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A SOCIAL BEHAVIORISM THEORY OF LEARNING DISABILITIES: THE EFFECT OF EMOTIONAL-MOTIVATIONAL CHARACTERISTICS OF ATTENTION

University of Hawaii

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A SOCIAL BEHAVIORISM THEORY OF LEARNING DISABILITIES:
The Effect of Emotional-Motivational
Characteristics on Attention

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN EDUCATIONAL PSYCHOLOGY
DECEMBER 1982

by
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ABSTRACT

The approach and general theory of Staats' social behaviorism were extended to the problem of learning disabilities. Utilizing evidence from the clinical, educational, and research literature pertaining to learning disabilities and in accord with the theoretical framework provided by social behaviorism, behaviors associated with learning disabilities were reconceptualized as deficits in normal behavior and inappropriate behaviors (1) which may occur in any of a child's personality repertoires, i.e., the child's emotional-motivational, language-cognitive, or instrumental repertoire, (2) which are caused and maintained by inadequate and/or inappropriate learning environments, and (3) which function, in various interactive ways, to handicap or interfere with school learning and performance. It was indicated that this view provides a new way of conceptualizing learning disabilities with extensive implications for research as well as education.

In addition, the dissertation used social behavioral concepts and principles to analyze a specific aspect of learning disabilities, namely, sustained attention deficits. Toward this end, (1) literature involving the Continuous Performance Test was reviewed; (2) it was stated that the role of motivational factors needs to be specified more adequately; and (3) hypotheses based on previous research and derived from the social behaviorism theory of motivation (A-R-D theory) were formulated.
The first conceptual hypothesis was that learning disabled children differ from non-learning disabled children in their emotional-motivational characteristics, with learning disabled children having a less positive attitude toward school-related stimuli. The second conceptual hypothesis was that these differences may, to a large extent, account for the relatively poorer performance shown by learning disabled children on sustained attention tasks.

Two experiments were conducted to test the hypotheses. In the first experiment, the attitudes of 15 learning disabled, 15 normal achieving, and 15 high achieving children were compared on a questionnaire composed of school and play-related words. The second experiment compared the sustained attention performances of 29 learning disabled, 30 normal achieving, and 30 high achieving children on two adaptations of the Continuous Performance Test, one which used the school-related words as task stimuli, and the other which used the play-related words.

The results of Experiment 1 indicated that learning disabled children expressed a less positive attitude toward the school-related words than either of the other two groups of children and that the groups did not differ in attitude expressed toward the play-related words, thus providing support for the first conceptual hypothesis.

Experiment 2 yielded a number of findings, four in support of the second conceptual hypothesis, and two which were not as predicted. The findings that learning disabled children performed less well than normal achieving children on the task which used school-related words, but not significantly different on the task which used play-related words, were considered to provide the most relevant as well as most
convincing support for the second conceptual hypothesis since differences between the two groups on the tasks could be related to whether or not there was a corresponding difference in attitude toward the two types of stimuli involved.

The findings which were not as predicted, i.e., those which showed no difference between learning disabled children on the school and play stimuli versions of the task and which showed high achieving children to perform better on the school stimuli version than the play stimuli version, were not viewed as negating the second conceptual hypothesis in light of results related to the other hypotheses. Instead, the nonsupportive findings were seen as indicating that other variables, possibly competing stimuli and additional attitudinal characteristics of the children, were operating in the experimental situation, and that further analysis and experimental investigation is needed in order to understand the complex relationship between motivation and attention, even on a simple laboratory task such as the one used in the present study.
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CHAPTER I
INTRODUCTION

Staats (1975) has developed social behaviorism as an approach and general theory which provides a basis for unified study in several areas of concern to psychologists. One area that has interested psychologists, as well as educators and physicians, for a number of years is the area of learning disabilities. Despite its long history, the field connected with learning disabilities has been described as eclectic (Weiderholt, 1974), still in its infant stages with regard to fundamental issues (Smith & Neisworth, 1975), and lacking in conceptual models which would suggest further research and development (Wong, 1982).

It is suggested that the approach provided by social behaviorism, applied to the problem of learning disabilities, would yield a conceptualization of learning disabilities that would help both define important issues in the field and stimulate productive research. Thus a major purpose of this dissertation is to consider the heuristic value that social behaviorism may have for the study of learning disabilities. Toward this end, the dissertation will (1) reconceptualize learning disabilities from and within the theoretical framework of social behaviorism; (2) use social behavioral concepts and principles to analyze an aspect of learning disabilities, namely, the poor attention shown by learning disabled children; and (3) test the validity of the analysis experimentally.
As background to the present effort, the remaining sections of this chapter will describe (1) earlier attempts to conceptualize and investigate learning disabilities, and (2) the need for more adequate theory as expressed by professionals in the learning disabilities field.

Background of the Problem

The phenomenon of learning disabilities began to concern investigators as early as the late 1800's. In 1896, Morgan, an English physician, reported the case of a 14-year-old boy who appeared intelligent but could not read (Morgan, 1896). Although the term "congenital word blindness" was applied to the child Morgan described, today the child would probably be identified as learning disabled. Despite the different labels, however, the problem for investigators remains largely the same--namely, trying to understand why children with normal intelligence and no obvious handicap (physical, emotional or environmental) achieve so poorly in school.

Theory and Research in Learning Disabilities

Investigators who have reviewed the historical development of the field of learning disabilities report that a great deal of research and theorizing has been done in an attempt to understand learning disabilities (Bryan & Bryan, 1978b; Hallahan & Cruickshank, 1973; Torgesen & Dice, 1980; Weiderholt, 1974). According to Eichenwald (1967), in the 70 years preceding the mid-1960's over 20,000 books, articles, and papers were published on the subject.
Early efforts. According to Bryan and Bryan (1978b), much of the earliest work in the area of learning disabilities was inspired by Strauss and Werner. During the 1930's and 1940's, Strauss and Werner observed that many mentally retarded children are hyperactive, distractible, and inattentive. Since these symptoms are also commonly found in brain-injured adults, these investigators reasoned that (1) mentally retarded children who evidenced these symptoms were also brain-injured and that (2) learning problems could therefore be organic rather than just genetic (as had previously been assumed).

The notion that learning problems could be organic soon became popular among investigators working with children who had normal intelligence and learning problems. As a result, the learning problems of otherwise normal children were theoretically linked with one or another kind of organic impairment, e.g., lack of cerebral dominance, minimal brain dysfunction, endocrine disturbance, chemical imbalance, and poor neurological organization, and numerous studies were conducted to find evidence in support of the theories.

Despite concerted efforts, however, concrete evidence in support of an organic etiology for learning disabilities was not established (Bryan & Bryan, 1978b; Hallahan & Cruickshank, 1973; Smith & Neisworth, 1975; Ross, 1976; Weiderholt, 1974). Although the view that learning disabilities are caused by organic impairment has nonetheless continued to remain popular today, by the 1960's several investigators had begun to shift their interests to other concerns; and the relative number of studies devoted to organic factors since then has steadily declined (Bryan & Bryan, 1978b; Torgesen & Dice, 1980; Weiderholt, 1974).
Later efforts. For several researchers, the shift from etiological concerns was reflected in a shift toward a concern with diagnosing and assessing learning disabilities (Bryan & Bryan, 1978; Weiderholt, 1974). In line with this interest, efforts were made to identify characteristics or symptoms common to learning disabled children.

One approach taken to identify common characteristics involved surveying the literature to determine what other professionals considered indicative of learning disabilities. In examining over 100 publications concerned with identifying the characteristics of children with learning disabilities, Clements (1966) found the following characteristics cited most frequently: (1) hyperactivity, (2) perceptual-motor impairments, (2) emotional lability, (4) general coordination deficits, (5) disorders of attention, (6) impulsivity, (7) disorders of memory and thinking, and (8) specific learning disabilities, i.e., reading, writing, spelling, and arithmetic.

Beyond an interest in identifying characteristics common to learning disabled children, a number of investigators also attempted to demonstrate how one or another characteristic, e.g., perceptual-motor skills, language skills, memory, attention, was particularly significant (that is, basic) to the learning disabilities problem. Several researchers (e.g., Dykman, Ackerman, Clements, & Peters, 1971; Frostig, 1969; Kirk & Kirk, 1971; Wepman, 1960) developed tests or instruments to assess children's performances in the area they considered especially relevant; and in addition, educational materials and techniques which focused on the area were often developed as well.
Of all the psychological characteristics investigated prior to the 1970's, Hallahan & Cruickshank (1973) found perceptual-motor ability to be the most frequently researched characteristic by far. During the early 1970's, however, the amount and kind of attention devoted to this area began to elicit the criticism of a number of professionals. Among others, such reviewers as Mann (1970), Myers and Hammill (1969, 1974), Hallahan and Cruickshank (1973), and Hammill and Weiderholt (1973) found fault with (1) the assumption that perceptual-motor impairments underlie reading and other achievement problems; (2) the lack of empirical validity to support the tools designed to assess perceptual-motor skills; (3) the poor quality of the research investigations; and (4) the conflicting and/or negative results related to perceptual-motor training.

Since publication of the critical reviews, the proportion of research devoted to perceptual-motor skills has declined dramatically. Whereas Hallahan and Cruickshank (1973) found 65% of the learning disabilities research devoted to this area prior to the 1970's, Torgesen and Dice (1980) reported a figure of 6% for the three year period from 1976 to 1978.

Recent efforts. Based on their survey of recent research in the area of learning disabilities, Torgesen and Dice (1980) indicated that research is now being conducted on a variety of different topics, including: (1) memory, (2) academic tasks, particularly reading sub-skills, (3) intelligence, (4) social interaction behaviors, (5) personality factors, e.g., cognitive style, (6) higher-order cognitive skills, (7) nonbehavioral treatment methods, (8) behavioral treatment methods, i.e., reinforcement effects, (9) attention, (10) perception and
perceptual-motor skills, and (11) brain processes.

That the nature of the topics which are the focus of recent research is so diverse supports Weiderholt's (1974) contention that today's field of learning disabilities may be described as eclectic. While the early organically-oriented theories upon which the field was established still continue to influence beliefs about the causes of learning disabilities, efforts to understand and treat them are largely influenced by work in such areas as remedial education and developmental, cognitive, and behavioral psychology (Weiderholt, 1974). As an illustration: (1) The influence of Flavell's (1976) work in developmental psychology may be seen in much of the recent work on the memory and metacognitive abilities of learning disabled children (e.g., Torgesen, 1977a, 1977b; Swanson, 1979; Wong, 1978, 1980, 1982). (2) Similarly, a number of studies have been influenced by Kagan's (1965) concept of impulsivity/reflectivity (e.g., Campbell & Douglas, 1972; Campbell, Douglas, & Morgenstern, 1971; Douglas, 1972) and by Witkin's (Witkin, Dyk, Paterson, Goodenough, & Karp, 1962) notion of field dependence/independence (e.g., Keogh & Donlon, 1972; Keogh, Wells, & Weiss, 1972). (3) Concepts and principles from remedial education have also had an effect on the learning disabilities research, particularly in the area of reading (e.g., Leigh, 1980; Stockdale & Crump, 1981). (4) Finally, work in behavioral psychology has led to countless studies dealing with the modification of a wide variety of study, social, and cognitive behavior problems shown by learning disabled children (e.g., Haring, Lovitt, Eaton, & Hansen, 1978; Lovitt, 1975a, 1975b; Lovitt & Hansen, 1976).
Need for More Adequate Theory

Among others, Senf (1972, 1976) and Lerner (1976) have attempted to indicate the overall role that theory should play in the field of learning disabilities. According to Senf (1972), in order to understand the deviant functioning of learning disabled children, what is needed is a coherent theoretical framework which can both direct systematic investigations and integrate the data obtained in a meaningful way. In addition, Lerner (1976) has further indicated the need for theory that can provide a foundation for diagnosing and treating learning disabilities. According to Lerner:

Without a theoretical basis for diagnosing and treatment, decisions are based on faith in what the experts say, intuitive homilies and principles, or the bandwagon approach to decision in education—the use of materials or techniques that appear to be popular at the moment. (p. 129)

That learning disabilities professionals have become increasingly aware of the need for theory that can serve the functions discussed by Senf and Lerner has been observed by Wong (1979b). In examining the productiveness of recent efforts to understand learning disabilities, the field has begun to criticize the quality of research (Cohen, 1976; Elkins, 1976; Keogh, 1976) and seriously question its approaches to treatment (Hallahan & Hains, 1976; Sontag, 1976). It may be observed that learning disabilities professionals have linked their criticisms to a lack of adequate theory in the following ways: (1) by pointing to the need for conceptual frameworks which are capable of making sense of the diverse findings that exist within the field (Senf, 1972; Wong, 1979b), (2) by indicating the need for more theory-based, programmatic research (Cohen, 1976; Elkins, 1976; Keogh, 1976; Wong, 1976b), and
(3) by pointing to the need for empirically-supported theoretical bases upon which to establish more adequate diagnostic and treatment approaches (Hallahan & Heins, 1976; Sontag, 1976; Wong, 1979a).

In addition, it is suggested that a number of learning disabilities professionals have begun to recognize the importance of indicating the particular theoretical needs of the field more specifically. Mindful of the problems associated with earlier theories of learning disabilities, investigators such as Dunn (1968), Lerner (1976), and Wong (1979) have pointed to a number of characteristics that would be viewed as highly desirable in a theory of learning disabilities. Taken together, investigators have called for:

(1) a theory that provides a conceptual framework which comprehensively deals with the various kinds of learning difficulties found in children who are not progressing in school as expected (Dunn, 1968; Lerner, 1976);

(2) a theory that provides a rational explanation for the heterogeneity of learning disabilities (Wong, 1979c).

(3) a theory that comprehensively deals with child variables and situational variables in the classroom (Wong, 1979c);

(4) a theory that indicates the nature of the interaction between the child and the school which determines school success or failure (Wong, 1979c);

(5) a theory that provides a framework for interpreting what is known about learning disabilities, i.e., empirical findings from various branches of the field (Senf, 1972, 1976);

(6) a theory that has direct implications for research and
education (Dunn, 1968; Lerner, 1976); and

(7) a theory that provides a framework which enables learning disabilities researchers to relate their findings to theory and research in mainstream psychology, e.g., developmental, cognitive, and behavioral psychology (Torgesen & Dice, 1980; Wong, 1979b).

Summary

In summary, it was stated that a major purpose of this dissertation is to examine the heuristic value of the social behaviorism paradigm for investigating the problem of learning disabilities. In the first part of the chapter it was indicated that a great deal of research and theorizing has been done in an attempt to understand learning disabilities. Much of the early research was guided by specific theories which attempted to link learning problems to various kinds of organic impairments. Despite considerable and systematic research, however, the findings were generally disappointing. As a result, the focus of the learning disabilities research shifted to (1) identifying behavioral symptoms of learning disabled children, a number of which were herein reported, and to (2) assessing the psychological functioning of learning disabled children, in particular their perceptual-motor abilities. During the last decade, following a great deal of criticism of the amount and kind of attention paid to perceptual-motor skills, the content of research studies has become far more diversified. It was noted that today's field has been described as eclectic since efforts to understand learning disabilities are now being influenced by work from a number of areas outside the field, including remedial reading.
and developmental, cognitive, and behavioral psychology.

The growing awareness among learning disabilities professionals of
the need for more adequate theory was also discussed in the chapter.
It was indicated that investigators have (1) recognized the general
importance of theory for guiding research, integrating findings, and
providing a base upon which to develop treatment and (2) linked the poor
quality of today's research and treatment efforts to a lack of adequate
theory. Finally, it was stated that professionals in the field, mindful
of the problems associated with previous theories, are beginning to
recognize and identify the particular theoretical needs of the field
more specifically; and a number of these needs were reported herein.
CHAPTER II

SOCIAL BEHAVIORISM AND LEARNING DISABILITIES

In this chapter learning disabilities are reconceptualized from and within the framework of social behaviorism. Before attempting to extend social behaviorism to the area of learning disabilities, however, it is important to consider several characteristics of the approach. The first part of the chapter provides an overview of social behaviorism, indicating aspects of the paradigm that are especially relevant to a social-behavioral conceptualization of learning disabilities; while the remainder of the chapter is devoted to developing the conceptualization.

Overview of Social Behaviorism

The theory of social behaviorism developed by Staats (1968, 1971, 1975) has as its central concern the understanding of human learning and behavior. A basic concept of the theory is that complex functional human behavior is learned. As in traditional behavioral theories, the basic learning principles of social behaviorism are derived from the study of conditioning. In contrast with traditional behavioral approaches, however, additional levels beyond the basic principles are considered necessary for dealing with the various levels of phenomena that must be confronted in studying human behavior.
In attempting to deal with the complexities presented by human behavior social behaviorism has developed a theoretical framework which, while organizing and integrating much of the existing knowledge in psychology, also serves an heuristic purpose in indicating where further research and theoretical development may be productive. The theoretical framework includes: a philosophy of science, which emphasizes the importance of using concepts that are specified by observations; a basic learning theory, which interrelates the processes of classical and instrumental conditioning; a personality theory, which recognizes personality as a cause as well as an effect; and theories of emotions and motivation, language and cognition, sensory-motor skills, abnormal personality, and social interaction and attitudes.

Of particular relevance to the task of reconceptualizing children's learning disabilities are social behaviorism's theories of personality and abnormal personality. Briefly described in the following sections are concepts and principles of the theories, as they specifically relate to the study of children.

**Social-Behavioral Personality Theory**

The social behavioral conception of personality is that the child learns basic systems of skills according to the principles of conditioning. The systems, called basic behavioral (or personality) repertoires, are considered to constitute the child's "personality" and are known in the theory as (1) the emotional-motivational system, (2) the language-cognitive system, and (3) the instrumental system. Each are considered to involve aspects of the other repertoires, and all are
considered important to the child's learning and adjustment.

The emotional-motivational (A-R-D) system. The social behavioral conception of the emotional-motivational system, also known as the A-R-D system, is that the child has, mostly through learning, an emotional response to a wide number of stimulus events and objects in his or her environment--school stimuli, play stimuli, social stimuli, food, words, ideas, and so on. The letters A, R, and D stand for the various functions stimuli can have for an individual, i.e., attitudinal, reinforcer, and directive functions.

Social behaviorism's basic learning principles provide the basis for understanding how the emotional-motivational system functions. In accord with the principles, stimuli which elicit an emotional (or attitudinal) response for the child also, as a consequence, have motivational value for the child in that they are capable of reinforcing as well as directing the child's behavior. This means that what a child experiences and learns in a situation, and how he or she behaves, will in part be determined by the nature of the child's emotional-motivational system.

Staats, Gross, Guay, and Carlson (1973) have demonstrated the principles with college students. Students were given a test to measure an aspect of their emotional-motivational systems, namely, their attitudes (emotional responses) toward various vocational stimuli. Later, among other tasks, they were presented with a choice task, that of selecting to read one of two articles. The results showed that the students behaved differently in selecting materials to read depending on their different attitudes, indicating that the same stimulus
situation was experienced differently and responded to differently depending on the nature of the students' emotional-motivational systems. In addition, it was noted that students gave better answers to questions coincident with their interests, suggesting that the nature of students' emotional-motivational systems also had an effect on their learning.

Language-cognitive system. The second personality system considered in the personality theory is the language-cognitive repertoire. The social behavioral conception of the language-cognitive repertoire is that it is composed of a number of learned subrepertoires which together yield the child's functional language. The subrepertoires include: (1) a verbal imitation repertoire, which involves being able to repeat sounds and sequences; (2) a labeling repertoire, which involves being able to name objects and events, describe oneself, experiences, complex ideas, and so on; (3) a verbal-emotional repertoire, which involves having words that elicit emotional responses; (4) a verbal-image repertoire, which involves having words that elicit images; (5) and a verbal-motor repertoire, which involves having words that elicit instrumental behaviors.

While traditional behavioral approaches have considered the language subrepertoires something simply to be described and explained, social behaviorism, in a contrary manner, recognizes the extensive and essential functions of the repertoires in the many cognitive processes they are seen as underlying, e.g., memory, reasoning, problem solving, concept formation, self-direction, planning, evaluation, and so on. It is relevant to note that most intelligence tests are designed to measure the child's abilities or skills in cognitive areas. A social behavioral
analysis then would suggest that children who obtain high scores on intelligence tests, and are thus viewed as more "intelligent," have larger, more developed language repertoires than children who do not obtain high scores.

The instrumental system. The third personality system considered in the personality theory is the instrumental repertoire. The social behavioral conception of the instrumental repertoire is that it consists of learned, overt sensorimotor behaviors. Since what an individual does is frequently the most obvious and significant aspect of his or her activity, the child's instrumental repertoire is considered an essential part of his or her personality.

The following kinds of behaviors have been included in social behaviorism's consideration of the instrumental repertoire: imitative skills; aggressive and verbal aggressive behaviors; motor skills; modeling; and attentional skills.

