensured by using two trainers: one who acts as the physical prompter and one who provides prompts from outside the communicative interaction.

The initial training episode begins with the communicative partner showing the child what is available or enticing the child with that item. Teaching the child to initiate a communicative exchange takes advantage of the child's tendency to reach for rewarding items. Note that the initial reach for the item is not a communicative act—it is controlled by the properties of the item itself, and thus there is as yet no listener for the child. On seeing this reach, the physical prompter provides physical assistance to pick up the picture, reach to the communicative partner, and release the picture into the communicative partner's hand. The communicative partner reacts by immediately giving the item to the child while naming the item ("Ball!"). The child is allowed to play with the item for several seconds or consume a small portion, if edible.

Training continues in this manner: The communicative partner silently entices the child with the desired item, and the physical prompter waits for the child to reach before providing physical assistance to pick up the picture, reach to the communicative partner, and release the picture into the communicative partner's hand. Over several trials, the physical prompter gradually fades assistance so that the child learns independently to exchange the pictures to gain access to the desired item. The communicative partner should take care to not prompt the child by holding out a hand before the child has picked up the picture. Once the student is reliably picking up the picture and reaching toward the communicative partner's open hand, the partner fades this open-hand cue by waiting increasingly longer to show a hand once the student is reaching with the picture.

This initial training often takes as few as 10 or 15 minutes before the child learns to independently exchange the picture. This arrangement is repeated across the day using a variety of reinforcers and a variety of trainers so that generalization across materials and trainers is taught from the beginning. The outcome of Phase 1 is that the child, upon seeing a desired item, can pick up a picture, reach toward the communicative partner, and release the picture into the communicative partner's hand to obtain the desired item.

Phase 2: Distance and Persistence

A critical component of spontaneous communication is persistence when no reaction is given to an initial attempt. During Phase 2, children are taught to persist in their communicative attempts despite a variety of obstacles or when lesson parameters change slightly. Generalization is taught by systematically eliminating both overt and subtle prompts that might be cueing the child to initiate communication. Typically developing children use volume or loudness of their voices when initial communicative attempts are not acknowledged.[1] Children using PECS may not have these vocal components, so they must be taught to persevere via other strategies. The child will learn to reach farther to get to the hand of the communicative partner or to actually travel to the partner by walking increasingly greater distances. The child will learn how to be consistent at delivering the pic-

ture even when the communicative partner is not looking at the child or has his or her back turned to the child. Children become so persistent, we often say that they are nagging us!

During Phase 2, the children also will learn that the pictures with which they are communicating do not always magically appear in front of them when they need them. If this were the case, the children would not be truly spontaneous communicators because the pictures would serve as a cue or prompt to communicate. Therefore, the students are taught to get their pictures when they need to communicate, including when they do not see a picture immediately before them. Another goal is for a child to be able to continue approaching (and even finding) his or her audience when that person is not immediately nearby or even is in another room.

During subsequent lessons, the trainers teach the child to go get the picture when he or she needs to communicate. A communication binder is created, and the one picture that is in use is placed on the front cover of the book. Additional pictures of desired items are stored inside the binder. Also in Phase 2, additional prompts that are identified as unique to a student's particular learning environment are eliminated. Many trainers appropriately use an expectant look when waiting for students to initiate. Some trainers use slight gestural cues or eye gaze to direct a student to initiate. All of these cues should be identified and eliminated so that the child learns to be spontaneous within all situations. To further enhance spontaneity, training continues to take place with a variety of trainers, across all daily activities, in a variety of contexts, and with a variety of reinforcing items.

Phase 3: Discrimination Between Symbols

Once students have become persistent communicators who reliably approach different people in order to request a variety of favored items, the next step is to teach discrimination between symbols so that messages become specific. Many traditional picture-based communication programs begin picture discrimination by teaching the child to "match to sample." This type of lesson progresses from having the student match objects to objects, then objects to pictures, pictures to objects, and so on. For many of our students, this lesson is minimally

motivating, so we must encourage the student to participate in it by offering reinforcers that are usually arbitrary to the situation. These lessons also may not be communicative because the action taught is directed to objects and pictures, not another person. Therefore, even when mastered, visual matching skills do not necessarily generalize to communicative use of the pictures. The PECS training protocol arranges for "picture learning" lessons to occur within the communicative context and does not depend on previously established matching skills.

Discrimination training begins by presenting the child with a choice of two pictures and then demonstrating that choosing and exchanging a particular picture results in specific consequences. A common error is to begin discrimination training with two or more items that are equally rewarding to the child. In such cases, when the child selects one picture, we cannot be certain which item he or she truly desires. If both items are equally rewarding, then giving either picture results in equally desired outcomes. Therefore, at the beginning of Phase 3, the difference between these consequences is exaggerated by using a highly desired item and a nondesired item with corresponding pictures placed on the front of the communication book. If the child exchanges the picture of the desired item, the trainer gives the child that item along with some animated social praise. If the child gives the teacher the distracter picture, he or she is given that item. When the child reacts negatively to receiving this item, then an error correction sequence is used that involves (a) demonstrating (via tapping or other visual cues) making the correct selection, (b) prompting the selection of that picture but only providing praise rather than the item for that prompted response, (c) switching to a known skill, and (d) repeating the choice with the provision of the item upon selection of the correct picture. Furthermore, to assure the shortest possible time between the new skill (select the correct picture) and reinforcement, the teacher provides some type of conditioned reinforcer (i.e., tone of voice, thumbs-up sign, etc.) the instant that the correct picture is touched (and thus prior to putting the picture in the hand of the communicative partner).

When this type of discrimination training is effective, the trainer then arranges for the two pictures on the front of the book to gradually

become more equal in desirability. When pictures of two desired items are on the front of a communication book, a potential dilemma occurs. It is possible that the student could exchange one picture while wanting the other item. Because both items are preferred, though, the child would not be upset at receiving the item matching the picture he or she exchanged. For example, during free play, the teacher might place a picture of blocks and toy cars on the front of the book because these are two favorite play activities for the child. The child could want the blocks but exchange the toy cars picture. When the teacher gives the child the toy cars, though, the child is content to play with the cars.

To determine what the child really wants, the trainer conducts a correspondence check to assess whether the child's actions correspond to his or her requests. In this manner, we can test whether there is true correspondence between the selected picture and the selected item. When the child gives the teacher a picture of toy cars, the teacher presents both the toy cars and the blocks to the child and says, "Take it." If the child reaches for the cars, having asked for them, he or she is allowed to take them and play. If the child reaches for the blocks after exchanging the toy cars picture, the teacher blocks access to the blocks and proceeds with an error correction sequence similar to that noted earlier. An important aspect of these correspondence checks is the teacher saying, "Take it" rather than "Take cars." The neutral statement helps assure that the child is making a visual discrimination rather than an auditory discrimination.

Discrimination training continues by increasing the number of pictures on the front of the book and increasing the number of items from which the child must choose when correspondence checks are used. Once children can discriminate between up to five or six pictures on the front of the book (in an X-like pattern), they also learn to look inside the book and perhaps through several pages to find desired pictures.

Phase 4: Using Phrases

So far in PECS, students have learned to request a variety of desired items from a variety of communicative partners across various settings. The communication skill still to be addressed is *commenting*.

When typically developing children begin learning language, they generally acquire comments at the same time they acquire requests because each type of reinforcer—social and direct—is highly motivating. The two functions codevelop and are used with roughly equal frequency. Typically developing children who use only single words (i.e., not yet combining words into short phrases) let the listener know whether they are commenting versus requesting by their use of intonation and gestures. The requesting word is accompanied by a demanding tone of voice and reaching toward the desired object. The commenting word is accompanied by an exclamatory tone of voice and pointing. Because they are nonspeaking, children who use PECS are not able to provide the listener with tone-of-voice cues. Because of their social deficits, many of these children do not develop common reaching and pointing gestures. Consequently, in preparation for teaching commenting, we must anticipate that our children will need to learn alternative methods of letting their listeners know if their pictures are being exchanged to request something or to comment on something.

Children using PECS are taught to mark this new function with various sentence starters. For example, "I want" would mark a request, whereas "I see" or "it is" or "I hear" would mark comments. Because requesting (and its related consequences) continues to be a more motivating communication skill to engage in, Phase 4 begins by teaching children to use a sentence starter within a request.

The social approach necessary for communication is maintained by teaching the child to construct a two-picture sentence ("I want" and "cookie") that is exchanged. A sentence strip is attached to the communication book, and the child learns to build and exchange the phrase by attaching the "I want" picture to the strip, attaching the desired item picture to the strip, removing the strip, and exchanging the strip. The communicative partner reacts by turning the strip back to the student and reading it back to him or her while delivering the requested item. This new sequence of skills typically is acquired rapidly (Weatherup, Forgeron, Canesi, & Thibadeau, 1996) when taught via backward chaining (see Sulzer-Azaroff & Mayer, 1991).

Phase 5: Answering a Direct Question

Phase 5 continues to build on current skills in anticipation of teaching new functions. Children with ASD who are at this stage in PECS generally remain relatively insensitive to social consequences such as those that follow commenting. Therefore, teaching spontaneous commenting is often difficult. Bondy, Ryan, and Hayes (1991) found it more effective to teach commenting initially in response to a simple question (i.e., "What do you see?"). To further ready children to answer a question about commenting, training first focuses on teaching children to answer a question related to requesting. The outcome associated with this act continues to be access to a desired item. Thus, in Phase 5, children learn to answer the question, "What do you want?"

This lesson is taught using a delayed prompting procedure (Halle, Marshall, & Spradlin, 1979) in which the question is paired with presentation of a helping prompt that will ensure success. Initially, the question and prompt are presented simultaneously, but over time, a delay is inserted between asking the question, "What do you want?" and providing the additional gestural prompt toward the "I want" icon. The goal is for the student to begin answering the question before the trainer uses the helping prompt. Because constructing a sentence is a familiar response for the student and because the outcome of answering the question is motivating for the child, Phase 5 typically is acquired rapidly. It also is important to ensure that although teachers and parents may now ask the question, "What do you want?" children should be able to maintain their spontaneous requesting skills.

Phase 6: Commenting

When students reach this point in training, they can communicate with a variety of people in order to make frequent spontaneous requests using the phrase sentence starter, "I want." They can answer the question, "What do you want?" Their vocabulary consists of a variety of pictures representative of preferred items and activities. When beginning Phase 6, the trainer relies on the student's mastery of all of these skills. The trainer adds a picture representing a phrase such as "I see" to the student's communication board and begins training by

arranging interesting and/or surprising items to appear. The teacher then uses the delayed prompting procedure to ask, "What do you see?" while pointing to the "I see" picture. Because students are familiar with this prompting procedure and with constructing a picture sentence when the trainer points to the sentence starter, they are likely to put together the sentence, "I see . . . ." The trainer's response at this point in training is crucial. He or she must respond with only social feedback ("Yes, I see a fire truck, too!") rather than providing access to the item. It is this differential outcome that teaches students the distinction, in addition to form, between commenting and requesting. Presenting an interesting but minimally preferred item will reduce the likelihood that the child will react negatively when the item is not provided (as it has been up to this point).

Another critical step in Phase 6 training is teaching the child to differentially answer "What do you see?" and "What do you want?" by appropriately using the "I see" or the "I want" icon. During this training, multiple opportunities for spontaneous requesting must be created so that the student maintains this skill.

To develop spontaneous commenting, training should, first of all, replicate situations during which typically developing children comment. Situations during which surprises or violations in expectations occur elicit spontaneous comments from typically developing children. Frequent opportunities for this skill can be created in structured lessons and via incidental occasions throughout the day.[2] Across several consecutive opportunities, the trainer gradually can fade the question, "What do you see?" so that the environmental event itself comes to elicit the comment. Other types of commenting questions and their corresponding icons can be introduced, including "What is it?" "What do you hear?" "What do you have?" and similar questions.

ADDITIONAL VOCABULARY TRAINING

Once children have mastered Phase 4, and while learning Phases 5 and 6, additional vocabulary can be introduced beyond those associated with preferred items and activities. Many teachers have found that students often have difficulty learning language concepts such as colors, sizes, shapes, quantity, and location. It is often assumed that

these concepts must be learned in a receptive format (i.e., "Touch big," "Give me blue.") before the student will be able to use them expressively. The early tendency to insist on these lessons may be related to the need to work on communication in some fashion while children are learning to imitate actions and vocalizations. For children who have learned to request via PECS, other communication lessons are available that do not depend on receptive skills. The rapid acquisition of requesting within PECS offers a unique avenue for teaching these concepts (Frost & Bondy, 1994). For example, if a child prefers a white doughnut to a brown doughnut, he or she could be taught to request that doughnut using the picture sentence "I want white doughnut." The advantage of teaching attributes and other concepts within a requesting function acquired via PECS is the use of a more naturally reinforcing, child-selected contingency. When a variety of items is identified for which the child has a particular color preference, and the child learns to request specific colors, then mastery of color concepts is assessed by conducting further correspondence checks. When the child asks for a red Skittle, the teacher holds out red, green, and blue Skittles and says, "Take it." If the child consistently takes the correct Skittle, then he or she is learning colors.

A variety of attributes can be taught following this requesting format. Shapes might be important to a child if he or she prefers one particular shape of a cookie to another. For example, Lorna Doone cookies are square, Vienna Fingers are oval, and Oreos are round. Location can be made important when a child must ask for a favorite toy car that is on the top shelf as opposed to a nonpreferred toy car that is on the bottom shelf. Size is usually extremely important if it is related to serving quantity! Most children would prefer a big pretzel to a small pretzel. Of course, the teacher must find opportunities for when little is important from the child's perspective (as in obtaining a little spoon when a regular spoon and cafeteria serving spoon are offered). If a child likes to draw and all of the long pencils have broken leads, then short pencils with their intact tips would become important. It should be noted that although receptive use or understanding of a picture is not a prerequisite for use of that picture within a PECS request, use of the picture within requests does not guarantee appropriate receptive understanding of the picture. Each skill (receptive and expressive use

of symbols) initially is independently acquired, thus necessitating two distinct lessons.

When children use attributes such as color or size, are they merely responding to matching to sample as opposed to responding to more generalized cues? That is, the red color used in the icon for red has some degree of dimensional overlap with the red color of the item referred to. Does this dimensional overlap account for all use of attributes within PECS? Although no direct study on this question has been conducted, consider situations in which a child requests or comments about something heard, as in "I hear the bell" or "I want loud music." In such cases, there is no possible dimensional overlap between the icon representing bell or loud and the referent (i.e., the sound of the bell or the volume of the music). Thus, although such stimulus overlapping may be present in some circumstances, there is no evidence that it is the only causal variable in the use of the visual icons.

In addition to incorporating attributes into requests, additional vocabulary related to items associated with reinforcers can be taught. If a child asks for juice and is handed a full half-gallon pitcher, then he or she will be motivated to learn to ask for a cup. If a child enjoys listening to cassette tapes but the tape player is missing, then he or she would need to learn to ask for "tape player."

Within functional routines such as preparing a snack, setting the table, or brushing teeth, additional vocabulary can be taught using a variety of sabotage strategies or an interrupted behavior chain format (Halle et al., 1979). Before these lessons can be developed, though, it is necessary to assess whether or not these routines are fun or motivating for the child. If a child likes organizing dishes and matching a cup, plate, fork, and so on to the place mat template, then he or she will be motivated to ask for a missing cup. On the other hand, if a child hates brushing his or her teeth, the child may not be motivated to ask for missing toothpaste. But, if a nonfavorite routine is always followed by a favorite activity, then finishing the routine will be motivating. In this case, the child can be taught to ask for the missing toothpaste. In addition to the routine being reinforcing, it is important for the child to have mastered the routine. A child who does not know that toothpaste goes on the toothbrush will not know to ask for it regardless of whether the child is motivated to brush his or her teeth.

THE RELATIONSHIP OF PECS TO OTHER COMMUNICATION LESSONS

Requesting desired and needed items is perhaps the most crucial communication skill for students to learn if they are to function independently. In addition to requesting, however, several other skills are important and should be taught along with PECS. For example, the ability to answer yes-no questions is commonly assessed by standardized language tests. These assessment tools typically do not differentiate between the two types of yes-no questions, so answering "Do you want this?" and answering "Is this a . . . ?" are considered equivalent skills. However, the teacher's response to appropriate answers to the former question involve providing or removing the item, whereas the response to the latter question is purely social (i.e., "That's right, it is a pencil!"). If a child is motivated to gain access to a favorite toy or avoid a nonpreferred activity but is not particularly motivated by hearing "Good job!" then he or she is more likely to learn to respond to the question, "Do you want your GameBoy?" than "Is this a cup?" Once children have mastered Phase 1 of PECS, they should be taught to answer, "Do you want this?" Rather than use an abstract or arbitrary symbol, a head shake or nod is recommended. Two trainers are used as when teaching initiation within Phases 1 and 2 of PECS: one to interact with the child and the other to provide physical prompting to help the student nod or shake his head.

Another critical communication skill is requesting assistance. When encountering an obstacle, children with autism frequently engage in inappropriate behavior rather than approach an adult for help. Therefore, the first step in teaching a student to request help may be to teach him or her to approach an adult. As this act is one of initiation, two trainers are required. The communicative partner approaches the student and hands him or her a favorite item with which there is a problem. As soon as the child discovers the problem (and before he or she engages in inappropriate behavior), the second trainer physically prompts the child to hand the toy to the communicative partner. The communicative partner says, "Oh you need help with this!" provides the assistance, and gives the item back to the child. Once the student independently brings items to an adult for assistance, then he or she can be taught to request assistance either gesturally or with a symbol.

Again, the physical prompter initially manually helps the child to manipulate the symbol or gesture for help. A symbol for help also will be necessary in situations in which the child cannot bring the item to the adult (i.e., a door that will not open, a television that will not turn on, etc.).

All of us experience situations from which we wish to momentarily escape. Therefore, another critical communication skill is asking for a break. This response should mean something other than "I quit" or "No!" Communicating "no" indicates that the child does not want to participate in an activity at all. "I need a break," however, indicates that the child needs to leave an activity for a moment but will return to that same activity. Children sometimes engage in inappropriate behaviors in order to escape (Carr, Newsom, & Binkoff, 1980). In such cases, a child can be taught to exchange a symbol for "I need a break" and then be allowed to leave the group for a moment. Such breaks would involve various rules concerning how long the break should last and what the child can do during the break. At the signaled end of the brief break, the child should be reminded about what reinforcement is available for returning to the group.

Just as many children with ASD benefit from learning to communicate with pictures, they can benefit from picture-based communication that is directed at them. A common complaint from those teaching or living with children with ASD is that the children have difficulty with transitions. This difficulty is assumed to be due to children's not understanding what they are expected to do next. It may be more pertinent that a child does not know if an effective reinforcer is associated with the next activity. That is, when a child playing in a classroom is told to line up and go to gym, a negative reaction may be due to the immediate loss of the item being played with, as opposed to not understanding where to go. An effective method for signaling to the child both what activity and what reinforcers are next is to use visual cues. For example, at transition times, the teacher approaches the child and shows a picture of a preferred item (or the item itself) and then shows a picture representing the next activity while saying, "Go here." The trainer physically guides the child to the designated activity. As the child learns to respond to a variety of these picture-based directions, the pictures then could be arranged in a schedule that the child uses to

independently transition throughout the day (MacDuff, Krantz, & McClannahan, 1993).

One final critical skill involves responding to the direction, "Wait." Children who are told to wait often are unsure of when or if the desired item (or activity) will be available. Essentially, children may interpret "wait" as equivalent to "not now, not ever!" Children who use PECS to request an item are signaled to wait by being handed a picture or symbol representing "wait." The initial wait intervals are kept very short (3-5 seconds) to ensure success. Furthermore, this lesson is only arranged when the teacher has complete control over the item requested. Over time, the period of waiting is gradually lengthened. As the wait period is stretched, the "wait" symbol comes to serve as a promissory note—children learn that as long as they are holding it, they eventually are going to receive the desired item or activity. Children also are taught what they can do while waiting (rather than merely being told to stay out of trouble).

PECS AND THE CODEVELOPMENT OF SPEECH

PECS is introduced to children to help them acquire functional communication skills. Many parents and professionals are concerned that use of a picture-based system, especially with very young children, could be detrimental to the potential acquisition of speech. Research over the past 25 years (Carpenter & Charlop-Christy, 2000; Mirenda & Erickson, 2000; Romski & Sevcik, 1996) has shown not only that augmentative communication systems (aided or unaided) do not inhibit speech development but that use of these systems enhances the likelihood of the development or improvement of speech.

Follow-up observations of children age 5 years or younger who used PECS for more than 1 year showed that 59% developed independent speech (Bondy & Frost, 1994). They discontinued use of PECS and spoke as their sole mode of communication (although often with language delays). Another 30% spoke while using PECS. Schwartz, Garfinkle, and Bauer (1998) also found strong support for the use of PECS with preschoolers with various communication deficits and noted a positive correlation regarding the development of speech.

Marjorie H. Charlop-Christy from Claremont McKenna College and several of her graduate students at Claremont Graduate University presented a series of studies during recent conventions. In each study, they documented empirical evidence for the effective use of PECS by a variety of learners. They also presented data regarding the decrease in maladaptive behaviors following the introduction of PECS (Carpenter, Charlop-Christy, LeBlanc, & Kellet, 1998) as well as data supporting improved social behaviors (Le & Charlop-Christy, 1999; Le, Charlop-Christy, Carpenter, & Kellet, 1999). In addition, they offered evidence of improvements in speech development following the acquisition of PECS (Carpenter & Charlop-Christy, 2000; Carpenter, Charlop-Christy, LeBlanc, & Le, 1998). Another phenomenon observed with children using PECS while acquiring speech is that their speech output improves in number of words spoken and the complexity of their communication when given access to their PECS books (Frost, Daly, & Bondy, 1997).

CONCLUSION

PECS is a functional communication system for children with ASD and for children who are not using or developing speech in a functional manner. Successful implementation of PECS presents several distinct advantages. PECS teaches the social nature of communication initially; the first skill the children learn is to approach a communicative partner in order to request a desired item. Once this skill is learned, PECS use is expanded so that the children develop a broad vocabulary, sentence structure, and additional communicative functions. Through PECS, many children also learn to use conceptual vocabulary because the lessons are motivating from the child's perspective.

Research is currently focusing on systematic evidence associated with (a) PECS acquisition, (b) the impact of PECS on social approach, (c) the impact of PECS on behavior management, and (d) the relationship between PECS use and the codevelopment of speech. The continued success of PECS also will depend on the quality of training provided by those implementing the system. For many children, PECS

has proven to be their key to enhanced social and communicative growth.

NOTES

1. Skinner (1957) defines these types of behaviors as autoclitics.

2. This strategy also has been described as contriving an establishing operation (Michael, 1982).

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This study assessed play and social behavior of young children with autism in inclusive school settings to identify important targets for intervention. Data were collected for five children with autism and for typically developing peers. All children with autism received intervention in one-on-one settings but did not have individual education plan goals that provided systematic intervention for developing play and social skills in their school settings. Results indicated the children with autism and their typically developing peers played with a comparable number of stimulus items (e.g., toys), but the children with autism engaged in these activities for shorter durations. Both children with autism and their typically developing peers engaged in similar levels of social interaction with adults. However, the children with autism rarely or never engaged in social interactions with their peers, whereas the typically developing peers frequently engaged in social interactions with other children. The results suggest important targets for intervention.

Identifying Early Intervention Targets for Children With Autism in Inclusive School Settings

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A trend toward inclusion has resulted in an increased number of children with disabilities attending their neighborhood schools and being educated in the same classrooms with their typically developing peers. The values of inclusion involve providing a normalized setting for children with disabilities, where opportunities for building friendships and having role models for socialization are available (Kohler & Strain, 1999; Nickels, 1996; Peck & Cooke, 1983). Moreover, social

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behavior change has shown to be greater in integrated settings than in developmentally segregated settings (Strain, 1983), further supporting the positive effects of the least restrictive environment for children with developmental disabilities.

In the early years of a child's life, an important developmental task is the formation of peer-related social behavior (Hartup, 1983; McGee, Feldman, & Morrier, 1997; Strain, Guralnick, & Walker, 1986). It is now a widely accepted fact that peers can contribute considerably to the development of social and communicative competencies. However, in light of significant communication delays exhibited in children with autism, considerable social isolation may exist, particularly with peers. This isolation may be further exacerbated given that social interactions with peers require different skills from those needed with adults. Unlike child-adult interactions, where adults tend to be the initiators and provide a highly responsive and often anticipatory social environment, child-child exchanges rely on the effective participation and balanced contribution of both partners (Guralnick, 1990, 1992; Odom, McConnell & McEvoy, 1992). As a result, children with developmental disabilities who appear socially competent with adults may fail to seem so with peers (Guralnick, 1990; Odom et al., 1992). Thus, without adequate child-child exposure and assistance, beginning very early on, children are not likely to gain the variety of experiences needed to learn social competence. Data collected from individuals with developmental disabilities are particularly troubling; these data indicate that the peer-related social behaviors of individuals with developmental disabilities often lag substantially behind their level of cognitive development (Guralnick, 1990).