The basic behavioral (personality) repertoires and cumulative-hierarchical learning. As Staats (1975) has indicated, "When the complex repertoires of human behavior are subjected to analysis in terms of the constellations of skills involved, it becomes evident that a long time and many learning trials are involved in the acquisition process" (pp. 62-63). In recognizing the complexity and length of human learning, social behaviorism has described principles of cumulative-hierarchical learning which indicate that the acquisition of an individual's personality repertoires in addition to involving the elementary conditioning principles also involves "... extended
series where the acquisition of one skill enables the individual to acquire another skill, or the elaboration of the first skill, and this then enables the next learning level to be attained" (Staats, 1975, p. 63). Thus the cumulative-hierarchical learning principles indicate how the basic behavioral repertoires acquired by the child provide the foundation for acquiring additional, more advanced skills, a development that is both cumulative and hierarchical in nature.

**Personality as a cause and effect.** In contrast with most behavioral approaches which view personality solely as an effect of what the child experiences, the social behavioral position is that personality is also a cause. To be more specific, while the child is considered to acquire his or her personality repertoires on the basis of learning, the child's personality repertoires are considered to affect, in the causative sense, what the child later experiences and learns in a situation as well as how he or she behaves.

Social behavioral theory has outlined a number of different ways in which a child's basic behavioral (personality) repertoires may interact with each other and the environment to determine behavior—one reason why it has also been called a "behavioral interaction approach" (Staats, 1971). As indicated above, the child's personality repertoires are seen as interacting with the situation to help determine the child's experience, learning, and behavior. In addition, the child's experience is considered to act back upon the child's personality development through the learning the experience produces. Moreover, the child's behavior may affect the environment in ways that will act back upon the child in determining his or her later experience, learning, and behavior.
Social-Behavioral Abnormal Personality Theory

Social behaviorism's abnormal personality theory is concerned with the same personality repertoire areas, the emotional-motivational system, the language-cognitive system, and the instrumental system, described in the personality theory. The social behavioral conception of abnormal personality is that the child may not have acquired behaviors that he or she needs in order to adjust to the environment, and/or the child may have acquired behaviors that handicap his or her adjustment. These two kinds of maladjustments, deficits in behavior or inappropriate behaviors, could occur in any of the child's three personality repertoire areas. The view of social behaviorism is that abnormal or maladjustive behavior is acquired and functions according to the same principles which apply to normal, adjustive behavior.

Summary

In summary, important characteristics of social behaviorism, and in particular its theories of personality and abnormal personality, have been described. The personality and abnormal personality theories of social behaviorism were cited as particularly relevant to the study of learning disabilities, and it was stated that the view of social behaviorism is that the child learns systems of skills which are seen as constituting his or her personality, and that some of the skills involved may be considered normal in that they help the child adjust to his or her environment, while others may be considered abnormal in that they handicap the child.
It was further indicated that the personality systems of the child are viewed as affecting, in the causative sense, what the child experiences and learns in a situation, as well as how he or she behaves. In addition, what the child experiences is considered to act back upon the child's personality development through the learning the experience produces; and, moreover, how the child behaves may affect the environment in ways that will act back upon the child in determining his or her later experience, learning, and behavior.

An extension of social behavioral concepts and principles to the area of learning disabilities would constitute a new way of conceptualizing learning disabilities. In the remaining sections of the chapter such an extension is attempted.

A Social Behaviorism Conceptualization of Learning Disabilities

As indicated in the first chapter, a major purpose of this dissertation is to consider the heuristic value that social behaviorism may have in the area of learning disabilities. In line with this goal, clinical observations and empirical findings that have been recognized as significant aspects of the learning disabilities problem are reconceptualized and incorporated into the framework provided by social behaviorism; and following this social behavioral principles are used to suggest the causes of learning disabilities, how they are maintained and function, and how they can be treated.

As an initial effort to extend social behaviorism to the area of learning disabilities, the conceptualization herein developed is not
intended to provide a complete or definitive analysis of the learning disabilities phenomenon. The intent is rather to illustrate how social behaviorism may be used (1) to conceptualize learning disabilities, (2) to integrate important findings, and (3) to indicate where additional theoretical analysis and empirical development may be productive.

**Basic Behavioral (Personality) Repertoires and Learning Disabilities**

Presented in Table 1 is a schema for considering the behavioral characteristics (or symptoms) that have been associated with learning disabilities in children (see Table 1). As the table indicates, the characteristics are classified in each of two ways: first, as representing either deficit behavior or inappropriate behavior, and second, as being within the realm of the emotional-motivational (A-R-D) system, the language-cognitive system, or the instrumental system.

With regard to the first classification, the suggestion is that the learning disabled child may not have acquired behaviors that he or she needs for adjusting to the school environment, and/or that the child may have acquired behaviors that are inappropriate in that they handicap his or her adjustment. The suggestion of the second classification is that the two kinds of maladjustments--deficits in behavior and inappropriate behaviors--may occur in any of the three basic behavioral repertoire areas considered to constitute the child's personality, namely, the child's emotional-motivational (A-R-D) system, his or her language-cognitive system, or his or her instrumental system.

In the following sections each cell of the schema is described more fully. To reiterate, the schema incorporates behavioral characteristics
Table 1  
Basic Behavioral Repertoires and Learning Disabilities

<table>
<thead>
<tr>
<th>BASIC BEHAVIOR (PERSONALITY) REPERTOIRE</th>
<th>SYMPTOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deficit behavior</td>
</tr>
<tr>
<td></td>
<td>Lack of self-esteem</td>
</tr>
<tr>
<td></td>
<td>(positive feelings toward self as learner)</td>
</tr>
<tr>
<td></td>
<td>Lack of achievement motivation (pride in new learning, task completion, etc.)</td>
</tr>
<tr>
<td></td>
<td>Lack of positive attitude toward school learning situation (teachers, academic tasks, peers)</td>
</tr>
<tr>
<td></td>
<td>Lack of interest in typical classroom rewards (teacher praise, grades, peer approval)</td>
</tr>
<tr>
<td></td>
<td>Lack of pro-learning conceptual systems (e.g., realistic performance expectations, attribution of success to self)</td>
</tr>
<tr>
<td></td>
<td>Memory and thinking deficits (e.g., number word associations, grammatical word associations, academically-related word associations)*</td>
</tr>
<tr>
<td></td>
<td>Deficit formal (academic) learning skills (e.g., verbal self-direction, metacognitive skills)</td>
</tr>
<tr>
<td></td>
<td>Academic deficits (reading, arithmetic, spelling, oral language, writing)*</td>
</tr>
</tbody>
</table>

A-R-D system (emotional-motivational system)

Language-cognitive system
Table 1 (Continued)

Basic Behavioral Repertoires and Learning Disabilities

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>Deficit behavior</th>
<th>Inappropriate behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Deficit behavior</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deficit motor skill</td>
<td>Deficit motor skill (coordination, laterality, copying, handwriting)*</td>
<td>Atentional disorders (attends to non-task stimuli, perseverates)*</td>
</tr>
<tr>
<td>Lack of attending skills</td>
<td>Lack of attending skills (selective attention, sustained attention)*</td>
<td>Hyperactivity (frequently out-of-seat, tapping pencil, talking)*</td>
</tr>
<tr>
<td>Instrumental repertoire</td>
<td>Lack of discrimination skill (visual and auditory perception)</td>
<td>Impulsivity (acts/responds before thinking)*</td>
</tr>
<tr>
<td></td>
<td>Lack of social interaction skill (teachers, peers)</td>
<td>Emotional lability (cries, is demanding, silly, immature)*</td>
</tr>
<tr>
<td><strong>Inappropriate behavior</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acting-out (hits, throws things)</td>
</tr>
</tbody>
</table>

As indicated in the chapter, no learning disabled child would be expected to evidence all of the behavioral problems listed; nor would a child likely be considered learning disabled on the basis of any one symptom. What the schema does show is the different kinds of problem behaviors that learning disabled children as a group evidence relative to normal achieving children. Moreover, given the various combinations of maladjustive behaviors that different children could conceivably learn, the schema also provides a basis for understanding the heterogeneity of learning disabilities, a factor that other conceptions have had difficulty dealing with (see Wong, 1979b).

Beyond providing a framework which yields a rational explanation for the heterogeneity of learning disabilities and which comprehensively deals with the various kinds of learning difficulties found in children who are not progressing in school as well as expected, the present formulation also addresses other theoretical needs that learning disabilities professionals are beginning to recognize and identify (see Chapter I). To be specific, the framework indicates the kinds of interactions, e.g., behavior-behavior/behavior-environment, which can determine school success and failure, and provides a basis for comprehensively considering child variables (the child's basic behavioral repertoires) and situational variables (the child's learning environment) in the classroom. Moreover, by basing itself in the social behaviorism paradigm, the conception of learning disabilities developed here was able to (1) integrate findings from various branches of the field, (2) provide a framework which would enable learning disabilities researchers to relate their findings to theory and research in other
which have been commonly associated with and/or investigated as part of the learning disabilities problem. No learning disabled child would be expected to evidence each of the symptoms described; nor would it be likely that a child be considered learning disabled on the basis of any one symptom.

**Deficit emotional-motivational (A-R-D) system.** The first cell deals with possible deficits in the emotional-motivational (A-R-D) system of the learning disabled child. The first kind of deficit listed in the cell is lack of self-esteem. Despite the frequency with which this characteristic has been attributed to learning disabled children (Bruininks, 1978a, 1979b; Lerner, 1976; Ross, 1976), relatively little research has been conducted to explore how learning disabled children feel about themselves, or to what extent their feelings differ from normal children's. Among the few findings stemming from research in this area are those of Tollefson, Tracy, Johnsen, Buenning, Farmer, and Barké (1982). These investigators found that learning disabled children did not differ from normal children on group tests of self-esteem; however, the responses of the learning disabled children to a task-specific attributional measure showed that learning disabled children are less likely than normal children to attribute their success to their own efforts, indicating that they may lack positive feelings about themselves as learners.

The second deficit listed in the cell involves the learning disabled child's motivation or interest in achieving. According to Alley, Deshler, and Warner (1979) and Rosenthal (1973), learning disabled children may not have positive feelings about completing a task and/or
pride in new learning. As Adelman (1978) points out, very little research has focused specifically on these matters, however, or on matters relating to the achievement motivation of learning disabled children in general.

The third kind of deficit listed in the cell, namely, lack of positive attitude toward stimuli, e.g., the teacher, academic tasks, academic materials, in the school learning has also been discussed as a possible problem of learning disabled children. Ross (1976), for example, has suggested that because of a history of repeated failures, neither reading nor the teacher may be reinforcing to learning disabled children. Inasmuch as the first experiment deals with attitudes of learning disabled children toward stimuli in the school learning situation, literature relating to these kinds of deficits will be considered more fully in the problem section of the dissertation.

Finally listed in the first cell is lack of interest in typical classroom rewards. While Lovitt (1978) has suggested that learning disabled children may not be reinforced by rewards typically used by classroom teachers, e.g., teacher praise, grades, stars, Wender (1971) uses the term "reinforcement disorder" to suggest that learning disabled children may have a decreased sensitivity to reinforcement. Although behaviorally-oriented psychologists have provided ample evidence that various kinds of reinforcers such as teacher praise and checkmarks can be used successfully with children with learning problems if systematically delivered (see Ashem & Poser, 1973), differences between learning disabled and normal children in their responsiveness to different stimuli have not been systematically investigated.
Inappropriate emotional-motivational (A-R-D) system. The second cell in the classification deals with possible inappropriate responses in the emotional-motivational (A-R-D) systems of the learning disabled child. Although the kinds of inappropriate emotional-motivational responses listed in the cell have been widely discussed as important aspects of the learning disabilities problem, very little research on the various topics has been conducted. Thus most of the discussion of the various kinds of inappropriate responses presented here is based on clinical and/or educational observations made by learning disabilities professionals.

The first kind of inappropriate emotional-motivational response listed in the cell involves the learning disabled child's self-esteem. In addition to the possibility that a learning disabled child may lack positive feelings about himself or herself (considered in the previous cell) is the possibility that a learning disabled child may have negative feelings about himself or herself. Among others, Ziegler (1981, p. 392) has cited case history material which reveals a learning disabled child referring to herself as "stupid," "slow," and "like preschool."

The second kind of inappropriate response listed in the cell are school-related phobias. According to Harris (1971), it is possible for learning disabled children to develop emotional reactions to their problems. These emotional reactions may be considered fears and can be seen in (1) the anxiety the children face when having to learn something new, (2) their resistance to pressure in the learning situation, and (3) their quick discouragement.
Listed third in the cell is preoccupation with nonacademic stimuli. According to Harris (1971), as another kind of emotional reaction to learning problems, the learning disabled child may become overly absorbed in a private world. Analyzed from a social behavioral point of view, the fantasy life of a child who has acquired this kind of reactive response would be expected to affect (or interfere with) the child's school learning in that the child may prefer to engage in fantasy rather than academic learning activities.

Finally listed in the cell is dislike for school-related stimuli. A number of professionals accept the idea that learning disabled children may not only lack positive attitudes to school stimuli, i.e., have deficits in their emotional-motivational systems with regard to school stimuli, but they are apt to have negative emotional responses to such stimuli as well: (1) According to Ross (1976), because of a history of repeated failure, reading may be negative to the learning disabled child. (2) Harris (1971) has suggested that the learning disabled child may have a negative attitude toward learning in general. (3) Finally, Stephens (1977) suggests that learning disabled children may differ in their attitudes, with some having a negative attitude toward school in general, and others having a negative attitude toward specific academic subjects.

Deficit language-cognitive repertoire. The third cell deals with possible deficits in the language-cognitive repertoire of the learning disabled child. One major kind of deficit that has been discussed in the literature involves the lack of what may be termed "pro-learning" concepts. Gardner (1974), for example, has suggested that learning
disabled children may lack realistic expectations about their performance in school. The learning disabled child may not, for example, have the understanding that some kinds of learning require more than one trial; thus when they fail to learn after a single exposure to the material, they may believe they are unable to learn. Studies by Pearl, Bryan, and Donahue (1980) and Tollefson et al. (1982) also indicate that learning disabled children tend not to attribute their success to their own efforts; and this would also be an example of a deficiency in pro-learning concepts.

A second possible area in which learning disabled children may have deficits is the area of memory and thinking. It was mentioned earlier that deficits in memory and thinking are among the most frequently cited symptoms associated with learning disabilities. Teachers commonly report that learning disabled children seem to forget information from one day to the next, misunderstand instructions, and do not follow directions well. A recent study by Levine, Clarke, and Farbe (1981) indicates that learning disabled children themselves report having trouble remembering things the teacher just said, and getting mixed up when the teacher talks in long sentences.

Several attempts have been made to more precisely understand the nature of the learning disabled child's memory problem. One line of research has involved trying to determine the specific types of stimuli that learning disabled children have difficulty remembering. Taken together, the findings from studies by McLeod and Greenough (1980) and Ceci, Ringstrom, and Lea (1981) indicate that as a group learning disabled children do not show a generalized memory deficit. While learning
disabled children are less likely than normal achieving children to remember verbal material, e.g., digits, letter sequences, and spoken word sequences, they do not differ from normal achieving children in their recall of nonverbal stimuli, e.g., pictures, sounds, and colors.

McLeod and Greenough (1980) suggested that one reason for the superior performance of normal achieving children on verbal recall tasks may be their ability to use sequential constraints that they have already learned from repeated exposures to verbal linguistic material. This explanation is in agreement with the view of social behaviorism which suggests that the grammatical and sequential word associations a child learns are reflected in the child's ability to repeat longer and longer sentences (Staats, 1971).

More generally, social behaviorism has related poor memory and poor comprehension to deficits in the number and kind of word associations a child has in his or her word associations repertoire (Staats, 1971). Thus, a social behavioral analysis of the findings from the studies cited above, together with the retention difficulties teachers and learning disabled children themselves report would suggest that because of inadequate learning experiences learning disabled children may have deficits in their word associations repertoires, in particular those which involve stimuli of an academic nature, e.g., number associations, letter associations, and grammatical and sequential word associations. Stated differently, the view of social behaviorism is that the richness of a child's word associations is dependent on learning experiences and functions to determine the ease with which the child understands new material, as well as the extent to which the child will be able to
retain it—a child who has not learned a great many word associations would not be expected to understand or retain new material as well as a child whose repertoire is very rich.

Another line of research which may be relevant to the memory and thinking problems of learning disabled children, as well as to their possible deficits in formal learning skills (the third kind of deficit listed in the cell), involves studies which have investigated skills involved in competent memory performance. Recent studies comparing young learning disabled children with young normal achieving children indicate that learning disabled children are less likely to label stimuli to be recalled or to rehearse during periods of delayed recall (Kastner & Richards, 1974; Haines & Torgesen, 1979; Torgesen & Goldman, 1977). Studies with older learning disabled and normal achieving children further indicate that learning disabled children are also less likely to group stimuli into conceptual categories, i.e., to engage in "chunking," a mnemonic strategy which is useful when the task requires that several stimuli be recalled (Dallago & Moely, 1980; Shepherd, Fleisher, & Gettinger, 1979; Torgesen, Murphy, & Ivey, 1979; Wong, Wong, & Poth, 1977).

Because Torgesen found it easy to get learning disabled children to perform as well as normal achieving children by encouraging them to rehearse (Torgesen & Goldman, 1977), or by providing them with brief training in categorizing (or chunking) stimuli to be recalled, Torgesen (1980) suggested that the poor memory performance of learning disabled children may be a function of deficient "metacognitive" skills, a term used by Flavell (1976) to denote those skills which are used to
deliberately control one's actions in keeping with one's goals. As Torgesen himself noted, however, a study by Hallahan, Tarver, Kauffman, and Graybeal (1978) showed that positive reinforcement (delivery of pennies) alone was sufficient to get learning disabled children to improve their recall and, apparently, either to use a verbal-rehearsal strategy already in their repertoires, or to develop one over the course of the experiment. Thus it is apparent that the relationships between motivation, metacognition and memory require further investigation and clarification. While Torgesen would seem to prefer that the memory problem of learning disabled children be reduced either to deficits in metacognitive skills or to deficits in motivation, the social behavioral conception of learning disabilities presented here would suggest that deficits in either area or both areas may be operating. That is, some learning disabled children may not be sufficiently motivated by academic tasks and situations to employ proper formal learning skills; others may be motivated but may lack or have poorly developed formal learning skills; while still others may lack sufficient motivation as well as appropriate formal learning skills.

Finally listed in the third cell are academic deficits. By definition learning disabled children have deficits in reading, arithmetic, spelling, oral language, and/or writing. Of these, reading deficits are by far the most commonly identified among learning disabled children (Mercer, 1979).

While the research in other academic areas has been meager, a number of studies have been conducted to investigate the nature of the reading difficulties of learning disabled children. According to Bryan
and Bryan (1978) many of the early investigations involved attempts to relate reading difficulties of learning disabled children to deficits in visual or auditory perception or to cross-modal integration deficits. At best, the results of such studies have been mixed; and studies of training programs designed to compensate for presumed perceptual or integration deficits have failed to demonstrate that the programs improve children's reading skills.

More recently, a number of investigators have looked at reading as a multifaceted phenomenon, dependent upon many different kinds of sub-skills and subject to interference from several sources (Bryan & Bryan, 1978). This view is in agreement with the social behavioral theory of reading (Staats, 1968b, 1971, 1975).

Investigators interested in identifying important subskills that differentiate normal readers from learning disabled readers have noted that learning disabled readers show poorer abilities in a number of different areas. One area that has frequently appeared in the learning disabilities literature, as well as the popular media (see, for example, Horvath, 1977), is the deficient ability some learning disabled readers evidence in labeling the alphabet letters b, d, p, and q. Learning disabled readers frequently confuse the configurally similar letters; and for years this confusion was taken as evidence of neurological dysfunction. Recently Moyer and Newcomer (1977) challenged the assumption, arguing that letter discrimination is a learned cognitive skill. Later Deno and Chiang (1979) selected a group of severely learning disabled readers who had long evidenced confusion in labeling the four letters. Incentives were used to train the children in correctly naming the
letters, and the training was accomplished in a single ten minute training period.

Other areas in which differences have been found between learning disabled and normal readers include phonemic analysis (Vellutino, 1974); use of syntactical cues in processing sentences (Friedlander & DeLara, 1973); and reading comprehension (Pflaum & Bryan, 1982). It is interesting to note that Bryan and Bryan's review of reading research in the area of learning disabilities reports that when differences are found between good and poor readers at an early age, they are differences of amount, not type.

While many researchers have been interested in showing that learning disabled readers differ from normal readers on several important subskills, Staats and his associates have focused on demonstrating that learning disabled children with normal language are capable of making good progress in learning to read when measures are taken to insure that the children receive the vast number of learning trials necessary to acquire the various repertoires underlying successful reading (Staats, 1968s; Staats & Butterfield, 1965; Staats, 1967; Staats, Minke, & Butts, 1970; Ryback & Staats, 1970). The social behavioral theory of reading outlined by Staats (1968b, 1975) indicates several repertoires, e.g., the letter discrimination repertoire, the attention-discrimination repertoire, the grapheme-phoneme repertoire, the sounding-out repertoire, the whole-word repertoire, which make up reading, and suggests that any breakdown in attention and participation of the child during reading training will result in retarded development of the various repertoires. Staats (1975) has suggested that the learning of all of
the repertoires needs to be studied in more detail, as do training procedures that will insure that children actually receive the training trials.