It has been suggested that some children with developmental delays have difficulty engaging in group play, have difficulty forming reciprocal friendships, are likely to exhibit difficulty with new social relationships, and once involved in a social relationship, often may have difficulty in maintaining that relationship (Guralnick, 1990; Guralnick, Conner, Hammond, Gottman, & Kinnish, 1995). The importance of social competence in peer interactions for later adjustment, for acceptance by others, and ultimately, to one's quality of life

argues for its significance in the design of early intervention programs (Guralnick, 1990). Even though inclusive settings appear to be conducive to the development of skills required for social competence (Kohler & Strain, 1999; Roeyers, 1996; Strain, 1983; Zanolli, Daggett, & Adams, 1996), mere placement in inclusive settings does not guarantee positive outcomes and does not eliminate the need for specific social skills intervention (Guralnick, 1990; Sontag, 1997; Strain & Hoyson, 2000).

One difficulty in addressing social behavior is the widespread variations in defining appropriate social behaviors. Also, there is a wide variability of appropriate social behavior evident in typically developing children. In addressing these problems, behavioral observations offer a number of distinct advantages relative to other methods of assessing children's peer relationships. Such measures minimize the subjective bias inherent in more traditional assessment procedures, such as teacher and parent reports, and provide information on actual peer exchanges within a particular setting. Behavioral observations have been shown to be sensitive to intervention effects and are also more conducive to frequent repeated measures, making them ideally suited for evaluating treatment outcome (Foster & Ritchey, 1979).

To date, most naturalistic behavioral observations tend to be obtained prior to treatment intervention and often do not include normative data. Thus, there is a definite need for more detailed information relating to typical children's social development (Rogers, 2000; Stone & La Greca, 1986) in context with their disabled peers if the quality and quantity of social behavior is to be targeted. Naturalistic observation of social behavior is an important assessment method and is essential in furthering our understanding of children's social relationships. The purpose of this study was to collect naturalistic observations of children with autism in inclusive school settings over a period of time. In addition, to further our understanding of these children's behaviors, the same data were simultaneously collected for their typically developing peers in order to systematically compare their peers' behaviors in that same setting.

METHOD

PARTICIPANTS

Five children, four male and one female, all diagnosed as having autism spectrum disorders by at least one outside agency and referred to our autism center, participated in this study. They were selected because their parents made the decision to place them in a classroom setting for typically developing children. An initial intake interview was conducted, and the children were all observed to have behaviors characteristic of autism according to the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1994), including communication delays, failure to develop cooperative play and friendships, lack of responsiveness to and interest in others, and repetitive and ritualistic behavior. Some of the children also exhibited aggressive and disruptive behaviors. Prior to the start of this study, medical doctors confirmed that the nature of the problems was not caused by testable physiological factors such as hearing or visual impairments. Furthermore, gross and fine motor skills appeared to be developing normally for all the children. Individual child descriptions follow.

Child 1. Child 1 was 3 years 8 months at the start of this study. He demonstrated high levels of self-stimulatory behavior, such as lying on his side and sifting sand through his hand for hours at a time. He also displayed a repetitive interest in books and exhibited excessive tantrums for 2 or more hours when this activity was disrupted. Aside from books, he had little interest in other activities. Cognitively, he was considered to be high functioning. His IQ on the Stanford Binet Intelligence Scale was 101. He scored 93 on the Leiter International Performance Scale. Receptive vocabulary, tested on the Peabody Picture Vocabulary Test–Revised (PPVT), was in the 93rd percentile. Receptive language, tested on the Assessment of Children's Language Comprehension (ACLC), was 92% correct on the vocabulary section, 90% correct on the two critical items section, 60% correct on the three critical items section, and 70% correct on the four critical items section.

Child 2. Child 2 was 10 years 7 months at the start of the study. School observations indicated that he had difficulty following teacher directives and completing assigned tasks, especially reading and comprehension tasks. He frequently needed to be redirected to tasks at school. During conversations, he typically made noises and responded with repetitive nonsense words or words unrelated to the topic. He also exhibited inappropriate and uncontrollable laughter, touched peers inappropriately, and was reported to parallel play rather than to interact with other children. He had a preoccupation with certain topics such as electricity and batteries, which were the only topics of conversation in which he would participate. Finally, his parents reported that he was afraid of the dark, mirrors, and several other specifically shaped objects. He was referred for special education services at 3 years 2 months for difficulties in comprehension of verbal information. At that time, there was concern due to his echolalia, inappropriate play, and repetitive stereotypic behavior. At the start of this study, he was considered to be functioning at a high level cognitively. His IQ on the Stanford-Binet was 122, the PPVT yielded a receptive vocabulary score at the 53rd percentile, and no errors were made on any of the levels of the ACLC.

Child 3. Child 3 was 3 years 3 months at the start of this study. Behaviorally, he frequently engaged in repetitive stereotypic mannerisms such as twisting his fingers in front of his eyes and twisting sticks and other objects between his fingers. Toy play lacked symbolism and tended to be stereotypic and repetitive in nature, such as breaking toys into their component parts and spinning objects. His language was marked by immediate echolalia of the last part of an utterance addressed to him. Cognitively, he was considered to be relatively high functioning, although his test performance was inconsistent due to numerous interfering behaviors. His IQ on the Stanford-Binet was 84, and he was untestable on the Leiter. His receptive vocabulary, tested on the PPVT, was at the 34th percentile. Receptive language on the ACLC was 90% correct on the vocabulary section, 80% on the two critical elements section, 50% on the three critical elements section, and 40% on the four critical elements section.

Child 4. Child 4 was 3 years 8 months at the start of the study. He would not sit in a chair for more than a few seconds. Instead, he engaged in disruptive behaviors, such as crying, falling off the chair, kicking, hitting himself and others, and so on. Even though he had approximately 10 words and word approximations that he would use infrequently (such as "push"), he was primarily considered nonverbal. In addition, his mother reported that he could understand at least 10 words (including "yes" and "no"). He was not toilet trained and could not dress or bathe himself, but he was able to partially use a fork and a spoon when prompted. Ritualistic behaviors included twisting twigs between his fingers, flapping his hands, and jumping up and down. He also had an intense interest in small objects such as toy cars, which he held for lengthy periods of time without engaging in any appropriate symbolic play. Cognitively, he was considered to be low functioning. He was untestable on all standardized measures.

Child 5. Child 5 was 3 years 4 months at the start of this study. She was untestable on the Stanford-Binet, the Leiter, the PPVT, and the ACLC. Behaviorally, she frequently engaged in stereotypic mannerisms, such as rocking back and forth while sitting, and was preoccupied with videotapes, oftentimes repeating parts of the video script. In addition, she frequently engaged in inappropriate repetitive behavior, generally masturbating on the corners of tables. She had a vocabulary of fewer than 20 labels and demonstrated the meaning of at least 10 words. However, her language was primarily marked by immediate echolalia of the last part of an utterance addressed to her. Cognitively, she was considered to be low functioning.

Comparison classmates. To provide an indication of typical behavior for nondisabled children in these individual settings, data were also recorded for typically developing classmates throughout the study in addition to those of the children with autism described above. None of the classmates had been diagnosed as having a disability, and all appeared to be functioning at age level or above according to their teachers and our observations in the classrooms. To provide a random and varied sample for comparison, data were recorded for a different

typically developing peer, who served as a comparison for each session.

SETTINGS

All sessions were conducted in the children's regular schools (preschools or early elementary regular education classrooms). To provide for external validity across a variety of individual school settings and different teachers, six different private and public school settings were employed. Children 1, 4, and 5 each attended a different preschool. Child 3 attended two different preschools during the course of the study. Child 2 attended an upper elementary (4th grade) class. For Children 1, 3, 4, and 5, data were recorded during "work time," when the children were allowed to work independently on an individually chosen task (e.g., puzzles, books, coloring, painting, play dough, etc.) available within the classroom. Data for Child 2, who attended elementary school, were taken during recess time. He had access to various activities such as swings, slides, bars, various ball games, and so on.

PROCEDURE

One or two observers recorded data continuously. Sessions were 20 minutes in length and occurred once or twice weekly. Observers were selected from a pool of seven, consisting of undergraduate students, graduate students, and licensed speech pathologists. All had completed at least one academic course in behavior analysis and had a minimum of one quarter of supervised data recording in a clinical setting.

Each observer used a stopwatch and a data sheet. For each 20 minute period, the recorder used the stopwatch to record the minutes and seconds that the child engaged in appropriate, on-task behavior. In addition, data were collected on task items utilized and social interactions. The individual behaviors recorded for both the experimental and comparison children are described in detail in the following.

1. The number of minutes the children appropriately engaged in a task was recorded for each child. Appropriate behavior was defined as the

child's engaging in a school task in a manner consistent with the school curriculum. Inappropriate behavior was identified as self-stimulatory behavior, disruptive behaviors (e.g., tantrums, aggressions, etc.), and off-task behaviors (e.g., staring into space).
2. The number of stimulus items the children used during the minutes in which they were engaged in a task was recorded.
3. The number of social-communicative interactions the children exhibited was recorded. This included each time a child began or responded to a verbal social interaction (or nonverbal social interaction, for Child 4) with another child or an adult during the 20-minute period. Social interactions were recorded for interactions between the children with autism and adults and between the children with autism and their peers. Initiations ranged from gestures (for Child 4) to one word (e.g., "water"), to complete sentences (e.g., "Mrs. Brown, can I have a cup of water?"). A correct verbal response was counted if a child's response was appropriate and relevant to the pragmatic context, for example, if a child said "no" after another child asked, "Do you want me to pour this?"

RELIABILITY

Reliability measures were recorded for each of the children with autism and the comparison peers for all of the dependent measures during 29 unsystematically selected sessions across the five children. Specifically, for minutes engaged in a task, reliability was calculated by dividing the number of seconds that both observers agreed that the child was engaged in appropriate play by the number of seconds agreed upon plus the number of seconds not agreed upon, then multiplying by 100 to yield a percentage. In addition, the total number of stimulus items with which the children interacted during the 29 sessions was counted by each observer. Reliability was then calculated by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100.

For social interaction, reliability percentages were calculated for the number of verbal and nonverbal social interactions the observed child made with peers and for the number of verbal and nonverbal social interactions the observed child made with adults. Reliability was calculated by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100.

The average reliability for minutes engaged in a task was 91%. Average reliability on the number of stimulus items was 97%. For social interactions, the average reliability was 85%.

RESULTS

The first question asked in this study was, How did the amount of appropriate on-task behavior of children with autism compare with that of typically developing children in inclusive school settings? The results pertaining to this question are shown in Figure 1. Figure 1 shows individual session data for the children with autism and the mean (horizontal line) and standard deviations (shaded areas) for the typically developing peers. These data show that although the children with autism did engage in appropriate on-task behavior, they did so for much less time than their typically developing peers. That is, the children with autism only engaged in appropriate, on-task behavior about half of the time, in contrast to their typically developing peers who typically engaged in appropriate, on-task behavior for almost the entire session.

The second question asked in this study was, How many stimulus items did children with autism use in comparison to their typically developing peers? Figure 2 shows that the number of stimulus materials with which the children with autism interacted was comparable to the number of stimulus materials used by their peers. In other words, the number of stimulus items used by the children with autism in these inclusive school settings was similar to that of their typically developing peers (see horizontal lines and shaded areas, which represent means and standard deviations).