**Inappropriate language-cognitive repertoire.** The fourth cell of the classification deals with possible inappropriate behaviors in the language-cognitive repertoire of the learning disabled child. Although not well researched, one important kind of inappropriate behavior mentioned in the literature is the possibility that learning disabled children have, what may be termed, anti-learning language-cognitive behaviors. Gardner (1974), for example, has suggested that learning disabled children may not only lack realistic expectations about their school performance (a kind of deficit that was considered in the third cell of the present classification), they may also have acquired unrealistic ideas. Thus, it is not uncommon for teachers of learning disabled children to report that learning disabled children either set impossible standards for themselves, or that they set unrealistically low standards.

Gardner (1977) and Zeigler (1981) have discussed a second kind of inappropriate, anti-learning language-cognitive behavior. These investigators suggest that as a result of excessive failure experiences, learning disabled children may develop various defensive (or avoidance) behaviors. These behaviors could include rationalizations, denials, and projections which the child may think or say to himself or herself.

A second possible area in which learning disabled children may have learned inappropriate language-cognitive behaviors is the academic area. While academic deficits, rather than inappropriate academic behaviors
are the focus of most of the research, the notion that learning disabled children acquire certain inappropriate language-cognitive behaviors, e.g., incorrect letter naming, counting on fingers, inappropriate directional habits in reading, has also been discussed in the literature (see, for example, Bond & Tinker, 1973).

**Deficit instrumental repertoire.** The fifth cell of the classification deals with possible deficits in the instrumental repertoire of the learning disabled child. One possible area in which a learning disabled child may have deficits is the area of motor skills. As mentioned earlier, motor skill deficits are among the most frequently cited behavioral characteristics associated with learning disabilities (Clements, 1966; McCarthy & McCarthy, 1969). Gross-motor coordination deficits, e.g., clumsiness, difficulty skipping, deficits in orientation and laterality, e.g., directional difficulties, right-left discriminations, and fine-motor coordination deficits, e.g., catching, throwing, tracing, and handwriting, have all been considered important indicators of learning disabilities and, in Wender's (1971) view, affect a large number of learning disabled children. While many investigators, such as Barsch (1967), Kephart (1960), Getman (1965), and Doman and Delecato (1965), have proposed theories which suggest that motor skill deficits are basic to understanding the learning problems of learning disabled children (as indicated earlier), investigations of training programs based on this assumption have not provided evidence in support of the theories (Dunn, 1973; Lerner, 1976).

A second type of deficit that a learning disabled child may have is in the area of attention. Along with hyperactivity and impulsivity, two
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major kinds of attentional problem—deficits in attention and inappropriate attention—are the symptoms most commonly associated with learning disabilities in the literature (Bryan & Bryan, 1978b). Deficits in attentional behavior, e.g., does not attend to task stimuli, lacks ability to sustain attention to tasks over prolonged periods of time, are appropriately classified as deficit instrumental behaviors, while behaviors associated with hyperactivity, e.g., runs about or climbs on things excessively, has difficulty sitting still or fidgets excessively, impulsivity, e.g., acts or responds before thinking, and attentional disorders, e.g., attends to non-task stimuli, perseverates, are appropriately classified as inappropriate instrumental behaviors, and as such are considered in the sixth cell. It is relevant, however, to note that while hyperactivity, impulsivity, and attentional problems (whether deficit or inappropriate) are generally investigated separately, in recent years researchers have discussed them together as related aspects of the same problem (Douglas, 1972; Douglas & Peters, 1979; Keogh & Margolis, 1976; Ross, 1976). It is notable also in this regard that the Diagnostic and Statistical Manual of Mental Disorders of the American Psychiatric Association (1980) now uses symptoms of inattention (deficits and inappropriate behaviors), impulsivity, and hyperactivity to diagnose "attentional deficit disorder", a behavioral problem that was referred to as "hyperkinetic disorder of childhood" in the 1968 edition of the manual.

A number of investigators (e.g., Douglas, 1972; Douglas & Peters, 1979; Harris, 1976; Keogh & Margolis, 1976; Krupski, 1980; and Tarver & Hallahan, 1974) have reviewed the literature related to attentional
deficits. In general the research has been characterized as either as involving observation of the attentional behavior of learning disabled and normal children in naturalistic settings, such as the classroom, or as involving administration of a single task to groups of learning disabled and normal achieving children.

Investigators using the observational approach have looked at such variables as the degree of structure in a situation; the relationship between attention and academic achievement scores, and what children do when they are not engaged in a task. Results of studies investigating these variables indicate (1) that learning disabled children are more likely to differ from normal children when observed under structured conditions rather than unstructured or free-play situations (Routh & Schneider, 1976; Schliefer, Weiss, Cohen, Elman, Cvejic, & Kruger, 1975); (2) that learning disabled children are significantly less attentive while working on classroom tasks than their nonhandicapped peers (Bryan, 1974); and (3) that when not attending to classroom tasks, learning disabled children engage in primarily nondisruptive activities such as doodling, fiddling, playing with toys, and so on (Forness & Esveldt, 1972; Werry & Quay, 1969).

Investigators using the task-oriented approach have found Hagen's (1967) incidental/central learning task and versions of the Continuous Performance Test, first developed by Rosvold, Mirsky, Sarason, Bransome, and Beck (1956), particularly useful in studying the attentional problems of learning disabled children. Taken together, the results of studies using these tasks have indicated that learning disabled children have greater difficulty than normal children in remembering relevant
stimuli, although they do not differ in their recall of irrelevant stimuli (Hallahan, Kauffman, & Ball, 1973; Tarver, Hallahan, Kauffman, & Ball, 1976); the studies also indicate that learning disabled children have more trouble than their peers in maintaining attention to tasks over prolonged periods of time (Anderson, Halcomb, & Doyle, 1973; Douglas, 1972; Grassi, 1970). Since one of the experiments conducted as part of this dissertation focuses on the sustained attention performance of learning disabled children, studies using the Continuous Performance Test with learning disabled children will be reviewed more fully in the problem section of the dissertation.

A third kind of deficit that learning disabled children may have is in discrimination (or perceptual) skills. Not being able to make discriminations between similar stimuli, whether visual or auditory, is a symptom that has frequently been associated with the learning disabilities problem (Hallahan & Cruickshank, 1973). While there is considerable controversy today concerning (1) perceptual testing and training, (2) whether perceptual deficits are neurologically caused, and (3) the nature of the relationship between perceptual problems and reading disabilities, that perceptual deficits are found in larger numbers of learning disabled children than normal children (Kavale, 1981, 1982) indicates that deficits in discrimination skills are a problem of at least some learning disabled children.

A fourth area in which a learning disabled child may have deficits is in social interaction skill. While the lack of skill that learning disabled children have in relating to peers and teachers has frequently been discussed in the literature (Bryan & Bryan, 1970b; Johnson &
Myklebust, 1967; Lerner, 1976), only in recent years has it become the focus of a number of related experimental investigations. The most systematic research on the problem has been conducted by Bryan and her associates. According to Bryan and Bryan (1978b) there is an accumulating evidence which indicates that learning disabled children are not held in positive regard by their peers, parents, or teachers. The focus of the research conducted by Bryan and her associates is on identifying behavioral bases for this nonacceptance. In a series of studies which examine the communicative competence and peer relationships of learning disabled children, Bryan and her associates have collected various kinds of information on learning disabled children including the following: (1) compared with nondisabled children, learning disabled children lack the ability to understand subtle communications of emotions (Bryan, 1974); (2) learning disabled children produce a lower proportion of considerate exchanges with classmates than do normal achieving children (Bryan, Wheeler, Felcan, and Henek, 1976); (3) compared with normal achieving children, learning disabled children are less likely to assert themselves and give opinions in small group situations (Bryan, Donahue, & Pearl, 1981); (4) learning disabled pupils are less positive and social in their verbal interactions with peers than are nondisabled pupils (Bryan & Bryan, 1978a); and (5) compared with nondisabled pupils, learning disabled children are less likely to modify their language which interacting with younger children (Bryan & Pflaum, 1978).

Inappropriate instrumental repertoire. The sixth and last cell deals with possible inappropriate behaviors in the instrumental repertoire of the learning disabled child. Hyperactivity, the first
inappropriate behavior listed in the cell, is typically defined as an excessive amount of inappropriate activity (Werry & Sprague, 1970). According to Rosenthal and Allen (1978), hyperactivity is a chief complaint of learning disabled children, although it is also prevalent among other children seen in mental health clinics, such as neurotics, schizophrenics, and mentally retarded children.

During the past fifteen years a number of studies have focused on differences between hyperactive learning-disabled children and normal children. In general, the research has been directed toward measuring physiological, (e.g., activity level, cortical and autonomic arousal), and psychological (perceptual, cognitive, and social-emotional) differences between the two groups of children and the effects of stimulant medication on the behavior of hyperactive learning-disabled children. The results of studies in these areas have led to the following kinds of conclusions: (1) activity levels of hyperactive learning-disabled children do not differ from those of normal children under unstructured play conditions (Baxley & LeBlanc, 1976; Whalen & Henker, 1976); (2) hyperactive learning-disabled children are more likely to show higher activity levels than normal children when working on highly structured learning tasks (Whalen & Henker, 1976); (3) hyperactive learning-disabled are more impulsive than normal children and have difficulty maintaining attention to tasks over time (Douglas, 1972, 1974); (4) the use of stimulant medication seems to be helpful, at least temporarily, in improving the attentional performance of hyperactive learning-disabled children and in normalizing their activity levels (Rosenthal & Allen, 1978).
Research related to impulsivity, the second inappropriate type of behavior listed in the cell, has most frequently involved use of Kagan et al.'s (Kagan, Rosman, Day, Albert, & Phillips, 1964) Matching Familiar Figures Test (MFFT). According to Keogh and Margolis (1976), successful performance on the MFFT requires accurate visual scanning and the ability to delay responding. Children who have long response latencies and make few errors are considered reflective, while children who respond quickly and make many errors are characterized as impulsive. Investigators using the MFFT have found learning disabled children, in particular those designated as hyperactive, to respond differently than matched control groups, with the performance of learning disabled children far more likely to be evaluated as impulsive (Douglas & Peters, 1979; Juliano, 1974). In addition, investigators have attempted to show that the impulsive responding of learning disabled children on the MFFT is related to such behaviors as inefficient problem solving (Douglas & Peters, 1979), immature perceptual search strategies (Messer, 1976; Wright & Vlietstra, 1975), and poor sustained attention (Douglas, 1972, 1972; Douglas & Peters, 1979).

A third kind of inappropriate behavior a learning disabled child may have in his or her instrumental repertoire involves inappropriate attentional behavior. While deficit attentional behavior, considered in the previous cell, refers to attentional behaviors that are absent or poorly developed in the child, inappropriate attentional behavior refers to behaviors which are present in the child, but inappropriate, such as attending to nonrelevant stimuli (known in the literature as distractibility) and perseveration, e.g., continuing to attend to a
stimulus when it is no longer appropriate to do so. Beyond clinical
reports that learning disabled children sometimes perseverate, there is
little in the literature which deals with problem. On the other hand,
the topic of distractibility has been the focus of numerous investiga­tions.

In general, research on the distractibility of learning disabled
children can be characterized as falling into one of two categories--
that dealing with irrelevant information that is distal in proximity to
the task at hand, and that which is proximal, or part of the task it­
self. Findings from this research have been mixed, with learning dis­
abled children being more distracted, equally distracted, or occasion­
ally even less distracted by distractors than matched control groups
(Douglas & Peters, 1979; Hallahan & Bryan, 1981; Tarver & Hallahan,
1974). While the nature of the tasks and/or distractors would seem to
be important factors, as Douglas and Peters (1979) have indicated,
further research is needed to account for the equivocal findings.

The fourth kind of inappropriate behavior considered in the cell
is emotional lability. As indicated earlier, emotional lability is one
of the most frequently cited characteristics associated with learning
disabilities (Bryan & Bryan, 1978b; Clements, 1966; Hewett & Forness,
1977; McCarthy & McCarthy, 1969). While a number of professionals
(e.g., Giffin, 1968; Rappaport, 1966; Eisenberg, 1958, 1967) have dis­
cussed the various kinds of emotional behaviors displayed by learning
disabled children, mostly as a secondary symptom of their learning
failures, research in the area has been minimal.
Typical investigations either have attempted to determine the incidence of emotional problems in learning disabled children or to examine the kinds of emotional problems learning disabled children have by means of teacher rating scales. In general, the research has indicated that substantial numbers of learning disabled children have emotional problems (Gates, 1941; Fabian, 1951), and that learning disabled children are rated by their teachers as showing significantly more problems, e.g., cries over minor disturbances, withdraws socially, suggestive of emotional maladjustment than normal children (Cullinan, Epstein, & Lloyd, 1981).

Finally listed in the cell are classroom conduct disorders. Like inappropriate emotional behaviors, classroom conduct disorders are frequently discussed in the learning disabilities literature but not well researched. What research there is suggests (1) that teachers generally view the learning disabled child's classroom behavior as less desirable than the normal child's (Bryan & McGrady, 1972; Keogh, Tchir, & Windeguth-Behn, 1972); (2) that learning disabled children are seen by their teachers as having poorer interpersonal skills and as being more aggressive than mildly retarded children (Keogh, Tchir, & Windeguth-Behn, 1972); and (3) that in peer conversations, learning disabled children are more likely to make nasty comments to peers than normal children (Bryan, 1975).

Summary and directions. The present conception suggests that learning disabilities may be viewed as deficit behaviors and inappropriate behaviors in the personality repertoires of learning disabled children. Thus, the conceptual framework presented here selected
behavioral characteristics that have been described and/or investigated as significant aspects of the learning disabilities problem, analyzed them from a social behavioral point of view, and classified them in terms of whether they represent a deficit in behavior or an inappropriate behavior and with regard to whether they are best considered within the realm of the emotional-motivational personality repertoire, the language-cognitive personality repertoire, or the instrumental personality repertoire.

As Staats (1975) has indicated, the classification of behavior into these kinds of categories is not meant to suggest that there are structures within the individuals that correspond to these divisions, or that the classificatory system is based upon principles, such that there are clear and definite separations between the categories which allow for all of the behaviors of individuals to be appropriately sorted into one or the other category. The intent of the classification is, rather, to provide a framework which will be helpful for working toward a more adequate analysis of learning and learning problems.

Along this line, it is important to point out that examination of the schema presented in Table 1 reveals that the kinds of behaviors that the learning disabilities field has considered important fall into each and every cell of the classification. More specifically, learning disabilities are viewed as involving deficits in normal behavior as well as inappropriate behaviors, both of which are classifiable into all three personality repertoire areas outlined in social behavioral theory. That the problems of learning disabled children can be conceptualized in this manner has important implications for further research and
development. For one, the review of literature related to the kinds of deficits or inappropriate behaviors listed in the various cells indicates that more specific and detailed analyses of virtually all of the abnormal behaviors currently associated with learning disabilities are required. As social behaviorism has indicated, it is not possible to understand an abnormal personality disorder without adequate specification of the problem behaviors which compose it (see Staats, 1975, pp. 287-288).

Also central to understanding learning disabilities is establishing the causes of the abnormal behaviors associated with the problem and the conditions which maintain them. That learning environments play a causative role in the development of abnormal behaviors, as well as a maintenance role once they are acquired, are major tenets of social behaviorism. In the next section, research on the nature of learning environments of learning disabled children is considered.

Learning and Maintaining Environments

In contrast with traditional behavioral approaches, social behaviorism suggests that the learning history of a child is central to understanding his or her personality repertoires, as well as specific instances of behavior. According to Staats (1975), "... it is only through understanding the manner in which learning histories can produce normal and abnormal personality repertoires that it will be possible to provide appropriate experiential conditions for the child, and appropriate therapy to those with personality problems" (pp. 261-262).
The suggestion of social behaviorism is that the learning environments that produce abnormal personality repertoires can be characterized as having either a deficit or inappropriate character. This section considers some of the deficit and inappropriate environments that have been linked by investigators to the abnormal behaviors of learning disabled children.

Deficit learning environments. Of particular relevance to considering the nature of the learning disabled child's learning environments are two lines of research. One involves studies which have focused upon the homelife of learning disabled children, while the other involves investigations of their interactions at school.

Among other researchers, Freund, Bradley, and Caldwell (1979) and Senf (1978) have indicated that relatively little research has been directed toward assessing home environment variables of learning disabled children. What research there is, however, strongly suggests (1) that there are differences between the home environments of learning disabled children and non-learning disabled children, and (2) that at very early ages home environment variables, e.g., amount of educational stimulation, level of emotional support, are better predictors of learning disabilities than are assessment tools that focus solely on the behavior and development of children.

Research on the home environments of learning disabled children has, in general, involved (1) the use of clinical interview and self-report materials, (2) the use of experimental tasks in laboratory settings, and (3) observations of parents in the home. Using information based on clinical interviews, researchers have found a number of
different kinds of deficits which involve the home learning environments of learning disabled children. In reporting her casework findings, Grunebaum (1961) found parents of learning problem children to be restricted in their communication of facts and feelings, and to be poorly organized. Based upon interviews with parents of educationally handicapped children and normal controls, Owens, Adams, Forest, Stolz, and Fisher (1971) found parents of educationally handicapped children to be less well organized than parents of normal children, and to provide a less emotionally stable home environment. Additionally, Ackerman, Elardo, and Dykman (1979) found mothers of learning disabled boys and hyperactive boys to expect less achievement from their children than mothers of normal children. Findings from the Ackerman et al. study also indicated that hyperactive children had been given significantly fewer educational toys than normals, and were not as well supervised in their television usage.

Studies which involved administering tasks to parents also suggested deficits in the home environments of learning disabled children. For example, Peck and Stackhouse (1973) found that Father-Mother-Son triads in reading problem families were less communicative, exchanges less explicit information, and were less effective than normal families on a conjoint decision-making task.

Studies which have involved actual observations of the interactions taking place in the home environments of learning disabled children are consistent with findings from parent interviews in indicating that the home environments of learning disabled children are disorganized and dysfunctional (Freund & Elardo, 1978; Kronick, 1976).
Other home environment variables which have been found to be deficient based on home observations include (1) maternal involvement and responsivity (Wulbert, Inglis, Kriegsman, & Mills, 1974); (2) the emotional support found in the home, as measured by the stability of the parents' presence, parental sharing of activities with children, expression of affection and approval toward the child, and use of reasoning in discipline (Werner, Bierman, & French, 1971); and (3) the educational stimulation provided in the home, as measured by the extent and quality of opportunities to enlarge the child's vocabulary, the encouragement of disciplined work habits, parents' discussion of the child's homework, intellectuality of leisure-time activities, and availability of books (Werner, Bierman, & French, 1971).

The second line of research which reveals information about the nature of the learning environments of learning disabled children concerns the child's interactions at school, in specific those taking place between learning disabled children and their teachers and those taking place between learning disabled children and their peers. With respect to teacher-pupil interactions, investigators have found that the behaviors of learning disabled children are viewed as less desirable by teachers than the behaviors of nondisabled children (Bryan & McGrady, 1972; Keogh, Tchir, & Windeguth-Sehn, 1972) and that teachers are likely to lack objectivity in rating the behavior of children based on whether or not they are labeled learning disabled (Jacobs, 1978). Bryan (1974) and Bryan and Wheeler (1972) have found that learning disabled children are less likely to be responded to than normal children when they initiate interactions with the teacher. Bryan (1974) also found that
teachers were also less likely to interact with learning disabled children for purposes of sending the child on errands, eliciting the child's aid in organizing games, obtaining the child's help in helping other students, and other nonacademic matters. With regard to peer interactions, learning disabled children are also less likely than their peers to be responded to when they initiate interactions with their classmates (Bryan, 1974). Other studies found that learning disabled children also receive fewer statements of consideration from their peers than do nondisabled children (Bryan & Bryan, 1978a; Bryan, Wheeler, Felcan, & Henek, 1976).

Inappropriate learning environments. The research dealing with the home and school environments of learning disabled children provides evidence which suggests that their learning environments may also have inappropriate characteristics which would be expected to produce behaviors that would interfere with their school learning and adjustment. In a clinical study pertaining to the learning disabled child's home environment, Klein and her associates (Klein, Altman, Dreizen, Friedman, & Powers, 1981a, 1981b) found four kinds of dysfunctional attitudes among parents with learning disabled children. These included: (1) dysfunctional attitudes toward authority, e.g., parents blame school and teacher for child's behavior and learning; (2) dysfunctional parental attitudes toward responsibility for learning, e.g., parents believe that it is unnecessary to be concerned about poor academic performance; (3) dysfunctional attitudes toward the child, e.g., parents view academic problems of child as child's problem; and (4) dysfunctional attitudes based on cultural factors, e.g., because of parent's subcultural
identification parents overemphasize or underemphasize the importance of school work.

In addition to finding deficits in the home environments of learning problem children (as indicated in the previous section), based on her clinical work Grunebaum (1961) also found parents of learning problem children to habitually use defense mechanisms of renunciation, denial, avoidance, and reaction formation. According to Grunebaum (1961) parents of learning problem children also tended to create a home environment which seemed "fraught with a sense of precariousness."

Skillman (1964), a coworker of Grunebaum's, subsequently conducted a more controlled study to investigate the home environment of learning disabled children. Used in the study was an interview technique which involved completing stories about family situations. Mothers of children with learning problems and mothers of normal children were asked in the interview to indicate how a typical mother would talk to her son about the various problems of the stories. The results indicated that mothers of learning problem children distorted the stories by adding facts and by requesting that their sons keep information secret significantly more than mothers of children without learning problems.

A study by Doleys, Cartelli, and Doster (1976) also suggested a kind of inappropriate response in the home learning environments of learning disabled children. Using a laboratory setting, these investigators compared the mother-child interaction patterns of mothers of learning disabled children, mothers of noncompliant children, and mothers of normal children. The results of the study indicated that
mothers of learning disabled children rewarded their child more often and ask more questions of their child than did mothers of normal or noncompliant children. In analyzing the behavior of mothers of learning disabled children more closely, however, it became apparent that the mothers were (1) providing their child with attention as the child was beginning to abandon uncompleted tasks, and (2) verbally reinforcing their child when the child began complaining about the difficulty of tasks. Thus the rewards provided by mothers of learning disabled children were judged by investigators as inappropriate and/or inappropriately timed.

Maintaining environments. In developing a social behavioral conception of learning disabilities, it is not only important to understand how environments can produce abnormal behaviors, it is also important to know the conditions which maintain the behaviors. The view of social behaviorism is that deficits in behaviors as well as inappropriate behaviors may be maintained by environments that are either deficit or inappropriate in character.

In the previous section an example was given where mothers of learning disabled children reinforced their children following complaints from the children about the difficulty of the task. It was suggested that this created an inappropriate environment for the children in that their complaining behaviors were reinforced. It would be expected that complaining behaviors would be considered maladaptive in the classroom, particularly where persistence on tasks is required for many kinds of learning. The complaining behavior would be maintained by the home, however, which as Klein et al. have suggested may in some
cases also communicate to the child that he or she will learn when he or she is ready to learn.

It was also suggested in a previous section that learning disabled children who attempt to initiate an interaction with their teachers are often ignored. Children whose attempts to gain teacher attention are thwarted will often resort to other (inappropriate) ways to gain attention, for example, pulling at the teacher's clothing. Although the teacher may not like the behavior, the teacher may continue not to respond to the child's normal attempts to interact, but respond to the child's pulling behavior continually, thereby maintaining it, because of the belief that the child must really need the attention if he or she resorts to tugging at the teacher to get it.

Summary and directions. As indicated earlier the view of social behaviorism is that detailed analyses of the abnormal behaviors involved in abnormal personalities are necessary in order to make detailed analyses of the learning environments which produce and maintain the behaviors. Although detailed analyses of the abnormal behaviors of learning disabled children do not yet exist, the present section attempted to indicate that deficit and inadequate learning environments have been recognized in the learning disabilities literature contributing to the learning disabilities problem.

In the present section it was suggested that research relating to the home and school environments of learning disabled children is relevant to considering the nature of the learning environments which produce and maintain the abnormal behaviors of learning disabled children. While relatively little research has been conducted in these
areas, the research that does exist indicates that the home and school environments of learning disabled children differ from those of normal children in a number of ways that suggest that the learning environments of learning disabled children are deficient, in that they fail to provide appropriate experiential conditions, e.g., educational stimulation in the home, communication about facts and feelings, and inappropriate, in that they provide the child with inappropriate environmental circumstances, e.g., verbal reinforcement from parent following complaints about difficulty of tasks, negative parent attitude toward school personnel.

It is obvious that further research is needed in the analysis of how the home and school environment produce and maintain abnormal behaviors in learning disabled children. In addition a number of learning disabilities investigators (see, for example, Freund, Bradley, & Caldwell, 1979) have begun to recognize that it is also important to understand how the behaviors of learning disabled children affect the environment in ways that in turn affect them. As the following section will indicate, social behaviorism's behavioral interactions approach to personality provides a theoretical basis for understanding the various kinds of behavioral interactions that can occur.

Behavioral Interaction (Personality) Principles

As Staats (1975) has indicated, the task of analyzing and understanding abnormal behavior is not a simple one, and cannot be approached with a "conceptually simple set of tools" (p. 272). In developing a social behavioristic conception of learning disabilities, it is
necessary to describe the various kinds of abnormal behaviors that learning disabled show in the basic behavioral repertoire areas, and to indicate the learning conditions that produce and maintain them, as the previous sections attempted to show. It is also, however, necessary and relevant to indicate how the learning disabled child's deficits in normal, adjustive behavior or the child's display of inappropriate, maladjustive behavior interact with each other and the environment to further affect the child's experience, learning, and behavior. Thus the following section consider various principles of behavioral interaction that have been outlined in social behaviorism, including behavior-behavior interaction principles and behavior-environment principles.

Behavior-behavior interactions. Behavior-behavior interactions are one important kind of interaction that has been discussed in social behaviorism. Two kinds of behavior-behavior interactions have been specified, one which involves one behavior directly eliciting another, and the other in which the first behavioral state sets the conditions for the other to occur. Both types are important to a social behavioral conception of learning disabilities, and although not usually analyzed in this manner, both kinds of interactions have been discussed in the learning disabilities literature.

An example of the first type of behavior-behavior interaction will be given first. As Gardner (1977) suggested, the learning disabled child may set standards far below his or her potential. When given an assignment within his or her range, the child may reason, "Well, I can't possibly do that"--a language behavior that would directly elicit
another behavior in the child's repertoires such as throwing his or her book down or engaging in further negative thinking ("I'm just dumb. I'll never learn anything."), and so forth. The negative reasoning behavior, then, would be seen as directly eliciting the overt (throwing the book down) and/or covert (thinking that he or she is dumb) behaviors.

Examples of the second type of interaction were given in a previous section. One example was that the learning disabled child who does not have the basic reading repertoires will not be able to learn from classroom materials and textbooks, thereby setting the conditions for his or her failure in many academic areas other than reading. The child who cannot read will not be able to complete his assignments, respond appropriately to tests, participate in classroom discussions concerning assigned reading, and so on. In addition, the child may be taken out of the regular classroom for part or perhaps all of the day for the purposes of special education. The child's own personality is thus a determining condition for what he or she experiences and what happens to the child in various ways that will affect his or her success in school.

It is important to understand these types of behavioral interactions in order to understand the abnormal behaviors of learning disabled children and how to appropriately deal with them. Although one may be tempted to treat the book throwing of a learning disabled child directly, if the child's basic problem is his or her faulty reasoning ("I can't possibly do that"), then this would be the primary problem to deal with.

As Staats (1975) has indicated, the analysis of abnormal behavior must consider the manner in which various aspects of the child's
personality interact in producing problems of adjustment for the child. In considering behavior-behavior interactions, there are various kinds of interactions possible: (1) deficit behaviors that result in other behavioral deficits, (2) deficit behaviors that result in the child developing inappropriate behaviors, (3) inappropriate behaviors that result in deficit behaviors, and (4) inappropriate behaviors that result in the child developing other inappropriate behaviors.

Behavior-environment interactions. Presented in Table 2 is a categorization of interactions that may occur between the behavior of learning disabled children and the environment (see Table 2). In accord with social behaviorism's analysis of the kinds of behavior-environment interactions possible, the table shows categories which cover (1) deficits in behavior that lead to environmental (experiential) deficits for the child, (2) deficits in behavior that lead to inappropriate environmental conditions, (3) inappropriate behaviors that lead to deficit environmental conditions, and (4) inappropriate behaviors that lead to inappropriate environmental conditions. Although not previously conceptualized in this manner, the examples of behavior-environment interactions presented to illustrate each of the categories have frequently been discussed in the clinical and educational literature relating to learning disabilities.

An example of a deficit behavior that can lead to a deficit environment is provided in the first cell of Table 2. As stated in the table, deficits in the reading repertoire of a child lead to a restricted curriculum for the child. The learning disabled child who cannot read or who is a very poor reader will not be able to read the
Table 2
Behavior-Environment Interactions and Learning Disabilities

<table>
<thead>
<tr>
<th>Deficit environment</th>
<th>Inappropriate environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficit behavior</td>
<td></td>
</tr>
<tr>
<td>Deficit reading repertoire leads to restricted curriculum (child will not have opportunity for new learning that is dependent upon being able to read)</td>
<td>Deficit perceptual-motor skill (e.g., poor handwriting) leads to teacher disapproval</td>
</tr>
<tr>
<td>Inappropriate behavior</td>
<td></td>
</tr>
<tr>
<td>Acting-out behavior (e.g., hitting another child, throwing book across room) leads to being sent to principal's office (child will miss classroom learning opportunities)</td>
<td>Emotional outbursts (e.g., crying, temper tantrum) lead to social derision</td>
</tr>
</tbody>
</table>
books and materials assigned in such areas as science and social studies, for example, and thus will not receive the same learning opportunities available to students who can read.

This problem has been a concern of many learning disabilities professionals for a long time. While self-contained classroom programs—wherein learning disabled children are given instruction in areas of their academic weakness and alternative methods, i.e., methods which do not involve reading, are used to teach other areas of the curriculum—have frequently been used to deal with the restricted curriculum problem that learning disabled children face in the regular classroom, there is evidence to suggest that self-contained classroom programs may themselves constitute deficit environments. Beck, Lindsey, and Frith (1981) examined the effect of one or two year special education placement in a self-contained classroom program and found that children showed significant improvement in only one academic area—arithmetic, and that there was a significant decrease in IQ scores.

An example of a deficit behavior that can lead to an inappropriate environment is provided in the next cell of the table. It has been noted in the literature that teachers generally react negatively to difficult-to-read handwriting (a kind of deficit that many learning disabled children are said to have) in ways which include labeling the child lazy and unmotivated, rather than attempting to train the child in the skills necessary to improve his or her handwriting. The child who writes poorly may also be given a poor grade on a handwritten assignment based solely on the teacher's judgment that the work appears sloppy. Either type of teacher reaction would create an inappropriate
environment for the child in that the reactions will not ordinarily lead to improved handwriting, but rather to negative emotional responses toward the teacher and/or learning assignments in general.

As Table 2 indicates, there are also inappropriate behaviors that result in the child experiencing deficits in his or her environment. It was indicated earlier that some learning disabled children often display physically aggressive behaviors in the classroom such as hitting another child or throwing a book across the room. Typically these kinds of behaviors will result in the child's being sent out of the classroom, to the principal's office, or perhaps even home, which would mean that the child would miss classroom learning opportunities. If the aggressive behaviors are a (an avoidance) response to the child's learning failures, e.g., the child throws a book across the room after finding out that he or she cannot read it, then the child's being sent out of the classroom means that he or she is being sent from an environment with the very experiences that he or she requires.

An example of an inappropriate behavior leading to an inappropriate environment is that which involves emotional lability. Inappropriate emotional outbursts such as crying, excessive giggling, and temper tantrums have frequently been associated with learning disabled children. While these behaviors may not lead to being sent from the classroom, since they would not be expected to harm other individuals, it is likely that learning disabled children displaying such behaviors would be socially ostracized. Other children would regard the child as babyish and immature, tease the child, laugh at the child, or in other ways react to the child in ways which would provide an inappropriate
environment for the child in that he or she might develop negative emotional responses to other children.

**Human Learning Principles**

Social behaviorism has outlined some principles of human learning that are also relevant to considering the abnormal behaviors associated with learning disabilities. These principles are briefly described in the following paragraphs.

**Behavior competition.** The principle of behavior competition suggests that the development of one behavior skill may compete with (or prevent) the development of another. Allyon and Roberts (1974) conducted a study which investigated the principle of behavior competition in a classroom setting. Through reinforcing academic behaviors, Allyon and Roberts were able to demonstrate a decrease in discipline problems. As suggested by the principle of behavior competition, increasing one behavioral skill, in this case academic behaviors, had the effect of decreasing another behavioral skill, in this case problem behaviors.

As Staats (1971, 1975) has indicated, the principle of behavior competition has wide relevance both for understanding and for treating abnormal behaviors. One important implication is that the first attempt to treat the maladjustive behaviors of learning disabled children should involve making sure that the child learn adjustive (normal) behavioral repertoires. If well learned and sufficiently reinforced, these adjustive repertoires would be expected to compete with or displace the child's abnormal behaviors.
Cumulative hierarchical learning of abnormal skills. As indicated in the first part of the chapter, the principles of cumulative-hierarchical learning are important to understanding how complex repertoires of behavioral skills are acquired. The social behavioral conception indicates that the learning of skills takes place over a long, long period of time and that the nature of the learning is cumulative and hierarchical. To be more specific, the social behaviorism conception of human learning is that the child learns basic behavioral repertoires (systems of skills) which provide the foundation for the learning of additional, more advanced behavioral skills of various types. The acquisition of the more advanced skills together with those already acquired then provides the basis for the acquisition of even more skills, and as the child continues to build upon his or her basic behavioral repertoires by adding additional behavioral skills, the repertoires enlarge, advance, and become more complex.

It was indicated in the first part of the chapter also that while the principles of cumulative-hierarchical learning may be used to understand the development of normal (adjustive) behavioral repertoires, they are also applicable to understanding the development of abnormal (mal-adjustive) behavioral repertoires. Although not linking their observations directly to learning principles, a number of investigators have conceptualized the development of learning disabled children's abnormal behaviors in a similar manner. Werry and Sprague (1970, p. 400), for example, suggested that it is relatively easy to understand how a hyperactive child's behavior could interfere with the learning process and how after the child falls behind in learning the child "... may
develop an aversion or an avoidance response to academic material that is proving difficult to him, and thus become even more hyperactive."

Gardner (1977) has used the term "defeat cycle" to indicate what he sees resulting when a child acquires additional problematic behaviors because of the child's initial problems. In addition, Ziegler (1981) has proposed that there are stages of reactions to failure experiences for learning disabled children that begin with withdrawal behaviors, and if not interrupted, can lead to defensive, and sometimes delinquent behaviors. Along this line it is significant to note that juvenile delinquents have often been found to have a history of school failures, evidence which has in recent years led to an increased focus on the relationship between juvenile delinquency and learning disabilities (see, for example, Lane, 1980; Mauser, 1974; Wilgosh & Patrick, 1982).

The downward spiral of cumulative-hierarchical learning. It should be noted also that the principles of cumulative-hierarchical learning are relevant not only to the cumulative learning of more and more complex inappropriate behaviors, but also to the accumulation of the behavioral deficits that learning disabled children may acquire over time. Social behaviorism's concept of the downward spiral of cumulative-hierarchical learning is of particular relevance to understanding the finding that children with lengthy histories of severe learning disabilities seldom "catch up", even when provided with specialized educational experiences (see Koppitz, 1971). While part of the reason for their inability to catch up may lie in deficient or inappropriate treatment conditions, e.g., conditions which focus on abnormal behaviors to the exclusion of training of normal behavioral repertoires, or
conditions that in various ways maintain inappropriate behaviors, it is suggested that a good deal of the problem may lie in the amount and type of deficits that the children have accrued relative to their peers.

Staats (1971, 1975) has posed an analogy to help clarify the concept of the downward spiral of cumulative-hierarchical learning. In the analogy children are considered to be in a kind of race that involves speed and excellence in acquiring behavioral skills, e.g., walking, talking, reading, which help the child adjust to the environment. In the race the child who acquires certain skills more rapidly than his or her peers would be expected to accelerate his or her acquisition of more advanced skills and is reinforced for acquiring the skills earlier than his or her peers, rewards which also serve to strengthen the child's work and learning skills.

In contrast to the child who gains his or her systems of skills (basic behavioral repertoires) early in the race is the child who is slow in acquiring his or her adjustive repertoires (because of deficit or inappropriate learning conditions). This child will not be able to move on to acquiring the next level of skill as soon as the first child. He or she will not receive the social rewards for acquiring his or her skills early (rewards which would have served to strengthen his or her work and learning skills). Moreover, as a social consequence of being slow in the race the child may create conditions in the environment, e.g., parent or teacher disapproval, which set the stage for the child to learn abnormal (anti-learning) behaviors, e.g., negative attitude towards adults, dislike for learning, that will further retard the child's acquisition of adjustive behavioral skills. It is thus easy
to see, as the race continues, that the first child will be able to put
more and more distance between him- or herself and the second child,
and that the second child can expect to find him- or herself in a down-
ward spiral of relative learning. Along this line it is relevant to
note that a growing number of learning disabilities professionals are
concerned with the early identification and detection of children at
risk for learning disabilities (see, for example, Keogh & Becker, 1973;
Satz & Fletcher, 1979). In illustrating how deficits in the basic
behavioral repertoires can result in the learning of abnormal (anti-
learning) behaviors, the principles of cumulative-hierarchical learning
underscore the importance of identifying and treating children who are
not acquiring their basic behavioral repertoires early in the race,
early in the race.

Directions for Research

The social behavioral view is that it is the behavioral repertoires
that are central to understanding abnormal personalities, not the tradi-
tional labels; and this would apply to the learning disabilities label
as well. In accord with social behavioral theory, what is needed in
order to understand the problem of learning disabled children is a
description of the various basic behavioral repertoires that lead to
their school learning and achievement problem.

While the present effort is a step in this direction, a full
social behavioral conception of learning disabilities will require
more specific and detailed analyses of the basic behavioral (personal-
ity) repertoires associated with learning disabilities, including the
way they are learned and maintained, as well as the various behavioral
interactions that are involved. The suggestion of the social behaviorism paradigm is that investigations of this type will provide an understanding of the origins of learning disabilities, how they affect a child's school learning and achievement, the events which maintain them, and the steps that must be taken to treat them.

Summary and Conclusions

In summary, the second part of the chapter outlined a framework for developing a social behaviorism conception of learning disabilities. The section presented a schema which indicated the problem behaviors commonly associated with learning disabilities and described learning and maintaining environments, behavioral interaction principles, and principles of human learning which are relevant to considering the causes of the problem behaviors, how they are maintained and function, and the steps that must be taken to remediate them.

It was stated that the framework presented here provides a new way of conceptualizing learning disabilities. As the schema indicated, learning disabilities are conceptualized as deficits in normal behaviors and/or inappropriate behaviors which may occur in any or all of the three basic behavioral (personality) repertoires of a child. Within the conception, the abnormal behaviors evidenced by learning disabled children are viewed as caused and maintained by deficit and/or inappropriate learning environments, while principles of behavioral interaction and human learning explain how deficits and inappropriate behaviors interact with each other and the environment to interfere with a child's school learning, achievement, and further development.
areas of psychology, (3) provide implications for education, and (4) provide directions for research.

As mentioned in the previous section, one important research direction suggested by the present framework involves the need for more adequate specification of the abnormal (maladjustive) behaviors associated with learning disabilities, including the manner in which they interact. In line with this goal, the remainder of this dissertation uses social behavioral concepts and principles to analyze the attentional deficit shown by learning disabled children, and discusses the nature and results of two experiments which were conducted to test the validity of the analysis.
CHAPTER III

REVIEW OF THE LITERATURE

In Chapter I it was stated that in addition to developing a social behavioristic conception of learning disabilities, this dissertation also has the purposes of using the social behaviorism paradigm to analyze a specific aspect of learning disabilities and of testing the validity of the analysis experimentally. One of the several kinds of deficit and inappropriate behaviors incorporated into the conceptual framework developed in the previous chapter involved the poor sustained attention shown by learning disabled children. Over the past several years, a number of investigators have begun to regard sustained attention deficits as a major disability of learning disabled children (Douglas, 1972; Douglas & Peters, 1979; Dykman, Ackerman, Clements, & Peters, 1971; Keogh & Margolis, 1976; Krupski, 1980).

In the present chapter literature relevant to the sustained attention problem of learning disabled children will be reviewed. It will then be suggested that a more adequate specification of the problem needs to include an analysis of motivational factors. Following this, social behaviorism's A-R-D theory of motivation will be used to make predictions about how an emotional-motivational personality characteristic of learning disabled children may help to explain the poor sustained attention they show when compared with their non-learning disabled peers.
Before reviewing specific studies which deal with the sustained attention deficit of learning disabled children, however, the following sections will consider the history of research on attention in general, as well as a number of ways in which the construct has been defined.

**Background**

**History of Attention Research**

As Douglas (1974) indicated, "The concept of attention has had a very erratic career within the history of psychology" (p. 149). Although attention was considered a central construct in early psychological study (e.g., James, 1890; Ribot, 1903; Titchener, 1908), following the beginning of the Behaviorist and Gestalt movements in the early part of this century, attention became a neglected topic for several years (Boring, 1970; Hale & Lewis, 1979; Krupski, 1980).

A couple of reasons for this neglect have been suggested in the literature. First, in the early study of attention, attention was investigated primarily through introspection, a method later severely criticized by behaviorists (Krupski, 1980). Second, since attention was viewed as an internal mechanism, it was not seen as contributing to the simple and straightforward laws of behavior that many investigators then were seeking (Kahneman, 1973; Krupski, 1980).

Attention once again became a popular topic for investigation during the 1950's. Several reasons for the resurgence of interest have been discussed in the literature, and were recently enumerated by Krupski (1980). According to Krupski, among the reasons for a renewed interest in attention was the acceptability of using operational
definitions for defining the construct. In addition, during World War II, applied psychologists produced a wealth of research and theory relevant to understanding attention as a result of having to deal with a number of practical problems (such as how many things a person can attend to at any one time, and how long a person can attend without fatigue affecting accuracy). Also cited as having an impact on the study of attention are technological advances, including the invention of the tape recorder and computer. Finally, reviewers have suggested that the failure of early behaviorists to account for behavior in terms of stimulus-response principles alone, together with the emergence of cognitive psychology, helped bring about a renewed interest in attention as well as other internal mechanisms.