The third question asked in this study was, How did the social interactions of children with autism compare to those of their typically developing peers in inclusive school settings? The right portion of Figure 3 shows that the children with autism rarely or never initiated or responded to social interactions with their peers (with some variability for Child 2), whereas the typically developing children (see horizontal lines and shaded areas) initiated or responded to social

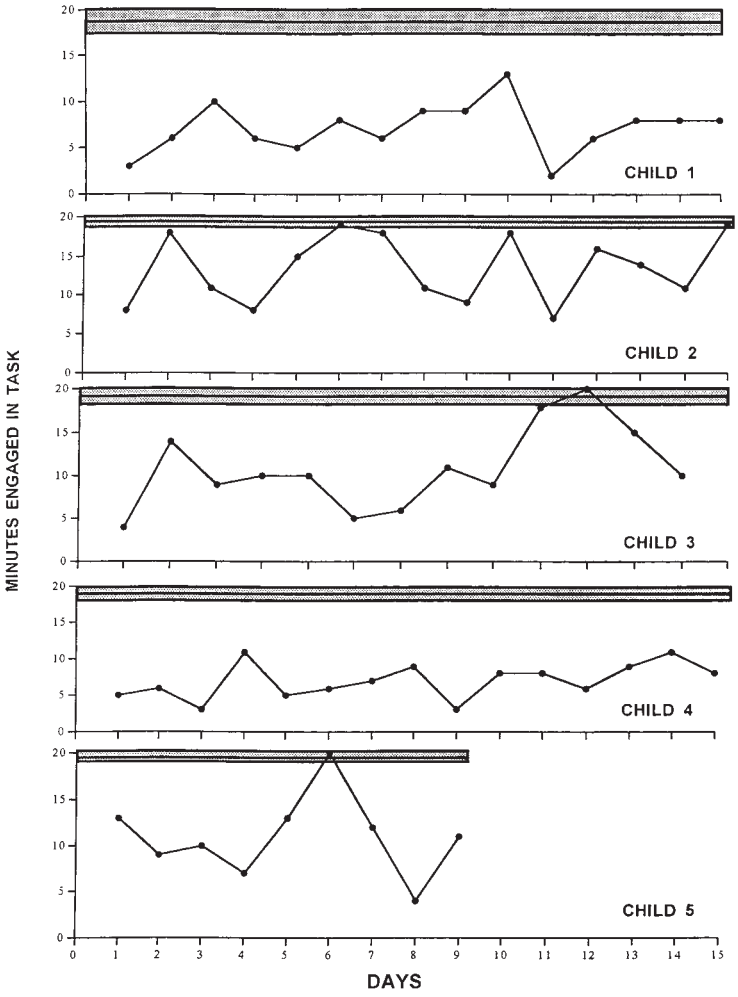

Figure 1. The number of minutes each participant spent appropriately engaged in a school activity.

NOTE: The horizontal line represents the average number of minutes each participant's peers engaged in school activities, and the shaded areas show peer standard deviations.

interactions with their peers an average of approximately 15 times per 20-minute session (with a range of an average of approximately 5 to 33 social interactions per session).

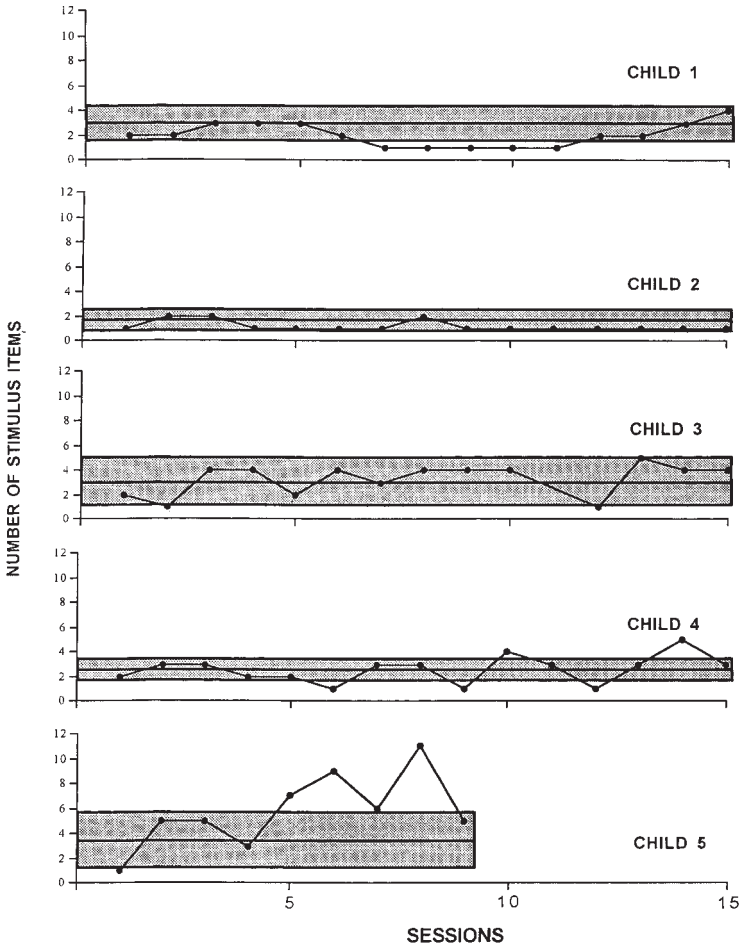

Figure 2. The number of stimulus items used by each participant.
NOTE: The horizontal line represents the average number of stimulus items used by each participant's peers, and the shaded area signifies peer standard deviation.

In contrast, the left portion of Figure 3 shows that interactions with adults were about the same for both the children with autism and their typically developing peers. That is, although the number of social interactions the typically developing children made with adults was on average much lower than the number of social interactions they

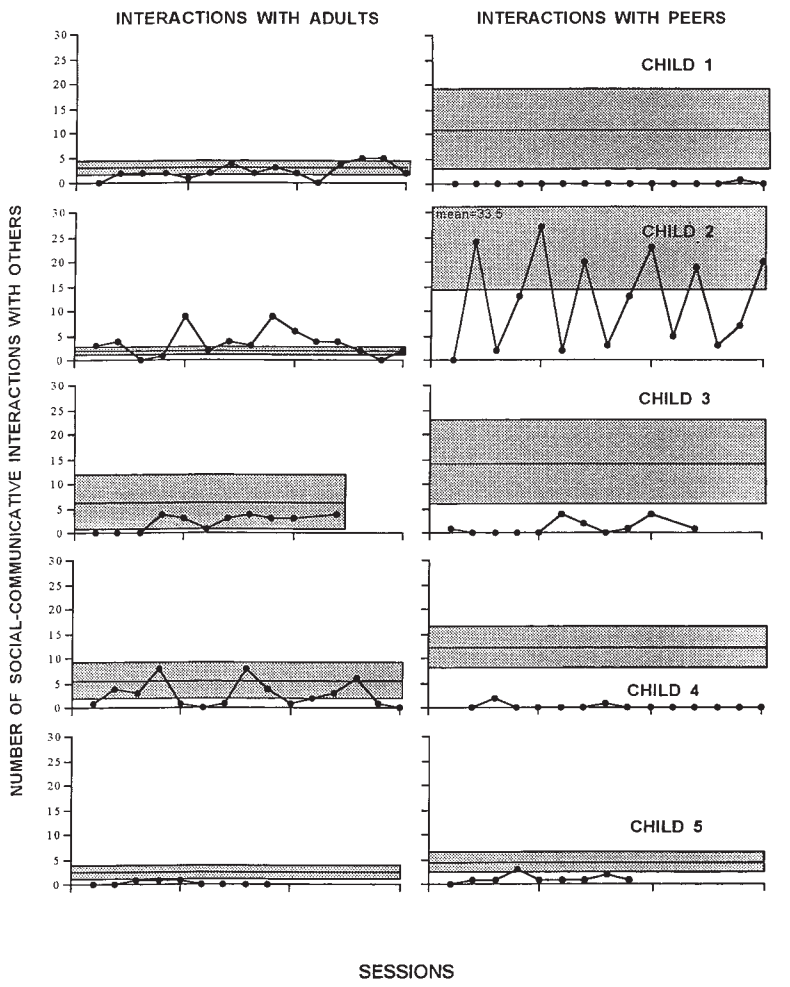

Figure 3. The number of social-communicative interactions each child made with adults and peers.

NOTE: The horizontal line represents the number of social-communicative interactions each participant's peers made with adults and other children, and the shaded area shows the peer standard deviation.

made with their peers, they did engage in some social interactions, and that number was similar to the number of social interactions the children with autism made with adults.

DISCUSSION

The results of this study showed that, with respect to classroom materials, the children with autism interacted with approximately the same number of task objects as did the typically developing children. However, the amount of time spent engaged with the task objects was far less for the children with autism. With respect to social interactions, both the children with autism and the typically developing children interacted with adults and other children in the classroom. However, the amount of social interaction was similar only with respect to interactions with adults. The children with autism rarely engaged in social-communicative interactions with other children, whereas the typically developing children engaged in most of their social-communicative interactions with other children throughout the class period.

These findings are consistent with previous studies examining the social interactions of children with autism and their peers (McGee et al., 1997; Sigman & Ruskin, 1999). Overall, the major difference between children with autism and their typically developing peers appears to be related to peer social interactions. Specifically, children with autism demonstrate fewer peer-related social interaction behaviors, including not being the recipients of social bids and showing little interest in peers (McGee et al., 1997). In addition, children with autism appear to be less socially engaged with peers, make and accept fewer initiations, and spend more time playing by themselves, in comparison to their peers (Sigman & Ruskin, 1999).

The results of this study can be related to several interesting areas in the literature in light of the current trend toward increasing the number of children who are fully included in school settings. First, despite the great variety of functioning levels of the children with autism who participated in this study, none of the children demonstrated complete absence of play or social interaction behavior. This is true notwithstanding the fact than none had received any formal and systematic support with social skill and friendship development. The quality of interactions were not assessed in this study; therefore, we are limited to commenting only on the quantity. However, the significance of peer social relationships for emotional functioning and later psychological

adjustment (Cowen, Pederson, Babigian, Izzo, & Trost, 1973) cannot be undervalued and needs to be addressed in the very early years (McGee et al., 1997; Strain & Hoyson, 2000). Further research in this area would be beneficial.

Related to the above point, although the older child who participated in this study showed more variable patterns of social interactions with his peers, all of his sessions were below his peers' average level of responding, and well over half of the sessions were below the range of his peers' responding. This issue of persistent failure to learn the necessary socialization skills over time was raised decades ago in Kanner's follow-up study of his original sample approximately 30 years later (Kanner, 1971; Kanner, Rodriguez, & Ashenden, 1972). It was reported that the original clients remained extremely aloof and continued to experience significant difficulties in interpersonal relationships. This also supports the findings of this study, demonstrating the need to target these areas.

Inclusion is now being considered as a primary goal in special education research and practice. However, without proper social support and systematic implementation of social skill and friendship development, such efforts can be problematic (Gresham, 1986; Guralnick, 1990). Although scientific studies that demonstrate the importance of specialized and systematic social skill and friendship development are available in the literature (e.g., Baker, 2000; Baker, Koegel & Koegel, 1998; Harrower, 1999; McGee, Almeida, Sulzer-Azaroff & Feldman, 1992; Odom & Strain, 1986; Pierce & Schreibman, 1997; Strain & Kohler, 1998), many are not available to educators (Rogers, 2000). The present study, along with others, again stresses the fact that without assistance, these important behaviors are not likely to develop with ease.

Another interesting issue relates to the comparable levels of child-adult interactions between the disabled children and their peers. Although there were generally low levels across all children, it may be possible that because the children with autism received a great deal of intervention with adults, some of the children with autism appeared to be more at ease when initiating social interactions with them. This further suggests the importance of incorporating peers in social skill support programs.

In relation to the child-child social interactions, there was quite a bit of variability across both the disabled and nondisabled children. In spite of this fact, all of the children with autism had levels that were greatly lower than the range of typical children, suggesting that regardless of verbal and cognitive ability (note that Children 1 and 2 scored quite high on standardized language and IQ tests), they still demonstrated considerable need for social and play development. While some have suggested that the degree of cognitive impairment may be the primary underlying disability affecting social behavior in autism, this study suggests that even those with relatively little cognitive impairment may exhibit depressed levels of socialization.

In summary, the purpose of this study was to assess, through behavioral observation, some characteristics of the play and social interactions of children with autism. On the positive side, although no systematic socialization treatment had been implemented with any of the participants, all of them demonstrated some appropriate social interaction with adults and peers. This study also demonstrates that specific behaviors, such as time engaged in tasks and peer-related social interactions, may be in significant need of intervention and support in this population. As a result, including systematic and long-term social skills training and social support as an integral component of early intervention programs may be warranted.

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Children with autism can benefit from participation in inclusive classroom environments, and many experts assert that inclusion is a civil right and is responsible for nurturing appropriate social development. However, most children with autism require specialized supports to experience success in these educational contexts. This article provides a review of the empirical research that has addressed procedures for promoting successful inclusion of students with autism. Strategies reviewed include antecedent manipulations, delayed contingencies, self-management, peer-mediated interventions, and other approaches that have been demonstrated in the literature to be useful. The article concludes with a discussion of future research needs.

Including Children With Autism in General Education Classrooms

A Review of Effective Strategies

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The educational inclusion of students with autism and other disabilities has been a fiercely controversial topic (Harrower, 1999; Kauffman & Hallahan, 1995). Historically, students with disabilities have been segregated from their peers, even from society as a whole (Karagiannis, Stainback, & Stainback, 1996). More recently, however, there has been an increasing trend to include students with autism and other disabilities in general education classrooms along with their typically developing peers (McDonnell, 1998). This trend has stemmed largely from theoretical arguments related to social development and legal issues related to the civil rights movement (for a review, see Harrower, 1999).

The purpose of this article is to provide a review of data-based strategies for facilitating the educational inclusion of students with autism. First, research on inclusion as an independent variable will be briefly

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reviewed with respect to social and academic outcomes. Second, intervention strategies that have been documented as successful in the process of including students with autism in general education classrooms will be presented. The intervention strategies that will be reviewed in this section include antecedent procedures, delayed contingencies, self-management strategies, peer-mediated interventions, and multicomponent strategies. We will also cover some empirically validated strategies that are not necessarily designed for use in inclusive settings but that may be very useful in some contexts. Last, a brief discussion of worthwhile areas for future research efforts in facilitating the inclusion of students with autism will be presented.

RESEARCH ON INCLUSION AS AN INDEPENDENT VARIABLE

One of the contributing factors in the controversy over inclusion has been the limited number of studies that have focused directly on procedures for facilitating educational inclusion (Hunt & Goetz, 1997). Before considering effective strategies, however, it is reasonable to question the extent to which inclusion results in the benefits that its proponents anticipate. The little research available that considers inclusion as an independent variable has documented generally, though not exclusively, positive results. This area of research has focused on both the social and the academic outcomes based on educational placement of children with autism.

With regard to the potential social outcomes of students with autism schooled in general versus special education settings, researchers have evaluated students with autism on a number of dependent variables, holding educational placement as the independent variable. For example, researchers have documented that students with disabilities, including students with autism, who are fully included (a) display higher levels of engagement and social interaction, (b) give and receive higher levels of social support, (c) have larger friendship networks, and (d) have developmentally more advanced individualized education plan goals than their counterparts in segregated placements (Fryxell & Kennedy, 1995; Hunt, Farron-Davis, Beckstead, Curtis, & Goetz, 1994).

Yet researchers have also found mixed results among students with autism in general education classrooms. For example, researchers have found that some fully included students with disabilities, including autism, are rated by their classmates as being among the most popular in class, whereas others are not (Evans, Salisbury, Palombaro, Berryman, & Hollowood, 1992). The study by Evans and colleagues (1992) also documented that students with disabilities were observed more frequently to be on the receiving, rather than the giving, end of social interactions, and this tendency was amplified over the course of the school year. Thus, studies addressing social behavior have yielded encouraging yet variable results (Evans et al., 1992; Hunt et al., 1994).

Relatively few studies have been conducted evaluating academic outcomes for students with autism as a result of educational placement (Hunt & Goetz, 1997). In one such study, Harris, Handleman, Kristoff, Bass, and Gordon (1990) compared five children with autism enrolled in a segregated preschool classroom, five children with autism in an inclusive classroom, and four typically developing peers in the inclusive classroom on measures of language ability before and after language instruction. Results failed to show significant differences in language ability between the children with autism in either setting (Harris et al., 1990). These types of findings have generally been interpreted as supporting educational inclusion, as segregated educational placements have historically been purported to provide more intensive educational opportunities for students with disabilities (Harrower, 1999).

Authors often note that the mere placement or proximity to typical peers and the general education curriculum may be beneficial, but it is insufficient in achieving an appropriate education for students with disabilities (e.g., Hunt & Goetz, 1997; Kohler, Strain, & Shearer, 1996). For this reason, many researchers have advocated for educational inclusion as a reallocation of specialized educational services, not merely as an intervention in and of itself (Sailor, 1996). Thus, the focus of the inclusion debate may best be reframed from segregated versus inclusive education to how to provide appropriate supports in inclusive settings. For inclusive placements to be successful, educators must have knowledge of and access to empirically validated strategies that will assist them in this process. Therefore, the following dis-

cussion provides a review of intervention strategies that have been documented as effective in supporting students with autism in inclusive educational contexts.

REVIEW OF STRATEGIES FOR FACILITATING THE INCLUSION OF STUDENTS WITH AUTISM

Prior to beginning a discussion of strategies for promoting inclusion, a few important considerations are warranted. As has been widely noted, autism is a highly heterogeneous disability with regard to level of functioning (G. Dunlap & Bunton-Pierce, 1999; Gillberg, 1999; Koegel, Valdez-Menchaca, Koegel, & Harrower, 2001). Thus, the level and intensity of supports required for a given student with autism will depend largely on the characteristics of the student's functioning. It would be beyond the scope of this review (and the status of the literature) to delineate specific strategies that are more or less appropriate for varying levels of functioning. In addition, much of the research on inclusion of students with autism has been conducted with young children. There is a lack of pertinent research on including students with autism at the middle school and high school levels. Again, it is not the purpose of this article to prescribe intervention strategies based on age or grade level. The purpose is to provide a review of documented strategies that can then be individually tailored to meet the idiosyncratic needs of particular students with autism participating in inclusive educational placements.

ANTECEDENT PROCEDURES

By modifying discriminative stimuli for both appropriate and inappropriate behavior, antecedent procedures can be designed to prevent and reduce challenging behavior. One very positive aspect of antecedent procedures is that they are proactive. Since these strategies all involve altering routines or environments, they address challenging behavior prior to its occurrence. Antecedent procedures that have been used specifically for students with autism in general education classrooms include priming, prompt delivery, and picture scheduling.

Priming. Priming, or prepractice, has been documented as an effective classroom intervention for children with autism. Priming consists of previewing information or activities that a child is likely to have difficulties with before the child actually engages in that activity (Wilde, Koegel, & Koegel, 1992). For example, if a child is having difficulties during circle activities where the teacher is reading the class a story, each day's story could be read to the child individually before the child experiences the story in the presence of the entire class. Priming is important in facilitating the inclusion of students with autism in that it links individual instruction to larger classroom group activities, a common feature of general education classrooms. Research has focused on using priming to improve social interactions between children with autism in regular education classrooms, and priming has been shown to be effective in increasing the initiations of social interaction with typical peers (Zanolli, Daggett, & Adams, 1996).

Prompt delivery. Prompting strategies have been successful in facilitating the inclusion of students with autism. Often, when teaching children with autism, in order to elicit an appropriate response in a targeted academic or behavioral activity, one must provide prompts that supplement the general instructional routine. Using various prompting strategies is important in facilitating the inclusion of students with autism, as these students may not respond to traditional instructions delivered in general education classrooms. For example, Sainato, Strain, Lefebvre, and Rapp (1987) compared the effectiveness of two prompting strategies for facilitating school transition times with three preschool boys with autism. In the peer buddy condition, the classroom teacher provided prompts and modeling to a typically developing student, who then provided prompts to the student with autism. The classroom teacher did not deliver prompts to the children with autism. In the antecedent condition, the classroom teacher alone provided prompts to the students with autism, instructing the peer buddies not to assist. Both conditions yielded increases in appropriate behaviors, with the teacher-only condition revealing superior results in all transition settings. Both conditions also resulted in significant reductions in teacher prompts over time, suggesting that the students began to make transitions independently.

Other types of prompting strategies have also been documented to improve outcomes for students with autism in inclusive classrooms. For example, Taylor and Levin (1998) examined the effects of a tactile prompting device for increasing the verbal initiations of a 9-year old student with autism. The device, carried in the student's pocket, made a slight vibration at prespecified time intervals, and this served as a prompt for the student to make a verbal initiation regarding his play activities. Increases in verbal initiations were observed not only toward an adult in a variety of play contexts but also during follow-up probes conducted during cooperative learning activities with typically developing peers in the student's general education classroom.

Picture schedules. Picture schedules are often used as a strategy for increasing predictability and as an alternative to verbal and written instruction. Transitioning from one activity to another can be problematic for some students with autism yet is a very common occurrence in general education classrooms. Picture schedules can serve as effective cues alerting students with autism to upcoming changes in activities. For example, Hall, McClannahan, and Krantz (1995) used a picture book schedule describing the daily general education classroom activities for three students with disabilities, including one with autism. Results demonstrated that, along with reductions in prompt use by classroom aides, the students followed their activity schedules 90% to 100% of the time. Furthermore, these strategies received high ratings of social validity in that the aides indicated that they would use the strategies with other students and would recommend their use to other aides.

DELAYED CONTINGENCIES

One goal of education is to increase the independent academic functioning of students. This has often been a daunting goal for educators working with students with autism. While successes have been well documented for students with autism under conditions of close adult supervision, there has also been evidence that the removal of supervision often leads quickly to a reappearance of challenging behavior and/or a decrease in appropriate behavior (Marholin &

Steinman, 1977; Stahmer & Schreibman, 1992). This failure of behavioral gains to generalize has been linked to the removal of contingencies (e.g., positive reinforcement) that typically accompany the removal of supervision. Thus, some researchers have examined the extent to which instruction using delayed or unpredictable contingencies can facilitate the generalization of behavior in the absence of direct supervision (G. Dunlap & Johnson, 1985; G. Dunlap, Koegel, Johnson & O'Neill, 1987). For example, G. Dunlap and Johnson (1985) used an unpredictable schedule of supervision with three children with autism and found that levels of on-task behavior and productivity were significantly higher during periods of no supervision than when a predictable schedule of supervision was in place.

Delayed and unpredictable contingencies were used by G. Dunlap, Plienis, and Williams (1987) to establish fully independent task completion by a young man with autism and profound intellectual disabilities after a gradual process of thinning reinforcement schedules and delaying the delivery of corrective feedback. These procedures were also used by G. Dunlap, Koegel, et al. (1987) to establish appropriate responding in inclusive educational settings for two boys with autism and one young man with autism in an integrated work setting. In these three instances, the participants' appropriate behavior was successfully maintained over extended periods of time without the need for close supervisory attention.

SELF-MANAGEMENT STRATEGIES

Self-management has been described as a viable intervention strategy for promoting independence in the classroom, as it shifts some responsibility for behavior management from the teacher to the student (L. K. Dunlap, Dunlap, Koegel, & Koegel, 1991), increasing a teacher's ability to focus on instruction. Self-management consists of teaching the student to (a) discriminate between appropriate and inappropriate behaviors, (b) evaluate her or his own behavior, (c) monitor her or his behavior over time, and (d) reinforce her or his behavior when prespecified criteria are met. Not only has self-management been documented to be an effective strategy for a variety of target behaviors, but research has also shown that teaching a child to self-

manage behavior in the classroom can result in independent functioning to the point where the student is no longer relying on the teacher or on a one-on-one aide (Koegel, Harrower, & Koegel, 1999). As a result of this decreased dependency on adult intervention, the student has increased opportunity to interact with classmates without the potential stigma of having a one-on-one aide. Thus, self-management allows students with disabilities to become actively involved in the intervention process and more involved in their classroom environments. For these reasons, self-management has been suggested in the literature as an ideal intervention for children with disabilities participating in full inclusion classroom settings (Reid, 1996).

Although documentation of the use of this intervention with students with autism and other disabilities participating in inclusive classrooms has been scarce (Reid, 1996), the studies that have implemented self-management interventions for students with autism in these settings have reported encouraging results. For example, self-management has been successfully utilized for improving social skills and reducing disruptive behavior (Koegel, Koegel, Hurley, & Frea, 1992), increasing independent work skills (Sainato, Strain, Lefebvre, & Rapp, 1990), and improving the social interactions of children with autism participating in integrated academic settings (Strain, Kohler, Storey, & Danko, 1994). In particular, Koegel et al. (1992) used self-management to improve the responsiveness of four children with autism to verbal initiations from others in community, home, and school settings without the presence of a treatment provider. The children were taught to use a wrist counter to record their correct responses to questions, which were then rewarded. The results demonstrated improvements in these students' independent responsiveness to others, along with concomitant reductions in disruptive behavior.

In another study, Sainato et al. (1990) evaluated the effects of a self-management intervention package on the independent work skills of children with autism participating in an integrated preschool classroom. Results of this study showed immediate and substantial improvements in the students' behavior and also showed that these gains were maintained after each intervention component was systematically withdrawn. Similarly, Strain et al. (1994) examined the effects

of a self-management intervention package on the social interactions of three preschool boys with autism. This intervention consisted of adult prompts, reinforcement, and self-monitoring and was implemented in the inclusive classroom setting and extended to the home setting for two of the three students. Results indicated that the intervention increased and improved each boy's social interactions with siblings and typically developing classmates. In addition, Callahan and Rademacher (1999) used a self-management strategy to increase rates of on-task behavior for a second-grade boy with autism participating in a full inclusion classroom. Although most of the literature on self-management and children with autism has focused on verbal children, Pierce and Schreibman (1994) taught daily living skills to three nonverbal boys with autism via pictorial self-management.

The combination of self-management strategies with functional assessment in supporting students with autism in full inclusion settings is a potential area for future research. In an initial demonstration of this approach, Frea and Hughes (1997) conducted functional analyses for two high school students with mental retardation in order to determine the function of the students' problem behaviors. Once the function was determined, a response that was functionally equivalent to the problem behavior (e.g., request a break, request for attention) was targeted for each student in a self-management intervention package. The results demonstrated increases in the use of the alternative behaviors with concomitant decreases in problem behavior (Frea & Hughes, 1997). This combination of methodologies has been used to teach students with disabilities in inclusive educational settings to self-manage their use of functionally equivalent responses, resulting in more functional reinforcement (Frea & Hughes, 1997; Todd, Horner, & Sugai, 1999).