Definitions of Attention

As a number of investigators (e.g., Hale & Lewis, 1979; Hallahan, 1975; Keogh & Margolis, 1976; Meldman, 1970) have indicated, the term "attention" is a global one. Many different definitions have appeared in the literature, with most varying in the particular kinds of processes and/or behaviors listed as attentional in nature: (1) Solley and Murphy (1960), for example, suggested that there are selective and integrative aspects; (2) Posner and Boies (1970) postulated alertness, selectivity, and processing capacity components; (3) Dykman et al. (1971) suggested that attention consists of four interrelated functions: alertness, stimulus selection, focusing, and vigilance; (4) Alabiso (1972) proposed span, focus, and selectivity aspects; (5) Keogh and Margolis (1976) suggested three separate but interactive components: coming to attention, decision-making, and sustaining attention; (6) and,
Moray (1969) delineated seven processes as attentional in nature, including mental concentration, vigilance, selective attention, search, activation, set, and analysis by synthesis.

**Attention and Learning Disabilities**

According to Doublas and Peters (1979), since it was a neglected topic for so many years, the attempts that investigators have made to label and operationally define the various aspects of attention are still preliminary. The effect this has had on work with learning disabled children has been considered by a number of reviewers, including Douglas (1974), Douglas and Peters (1979), Keogh and Margolis (1976), and Krupski (1980). Taken together, the view these investigators have presented is that the failure of psychologists to adequately define attention has meant that there has been little experimental work on which professionals within the applied fields could build (Douglas, 1974; Keogh & Margolis, 1976; Krupski, 1980); and accordingly (1) a lack of adequately designed research on the attentional problems of children (Douglas, 1974); (2) a lack of well-standardized techniques to use in evaluating attentional problems (Douglas, 1974, Krupski, 1980); and (3) a lack of effective plans to use in treating children with learning and attentional problems (Douglas, 1974; Keogh & Margolis, 1976; Krupski, 1980).

Despite the above, recent years have witnessed a growing body of experimental work on the attentional problems of learning disabled children. Differences between learning disabled and normal children in their attending behaviors have been documented consistently (Douglas,
1972; Dykman, Ackerman, Clements, & Peters, 1971; Keogh & Margolis, 1976; Krupski, 1980). For the most part, however, this work has involved only the selective or sustained aspects of attention, and is yet to result in a wealth of well-standardized assessment instruments or effective treatment plans (Douglas & Peters, 1979; Krupski, 1980).

That some investigators have not attempted to separate the selective and sustained aspects of attention has been noted by Douglas and Peters (1979). Typically, however, laboratory tasks which require the child to attend to relevant stimuli in the presence of irrelevant (and potentially distracting) stimuli are used to measure selective attention, while tasks which require the child to maintain his or her attention to a task over a prolonged period of time, attending to relevant (called "significant") stimuli that appear infrequently and at random in a series of relevant and irrelevant stimuli, are used to measure sustained attention.

Results from studies using selective or sustained attention tasks have generally indicated that learning disabled children perform less well than normal children. While the kinds of abilities measured on both kinds of tasks are clearly necessary for academic learning, inasmuch as learning disabled children seem to show an even greater, or at least more consistent deficit on tasks which measure sustained attention, the present study selected to further investigate this aspect of the learning disabled child's attention. In line with this objective, the remainder of the chapter will review the literature related to the sustained attention abilities of learning disabled children. Since the Continuous Performance Test (CPT) is purported to be particularly
sensitive to deficits in sustained attention (Douglas, 1972), the review will focus on studies using the CPT. First, however, it is relevant to consider earlier research on sustained attention which has involved other tasks and other population groups.

Early Studies of Sustained Attention

Experimental investigations of sustained attention, also called vigilance, have been traced back to the early 1940's (Kupietz & Richardson, 1978). As alluded to earlier, psychologists during this period were concerned with determining why the detection accuracy of radar operators declined over prolonged periods of time. Studies designed to investigate the phenomenon were essentially laboratory simulations of the watchkeeping task. Adults participating in the studies were instructed to monitor the periodic occurrence of auditory or visual stimuli for periods of up to several hours and to detect the presence of a preselected "target" stimulus which occurred infrequently and on a random basis.

Results from studies using vigilance tasks indicated that participants did not perform consistently over time (Davies & Tune, 1969; Stroh, 1971). As in actual radar watches, the participants exhibited a progressive decline in detection rate called the "vigilance decrement." In addition to reporting this kind of finding, studies of sustained attention also revealed a number of factors found to affect the overall performance of participants. As Davies and Tune (1972), Lynn (1966), Mostofsky (1970), and Stroh (1971) reported, these factors included: (1) characteristics of the task, e.g., signal frequency,
signal duration, task complexity, and task length; (2) characteristics
of the participants, e.g., extraversion/introversion, flexibility, and
self-control; (3) drugs, e.g., alcohol and amphetamines; and (4) rein-
forcer variables, e.g., monetary rewards and knowledge of results.

Use of the CPT
with Clinic Samples

Use of the vigilance paradigm in clinic settings followed research
with adult, primarily male, and presumably normal participants. Because
attentional problems have long been considered a primary characteristic
of psychopathology, vigilance tasks have been used to investigate the
sustained attention abilities of many different types of patients, in-
cluding children and adults diagnosed as schizophrenic, depressive,
brain-damaged, mentally retarded, low achieving, hyperactive, or learn-
ing disabled (Krupski, 1980; Meldman, 1970).

Of the various tests used to measure sustained attention, the
Continuous Performance Test, developed by Rosvold, Mirsky, Sarason,
Bransome, and Beck (1956), has probably been the most popular type of
vigilance task used in clinic settings. Briefly described (a more
complete description of the CPT is presented in the next chapter), the
original version of the CPT is composed of two experimenter-paced tasks,
one labeled X and the other AX. Individuals taking the CPT are asked
to monitor a screen upon which a series of letters appear one at a time
and to detect the occurrence of a letter ("X" in the X task) or letter
sequence ("X" when preceded by "A" in the AX task) presented intermit-
tently and at random over a five to ten minute period of time.
In general, results of studies using the CPT in clinic situations have been fairly consistent in indicating that patients—whether schizophrenic (Orzack & Kornetsky, 1971), brain-damaged (Campanelli, 1970; Grassi, 1970; Rosvold et al., 1956), or mentally retarded (Rosvold et al., 1956)—typically have a poorer overall performance, i.e., make fewer correct detections and/or more false alarms than normal individuals, in addition to showing a more rapid decline in performance over time.

**CPT Studies with LD Children**

Appearing in the literature prior to 1979 (the date of the inception of the present investigation) were eighteen studies which had used the CPT to investigate sustained attention in children having learning problems commonly subsumed under the learning disabilities rubric. Since such children are the concern of the present study, the studies are briefly summarized in Table 3 and reviewed in this section (see Table 3).

As Table 3 indicates the studies date back to 1968. Of the eighteen investigations, seven involved samples of children identified as hyperactive, five involved children identified as learning disabled, four involved children identified as learning/behavior disordered, and two involved children identified as underachieving. In nine of the studies, a normal comparison group was also used, with one study additionally involving a group of brain-damaged children.

As Table 3 also shows one or more adaptations of the original version of the CPT were used in almost all of the studies. The tasks used
<table>
<thead>
<tr>
<th>Authors</th>
<th>Subjects</th>
<th>Task</th>
<th>Duration</th>
<th>Results</th>
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<tbody>
<tr>
<td>Conners &amp; Rothschild, 1968</td>
<td>37 Learning disabled (methylphenidate/placebo)</td>
<td>Visual: Colored Buttons (Red-vertical) Visual: Letters (A)</td>
<td>10 min.</td>
<td>Colored Buttons: Error scores for drug and placebo groups decreased with practice; drug group performed better on drugs, all indices; latency of placebo group for commission errors was shorter over time. Letters: Both groups made more omission errors, although differences were not significant for drug group; drug group made fewer commission errors over sessions.</td>
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<tr>
<td>Conners, 1970</td>
<td>71 Behavior/learning disordered (methylphenidate/dextroamphetamine/placebo)</td>
<td>C.P.T. (no further details given)</td>
<td>5 min.</td>
<td>Drugs influenced C.P.T. performance more than others (Frostig, Mazes, WRAT, WISC), i.e., fewer errors of omission; errors of commission were correlated with reading (WRAT scores); drugs affected performances of different children differently.</td>
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Table 3 (Continued)

CPT Studies with LD Children

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<thead>
<tr>
<th>Authors</th>
<th>Subjects</th>
<th>Task</th>
<th>Duration</th>
<th>Results</th>
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<tbody>
<tr>
<td>Grassi, 1970</td>
<td>25 Brain-damaged</td>
<td>Auditory: Digits</td>
<td>20 min.</td>
<td>Normals &gt; behavior disordered &gt; brain-damaged in correct responses; all groups deteriorated over time, although behavior disordered and brain-damaged appeared to deteriorate more rapidly, the differences were not significant.</td>
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<tr>
<td></td>
<td>25 Behavior disordered</td>
<td>(6)</td>
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<tr>
<td></td>
<td>25 Normals</td>
<td></td>
<td></td>
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<tr>
<td>Grais, 1971</td>
<td>20 Learning disabled</td>
<td>Visual: Letters (X)</td>
<td>4.5 min.</td>
<td>LD's and normals did not perform differently on X task; LD's made more omission and commission errors on AX task; minimal decrement was found for younger LD's. Performance was not correlated with Motor Impersistence Task.</td>
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<tr>
<td></td>
<td>20 Normals</td>
<td>Visual: Letters (AX)</td>
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<tr>
<td></td>
<td></td>
<td>Visual: Form (Red triangle)</td>
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</tr>
<tr>
<td>Sykes et al., 1971</td>
<td>19 Hyperactives (methylphenidate/placebo)</td>
<td>Visual: Letters (X)</td>
<td>15 min. &amp; 9.9 min.</td>
<td>Hyperactives made fewer correct responses on all forms; hyperactives made more errors of commission when stimuli were presented slow, but not fast; for both groups, X was easier than Form or AX on slow presentation, and Form was easier than X and AX on fast presentation; white noise distraction produced no effect. Drugs improved performance for hyperactives on X and Form versions, but not AX.</td>
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<tr>
<td></td>
<td>19 Normals</td>
<td>Visual: Letters (AX)</td>
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<td>Visual: Form (Red triangle)</td>
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### Table 3 (Continued)

CPT Studies with LD Children

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<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Sykes et al., 1972</td>
<td>24 Hyperactives (methylphenidate/</td>
<td>Visual: Letters</td>
<td>15 min.</td>
<td>Methylphenidate improved all indices for hyperactives, with performances comparable to normals; initial performance for hyperactives was poorer on auditory than visual task.</td>
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<td></td>
<td>placebo)</td>
<td>(AX)</td>
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<td></td>
<td>Auditory: Letters</td>
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<tr>
<td></td>
<td></td>
<td>(AX)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sykes et al., 1973</td>
<td>20 Hyperactives</td>
<td>Visual: Letters</td>
<td>15 min.</td>
<td>Hyperactives made more errors of omission and commission than normals on visual and auditory combined; hyperactives made more anticipatory, multiple responses, and late responses; both groups made more errors on auditory than visual task; hyperactives made more omission and commission errors over time, while normals did not.</td>
</tr>
<tr>
<td></td>
<td>20 Normals</td>
<td>(AX)</td>
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<tr>
<td></td>
<td></td>
<td>Auditory: Letters</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(AX)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ricks &amp; Mirsky, 1974</td>
<td>17 Underachieving second-graders</td>
<td>Visual: Letters</td>
<td>Six</td>
<td>Underachievers made fewer correct responses than normals on AX task, particularly during final period. For underachievers, control period, correct responses and commission errors correlated significantly with scores on Fruit Distraction Test. Underachievers were significantly more distractible than controls when distracting stimuli were close to dimensions of the central task.</td>
</tr>
<tr>
<td></td>
<td>16 Normals</td>
<td>(X)</td>
<td>periods</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Visual: Letters</td>
<td>(duration not stated)</td>
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Table 3 (Continued)

CPT Studies with LD Children

<table>
<thead>
<tr>
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<th>Results</th>
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<tbody>
<tr>
<td>Dykman et al., 1975</td>
<td>99 Hyperactives (methylphenidate/pemoline/placebo)</td>
<td>Visual: Letters (X)</td>
<td>2.84 min.</td>
<td>Hyperactives made more correct responses under drugs than placebo; performance on AX was age-related; hyperactives made more early correct responses under methylphenidate; under methylphenidate older siblings made more correct responses than younger.</td>
</tr>
<tr>
<td>Werry &amp; Aman, 1975</td>
<td>24 Hyperactives (with severe hyperactivity/aggressiveness) (methylphenidate/haloperidol/placebo)</td>
<td>Visual: Letters (X)</td>
<td>6.75 min.</td>
<td>Drugs did not significantly reduce seat movement; drugs decreased omission and commission errors, with methylphenidate producing the greater improvement; drugs did not affect speed and latency; Haloperidol (high dose) had worse effect than placebo on performance.</td>
</tr>
<tr>
<td>Kupietz &amp; Balka, 1976</td>
<td>20 Learning disabled (with hyperactive and aggressive behavior problems) (methylphenidate/amitriptyline/placebo)</td>
<td>Auditory: Letters (AX)</td>
<td>6 min.</td>
<td>Drugs improved correct responses more than placebo; performances deteriorated over time; commission errors increased over time during pretreatment, but not under drugs or placebo.</td>
</tr>
</tbody>
</table>
Table 3 (Continued)
CPT Studies with LD Children

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Kupietz, 1976</td>
<td>16 Behaviorally deviant (with symptoms consis-</td>
<td>Auditory: Letters (AX)</td>
<td>6 min.</td>
<td>BD's made more errors of omission; BD's had a larger performance decrement; task showed good reliability.</td>
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<tr>
<td></td>
<td>tent with MBD)</td>
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<tr>
<td></td>
<td>16 Normals</td>
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<tr>
<td>Yepes et al., 1977</td>
<td>22 Behaviorally disordered (with hyperactive/</td>
<td>Auditory: Letters (AX)</td>
<td>5.15 min.</td>
<td>Drugs improved performance as measured by absolute score, relative percentage correct, omission errors, and commission errors.</td>
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<td></td>
<td>aggressive symptoms)</td>
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<tr>
<td></td>
<td>(amitriptyline/methylphenidate/placebo)</td>
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<tr>
<td>Kupietz &amp; Richardson,</td>
<td>16 Remedial Reading Pupils (Low SES)</td>
<td>Visual: Letters (AX)</td>
<td>10 min.</td>
<td>Younger children tended to make more errors of omission and commission than older children and were off-task more on other measure; omission errors were not related to performance on other measures of auditory and visual performance, although commission errors were highly correlated; a performance decrement was found; performance was correlated with off-task behavior, but not PIAT reading achievement test.</td>
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<td>1978</td>
<td></td>
<td>Auditory: Letters (AX)</td>
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Table 3 (Continued)

CPT Studies with LD Studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Subjects</th>
<th>Task</th>
<th>Duration</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Rugel et al.,</td>
<td>83 Learning disabled</td>
<td>Auditory: Digits</td>
<td>30 min.</td>
<td>Exp. 1: LD's correctly identified fewer correct stimuli than normals, had higher skin conductance, and showed more deterioration over time; Exp. 2: replicated Exp. 1 findings; LD's showed more body movement than normals; Exp. 3: (normals only) normals showed performance decrement, poorer performance when fewer correct stimuli were presented; Exp. 4: LD's did not differ from normals when correct stimuli were very frequent or not very frequent; both groups showed more body movement under low frequency, but movement was not related to performance.</td>
</tr>
<tr>
<td>1978</td>
<td>99 Normals</td>
<td></td>
<td>(6)</td>
<td></td>
</tr>
<tr>
<td>Aman, 1979</td>
<td>28 Learning disabled</td>
<td>Visual: Letters</td>
<td>7 min.</td>
<td>LD's made more errors of omission and commission than normals on X task; no difference between groups on perceptually similar task; body movement appeared to be a by-product of LD's inability to cope, not a determinant.</td>
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<tr>
<td></td>
<td>(with severe reading retardation)</td>
<td>Perceptually similar (not</td>
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<tr>
<td></td>
<td>28 Normals</td>
<td>specified)</td>
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<tr>
<th>Authors</th>
<th>Subjects</th>
<th>Task</th>
<th>Duration</th>
<th>Results</th>
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<tbody>
<tr>
<td>Conners, 1979</td>
<td>17 Hyperactives (Caffeine/placebo)</td>
<td>Visual: Colored Buttons (Red-vertical)</td>
<td>10 min.</td>
<td>Caffeine did not significantly reduce errors of omission or commission, although trend occurred; caffeine affected evoked potential with a decrease in amplitude of negative component of wave.</td>
</tr>
<tr>
<td>Klorman et al., 1979</td>
<td>18 Hyperactives (methylphenidate/placebo)</td>
<td>Visual: Letters (X)</td>
<td>5 min.</td>
<td>Under placebo, hyperactives made more errors of omission and commission than normals, and also had smaller amplitude LPC when performing task, but not under passive condition; methylphenidate tended to normalize hyperactives' performances and corresponding LPC's.</td>
</tr>
</tbody>
</table>
across studies differed from one another in such dimensions as (1) mode, i.e., auditory, visual; (2) nature of task stimuli, i.e., letters, digits, geometric forms, colored buttons, perceptually similar figures; (3) task complexity, i.e., X, AX, 6, red triangle, red-vertical button; and (5) task duration, i.e., ranging from 2.84 minutes to 30 minutes.

While all eighteen studies used correct detections (responses made to significant stimuli) or their converse--errors of omission--as measures of performance on the CPT, thirteen of the studies also examined errors of commission (responses to nonsignificant stimuli). A third type of index, total error scores (errors of omission + errors of commission), was employed five studies by investigators who reasoned that successful performance on the CPT is indicated both by low error of omission scores and low error of commission scores, in that a child could conceivably detect all significant stimuli (and thus make no errors of omission) at the expense of obtaining the maximum possible error of commission score.

Other, less frequently reported measured used in the studies included (1) latency of response, (2) speed of response, (3) multiple responses, i.e., more than one press following the presentation of a stimulus, (4) percentage of correct responses, i.e., number of correct responses divided by number possible, (5) relative score, i.e., number of correct responses divided by number correctly and incorrectly attempted, and (6) type of commission error, i.e., delayed response, anticipatory response, or random response.

Before reviewing the results of the studies, it is relevant to consider what the specific purposes of the investigations were. As
Table 3 indicates, ten of the eighteen studies reviewed in this section involved the use of drugs, including a variety of amphetamines and tranquilizers. In general, such studies were interested in assessing the effectiveness of one or more drugs on the CPT performance of children with learning problems. Among the most frequently cited reasons for using the CPT as a measure of drug effectiveness were the following: (1) its proven sensitivity to pharmacologic intervention (Conners & Rothschild, 1968; Werry & Aman, 1975); (2) its face validity as a measure of attention, a function viewed as clearly necessary if not sufficient for learning (Conners, 1970; Conners & Rothschild, 1968; Kupietz, 1976); and (3) its apparent reliability (Werry & Aman, 1975).

As stated in the research reports, other purposes of studies using the CPT with learning disabled (or LD) children have included: (1) specifying the nature of the hypothesized attention deficit of LD children through measuring various aspects of their CPT performance, including correct detections, errors of omission, errors of commission, and performance over time; (2) measuring concomitant physiological or behavioral responses of LD children, including brain-event related potentials, skin conductance levels, nonobserving responses, seat movement, and body movement; (3) evaluating the relationship between the CPT performance of LD children and indicators of their classroom performance, including off-task behavior and achievement test scores; (5) determining the CPT's reliability for LD children; (6) examining the effect of different variables on the CPT performance of LD children, including age, practice, and distractors; and, finally, (7) testing theoretically-derived hypotheses related to the sustained attention
performance of LD children, including Eysenck's notion that behaviorally-disordered children should perform in a more extraverted manner than normal, and the view, from a homeostatic arousal model, that under-arousal in a child results in an increase in the child's body movement and that a child's attention affects his or her arousal level and body movement.

In the following paragraphs the results of the eighteen studies will be reviewed in accord with the various purposes of the studies outlined above.

Nature of the Deficit

Efforts made by different studies to more adequately understand the nature of the sustained attention deficit of LD children have involved a variety of different measures. For the purposes of the present discussion, findings from the studies are grouped with regard to whether they provide an indication of (1) the overall performance of LD's, i.e., correct detections, errors of omission, or errors of commission summed over the length of the task; (2) the type of commission error made by LD's, i.e., anticipatory response, late response, or random response; (3) LD's performance over time, i.e., correct detections, errors of omission, or errors of commission compared at specified intervals of the task; (4) the nature of the response made by LD's, i.e., response latency, multiple response, or speed of response; or (5) the relationship between omission and commission errors made by LD children.