PEER-MEDIATED INTERVENTIONS

Due to common deficiencies in the social relationships of children with autism, peer-mediated interventions have been advocated as potentially useful approaches for facilitating the participation of children with autism in general education classrooms. Utilizing typical

peers to support the academic functioning of students with autism has the potential to reduce the need for continuous one-on-one adult attention, thus allowing students with autism to function with increased autonomy and in a manner that more closely matches that of their typical classmates (Putnam, 1993).

Peer tutoring. Peer tutoring consists of pairing two students together to work on any instructional strategy, with one student providing assistance, instruction, and feedback to the other (DuPaul & Eckert, 1998). Peer tutoring strategies have been shown to be effective in producing increases in on-task behavior, math performance, and social interactions for children with disabilities in inclusive classrooms (DuPaul & Henningson, 1993; Locke & Fuchs, 1995). In classwide peer tutoring (CWPT), all children in the class are paired and work simultaneously. The purpose of CWPT is to increase the amount of instructional time that all students engage in academics and to provide pacing, feedback, immediate error correction, high mastery levels, and content coverage (Fuchs, Fuchs, Mathes, & Simmons, 1997).

In a study examining the effects of CWPT in reading instruction among three students with autism participating in regular education classrooms, results of reading assessments revealed gains in reading fluency and correct responses to reading comprehension questions (Kamps, Barbetta, Leonard, & Delquadri, 1994). Furthermore, in unstructured free-time activities, increases in the duration of social interactions between the students with autism and their nondisabled peers were observed after the implementation of CWPT (Kamps et al., 1994). However, there is some evidence suggesting that increasing the rate of social interaction among children with disabilities by implementing CWPT programs may be insufficient in producing enduring changes across unprogrammed settings (Hundert & Houghton, 1992). Thus, even though this strategy appears ideal for use in inclusive classroom settings, more research is needed to assess the generality of findings as well as to verify the effects on social and academic achievement among children of different ages with different needs in general education classrooms.

Utilizing peer supports. A number of researchers have focused on recruiting typically developing students to serve as peer supports for students with autism (Haring & Breen, 1992; Odom & Strain, 1986). The goal of this strategy is similar to that of peer tutoring but with the focus being on improving the social interaction skills of students with autism. Odom, Hoyson, Jamieson, and Strain (1985) evaluated the effects of peer initiations on the social interactions of preschoolers with autistic-like symptoms. Teachers prompted and reinforced social initiations made by identified peer supports. Results showed increased frequencies of positive social interaction, and although these results maintained when the teachers faded their reinforcement of peer-initiated interactions, there were decreases in interactions when teacher prompts were withdrawn. Furthermore, the results were not observed to generalize to other classroom settings.

In another study, Odom and Strain (1986) found that when typical children initiated contact with their peers with autism, social responses by the students with autism increased, and that when teachers prompted the social interactions, both social responses and initiations increased. These findings suggest the potential of multicomponent intervention strategies in producing improvements in a variety of behaviors among students with autism in inclusive classrooms (Odom & Strain, 1986).

In some circumstances, simply training nondisabled peers to interact with classmates with autism has been shown to improve spontaneous social interactions between students with autism and their trained and untrained peers (Brady, Shores, McEvoy, Ellis, & Fox, 1987). In addition, Goldstein, Kaczmarek, Pennington, and Shafer (1992) found that simply having peers attend to, comment on, and acknowledge the behavior of their classmates with autism resulted in improved rates of social interaction. Haring and Breen (1992) involved nondisabled peers in weekly discussions with an adult integration facilitator to increase opportunities for social interaction for two 13-year old students, one with autism and one with mental retardation. The nondisabled peers participated in the implementation of social skills interventions and used self-monitoring strategies to record the quantity and quality of interactions with classmates with disabilities. Results of this study revealed increases in the frequency of interac-

tions, number of opportunities for interactions, and overall appropriateness of the interactions with their peers with disabilities.

Cooperative learning. A number of studies have demonstrated that teaching social and academic skills to children with autism and their nonhandicapped peers in cooperative groups in integrated settings results in increased frequency, duration, and quality of social interactions (Kamps et al., 1992; Kohler et al., 1995). Cooperative learning groups have been used in inclusive classroom settings as an instructional activity for increasing both academic success and social interaction (see Putnam, 1993).

In one such study, Dugan et al. (1995) evaluated cooperative learning groups during fourth-grade social studies activities, where the group activities consisted of tutoring on key words and facts, a team activity, and a whole class wrap-up and review. This resulted in improvements in test scores and academic engagement and increased duration of student interaction between children with autism and their nondisabled classmates. Similarly, Hunt, Staub, Alwell, and Goetz (1994) used cooperative learning groups to support three fully included second-grade students with multiple severe disabilities, including one with autism and an intellectual disability. Results showed that with gradually fading assistance from the teacher, the nondisabled members of the learning groups provided cues, prompts, and consequences that assisted the students with disabilities in demonstrating targeted basic skills in the original cooperative learning group as well as in a newly formed group. Furthermore, achievement tests indicated that the nondisabled students who participated in cooperative groups performed as well as members of groups that did not include a student with a disability. In addition, Kamps, Leonard, Potucek, and Garrison-Harrell (1995) conducted two experiments related to cooperative learning groups and their academic effects on including students with autism in general education classrooms. In both, cooperative learning groups were implemented and consisted of activities that included comprehension questions, academic games, and peer tutoring on vocabulary words. Results of both experiments in this study revealed increased reading gains, academic engagement, and peer interaction among students with autism and their peers par-

ticipating in general education classrooms. Researchers have also used sociodramatic scripts during social routines for various play activities between students with autism and their typical peers and found increases in theme-related social behaviors, even when new scripts were introduced and the play groups were rearranged (Goldstein & Cisar, 1992).

Many researchers have used cooperative groups specifically for improving the social skills of students with autism in inclusive classrooms. For example, Kamps et al. (1992) investigated the use of social skills groups to facilitate the increase of social interactions among three boys with autism who were integrated into a general education first-grade classroom. Group members were taught how to (a) initiate, respond, and keep interactions going; (b) greet others and converse on a variety of topics; (c) give and accept compliments; (d) take turns and share; (e) ask for help and help others; and (f) include others in activities. Results demonstrated increases in the frequency of, time engaged in, and duration of social interactions, as well as in the responsiveness of students and peers to each other (Kamps et al., 1992). Similarly, Kohler et al. (1995) used a group-oriented contingency to reinforce peers to share, provide assistance, and organize play exchanges with their preschool classmates with autism. Results revealed increases in these social and supportive interactions.

Peer-mediated interventions not only have been documented as effective in facilitating the educational inclusion of children with autism but have also been identified as having social validity. Research on the social validity of peer-mediated interventions has documented positive ratings made by typical peers regarding their perceptions of peer-mediated interventions (Kamps et al., 1998) and positive academic outcomes for typical students who participated in peer-mediated interventions (Cushing & Kennedy, 1997).

MULTICOMPONENT INTERVENTIONS

Some intervention strategies have made use of multiple research-based techniques to facilitate the educational inclusion of students with autism. Because multicomponent approaches may be more common in practice than single-component interventions, it is appropriate

to include an example in this review. Hunt, Alwell, Farron-Davis, and Goetz (1996) evaluated a comprehensive individualized intervention consisting of (a) ongoing information to classmates about various aspects of the disability experienced by the target student during naturally occurring interactions or in weekly "club" meetings, (b) various media used for communicative interactions, and (c) the establishment of a rotating buddy system. This multicomponent intervention was found to dramatically increase reciprocal interactions and target student-initiated interactions for students with significant physical and intellectual challenges and sensory impairments. These findings have been replicated for students within the autism spectrum participating in full inclusion classrooms (Hunt, Farron-Davis, Wrenn, Hirose-Hatae, & Goetz, 1997). Specifically, the multicomponent intervention used in this replication study consisted of the development and use of conversation books, rotating peer buddies, weekly class meetings, media-related activities, and staff prompting. Results demonstrated increases in exchanges with peers, with the focus students more frequently initiating the interactions and providing information, as compared to being the recipients of communication and assistance. Overall, interactions between the focus students and their peers were observed to closely approximate those between nondisabled students as a result of the intervention (Hunt et al., 1997).

ADDITIONAL STRATEGIES FOR FACILITATING THE INCLUSION OF STUDENTS WITH AUTISM

Although the strategies that will be discussed in this section have considerable empirical support documenting their effectiveness in teaching children with autism, they have not been specifically designed to support participation in inclusive classrooms. Rather, the strategies are effective teaching techniques that could be used when supporting a student with autism in a general education classroom. We include them in this review because they constitute well-researched strategies that can be used to improve the responding of students with autism and because the relevant research includes at least some extensions to inclusive educational contexts.

PRETASK SEQUENCING

High-probability (high-P) requesting has a long history of empirical support as an effective antecedent-based strategy for increasing responsiveness to requests among individuals with disabilities (Singer, Singer, & Horner, 1987). This antecedent procedure involves preceding a difficult request with a rapid series of short, easy requests and reinforcing compliance with these easy requests. By preceding a difficult task with a series of short and easy tasks that have a high probability of being followed, a child will achieve repeated success and build momentum for improved responding through obtaining repeated reinforcement (Mace et al., 1988; Singer et al., 1987). Although task interspersal procedures have typically focused on increasing compliance to adult-initiated directives, many researchers have suggested the utility of such interspersal procedures when incorporated into a variety of instructional techniques for a variety of target behaviors (Davis & Brady, 1993). For example, Davis, Brady, Williams, and Hamilton (1992) investigated the effects of high-P requests on the acquisition and generalization of responding to low-P requests among two boys with disabilities, including one with autism and mental retardation. Results demonstrated not only increases in appropriate responding to adult requests but generalized appropriate responding to low-P requests by adults not involved in the delivery of the high-P sequence. Davis, Brady, Hamilton, McEvoy, and Williams (1994) later replicated and extended these findings to include generalization of responsiveness to requests to initiate social interaction, along with increases in unprompted initiations and extended interactions with peers in inclusive settings.

PIVOTAL RESPONSE TRAINING AND NATURALISTIC TEACHING STRATEGIES

Incidental teaching approaches and pivotal response training (PRT), which focus on increasing motivation to learn among children with autism by incorporating choices, reinforcing attempts, using adequate modeling, and providing natural consequences, have also been used as strategies for facilitating the inclusion of children with autism in general education classrooms (McGee, Almeida, Sulzer-Azaroff, &

Feldman, 1992; Pierce & Schreibman, 1995, 1997; Thorp, Stahmer, & Schreibman, 1995). Both incidental teaching approaches and PRT focus on using conditions of natural language teaching interactions such that (a) stimulus items are functional and varied, (b) natural reinforcers are employed, (c) communicative attempts are reinforced, and (d) trials are conducted within a natural interchange (Koegel, Koegel, Harrower, & Carter, 1999; McGee, Morrier, & Daly, 1999). Yet, although incidental teaching approaches and PRT share these commonalities, PRT also focuses on targeting motivational variables, incorporating child choice, interspersing maintenance trials, increasing responsiveness to multiple cues, teaching self-management, and teaching self-initiations (see Koegel, Koegel, et al., 1999). Both incidental teaching and PRT have been used with peer-mediated strategies and documented as successful multicomponent intervention strategies that can be used for facilitating the inclusion of children with autism in general education classrooms.

An example was reported by McGee and her colleagues (1992), who used peer-delivered incidental teaching strategies to promote reciprocal social interactions between preschool students with autism and their typical peers. Peer tutors were identified and used incidental teaching to elicit verbal labels of preferred toys by students with autism. Adult assistance was successfully faded, with improvements in social interactions being maintained. In addition, teachers and peers in this inclusive preschool made positive ratings regarding the strategies and their effectiveness, supporting their social validity. Similarly, Pierce and Schreibman (1995) found that by utilizing typical peers to implement naturalistic teaching strategies (PRT) in the absence of direct supervision in a general education classroom environment, students with autism engaged in prolonged interactions, initiated play and conversations, increased engagement in language and joint attention behaviors, and displayed positive changes in social behaviors as reported by their teachers. Although these gains were documented to maintain over time and generalize to some unprogrammed settings, generalization did not tend to occur across untrained peers (Pierce & Schreibman, 1995). Generalization across untrained peers was achieved when multiple peers were involved in implementing the PRT strategies (Pierce & Schreibman, 1997). Teachers have also embed-

ded naturalistic language procedures within their classrooms to facilitate the inclusion of children with autism. For example, Smith and Camarata (1999) demonstrated that general education teachers could successfully implement naturalistic language procedures to improve intelligibility in language skills and spontaneous language use among students with autism.