Of the eighteen studies summarized in Table 3, nine involved a comparison of correct detections or error of omission scores between LD and normal children. In each of the nine studies, significant
differences were found between LD's and normals on at least one of the different versions of the CPT used in the study (Aman, 1979; Grais, 1971; Grassi, 1970; Korman, Salzman, Pass, Borgstedt, & Dainer, 1979; Kupietz, 1976; Ricks & Mirsky, 1974; Rugel, Cheatam, & Mitchell, 1978; Sykes, Douglas, Weiss, & Minde, 1971; Sykes, Douglas, & Morgenstern, 1973). Since correct detections and omission error scores are considered indicative of a child's ability to sustain his or her attention over a prolonged period of time, the findings suggest that LD children do have a deficit in this area relative to normal children. Exceptions to the significant difference findings were found, however, on one of the versions of the CPT given in each of four studies. A comparison of versions of the CPT upon which correct detection or error of omission scores differed for LD's and normals with versions which did not show a difference, indicates that the performance of LD's tended to be most like those of normal children (1) on versions of the CPT, versions which involved only one stimulus to respond to and are thus considered less difficult than AX versions which involve a two-sequence stimulus (Grais, 1971; Ricks & Mirsky, 1974); (2) on a version which used perceptually similar figures (which differed from the conventionally-used letter, digit, or geometric-form stimuli) as task stimuli (Aman, 1979); and (3) on versions of the CPT which presented significant stimuli at either very frequent or very infrequent intervals (Rugel et al., 1978). That learning disabled children show a deficit ability to respond to significant stimuli relative to normals on some versions of the CPT but not others indicates that task characteristics are an important variable in understanding the nature of the sustained attention deficit
of learning disabled children and thus require both additional theo-
retical analysis and experimental investigation.

Of the nine studies which compared the correct detection or error
of omission scores of LD's and normals, six also involved comparisons
of error of commission scores. In all six of the studies, LD's were
found to make significantly more errors of commission than normals, or
to show a strong tendency in this direction, on at least one version of
the CPT given. While correct detection and error of omission scores are
viewed as indicating a child's ability to maintain his or her attention
over time (and, in addition, require the child to make a discrimination
between stimuli and selectively respond to a particular one), errors of
commission are considered a measure of the child's ability to inhibit
responding to nonsignificant stimuli. Since discriminations between
significant and nonsignificant stimuli on the CPT are considered rela-
tively easy to make, high error of commission scores are generally seen
as reflecting a problem with impulsivity.

Thus, the results of the six studies dealing with commission errors
of LD's suggest that the sustained attention deficit LD children show
may be related to impulsivity. As in the case of correct detection or
error of omission scores, however, exceptions to the difference findings
occurred on one of the versions of the CPT used in each of three
studies. Once again, following a comparison of errors of commission
on versions of the task which did not reveal a difference between LD's
and normals with versions showing a difference LD's were found to per-
form most like normals (1) on $X$ versions of the CPT as opposed to the
more complex $AX$ version (Grais, 1971); (2) on a task which used
unconventional, perceptually similar figures as opposed to the conventionally-used letters, digits, or geometric forms (Aman, 1979); and (3) on a task which presented the significant stimuli at a different pace from normal (in this instance, fast as opposed to slow) (Sykes et al., 1971). That LD's differ from normals in commission errors as well as correct detection errors on some but not all versions of the CPT further underscores the need for recognizing and elucidating the role of task characteristics in the sustained attention problem of learning disabled children.

The second aspect of the sustained attention performance of LD children considered in this section involves a more detailed analysis of the kinds of errors of commission made by LD children. Two studies examined either (1) late responses, i.e., those too slow to be counted as correct; (2) anticipatory responses, i.e., responses to the letter A before the occurrence of an X on the AX versions of the CPT; or (3) random responses, i.e., responses to nonsignificant stimuli. Results of the studies indicated (1) that LD children made more late responses than normals on an AX version of the CPT, visual mode, although significant differences were not found on the auditory mode given (Sykes et al., 1973); (2) that LD's made significantly fewer late responses on methylphenidate or on placebo than during initial testing (Conners, 1968); (3) that LD's made more anticipatory responses than normals on both the auditory and visual modes of an AX version of the CPT (Sykes et al., 1973); and (4) that LD's made more random responses than normals on both the auditory and visual modes of an AX version of the CPT (Sykes et al., 1973).
The aspect of the sustained attention performance of LD children considered in this section involves their performance on the CPT over time. Eight of the studies summarized in Table 3 had the purpose of looking at this dimension of performance, with five comparing differences in trend of performance between LD's and a normal control group. In specific, the eight studies investigating this aspect of the sustained attention performance of LD's were interested in determining (1) whether LD's would demonstrate the vigilance decrement phenomenon previously found in adults; (2) whether normal children would also show a decrement; and/or (3) whether LD's would differ from normal children by showing a more marked decrement.

Correct detections, errors of omission, or errors of commission were the different measure used by the studies to assess childrens' performances over time. All eight of the studies used either correct detections or errors of omission, while three studies additionally looked at errors of commission. Results from the studies which looked at correct detections or errors of omission indicated that the performance of LD's did deteriorate as a function of time on task. One exception to this findings was found, however, on the X version of the CPT used by Grais (1971). While Grais failed to find a performance decrement for LD's on an X version of the CPT, it is relevant to note (1) that a performance decrement for LD's was found on the AX version of the CPT used in her study; (2) that the duration of Grais' tasks, 4½ minutes, might be considered relatively brief for measuring the vigilance decrement; and (3) that Grassi (1970) found a performance decrement for LD's on a simple version of the CPT, i.e., one which used
a single significant stimulus, a version which was presented over a 20 minute period of time.

Findings from studies which used errors of commission to evaluate the performances of LD's over time yielded results similar to those using either correct detections or errors of omission. Results from two studies showed LD's making more errors of commission over time (Grais, 1974; Sykes et al., 1973); another indicated a tendency for LD's to make more commission errors over time (Kupietz & Balka, 1976); which a fourth set of results did not show LD's making more errors of commission as a function of time (Grais, 1971). It should be noted that the lack of difference finding again occurred in the study by Grais on an X version, but not an AX version of the CPT, and involved the relatively brief administration (only 4 minutes) time.

Four of the eight studies which analyzed performances over time for LD's also involved analyses of the performances of normal children over time. The results of all four studies indicated that fewer correct detections or more errors of omission were made by both groups of children as a function of time (Grassi, 1970; Grais, 1971; Kupietz, 1976; Sykes et al., 1973); again, with the exception of the results for the X but not AX version of the CPT used in the Grais study. In three of the studies (Grais, 1971; Kupietz, 1976; Sykes et al., 1973), the decline in performance appeared to be more marked for LD's than for normals, and, in the fourth, a tendency for LD's to show a more rapid deterioration than normals with time on task appeared, but was not significant (Grassi, 1970).
The fourth aspect of the sustained attention performance of LD children considered in this section, namely, response characteristics, was investigated in six of the studies summarized in Table 3. Response latency, speed of response, and multiple responses were the different response characteristics investigated.

All four of the studies which looked at response latencies involved comparisons of the effects of drugs versus a placebo condition, with one study additionally involving a normal control group. In summary, the results of the studies indicated (1) that normals show a shorter response latency than LD children; (2) that older learning-disabled children show shorter response latencies than younger learning-disabled children (Klorman, et al., 1979); and (3) that methylphenidate is generally effective in shortening the response latencies of LD children over placebos (Conners, 1968; Dykman, McGrew, Harris, Peters & Ackerman, 1975; Klorman et al., 1979) and other drugs (Dykman et al., 1975), with only one study failing to indicate its effectiveness (Werry & Aman, 1975).

Speed of the response of LD children on the CPT was examined in a study conducted by Werry and Aman (1979). The results indicated that drugs did not significantly affect the speed of response for LD children when compared with placebos.

Two studies examined multiple response patterns in LD children. Results of the studies indicated that LD children make more multiple presses, i.e., respond more than once following a stimulus presentation, than normal children (Sykes et al., 1973), and that methylphenidate is effective in reducing the number of times multiple presses are made to
a level comparable to the number made by normals (Sykes, Douglas, & Morgenstern, 1972).

Finally, the fifth aspect of sustained attention performance considered in this section involves an investigation of the relationship between omission and commission errors made by LD children on the CPT. Results of the studies indicated that omission and commission errors are not correlated for LD's on either an X or AX version of the CPT (Grais, 1971), suggesting that the two types of errors measure two different aspects of their sustained attention performance.

Concomitant Physiological and Behavioral Responses

Measures of physiological or behavioral responses made concomitantly with the CPT performances of LD children have included indicators of (1) brain-event related potentials (ERP's); (2) skin conductance levels; and (3) motor restlessness, i.e., nonobserving responses, seat movement, and body movement. Of the eighteen studies summarized in Table 3, seven were designed to investigate one or more of these variables. Of the seven studies, one dealt with brain-event related potentials of LD and normal children during both a passive and an active phase of CPT administration. The passive phase involved presentation of the CPT task without asking children to attend or respond to a particular stimulus, while the active phase involved instructing children to respond to the letter X. Results of the study indicated (1) that along with performing less well than normals on the CPT, as evidenced by a higher number of omission and commission errors and longer response latencies, placebo-treated LD's showed smaller amplitude late positive
components (LPC's) than normals during the active phase of the task; (2) that LPC differences were not found between LD's and normals during the passive phase of the task; and (3) that methylphenidate both increased the amplitude of the LPC's of LD's and generally ameliorated their CPT performance, especially commission errors and response latencies (Klorman et al., 1978). It is relevant to note that large LPC amplitudes have been theoretically linked to the significance or meaningfulness that a stimulus has for an individual (Musso & Harter, 1978).

Skin conductance levels of LD and normal children were analyzed in the first of four experiments conducted by Rugel et al. (1978). Results of the experiment indicated (1) that the performances of both groups deteriorated over time; (2) that LD's performed considerably poorly than normals throughout the task; (3) that skin conductance levels of both LD's and normals increased over time; and (4) that skin conductance levels between LD's and normals were not significantly different. Rugel et al. interpreted the increase in skin conductance levels found for both groups of children to reflect discomfort resulting from an increase in underarousal on a monotonous task.

Six studies investigated various aspects of motor restlessness which occurred while LD's performed on the CPT. In one study nonobserving responses were evaluated. The results indicated (1) that LD's turned their head and eyes away from an AX version of the CPT, visual mode, significantly more often than normals; and (2) that methylphenidate was effective in reducing nonobserving responses for LD's over a placebo condition.
Seat movement was investigated in three studies. Results from the studies indicated (1) that hyperactive LD's made significantly more seat movements than normals (Sykes et al., 1971); (2) that hyperactive LD's and normals made more seat movements during the second session than during the first, with hyperactive LD's making more seat movements at a faster rate (Sykes et al., 1971); (3) that there were no significant differences in seat movement for hyperactive LD's between placebo and drug conditions (methylphenidate and haloperidol, two dosage conditions) (Werry & Aman, 1975); and (4) that LD's identified as having remedial reading problems did not significantly differ from normals in seat movement, although showing a tendency to make more seat movements on the version of the CPT that was more difficult for them (Aman, 1979).

Two studies investigated body movements of LD children as they took the CPT. The results of the studies showed (1) that body movements (arms, hands, legs, feet, head, and trunk) for both LD's and normals increased over time, and were significantly greater for LD's toward the end of the task (Rugel et al., 1978); (2) that for both LD's and normals, body movements decreased under conditions which presented significant stimuli at very frequent as opposed to very infrequent intervals (Rugel et al., 1978); and (3) that hyperactive, LD's did not show significant differences in body movement under placebo, low or high caffeine conditions (Conners, 1979).

**Relationship Between CPT and Other Ability Tests**

Four studies compared the performance of LD children on the CPT with their performance on other ability tests, including other measures
of attention, a motor task, and an IQ test. In one of the studies (Sykes et al., 1973), the performances of LD children and a normal control group were investigated on each of three tasks of attention: (1) the Choice Reaction Time task (CRT), described as self-paced and requiring intermittent attention, (2) the Serial Reaction Time (SRT) task, described as self-paced and requiring sustained attention, and (3) the CPT, which, of course, is experimenter-paced and requires sustained attention. Results of the LD-control comparisons for each task provided evidence indicating that LD's had the most difficulty on the experimenter-paced CPT. LD's also performed less well than normals on the self-paced SRT, although to a lesser degree than on the CPT; while on the self-paced CRT, no significant differences between LD's and normals were found. Sykes et al. interpreted the results as showing that the attention deficit of LD children is not independent of the duration and nature of the tasks involved. That is, LD's appear to have the most difficulty when sustained attention is required and when they are not allowed to proceed at their own pace.

Ricks and Mirsky (1974) also compared the CPT performances of LD and normal children with their performance on an attention task, namely, the Fruit Distraction Test. Like the CPT, the Fruit Distraction Test requires the child to selectively attend to relevant stimuli and withhold attention to irrelevant stimuli. Results of the study indicated that LD's performed less well than normals on both measures, and significant correlations were found between some CPT scores and some Fruit Distraction measures (correct detections and commission errors, \( \bar{X} \) version of the CPT, control period, and reading time difference between
colored bars and colored fruit) for LD children.

In comparing CPT performances (errors of omission and errors of commission) with performances on a motor task called the Motor Impersistence Test, Grais (1971) found performances for LD children not to be correlated. Similarly, Sykes et al. (1973) did not find a correlation between the IQ scores and CPT performances of LD's.

Relationship between CPT and Classroom Behavior

One study had the purpose of investigating the relationship between the CPT performance of LD children and their academic achievement scores (Aman, 1979), while a second additionally examined the relationship between CPT performance and off-task behaviors (Kupietz & Richardson, 1978). Results from Aman's study indicated that there was some correlation between reading scores, as measured on the Schonnel Reading Test, and CPT performance for LD's. Results from the study by Kupietz and Richardson provided additional evidence in support of a relationship between CPT performance and achievement, showing children who made relatively few vigilance errors to have higher scores on both the Peabody Individual Achievement Test (PIAT) and the Roswell-Chall. In addition, results from the Kupietz and Richardson study provided evidence that the CPT performance of LD children is related to their "off-task" behavior in the classroom, e.g., temper outbursts, talking to other children, making noises, through significant positive correlations of these behaviors, as recorded on the Behavior Rating Scale, with CPT errors of omission and commission.
Reliability of CPT

Two studies investigated the reliability of the CPT with LD children. Results from both studies indicated relatively good test-retest reliability, with correlation coefficients significantly different from zero and ranging from .64 to .83 in the Kupietz (1976) study and from .50 to .87 in the Sykes et al. (1973) study.

Effects of Different Variables on CPT Performance

A number of studies examined the effects of different variables on the CPT performance of LD children. As previously mentioned, ten investigated the effects of different drugs; as well, two studies examined the effects of practice; two examined the effects of different kinds of distractors; and four studies investigated the effects of age.

A review of the studies using drugs indicates that methylphenidate was consistently effective in improving the CPT performance of LD children over initial testing or placebo conditions (Conners, 1970; Conners & Rothschild, 1968; Dykman et al., 1975; Klarman et al., 1979; Kupietz & Balka, 1976; Sykes et al., 1971; Sykes et al., 1972; Werry & Aman, 1975; Yepes, Balka, Winsberg, Pialer, 1977). Other substances such as pemoline (Dykman et al., 1975), haloperidol (Werry & Aman, 1975), amitriptyline (Kupietz & Balka, 1975; Yepes et al., 1977), dextroamphetamine (Conners, 1970), and caffeine (Conners, 1979) generally showed themselves to be less effective or of no benefit. Among the indicators used in measuring the affects of drugs on CPT performance were correct detections, errors of omission, errors of commission, and response latencies.
Of the eighteen studies summarized in Table 3, two had the purpose of investigating the effects of practice. Results from the studies were mixed. Using AX versions of the CPT, both a visual and auditory mode, Sykes et al., (1973) found no significant differences in the performance of LD children from initial testing to retesting; Conners and Rothschild (1968), on the other hand, found a decrease in omission as well as commission errors for LD's on a geometric form version of the CPT following practice, and an increase in errors of omission for LD's following practice on a version of the CPT involving letter stimuli. It is thus apparent that the effects of practice require further investigation.

The effect of distractors on the CPT performance of LD children was examined in two studies. In one study, the effect of a noise condition involving 80 decibels of white noise occurring at frequent, random intervals was compared with a no-noise condition (Sykes et al., 1971). Results of the study did not indicate that LD's or normals performed any differently as a function of noise. Another study investigated the effects of two kinds of distractors, complex and meaningful stimuli and simple and unmeaningful stimuli, on the CPT performances of LD's and normals (Ricks & Mirsky, 1974). It was found that when letters were spoken during the administration of a version of the CPT requiring attention to visually presented letters, LD's were more distracted and performed less well than normal than when distractors took the form of tones, an alphabet song, or contradictory visual information. Results from the study were interpreted by the authors as providing evidence that CPT performance of LD's is more impaired when distractors are close
to the dimensions of the central task than when they are distally-related.

The effects of age on the CPT performance of LD children was investigated in four of the studies summarized in Table 3. As might be expected, results of the studies were generally consistent in indicating that older LD's performed better, i.e., made more correct responses and fewer errors, than younger LD's (Grais, 1971; Sykes et al., 1973; Dykman et al., 1975; Kupietz & Richardson, 1978).

Theoretically-Derived Hypotheses and CPT Performance

Two studies evaluated hypotheses derived from formal theories which attempted to account for aspects of the sustained attention performance of LD children. In the first, Grassi (1970) tested Eysenck's (1957) notion that behaviorally-disordered LD's should differ from normals on vigilance tasks because, like other extraverts, they accumulate more reactive inhibition and, as a result, show greater work decrements on such tasks. Results of Grassi’s study indicated that behaviorally-disordered LD's made fewer correct responses than normals on the CPT, and were interpreted as confirming the hypothesis that normal children made fewer errors since they accumulate less reactive inhibition. It may be argued, however, that Grassi's results while supporting the hypothesis that behaviorally-disordered children would perform less well than normal children on the CPT are not sufficient to confirm any hypotheses related to why this may be so.

Rugel et al. (1978) proposed and tested two hypotheses in an effort to explain the CPT performance of children described as hyperactive or
learning disabled. The two hypotheses were derived from the homeostatic arousal model advocated by such theorists as Fiske and Maddi (1961), Berlyne (1960), and Schultz (1965). Briefly summarized, the model suggests (1) that organisms experience a subjective state that can be described along a boredom-excitation continuum, (2) that the state is determined by external and internal sources of stimulation, and (3) that organisms seek to maintain an optimal level of arousal that is experienced as comfortable--too high a level is discomforting in that overexcitement is experienced causing the organism to seek lower arousal level by withdrawing from sources of stimulation, too low a level is discomforting in that boredom is experienced causing the organism to seek out additional sources of stimulation.

In applying the homeostatic arousal model to the behavior of learning disabled children, Rugel et al. observed that attentional deficits and excessive body movement are two primary characteristics of LD children, and proposed (1) that the attentional deficits of LD children contribute to their hyperactivity; (2) that LD's become inattentive to tasks requiring sustained attention especially quickly; (3) that as LD's decrease their attention, the task becomes increasingly unavailable to them as a source of stimulation resulting in a drop in their internal level of arousal; and (4) that when the drop becomes intense enough, LD's become uncomfortable and motivated to seek other sources of stimulation, including body movement, in part, because body activity usually occurs in moving from an environmental situation that is not stimulating to one that is and, in part, because body activity is itself a source of stimulation.
In applying the model to the performances of LD's and normal children on the CPT, Rugel et al. made the following hypotheses:

1. The overall lack of stimulation in the CPT will result in increasing underarousal and compensatory increases in body movement throughout the task; (2) attention, as measured by vigilance performance, will effect arousal level and subsequent body movement, i.e., when attention is directed toward the task, the stimuli will be useful in maintaining arousal level, and when attention switches away from relevant stimuli, since little else is available during CPT administration to maintain arousal level, the results will be increased underarousal and compensatory body movement.

Rugel et al.'s first hypothesis was supported by the finding that high signal frequency conditions, viewed as providing more meaningful stimuli for the child to respond to and thus more external stimulation, resulted in lower levels of body movement. Support for their second hypothesis was not found, however. While LD children did show greater body movement levels than normal children, differences were found in the absence of an attentional deficit in two of the four experiments reported by Rugel et al.

That Hypothesis 2 was not supported by the findings led Rugel et al. to propose a second view. The view states (1) that LD children may come into the task with inherently lower arousal levels than normals, (2) that they may also habituate faster to task-relevant stimuli, which also contributes to their level of arousal, (3) that their underarousal results in stimulus-seeking behavior, which is manifest in increased body activity, and (4) that increased body activity
interferes with task-relevant behaviors thus contribution to poor sustained attention. This position has, of course, not been systematically investigated by Rugel et al. It is relevant to note, however, that a number of investigators have failed to find experimental evidence to support the idea that the high level of body activity displayed by learning disabled children diagnosed as hyperactive either interferes with or adversely affects their performance on laboratory tasks (Douglas & Peters, 1979; Keogh & Margolis, 1976).

Summary of Findings

In summary, the findings from the eighteen studies summarized in Table 3 indicate that learning disabled children frequently perform less well than normal children on the CPT. In specific, when compared with normals, learning disabled children tended to detect fewer significant stimuli overall, to make more commission errors (of all kinds), and also to exhibit more decrement in performance over time. Exceptions to the relatively poor performances of LD's were found, however, (1) on versions of the CPT which were less difficult, i.e., X versions which require responses to a single stimulus rather than AX versions which require responses to a two-stimulus sequence, (2) on a version of the task which did not use the conventional letters, digits, or geometric forms as task stimuli, and (3) on versions of the task which presented significant stimuli at more frequent intervals or a faster pace than usual. Based on such exceptions, it is concluded that task characteristics are important variables in the sustained attention performance of LD children and require more adequate specification.
Studies which investigated concomitant physiological and behavioral responses, including brain-event related potentials, skin conductance levels, nonobserving responses, seat movement, and body movement, generally paralleled the CPT performance of LD children, and were usually interpreted as providing additional evidence of their poor sustained attention relative to normal children.

Studies which investigated the relationship between the CPT performance of LD children and their performances on other measures ability indicated that the CPT performance of LD children is related (1) to their performances on other measures of attention, although they experienced more difficulty with the CPT than other attention tasks; (2) to their off-task behavior in the classroom; and (3) to their academic achievement test scores, especially those in reading achievement. On the other hand, relationships between the CPT performance of LD's and their IQ scores or scores on a motor impersistence task were not found.

Studies investigating the effects of drugs indicated that methylphenidate, in particular, seems to have a beneficial effect on the CPT performance of LD's. The effects of other substances, however, such as haloperidol, caffeine, pemoline, and amitriptyline, appeared to be of less benefit, if any.

Studies investigating the effects of age on the CPT performance of LD children indicated that younger children performed more poorly than older children, as would be expected.

The results of studies on the effects of distractors were diverse, but seemed to indicate that stimuli have specifiable qualities which
determine whether or not they are distracting to learning disabled children: Stimuli which were not clearly related to the task such as white noise, the alphabet song, or tones did not adversely affect the performance of LD's; however, closely-related stimuli, such as spoken letters during a letter version of the CPT, were found to result in a poorer performance.

Studies which investigated theoretically-derived hypotheses provided support for some hypotheses, but not others. Two hypotheses were supported by the findings: (1) Eysenck's (1957) hypothesis that LD children identified as behaviorally-disordered would make fewer correct detections than normals on the CPT (Grassi, 1970); and (2) Rugel et al.'s (1978) hypothesis that body movement would increase as a function of lower levels of task stimulation. One hypothesis was not supported by the findings: Rugel et al.'s hypothesis that attention would affect arousal level and subsequent body movement. And, while Grassi considered a fourth hypothesis--Eysenck's hypothesis that behaviorally-disordered children would accumulate more reactive inhibition than normals on the CPT--to be confirmed, it may be argued that Grassi's study provided an insufficient basis for testing the hypothesis since the construct was not operationally defined in the study.

Need for a Motivational Analysis of the Sustained Attention Deficit of LD Children

That the nature of the sustained attention deficit of learning disabled children needs to be clarified further has been observed by a number of investigators who have reviewed the research in this area,
including Douglas and Peters (1979), Keogh and Margolis (1976), and Krupski (1980). One area that has been discussed by investigators as clearly relevant is the role of motivation. That none of the eighteen studies reviewed in the previous section had the purpose of investigating motivational variables is consistent with Kauffman and Hallahan's (1976) observation that despite the obvious relationship between motivation and the behavior of learning disabled children, very few studies have been directed toward understanding the specific manner in which they relate.

Based on the literature reviewed in Chapter II, it may also be said that in addition to there being relatively little research on the relationship between motivation and the behavior of learning disabled children, there is also very little research on the motivational characteristics of learning disabled children beyond that which indicates that rewards are generally effective in ameliorating their behavior problems. What has not been systematically explored, for example, is the nature of their attitudes toward different classes of stimuli, the kinds of stimuli that reinforce their behavior, and the kinds of stimuli that function to motivate or direct their behavior.

It may be recalled from the social behavioristic framework developed in Chapter II that deficit or inappropriate attitudes toward school-related stimuli, e.g., books, teachers, academic subjects, the learning situation, etc., (1) have frequently been attributed to learning disabled children, (2) are typically viewed as a result of their history of failure in school, and (3) are often considered a hindrance to their further learning. Nevertheless, an extensive review of the
research literature turned up only one study that specifically dealt with the attitudinal characteristics of learning disabled children (Guthery, 1971); and only a few more that were of relevance for clarifying the relationship between motivational variables and their sustained attention (Cohen, 1970; Firestone & Douglas, 1975; Parry, 1973).

Inasmuch as such studies constitute the little research that has been done in the area of direct concern to the present investigation, it is relevant that they be considered in the following paragraphs.

Research on the Attitudinal Characteristics of LD Children

In the study that dealt with the attitudinal characteristics of LD children, the attitudes expressed by a group of children identified as educationally handicapped were compared with the attitudes expressed by groups of normal and mentally retarded children (Guthery, 1971). Results of the study indicated that educationally handicapped children expressed a more negative attitude than normals on all three dimensions of the Burks' School Attitude Survey, including attitude toward teacher, attitude toward school, and attitude toward academics. Mentally retarded children were also found to express a more negative attitude than normals; however, they differed from normals only on the dimensions involving attitude toward school and attitude toward academics and not on the dimension involving attitude toward teacher.

Research on the Relationship Between Motivation and the Sustained Attention of LD Children

While not advancing an hypothesis that implicates motivation in the sustained attention problem of learning disabled children, the studies
by Douglas and her students at McGill University manipulated various reinforcer variables to determine their effects on the reaction-time task performances of hyperactive and normal children (Cohen & Douglas, 1972; Firestone & Douglas, 1975; Parry, 1973).

It should be noted that unlike the Continuous Performance Test, reaction-time tasks do not require continuous attention over time in order to perform well but rather sustained attention over a series of discrete trials. Nevertheless, a number of investigators view reaction-time tasks as measures of sustained attention (e.g., Krupski & Boyle, 1978; Wickens, 1974), and in support of such a view Douglas (1972) has produced significant positive correlations between reaction-time tasks and tasks typically used to measure sustained attention.

At any rate, the results of the studies conducted in Douglas' laboratory indicate that reinforcer variables affect the performance of hyperactive children on reaction-time tasks in a number of ways. Cohen and Douglas (1972), for example, found that praise for quick responding led to improved performances for both normal and hyperactive children while when no feedback was given (during an extinction condition), the normals maintained some improvement, but the hyperactives returned to their baseline levels.

Parry (1973), in an attempt to expand on the work of Cohen and Douglas, studied the effects of continuous versus partial reinforcement and contingent versus noncontingent reinforcement procedures. The results from Parry's study indicated that when praise was continuous and contingent, the reaction-time performance of both normals and hyperactives improved. When noncontingent praise was used, the
performances of normal children improved, but the performance of hyperactive children deteriorated. Partial reinforcement also led to a deterioration of performance for hyperactives, who appeared to become more upset than normals when praise was not delivered on a continuous schedule.

In the third of the studies conducted on reinforcer variables, Firestone and Douglas (1975) compared the effects of positive and negative feedback. Both types of feedback were found to be effective in improving reaction times for normals and hyperactives and for reducing variability in the hyperactive group. However, positive feedback also led to an increase in impulsive responses for hyperactives, an effect which did not occur when negative feedback or a combination of positive and negative feedback were used, and which was not found in normals.

Douglas and her students have drawn upon a number of theories to interpret their various findings, including Amsel's (1962) frustration theory which holds that the frustration produced by nonreinforcement causes an increase in drive which affects individuals differently depending on their frustration thresholds and the nature of the task, and Solokov's (1963) theory that individuals must develop a stable internal model of a stimulus situation, formed with repeated elicitation of their orienting response, if they are to be able to extract relevant information from the environment and make an appropriate response.

More recently, Douglas and Peters (1979) proposed yet another way of considering the findings. Since stimulant drugs and rewards are both known to enhance arousal and since improvement in performance
occurs when hyperactives are placed on medication or given rewards, Douglas and Peters suggest that it may be relevant to consider the findings from an arousal model point of view. Looking at the findings from an arousal-model perspective, Douglas and Peters posited three possible explanations for the performance of hyperactives under the different reinforcement conditions: (1) hyperactives have an unusually narrow range of arousal levels within which they can function effectively, i.e., relatively small changes in arousal cause either under-stimulation or overstimulation, both resulting in impaired performance; (2) hyperactives are particularly labile in their patterns of arousal; and (3) hyperactives are less capable than normals of modulating their own levels of arousal in order to achieve levels that are optimal for dealing with particular tasks or situations.

Summary

To summarize, although "common sense," as Keogh and Margolis (1976) have suggested, implicates a relationship between motivation and the attentional deficit of learning disabled children, theoretical analyses and research indicating the nature of this relationship are only beginning to accumulate. That this dissertation has the purpose of investigating the manner by which motivation may affect the sustained attention of LD children was stated at the beginning of the present chapter. It is suggested that social behaviorism's A-R-D theory of motivation provides a comprehensive basis for conducting systematic research in this area. As the overview in Chapter II indicated, A-R-D theory indicates (1) the importance of determining a
child's attitudinal (emotional-motivational) personality characteristics, (2) how these characteristics are acquired, (3) the manner by which they function to determine how a child will behave, and (4) why two children with different emotional-motivational systems will behave differently in exactly the same situation, depending, at least in part, on the nature of their emotional-motivational personality characteristics.

**Rationale and Hypotheses**

Research with learning disabled children indicates that learning disabled children typically perform less well than normal children on sustained attention tasks, most notably the Continuous Performance Test. While it is possible that learning disabled children have an organically-related inability to sustain attention which manifests itself in terms of school tasks and on laboratory tasks like the CPT, it is also possible that the poor sustained attention shown by learning disabled children is related to deficit or inappropriate motivation.

In the social behavioristic theory of learning disabilities developed in Chapter II, learning disabled children were conceptualized as having deficit and/or inappropriate attitudes to school-related stimuli. This conceptualization was based in part (1) on a commonly-held view of learning disabilities professionals and in part (2) on the findings from the study by Guthery (1971) which showed educationally handicapped children to express a more negative attitude than normal children toward teachers, school, and academic subjects.
It is of relevance to note that the Continuous Performance Test, the measure most frequently used to assess the sustained attention ability of children, typically involves letters, numbers, or geometric forms--stimuli which are all academic in nature. It is also relevant to note that one exception to the poor performance generally found for learning disabled children occurred on a version of the CPT that did not use academic stimuli (Aman, 1979).

Taking the above into consideration and using principles from social behaviorism's A-R-D theory of motivation, which indicates how attitudes help to determine behavior, the position argued here is that the conventionally-used stimuli of the CPT, academic in nature, elicit a negative emotional response in learning disabled children which results in their avoidance of attention, and accounts for their poor performance on the task relative to normal achieving children.

This social behavioristic analysis leads to various expectations. It is the purpose of this study to develop one of them. The study selects stimuli that are theoretically pleasant to all children, namely, play-related stimuli, and stimuli that are theoretically and empirically less pleasant to learning disabled children than to non-learning disabled children, namely, school-related stimuli. Attitudinal measures and attention tasks composed of these sets of stimuli are then used to evaluate (1) the hypothesis that learning disabled children differ from non-learning disabled children in their emotional-motivational (A-R-D) personality characteristics, with learning disabled children having a less positive attitude toward school-related stimuli; and (2) the theoretically-derived expectation that differences
between learning disabled and non-learning disabled children in their emotional-motivational (A-R-D) personality characteristics can be used to explain their performance differences on sustained attention tasks.
CHAPTER IV

EXPERIMENT 1

In order to investigate the first of the two conceptual hypotheses outlined in the previous chapter, namely, that learning disabled children differ from non-learning children in their attitude toward school-related stimuli, an attitude questionnaire composed of school-related and play-related words was developed and administered to 15 learning disabled (LD), 15 normal achieving (NA), and 15 high achieving (HA) children. This chapter describes the sample from which treatment groups for the experiment were assigned, the attitude questionnaire, and the procedures. Presented also in the chapter are the experimental hypotheses, questions, and results.

Sample

Forty-five children were randomly assigned to the first experiment from a sample of 135 children selected for Experiment 1 and Experiment 2. Comprising the sample were 45 learning disabled, 45 normal achieving, and 45 high achieving children in the third, fourth, and fifth grades. The children were selected from eight elementary schools of a large metropolitan school district in Southern California. Schools cooperating in the study were geographically close to one another and met the criteria of having (1) a special education program for children identified as learning disabled, (2) regular education classroom in which there were children achieving in the normal and high ranges as
indicated by school test scores from a 1979 administration of the nationally-normed California Test of Basic Skills (CTBS), and (3) a student body enrollment which was fairly representative of the school population of California with respect to race, ethnicity, and socio-economic status. The criteria for inclusion resulted in the exclusion of (1) schools that did not have programs for learning disabled pupils, (2) schools that did not have pupils achieving at the 50%ile level and above on the CTBS, (3) schools having a predominance of any one racial or ethnic group, and (4) schools in very poor or highly affluent neighborhoods.

Subject Pool

Third, fourth, and fifth graders in the special education programs of cooperating schools constituted the subject pool from which children for the LD classification group were selected, while third, fourth, and fifth graders in regular education classrooms comprised the pool from which children for the NA and HA classification groups were drawn. A parental consent requirement along with the several criteria established for operationally defining the groups formed the basis for subject selection.

Parental Consent

To satisfy school district policies which required that parental consent be obtained for access to pupil records and for a child to be allowed to participate in the study, letters informing parents about the nature of the study and requesting consent went drafted. Letters were sent to the parents of (1) all third, fourth, and fifth graders in
the special education programs of cooperating schools, and to the parents of (2) those third, fourth, and fifth graders in regular education classrooms who were identified by their teachers as meeting the criteria for either the NA or HA classification groups. Pupils not returning letters within a week or two were sent home with follow-up letters to insure a reasonable rate of return and to obtain the number of subjects planned for each group.

**Learning Disabled Classification Group**

When letters granting parental consent were returned by children in special education programs, individual pupil records were reviewed by the investigator. In order to be considered for the LD classification group, a child had to have been identified as learning disabled by the school assessment team, typically consisting of a school psychologist, special education teacher, school nurse, and school administrator. Because the level of a child's academic functioning would be expected to change from time to time and since diagnostic practices of different teams may vary, additional criteria were established to operationally define the classification group. Children were selected if (1) normal intelligence was reported in the case study, and (2) current academic functioning was at least 1½ years below grade level expectancy, as evidenced by individually administered achievement tests and according to teacher reports. Children were not selected if (1) there was evidence of gross signs of brain damage, such as epilepsy or cerebral palsy, (2) there was a report of sensory impairment, or (3) academic underachievement appeared to be secondary to some other
condition, such as serious emotional disturbance, mental retardation, bilingulism, or environmental disadvantage.

Using the above criteria as a basis for inclusion and noninclusion, 35 boys and 10 girls were selected into the LD classification group. Due to absences one child was not available during the data collection phase of the study, thus, 44 pupils, 35 boys and 9 girls comprised the final group. Eleven of the children were third graders; 17 were fourth graders; and 16 were fifth graders. The children ranged in age from 100 to 138 months, with a mean age of 120.66 months and a standard deviation of 11.52. Specific IQ scores as opposed to a simple notation of normal intelligence were available for 38 pupils (86.36%). The mean of the available IQ scores was 89.42, with a standard deviation of 11.76.

Normal and High Achieving Classification Groups

Potential subjects for the NA and HA classification groups were identified by their teachers. Third, fourth, and fifth grade classroom teachers were asked to send parent consent letters (1) to the homes of pupils achieving at or very close to grade level expectancy—in a range of ±3 months—in reading and arithmetic in order to obtain potential subjects for the NA group, and (2) to the homes of pupils achieving at least 1\text{\frac{1}{2}} years above grade level expectancy in reading and arithmetic in order to obtain potential subjects for the HA group.

Inasmuch as the LD classification group was composed of significantly more boys than girls, an outcome consistent with statistics cited by other researchers studying learning disabled children (Norman &
Zigmond, 1980), a stratified random sampling procedure was employed to control for sex when selecting subjects for the NA and HA classification groups. Thus when letters granting parental consent were returned by potential pupils for the NA and HA groups, 35 boys and 10 girls were randomly selected for each group.

Comprising the NA classification group were 16 third graders, 17 fourth graders, and 12 fifth graders. The children ranged in age from 99 to 136 months, with a mean age of 116.91 months and a standard deviation of 9.65. Achievement test scores on the CTBS were available for 22 pupils (48.89%). The mean percentile score in reading was 66.36, with a standard deviation of 14.03; while the mean percentile score in arithmetic was 65.00, with a standard deviation of 22.74.

Comprising the HA classification group were 13 third graders, 15 fourth graders, and 17 fifth graders. The children ranged in age from 96 to 136 months, with a mean age of 116.09 and a standard deviation of 10.59. Twenty-four of the children (53.33%) were identified as mentally gifted minors and enrolled in special programs for the gifted. IQ scores on the Stanford-Binet were available for 26 pupils (57.59%). The mean of the available scores was 137.23, with a standard deviation of 12.38. Achievement test scores on the CTBS were available for 24 pupils (53.33%). The mean percentile score in reading was 88.25, with a standard deviation of 10.69; the mean percentile score in arithmetic was 81.50, with a standard deviation of 19.65.
Methods

The design of the first experiment was a 3 x 2 subjects by treatments factorial, with the three classification groups, LD, NA, and HA, receiving both treatments (see Figure 1). Treatments were a set of school-related words and a set of play-related words presented in a questionnaire designed to measure attitudes.

Questionnaire Design and Development

Twelve words denoting objects and activities found in schools comprised the set of school-related words; while 12 words denoting objects and activities relating to play comprised the set of play-related words. The two word sets were selected for the purposes of investigating (1) hypothesized differences between subject classification groups in attitude toward school, and (2) a hypothesized lack of difference between subject classification groups in attitude toward play. Three adult judges selected the 24 words from compiled word lists on the basis of their relatedness to the general concepts of school or play, and because they were monosyllabic and would thus meet requirements established for the tasks employed in Experiment 2.

The school-related and play-related words were randomly ordered, and presented in 5-point Likert Scale formats. Five faces were drawn next to each of the 24 words to represent the following attitudes: very happy (5 points), a little happy (4 points), neither happy nor unhappy (3 points), a little unhappy (2 points), and very unhappy (1 point). The child's task was to mark a face in response to each word,
<table>
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<tr>
<th>Classification Group</th>
<th>Attitude Questionnaire</th>
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<tr>
<td></td>
<td>School Word Set</td>
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<tr>
<td>Learning Disabled (LD)</td>
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<tr>
<td>Normal Achieving (NA)</td>
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<td>High Achieving (HA)</td>
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Figure 1. Diagram of repeated measures design used in Experiment 1.
read by the experimenter, depending on how the word made him/her feel. Based on the number of points assigned to each face, two scores were calculated for each child: a score representing a total of the ratings for the 12 school-related words, and a score representing a total of the ratings for the 12 play-related words. Since the items were scaled from 5 points for very happy to 1 point for very unhappy, higher scores reflected more positive expressions of feelings.

Pilot-testing of the questionnaire was done with a classroom of 13 learning disabled pupils, who were not included in the study, to determine whether the general format and directions for responding to the questionnaire were understandable to children. The final form of the questionnaire can be found in Appendix A.

Procedures

Inasmuch as fifteen children from each classification group, LD, NA, and HA, were randomly assigned to Experiment 1, a total of 45 children were asked to respond to the 24 words of the questionnaire. The questionnaire took approximately 10 minutes to administer, and was given by the experimenter to each pupil individually.

As each child was brought to the room where the questionnaire was administered, he/she was asked to be seated at a table opposite the experimenter. Following this, the experimenter held up a 10 "by 30" card. On the card were enlarged replicas of the 5 faces that appear alongside each of the 24 words in the questionnaire. In order to acquaint the child with the feelings represented by the faces, the experimenter said, "Look at this card. On it are pictures of five faces". Pointing to each face in turn, the experimenter then said:
One is a picture of someone who is very happy. One is a picture of someone who is a little happy. One is a picture of someone who is neither happy nor unhappy. One is a picture of someone who is a little unhappy. And one is a picture of someone who is very unhappy.

Next, questions were asked to determine whether the child was able to identify which face represented each of the various feelings: (1) "Do you think you can remember who is very happy?" (2) "Which one is very unhappy?" (3) "Which one is a little happy?" (4) "Which one is a little unhappy?" and (5) "Which one is neither happy nor unhappy?"

If the child indicated the correct face following a question, the experimenter said, "Yes," "Right," or "Good." If the child gave an incorrect response following a question, the experimenter said "No," pointed to the correct response, and told the subject which face was correct, providing a reason why, e.g., "No, here is the one who is very happy. This face has the biggest smile." Questions and feedback were continued until the child correctly identified each feeling with the appropriate face. Once the child had done so, the experimenter said:

Okay, now that you have learned the faces, I'm going to ask you to use the faces to let me know how some different words make you feel.

A questionnaire and pencil were placed in front of the child and the experimenter gave the following instructions:

First put your name, age, and grade at the top of the page. Now find the number 1. After the number 1 the word "math" is written. In the same row are five faces. The first is a very happy face. The second is a face that is a little happy. The third is a face that is neither happy nor unhappy. The fourth is a face that is a little unhappy. And the last one is a face that is very unhappy. I want you to draw an "X" on the face that shows how the word "math" makes you feel. (While saying
"X", the experimenter reinforced what was being asked of the child by demonstrating the movement with her finger in the air.) There are no right or wrong answers. If the word "math" makes you feel very happy, draw an "X" on the very happy face, if the word "math" makes you feel a little happy, draw an "X" on that face, and so on.