FUTURE DIRECTIONS AND CONCLUSION

In one way or another, research on behavior analytic supports for students with autism in inclusive contexts has been in progress for nearly two decades. It is a very large and complex undertaking, and there are many questions to ask and problems to solve. None of the questions and none of the answers is simple.

As this review has shown, a number of studies have demonstrated encouraging findings for some children with autism in some inclusive classrooms. The studies have explored and implemented a diverse technology of behavior analysis, with interventions ranging from antecedent manipulations to delayed contingencies, peer-mediated strategies and programs of self-management. Together, these studies provide a rich source of intervention options, and it is likely that one or more of the options could be used to improve the responding of any child identified as being in need of systematic support.

Although the literature offers an encouraging research base, there is a great deal of applied study that needs to occur for us to advance the opportunities of students with autism in inclusive classroom environments. In general, it is important for researchers to look at the diversity of students with autism, including differences in intellectual and behavioral functioning and cultural and economic backgrounds (G. Dunlap & Kern, 1997). For instance, a growing number of students with Asperger's syndrome display unusual patterns of behavior (e.g., compulsive and perseverative responding) that constitute great challenges for educators, in spite of these students' other competencies. At the same time, there are students who have severe intellectual and/or behavioral disabilities, whose inclusion may require very extensive attention and partial participation. Research that distin-

guishes these students' support needs would be welcomed by the educational community (G. Dunlap & Fox, in press; Sailor, 1996).

There will continue to be a need for the detailed behavior analytic research of the kind that has been responsible for the progress to date. In particular, research should connect the technology of functional assessment with strategies for promoting inclusion (cf. Frea & Hughes, 1997), and it should examine team approaches for planning and implementing individualized behavior support plans (e.g., Kincaid, 1996; Nickels, 1996). It would be a significant contribution to have parametric analyses of the existing technology so that procedures could be matched to the settings, the resources, and the child and family circumstances.

Research is also needed at the systems level. Inclusion can only work well if the educational system (at the district, school building, and classroom levels) is designed to encourage and support its success. For instance, systems need to have workable strategies for delivering the ready availability of experts in autism and behavior analysis in inclusive classrooms, and the teachers responsible for implementing special strategies need to have adequate resources and social support, or they are likely to burn out and fail to address the need for systematic interventions.

Inclusion for children with autism is important because education and socialization for children with autism is important. It can be argued that our failures to produce quality inclusion for these students are tantamount to our failures to provide them with a quality education. Our successes possess an analogous equivalency. With a concerted focus on relevant research and a diligent approach to application, combined with a philosophical commitment to optimal and socially inclusive outcomes, we can anticipate further progress in our efforts to support students with autism in appropriate educational settings.

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The treatment of social skills deficits remains one of the most challenging areas in meeting the needs of people with autism. Difficulties in understanding social stimuli, in initiating and responding to social bids, and in appreciating the affect that is intrinsic to social interactions can be baffling for people with autism. Researchers and practitioners of applied behavior analysis have tried a variety of strategies for teaching social skills. This article examines a range of useful procedures for teaching social skills to people with autism, including skills that are adult mediated, peer mediated, and child-with-autism mediated. The authors also consider the potential of classwide interventions in inclusive settings, pivotal response training, and the use of scripts to teach social initiations.

Teaching Social Skills to People With Autism

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Social deficits are intrinsic to the definition of autism. From Kanner's (1943) original conceptualization to the most recent *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1994), problems in social relatedness have been diagnostic of the disorder. In spite of their ubiquitous nature, the remediation of these symptoms remains one of the most daunting challenges for professionals who serve people with autism. Although major progress has been made in the past decade, much work remains to be done.

Observational research has documented the pervasive nature of the social symptoms of disorders on the autism spectrum. Among these social problems are difficulties orienting to social stimuli (Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998), understanding facial expressions (Celani, Battacchi, & Arcidiacono, 1999), and responding to another's distress (Bacon, Fein, Morris, Waterhouse, & Allen, 1998). People with autism have difficulty using gaze to communicate

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(Willemsen-Swinkles, Buitelaar, Weijen, & van Engeland, 1998), initiating interactions (Hauck, Fein, Waterhouse, & Feinstein, 1995), using appropriate greetings (Hobson & Lee, 1998), establishing joint attention (McArthur & Adamson, 1996), and appreciating conventional humor (St. James & Tager-Flusberg, 1994). Children with autism show impairments in spontaneous play (Libby, Powell, Messer, & Jordan, 1998) and initiation of pretend play (Libby, Powell, Messer & Jordan, 1997). The deficits in social relatedness persist across time and are observed in adults as well as in children (Njardvik, Matson, & Cherry, 1999).

In response to these pervasive and persistent problems, there have long been efforts to teach people with autism social skills. Early efforts in applied behavior analysis focused on such skills as making eye contact and exchanging hugs. Our programming efforts have grown more subtle and complex as the field has matured. More recent work has ranged from teaching young people with autism to offer assistance to a person in apparent distress (Harris, Handleman, & Alessandri, 1990) to teaching pretend play (Goldstein & Cisar, 1992) and sociodramatic play (Thorp, Stahmer, & Schreibman, 1995). We have taught children to initiate social contact (e.g., Taylor & Levin, 1998; Zanolli, Daggett, & Adams, 1996) and ask questions (Taylor & Harris, 1995).

The bulk of the research on teaching social skills using applied behavior analysis has been with young children. This includes preschool children (e.g., Gena, Krantz, McClannahan, & Poulson, 1996; Goldstein, Kaczmarek, Pennington, & Shafer, 1992; Krantz & McClannahan, 1998; McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992; Odom, Chandler, Ostrosky, McConnell, & Reaney, 1992; Sainato, Goldstein, & Strain, 1992) and youngsters in elementary school (e.g., L. K. Koegel, Koegel, Hurley, & Frea, 1992; Pierce & Schreibman, 1995; Stahmer & Schreibman, 1992; Taylor & Harris, 1995; Werts, Caldwell, & Wolery, 1996). There has been some research on teaching social skills to adolescents (e.g., Haring & Breen, 1992; R. L. Koegel & Frea, 1993) but relatively little with adults (e.g., Farmer-Dougan, 1994).

The research on social skills has tested the full gamut of teaching technology in applied behavior analysis. This includes social scripts

(e.g., Goldstein & Cisar, 1992; Krantz & McClannahan, 1998), peer modeling (Carr & Darcy, 1990), cooperative learning groups, peer tutoring, classwide interventions (e.g., Kamps, Barbetta, Leonard, & Delquadri, 1994), pivotal skills (e.g., R. L. Koegel & Frea, 1993; Pierce & Schreibman, 1997), and incidental teaching (e.g., McGee et al., 1992).

In this brief article, we cannot provide a comprehensive summary of the state of the art in teaching social skills to children. Rather, we have selected some research that appears to us promising in helping young children master social skills and move toward spontaneous social behavior that is consistent with that of their peers. We focused on the relative contributions of adult-mediated and peer-mediated interactions, peer modeling, initiation by child with autism, classwide tutoring or intervention, and the use of scripts.

WHO IS THE MOST EFFECTIVE AGENT OF MEDIATION?

The research on teaching social skills to children with autism has looked at adults, peers, and children with autism themselves as the primary agents of change. Using each of these individuals as the focus has advantages and disadvantages, and in clinical practice they do not need to be mutually exclusive. However, there is some good work that has started to disentangle the impact of addressing social behavior from these different perspectives.

Learning to engage in reciprocal social exchange is a challenge facing every person on the autism spectrum (Rutter, 1985; Rutter, Mahwood, & Howlin, 1992). These interactions between children occur when they exchange social interactions, when their actions support each other, and when their actions become similar to each other (Cairns, 1979). Peer reciprocity is central to the development of social relationships and serves a variety of social functions (Dunn & McGuire, 1992). Because of this key role, it is of great concern that children with autism learn these skills and use them smoothly and comfortably.

Adult-mediated strategies. Most of the early work teaching reciprocal social skills focused on adults as mediators and as reinforcement agents of appropriate behavior (e.g., Strain, Shores, & Kerr, 1976; Strain & Timm, 1974). However, a major limitation of this approach was that, used in isolation, it encouraged the dependence of children with autism on adults. When adult support was withdrawn, there was a concomitant reduction in social behavior (Odom, Hoyson, Jamieson, & Strain, 1985). In addition, adult intervention may be intrusive or may alter the nature of the interaction once skills have been developed (McGee et al., 1992; Kliewer, 1995). As a result, researchers have emphasized the need for quick fading of adult support (e.g., Odom et al., 1992). Over time, the research shifted away from the focus on adults to considering the role that peers might play as mediators of change in reciprocal social skills of children with autism.

Peer-mediated strategies. A variety of peer-mediated procedures have been described in the literature (Lord & Magill, 1989; Odom & Strain, 1984). Odom and Strain (1984) identified three techniques for peer-mediated social interaction: proximity, prompt/reinforce, and peer initiation. Proximity involves placing typically developing, socially competent children together with children with autism. Usually, the peers are simply instructed to play with the target children and are given no other special training. Prompt/reinforce interventions involve training peers to prompt social behavior and to reinforce the use of such skills. Peer initiation training teaches them how to initiate to the child with autism. Interventions using this approach have been more successful at increasing interactions than at increasing initiations (Brady et al., 1984; Odom, et al. 1985).

Strategies that rely on the technique of proximity require little facilitation. Sheer proximity between children with autism and their typical peers is fairly common in inclusive environments (Johnson & Johnson, 1984; Rynders & Schlein, 1991; Rynders et al., 1993; Schleien, Mustonen, & Rynders, 1995). In one study, Roeyers (1996) assessed whether children with autism could benefit from a proximity intervention in which they had regular opportunities to interact with a typically developing peer. In this study, adults provided supervision but no intervention. Typically developing peers were simply told to

"do their best" to get the child with autism to play. Children in the treatment group demonstrated significant gains in social responsiveness and length of interactions, whereas no positive changes were observed in the control group. In spite of their gains, the children in the treatment group still had difficulties in initiation.

Although all of the peer-mediated approaches have produced positive changes, there is some consensus in the literature that the prompt/reinforcement and peer initiation procedures are more effective than proximity alone. Nonetheless, issues of generalization have been raised with the prompt/reinforcement and peer initiation procedures (e.g., Lord & Hopkins, 1986; Roeyers, 1996). The degree to which these trained behaviors approximate naturally occurring peer interactions is also questionable.

It is clear from the proximity literature that peer modeling alone is insufficient to bring about generalized and enduring social change in children with autism. It seems that simple demonstration of skills lacks the salience needed to produce changes in children with autism. Carrying modeling a step farther, Carr and Darcy (1990) taught children to play follow the leader through peer modeling and prompting. To be effective, the peer had to model and physically prompt the child with autism to engage in the task; asking the child with autism to watch was not sufficient to produce the skill.

The specific types of initiations that peers make to children with autism are also important. Most of the research has focused on teaching peers to make requests or ask questions. By contrast, Goldstein et al. (1992) taught peers to make comments to children with autism and found a marked increase in social behaviors. Peer comments, unlike a request or a question, do not necessarily demand a specific response from the child with autism.

Laushey and Heflin (2000) used a peer buddy system to build social interactions in two kindergartners with autism. This study employed an A-B-A-B reversal design to evaluate whether a peer buddy approach would increase non-adult-directed interactions. During the treatment phases, an active peer-training, buddy system program was implemented. During the return-to-baseline phase, the peers returned to a passive proximity peer-tutoring condition. The treatment entailed assigning a daily buddy, whose role was to stay with, play with, and

talk to his or her partner. Significant increases in social interactions occurred among the children with autism as a result of the peer buddy intervention. Specific skills examined included asking for an object and responding according to the answer given, appropriately getting the attention of another, waiting turns, and looking at or in the direction of someone speaking. Peer buddies were randomized, so the children with autism learned to respond to multiple peers, and some generalization of skills to a new classroom also occurred.

Peer children can learn to assess their own effort in being social partners for children with autism and thereby reduce adult intervention. Sainato et al. (1992) taught peers to get the attention of a child with autism, to initiate a play activity, and to respond appropriately to the child. The use of these social skills by the peers improved when self-evaluation strategies were used.

One of the most interesting developments in peer-mediated strategies for building social skills has been the success of peer-implemented pivotal response training (PRT). PRT endeavors to increase pivotal behaviors or behaviors that are central to wide areas of functioning (R. L. Koegel & Koegel, 1995). PRT is an efficient means of producing generalized behavioral improvement, and it addresses issues such as motivation and responsiveness to multiple cues. Pierce and Schreibman (1995) taught peers to use PRT through role-plays, modeling, and didactic instruction. Peers learned a comprehensive package of skills, which were implemented with minimal adult supervision. In this study, the two children with autism maintained prolonged interactions with the peers. Furthermore, increases in initiations were noted as were increases in engagement and joint attention. The authors postulated that PRT may be helpful in addressing deficits in joint attention because it requires individuals with autism to direct their attention to objects and events in the natural environment. Additional hypotheses regarding the effectiveness of PRT include the possibility that the frequent and varied selection of activities serves as an establishing operation and increases the reinforcing value of the activities (Michael, 1993; Pierce & Schreibman, 1995). Pierce and Schreibman (1997) replicated their findings with two additional children with autism and eight peers.

Initiation by child with autism. The ultimate goal in teaching social reciprocity skills to children with autism is for these skills to reside in the child, not in the adults or peers who might prompt them. Although trained peers are very helpful in building social behaviors, children with autism may be in environments where such peers are unavailable. It is therefore essential to teach them to initiate interactions. In addition, initiation training ensures that children with autism have skills in orchestrating interactions, and not simply in responding to the overtures of others.

Oke and Schreibman (1990) did one of the first studies to demonstrate empirically the need for and the efficacy of training in initiation skills. In the first phase of this study, peers were trained to initiate to children with autism, and there was a predictable increase in the social behaviors of the children with autism. However, when rates of peer initiation decreased, the rates of social responsiveness in the child with autism also declined. By contrast, when the child with autism was taught how to initiate to peers, social responding increased again without the need for peer training, and concomitant reductions in challenging behavior were also evident.

Initiation skills of the child with autism may transfer across settings and across individuals. Belchic and Harris (1994) noted that initiation skills generalized to the playground, to an untrained child with autism, and to a sibling at home. In this study, children were first taught to initiate play to an adult trainer, and this skill was then transferred to children. Zanolli et al. (1996) successfully used priming sessions to increase the spontaneous initiations of children with autism. During the priming session, the child with autism was prompted to direct social behaviors to a trained peer.

One specific type of social initiation is requesting information. Taylor and Harris (1995) used a time delay procedure to teach three children with autism to request information by asking, "What's that?" when novel stimuli were presented during an instructional task. All of the children learned to ask the question and generalized this skill across settings, people, and materials. Two of the three participants were able to acquire new information through this method. This study is noteworthy, as the failure to ask questions is a distinctive deficit of

children with autism that makes them discrepant from their typically developing peers.

One of the challenges to the demonstration of initiation skills is the issue of necessary adult mediation. Often, children with autism require prompting to initiate to other children. This alters the social context considerably and calls into question whether the child is truly initiating interaction. In response to this challenge, Taylor and Levin (1998) effectively used a small tactile prompting device to prompt a student with autism to make verbal initiations to adults about his play activities. A multiphase, multielement design was employed to assess the effectiveness of the device in prompting initiations in three play contexts. Teaching sessions focused on having the child talk about his play activities when the device vibrated. Follow-up probes were done with typically developing peers. The subtlety of the device in prompting the child with autism makes this an intriguing tool.

SOCIAL SKILLS TRAINING

Additional strategies for targeting social deficits focus on skill acquisition training for the individual with autism. Some of these strategies emphasize play skills. Children with autism tend to have limited and restricted repertoires of play (Baron-Cohen, 1987; Stahmer, 1995; Wulff, 1985), and symbolic play and sociodramatic play, in particular, are often lacking (Baron-Cohen, 1987; Mundy, Sigman, Ungerer, & Sherman, 1986).

Wolfberg and Schuler (1993) incorporated elements of the proximity approach and adult mediation in providing support for peer play. This included carefully designed play spaces and materials and the formation of balanced play groups. Using this structure, they found gains in language skills and in the generalization of skills by the children with autism.

Thorp et al. (1995) used PRT to teach sociodramatic play to children with autism. Positive changes in play, social, and language skills, including an increased variety and creativity of play, were noted. The authors suggested that this strategy may be particularly appealing because of its ease of use and the children's intrinsic motivation.

Another socially relevant skill is understanding and demonstrating appropriate affect. Gena et al. (1996) used a multiple baseline design to teach four individuals with autism to respond with appropriate affect. Affective responses had to contain appropriate verbal and facial reactions, be congruent with the presented scenario, and be emitted within five seconds of the presentation of the scenario. Response categories included talking about favorite things, laughing about absurdities, showing sympathy, showing appreciation, and indicating dislike. Results indicated increased responding within the categories for all participants. Effects were specific to the targeted response categories, and generalization occurred across time, settings, instructors, and scenarios.

SELF-MANAGEMENT TRAINING

Another skill that can significantly increase the success of social interactions is self-management. L. K. Koegel et al. (1992) taught children with autism to self-manage their responsiveness to others. Using a multiple baseline design, four children were taught to monitor the frequency of responses and to solicit rewards when the criterion had been achieved. The procedure was extended to community settings. It is noteworthy that adult mediation was minimal and that concomitant reductions in challenging behaviors occurred.

Self-management procedures can be used to build play behaviors. Stahmer and Schreibman (1992) taught three children with autism to play appropriately in the absence of a supervising adult. A multiple baseline design across children was employed, and participants were trained to use a wristwatch alarm to cue the target time interval. Reinforcement was available at the completion of intervals that consisted entirely of appropriate play. When the target duration reached 20 minutes, the experimenter would leave the room and on returning would ask the child, "Did you play correctly?" If the child responded accurately and had played correctly, the experimenter provided verbal praise and the interval continued. If the child played incorrectly, the child was corrected and the interval was restarted. The time that the child played alone without visits from the experimenter was gradually

increased. In addition to the fading of the experimenter, self-management materials were also faded. Skills were generalized to new settings, and two of the three participants maintained the skills at 1-month follow-up.

R. L. Koegel and Frea (1993) first taught two children with autism to differentiate appropriate and inappropriate instances of target behaviors and then to evaluate whether they had engaged only in appropriate behavior during a time interval. Three of the following five behaviors were targeted for each participant: facial expression and affect, eye gaze, nonverbal mannerisms, voice volume, and perseveration of topic. The participants learned to exhibit appropriate behavior in these contexts through the self-management technique. The study also found generalization to other, untreated social communicative behaviors and an improvement in overall appropriateness of the children's social interactions. The authors suggest the possibility of identifying pivotal response classes of social communicative behavior.

CLASSWIDE INTERVENTIONS IN INCLUSIVE SETTINGS

When children with autism are in inclusive educational settings, it is important to meet their needs in ways that are minimally disruptive to class functioning and that appear normative to their peers. Classwide interventions using methods that benefit the entire classroom are one approach to this goal of full inclusion. Kamps and her colleagues (1992) taught social skills to an entire first-grade class that included 3 boys with autism, 2 children with physical disabilities, and 11 typically developing peers. The targeted skills included such things as initiating, responding to, and sustaining interactions, conversations, turn taking, sharing, and giving and getting help. Using a multiple baseline across children, they found positive change in the social behaviors of both the children with autism and their peers. Their findings also identified the importance of focusing on a few basic skills at a time with multiple opportunities to practice these skills.

In another study on classwide instruction, Kamps and her colleagues (1994) looked at classwide intervention for early elementary

school students with autism and their typically developing peers. Using a multiple baseline across children, they compared traditional instruction with a classwide peer-tutoring approach to teaching reading. Consistent with their earlier work with preschoolers (Kamps et al., 1992), this study showed that both the children with autism and their typical peers benefited from the classwide intervention. An important finding was the indirect effect of improved social interactions for the students with autism in the free time that followed the peer-tutoring sessions. Kamps et al. (1994) suggested that the structured peer interactions during tutoring sessions promoted acceptance by typical peers.

Work by Dugan and her colleagues (1995) examined cooperative learning groups to integrate two fourth-grade children with autism into a social studies class. They used an A-B-A-B reversal design to compare a teacher-led session with lectures and questions to cooperative learning groups with a team activity. The results showed that both for children with autism and their peers, there were measurable benefits in information gained and the duration of student interaction in the cooperative learning condition. Kamps et al. (1994) pointed to several factors in the success of these classwide interventions. One is to provide support for the interactions between the students. Another is the importance of the teacher's adaptations in the curriculum for the students with autism. The authors also highlighted selecting curricular activities that lend themselves to interaction between the students.

SCRIPTS

Scripts of social interactions have been used to enhance the ability of children with autism to interact with their peers. For example, Goldstein and Cisar (1992) taught groups of preschool children, including one child with autism and two typical peers, to enact sociodramatic scripts set at a carnival, pet shop, and magic shop. For example, in the carnival script, the roles were booth attendant, assistant, and customer in a carnival hoop game. Using a multiple baseline design, Goldstein and Cisar found that learning these scripts increased the interactions between all of the children during their play sessions.

They also found that the children with autism engaged in behaviors that went beyond the scripts and were an elaboration of the assigned roles.

Krantz and McClannahan (1993) used a script to facilitate peer initiations by children with autism. A multiple baseline design across four children ranging in age from 9 to 12 years old was used to assess the benefits of systematically fading a script for initiating interactions. These initiations were unprompted statements or questions that were directed at another child. The scripted interactions included sentences that addressed the other child by name and then asked, "Would you like some candy or chips?" or "Did you like to swing outside today?" Initially, the children were given manual guidance to read these items from a card, and then that guidance was faded. The scripts increased the initiations of the children with autism, and after learning the scripts, they were noted to recombine elements from the scripts and add new words to their initiations.

In another application of scripts, Krantz and McClannahan (1998) worked with three young boys with autism. In this study, they embedded scripts in the children's photographic activity schedule. For example, the child might learn to look in his schedule and follow the instruction to play with a toy and direct a statement such as "look" or "watch me" to an adult sitting nearby. These simple scripts, a few words at the beginning-reader level, were faded. This intervention led to a marked increase in initiations to adults without the need for the verbal prompts (e.g., "Say, watch me") that are often hard to fade.

SOCIAL SKILLS AND INCLUSION FOR ADOLESCENTS AND ADULTS

The social skills literature is quite limited for older students and adults with autism. One specific social initiation that has been studied is offering assistance. Harris et al. (1990) taught three adolescent boys with autism to offer assistance to someone stating that he or she could not complete a task. They used a multiple baseline across participants and a multiple baseline across tasks for each participant. The tasks

were specific to each participant but included daily challenges such as putting a key in a lock, buttoning a button, and taking a top off of a jar. Results indicated that the adolescents were able to learn to respond to the cues of others indicating the need for assistance. Generalization to a new person in the familiar setting was consistently demonstrated, although other types of generalization were more variable. This skill is an important one, as it is a component of social sensitivity.

When efforts have been made to build social skills in adolescents and adults, the impact and generalizability of these interventions has been limited (Odom et al., 1985). Haring and Breen (1992) used a peer initiation model to facilitate social interactions with peers. They designed a social support network strategy in which groups of same-age nondisabled peers provided support to teens with autism throughout the school day. The nondisabled students recorded the quantity and quality of interactions. Haring and Breen found that frequency and appropriateness of interactions increased. Furthermore, many classmates described their classmates with a disability as a friend at the completion of the project, and many opted to initiate contact of their own accord.

Farmer-Dougan (1994) used an incidental teaching procedure to increase the requests made by adults with autism or moderate to severe mental retardation. One interesting aspect of this study was that all of the participants, peers and targets, were individuals with similar disabilities. Peer tutors were trained to evoke an appropriate request for needed items for lunch preparation. Specifically, peers were taught to watch for an initiation, remove the desired item, ask for a correct response, wait for a correct response, and reward. The peer use of incidental teaching was highly effective in increasing appropriate requesting. Effects were maintained when the program was withdrawn, and generalization to other individuals and to other meals was evident. The authors pointed out several specific benefits of this approach. The procedure was relatively easy to teach and to implement. Furthermore, the procedure was extremely appropriate for a community-based setting because the residents interacted in family-like activities and received practice in relevant domestic skills.

SUMMARY

Social skills deficits are a hallmark characteristic of autism spectrum disorders. While applied behavior analysis practitioners' efforts at remediating deficits have been highly successful in many realms of functioning, the impact on social deficits has been more modest. Social and affective deficits remain among the most formidable treatment challenges. Significant progress has been made in the development of methods to teach social skills and to build bridges between individuals with autism and their peers. Adult-mediated and peer-mediated strategies have both been successful means of building social responsiveness. Strategies aimed at building skills in the child with autism have also been fruitful. Among the most interesting of these are classwide interventions for inclusive settings and the use of scripts for developing complex social interactions. Much work needs to be done in assessing the relevance of this knowledge base to adolescents and adults with autism.

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