After the child responded to the first item, the experimenter said, "Now find the number 2. See the word 'toy.' Mark an 'X' on the face that shows how the word 'toy' makes you feel." The experimenter read each word on the questionnaire until the child had responded to all 24 items. Stimulus words and/or directions were repeated as necessary to encourage the child to respond.

**Experimental Hypotheses and Questions**

**Experimental Hypotheses**

Based on the attitude questionnaire developed to address the first conceptual hypothesis of the study, the following experimental hypotheses were formulated:

**Hypothesis I.** The learning disabled children will have a significantly lower total rating score for the School Word Set than will the normal achieving children.

**Hypothesis II.** For the Play Word Set, there will be no significant difference in total rating score between the learning disabled and normal achieving children.

**Hypothesis III.** Learning disabled children will have a significantly lower total rating score for the School Word Set than for the Play Word Set.
Questions

In order to make predictions about the performance of the pupil groups on the attentional tasks used to address the second major hypothesis of the study, the following questions were posed:

**Question I.** For the School Word Set, is there a significant difference in total rating score means between the normal achieving and high achieving children?

**Question II.** For the Play Word Set, is there a significant difference in total rating score means between the normal achieving and high achieving children?

**Question III.** For the normal achieving children, is there a significant difference between total rating scores for the School Word Set and the Play Word Set?

**Question IV.** For the high achieving children, is there a significant difference between total rating scores for the School Word Set and the Play Word Set?

Results

Prior to presenting the results there is a need for some general statement regarding the methods selected to evaluate the hypotheses and questions of the study. For Experiment 1 as well as Experiment 2, the methods of comparison chosen were based on the fact that although the hypotheses and questions were formulated in advance, not all were mutually independent, i.e., orthogonal. While some statisticians have
recommended performing t-tests on any and all comparisons planned in advance (e.g., Bruning & Kintz, 1977; Phillips, 1973), a more conservative approach, and one that is subject to fewer Type I errors, involves using t-tests to evaluate a selected subset of orthogonal comparisons, and more conservative tests, i.e., those usually reserved for post hoc analyses or data-snooping, to evaluate the remaining comparisons (Li, 1964). In the present study the latter, more conservative approach was employed. The most important subset of orthogonal comparisons was selected from the total number of comparisons dictated by the hypotheses and questions. The selected subsets of orthogonal comparisons were then evaluated with t-tests, while the remaining comparisons were evaluated with Newman-Keuls tests.

Before presenting the results of these tests, summary statistics, analysis of variance results, and associated follow-up tests will first be reported in order to provide an overall picture of the effects of the experimental conditions on the dependent measure.

**Summary Statistics**

The measure of attitude used in the data analyses that follow was total rating score. Following the design of Experiment 1, a total rating score was computed for each child on each of two different word sets: School Word Set and Play Word Set. Total rating scores on the School Word Set were obtained by summing the children's individual Likert-scale ratings over each of the 12 school-related words of the attitude questionnaire, while total rating scores on the Play Word Set were obtained by summing the children's ratings over each of the 12 play-related words.
The means and standard deviations for total rating scores are presented in Table 4 according to Classification Group, learning disabled, normal achieving, and high achieving, and Word Set, 12 school-related words, 12 play-related words (see Table 4).

**Repeated Measures Analysis of Variance and Associated Follow-up Tests**

Total rating scores were analyzed using a 3 x 2 (Classification Group X Word Set) analysis of variance with repeated measures on the last factor. Results of the ANOVA are summarized in Table 5 (see Table 5).

With the significance level for \( F \) values set at .05, the main effect for Classification Group was not found to be significant, \( F(2,42) = 2.34, p > .05 \). Significant differences were found, however, for the main effect of Word Set, \( F(1,42) = 18.48, p < .001 \), and, more importantly, for the Word Set X Classification Group interaction, \( F(2,42) = 3.24, p < .05 \).

Two things were indicated by the significant \( F \)'s: (1) in general, the play words (\( M = 52.47, SD = 5.59 \)) were responded to more favorably than the school words (\( M = 46.58, SD = 8.05 \)), and (2) at least two of the groups responded differentially to the two types of words.

\( F \)-tests for simple main effects were used to analyze the significant interaction. Results of the \( F \)-tests indicated that while the classification groups did not significantly differ in their overall rating of the 12 play-related words (Play Word Set), \( F(2,42) = 0.19, p > .05 \), there were differences between at least two of the groups in their overall rating of the 12 school-related words (School Word Set).
### Table 4
Means and Standard Deviations for Total Rating Scores

<table>
<thead>
<tr>
<th>Classification Group</th>
<th>School Word Set</th>
<th>Play Word Set</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Disabled (LD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>41.8</td>
<td>52.4</td>
<td>47.10</td>
</tr>
<tr>
<td>SD</td>
<td>10.08</td>
<td>4.85</td>
<td>7.47</td>
</tr>
<tr>
<td>n</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td><strong>Normal Achieving (NA)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>48.33</td>
<td>53.13</td>
<td>50.73</td>
</tr>
<tr>
<td>SD</td>
<td>6.99</td>
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<td>6.26</td>
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<tr>
<td>n</td>
<td>15</td>
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<td>15</td>
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<tr>
<td><strong>High Achieving (HA)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>49.60</td>
<td>51.87</td>
<td>50.73</td>
</tr>
<tr>
<td>SD</td>
<td>7.08</td>
<td>6.39</td>
<td>6.73</td>
</tr>
<tr>
<td>n</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>46.58</td>
<td>52.47</td>
<td>49.52</td>
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<tr>
<td>SD</td>
<td>8.05</td>
<td>5.59</td>
<td>6.82</td>
</tr>
<tr>
<td>n</td>
<td>45</td>
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</tr>
</tbody>
</table>
Table 5
Repeated Measures
Analysis of Variance Results for Total Rating Scores

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification (C)</td>
<td>2</td>
<td>132.01</td>
<td>2.34</td>
</tr>
<tr>
<td>Error</td>
<td>42</td>
<td>56.31</td>
<td>--</td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word Set (W)</td>
<td>1</td>
<td>780.28</td>
<td>18.48*</td>
</tr>
<tr>
<td>W X C</td>
<td>2</td>
<td>136.88</td>
<td>3.24**</td>
</tr>
<tr>
<td>Error</td>
<td>42</td>
<td>42.23</td>
<td>--</td>
</tr>
</tbody>
</table>

* p < .001  
** p < .05
A Newman-Keuls follow-up test was applied to the means for the School Word Set to determine which of the three classification groups differed from one another. Results of the test revealed that the mean total rating score for the learning disabled children ($M = 41.80$, $SD = 10.08$) was significantly lower, and therefore less positive, than the mean total rating score for either the normal achieving ($M = 48.33$, $SD = 6.99$) or high achieving ($M = 49.60$, $SD = 7.08$) children ($p < .05$); and that the mean total rating scores for the latter two groups did not significantly differ ($p > .05$).

Results of Comparisons for Hypotheses and Questions

Reported below are results of comparisons for the hypotheses and questions of Experiment 1. Two-tailed $t$-tests were used to evaluate the orthogonal comparisons, while Newman-Keuls tests were used to evaluate the nonorthogonal comparisons. For all comparisons the significance level was .05.

Hypothesis I. The learning disabled children will have a significantly lower total rating score for the School Word Set than will the normal achieving children.

As predicted, $t$-test results indicated a significant difference between the learning disabled ($M = 41.80$, $SD = 10.08$) and normal achieving ($M = 48.33$, $SD = 6.99$) groups, $t(24.9) = 2.06$, $p = .05$, with the learning disabled children having the lower mean total rating score for the school words, hence, the less positive attitude.
Hypothesis II. For the Play Word Set, there will be no significant difference in total rating scores between the learning disabled and normal achieving children.

As expected, the t-test failed to reveal a significant difference between the learning disabled ($M = 52.40, SD = 4.85$) and normal achieving ($M = 53.13, SD = 5.54$) groups for the Play Word Set, $t(27.5) = 0.39, p > .05$.

Hypothesis III. Learning disabled children will have a significantly lower total rating score for the School Word Set than for the Play Word Set.

Results of the comparison supported Hypothesis III. The mean total rating score of the learning disabled children on the School Word Set ($M = 41.80, SD = 10.08$) was significantly lower than their mean total rating score on the Play Word Set ($M = 52.40, SD = 4.85$), $p < .05$, indicating a less positive attitude toward the school-related words than toward the play-related words.

Question I. For the School Word Set, is there a significant difference in total rating score means between the normal achieving and high achieving children?

The results of a Newman-Keuls test failed to reveal a significant difference between the normal achieving ($M = 48.33, SD = 6.99$) and high achieving ($M = 49.60, 7.08$) children for the School Word Set, $p > .05$.

Question II. For the Play Word Set, is there a significant difference in total rating score means between the normal achieving and
high achieving children?

The results of a Newman-Keuls test did not find a significant difference in total rating score for the Play Word Set between the normal achieving (M = 53.13, SD = 5.54) and high achieving (M = 51.87, SD = 6.39) children, p > .05.

Question III. For the normal achieving children, is there a significant difference between total rating scores for the School Word Set and the Play Word Set?

Although the mean total rating scores indicate that the normal achieving children responded more favorably to the Play Word Set (M = 53.13, SD = 5.45) than to the School Word Set (M = 48.33, SD = 6.99), a Newman-Keuls test applied to the means did not find the difference significant, p > .05.

Question IV. For the high achieving children, is there a significant difference between total rating scores for the School Word Set and the Play Word Set?

Results of a Newman-Keuls test comparing the total rating score means of the high achieving children on the School Word Set (M = 49.60, SD = 7.08) and the Play Word Set (M = 51.87, SD = 6.39) did not indicate a significant difference, p > .05.

Summary of Results

Analysis of variance results. In summary, the repeated measures ANOVA and associated follow-up tests showed that the groups of children, learning disabled, normal achieving, and high achieving, did not differ
from each other in the attitude they expressed toward the play-related words. Significant differences were found for the school-related words, however, with the learning disabled children expressing a less positive attitude than either the normal achieving or high achieving children, who did not significantly differ from one another in the attitudes they expressed.

Results of comparisons for hypotheses and questions. Results of comparisons for hypotheses and questions of Experiment 1 are summarized in Table 6 (see Table 6).
Table 6
Summary of Results for Hypotheses and Questions Related to Experiment 1

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>a priori method (2-tailed t-test)</th>
<th>post hoc method (Newman-Keuls)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. (supported) LD's expressed a significantly less positive attitude toward the school-related words than did the NA's.</td>
<td>$t(24.9) = 2.06, p = .05$</td>
<td>--</td>
</tr>
<tr>
<td>II. (supported) LD's did not express a significantly different attitude toward the play-related words than did the NA's.</td>
<td>$t(27.5) = 0.39, p &gt; .05$</td>
<td>--</td>
</tr>
<tr>
<td>III. (supported) LD's expressed a significantly less positive attitude toward the school-related words than toward the play-related words.</td>
<td>--</td>
<td>$p &lt; .05$</td>
</tr>
</tbody>
</table>

Questions

I. NA's did not express a significantly less positive attitude toward the school-related words than HA's. | -- | $p > .05$ |

II. There was no significant difference in the attitude expressed by NA's and HA's toward the play-related words. | -- | $p > .05$ |

III. NA's did not express a significantly less positive attitude toward the school-related words than toward the play-related words. | -- | $p > .05$ |

IV. There was no significant difference in the attitude expressed by HA's toward the school- and the play-related words. | -- | $p > .05$ |
EXPERIMENT 2

Experiment 2 was designed to test the second conceptual hypothesis outlined in Chapter III, namely, that emotional-motivational (or attitudinal) differences between learning disabled and non-learning disabled children can be used to help explain their performance differences on measures of sustained attention. In order to investigate this hypothesis, modifications of the Continuous Performance Test (CPT), one with school-related words as task stimuli and the other with play-related words, were given to 29 learning disabled (LD), 30 normal achieving (NA), and 30 high achieving pupils.

The previous chapter described the sample from which children for the second as well as the first experiment were assigned. This chapter describes the tasks and procedures used in Experiment 2, and presents the experimental hypotheses, questions, results of the study.

Methods

The design of the second experiment was a 3 X 2 X 4 factorial, with children randomly assigned to either of two treatment groups and repeated measures on the last factor (see Figure 2). The first factor was classification group, LD, NA, and HA. The second factor was type of treatment, and consisted of two versions of the Continuous Performance Test (CPT): one with a set of school-related words as task
<table>
<thead>
<tr>
<th>Type Task</th>
<th>Classification Group</th>
<th>Trials</th>
</tr>
</thead>
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<tr>
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<td>Learning Disabled</td>
<td></td>
</tr>
<tr>
<td>Version</td>
<td>(LD)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal Achieving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(NA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High Achieving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(HA)</td>
<td></td>
</tr>
<tr>
<td>Play Stimuli</td>
<td>Learning Disabled</td>
<td></td>
</tr>
<tr>
<td>Version</td>
<td>(LD)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal Achieving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(NA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High Achieving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(HA)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. Diagram of the Lindquist Type III mixed design used in Experiment 2.
stimuli (School Stimuli Version) and the other with a set of play-related words as task stimuli (Play Stimuli Version). The third factor, trials, involved four repetitions of the series of 100 words used in either version of the attention task.

**Experimental Task and Apparatus**

The tasks used to measure the relative attentional performance of the classification groups in Experiment 2 are modifications of the Continuous Performance Test. The CPT was developed by Rosvold, Mirsky, Sarason, Bransome, and Beck (1956) to compare the attentional abilities of brain-damaged and non-brain-damaged, normal and mentally retarded children and adults. Designed as an improvement over traditional measures of attention, such as the Digit Span and Digit Symbol sub-tests, the CPT differs from them in that it requires a high level of continuous attention over time, does not allow the individual to choose his/her own time to respond, and thus does not allow the individual having momentary lapses in attention time to compensate by working rapidly between lapses. Since the CPT was first developed, the original format or its several modifications have been used to assess the sustained attention abilities of a number of different population groups, including normal, brain-damaged, mentally retarded, schizophrenic, hyperactive, and learning disabled children and/or adults.

**Design of the CPT.** Rosvold et al. designed two versions of the task, one labeled X and one labeled AX. The testing apparatus consisted of a revolving drum on which two series, each of 31 letters, were mounted side by side. One series served for the X task, the other
for the AX task. The drum revolved slowly, approximately twice a minute, in a boxlike case equipped with a visor through which the individual was required to look. The letters were illuminated briefly one at a time. The individual performed by pressing a response key whenever the significant stimulus was presented. The letters came into view at approximately 0.92 second intervals. A response was scored as correct if the response key was pressed within 0.69 seconds after the illumination of the significant stimulus. Correct and incorrect responses were recorded automatically on a set of counters facing the back of the machine where the experimenter sat. The X task consisted of eight X's in a series of 31 letters. The length of the task was either 5 minutes (10 repetitions of the series) or 10 minutes (20 repetitions of the series). The AX task consisted of six AX sequences among a series of 31 letters. Like the X task, either of two time periods, 5 or 10 minutes were used.

Modifications of the CPT. Various modifications of the CPT tasks and apparatus have been used in different studies. Some of the major changes have involved (1) the use of different task stimuli, (2) variations in task duration, and (3) an auditory mode presentation. As stimuli for one version of the task, Sykes, Douglas, Weiss, and Minde (1971) used seven geometric shapes in one of five colors, with a red triangle as the significant stimulus. Mirsky and Rosvold (1963) varied the task length by having subjects perform over a period of 15 minutes, while Sykes et al. (1971) modified task duration by employing two different interstimulus intervals, 1.0 second and 1.5 seconds. Auditory versions of the CPT, with the stimuli recorded on tape and played
through earphones, were used by Sykes, Douglas, and Morgenstern (1972) and Mirsky and Rosvold (1963).

Tasks used in the present study. The two tasks, School Stimuli Version and Play Stimuli Version, used in Experiment 2 most closely resemble the auditory mode modification of the CPT employed by Sykes et al. (1972). The stimuli for the School Stimuli Version were the 12 school-related words of the attitude questionnaire of Experiment 1 while the stimuli for the Play Stimuli Version were the 12 play-related words. All 24 stimulus words were one syllable long to control for task length and comparability.

For each task the stimuli were aurally presented, one at a time, with an interstimulus interval of 1.5 seconds. The significant stimulus which the child was asked to respond to on the School Stimuli Version was the word "test", while the significant word to be responded to on the Play Stimuli Version was the word "toy". The words "test" and "toy" were chosen as the significant stimuli for their respective tasks because they were judged as representative of the stimuli in their tasks with respect to word meaning, yet similar to each other in terms of sound characteristics. The criteria established for selection were employed to minimize the possibility that children might orient differently to stimulus words depending on the particular sound quality they have when spoken, the length of time it takes to comprehend their meaning, and the relationship they bear to their respective tasks.

For each version of the task, a practice set of words was presented. For the practice set, the 12 stimulus words for either task were randomized over a series of 25, within the restriction that 5 were
the significant stimulus. The actual task followed the practice set and consisted of 12 school-related words and 12 play-related words randomized over a series of 100, within the restriction that 15 were the significant stimulus. The series was repeated for the School Stimuli Version and the Play Stimuli Version 4 times, which meant that for each task there were 60 occasions for correct responding. Total time for administering either practice set was approximately 1 minute; the actual tasks, School Stimuli Version or Play Stimuli Version, lasted approximate 16 minutes.

Three types of errors were scored and summed in order to obtain a total error score for each child. The errors identified were:
(1) errors of omission, (2) late response errors, and (3) errors of commission. An error of omission was scored when the child failed to respond to a significant stimulus before the onset of the next stimulus. A late response error was scored when a response was made simultaneously with the onset of the stimulus word immediately following the significant stimulus. An error of commission was scored when the child made a response following any stimulus other than the significant one.

Apparatus used in the present study. The apparatus used to present the School Stimuli Version and Play Stimuli Version modifications of the CPT was designed to be portable so that it could be moved to the several experimental sites easily. It consisted of:

(1) a 24" by 24" by 18" (HWD) cardboard study carrel (by Ideal, available from Lakeshore Curriculum Materials Company, Los Angeles, CA, Catalog Number ID6259);
(2) two portable cassette tape recorders with built-in microphones (a GE 3-5091A and a Panasonic RQ309AS);

(3) a 5 3/8" by 2 3/4" (HWD), high-impact molded plastic, Morse Code Practice Oscillator with a key, lamp, 2 inch speaker, and controls for tone, lamp, and pitch (by Realistic, available from Rasio Shack, Fort Worth, Texas, Catalog Number 20-005);

(4) a set of lightweight stereo headphones with adjustable headbands (Pioneer SE-2);

(5) a stereo-to-mono headphone adapter (by Archer Electronic Parts, available from Radio Shack, Catalog Number 274-361);

(6) four TDK C-60, low-noise recording cassettes, each presenting one of the four stimulus sets, Practice-School Stimuli Version, Practice-Play Stimuli Version, Task-School Stimuli Version, and Task-Play Stimuli Version; and

(7) forty-five blank Concertape recording cassettes with 30 minutes recording time on each of two sides (available from Radio Shack, Catalog Number 44-607).

The study carrel was used to minimize visual distractions, and was positioned at the edge of a flat table or desk in front of the chair where the child sat. The Morse Code Practice Oscillator served as the response box, and was centered inside the carrel approximately five inches from the edge. The key of the oscillator served as the child's response key, and was set to emit a relatively low frequency tone when pressed. The two tape recorders were positioned outside the child's view immediately to the left of the carrel, side by side and with the button's facing outward so that they could easily be controlled.
by the experimenter. The GE recorder was used to play the four low-
noise TDK tapes on which the stimuli were recorded; while the Panasonic
recorder was used to record each child's responses and the actual
stimuli presentation as they occurred. Either side of one of the 45
blank Concertape 60 cassettes was used for each of the recordings.
Attached to the GE recorder were the stereo headphones through which
each child listened to the stimuli presentation. An adapter was used
to connect the headphones to the recorder so that the headphones could
be used with the monaural-type recorder. The TDK low-noise tapes
and the stereo headphones were selected and used for the purpose of
reducing ambient noise and in order to provide a reasonably uniform,
high quality presentation of the tasks. To maximize comfortability for
each child, the headphones were lightweight and had an adjustable head-
band and an open-air type construction designed to reduce fatigue.

Development and preparation of tapes. The four tapes, Practice-
School Stimuli Version, Practice-Play Stimuli Version, Task-School
Stimuli Version, and Task-Play Stimuli Version, were developed specifi-
cally for the study by the experimenter with the aid of a sound techni-
cian. Each of the 24 stimulus words on the two modifications of the
was spoken a minimum of five times into a Revox Att tape recorder by
the experimenter, an adult female. The sound technician recorded the
words at a speed of 15 inches per second on Ampex 456 Grand Master

1The assistance of Mark Burns, Sound Technician, Department
of Psychology, University of California, Los Angeles, in preparing the
tapes is acknowledged.
Tape. Each word was passed through a UREI537 1/3 octave monographic equalizer to make up for deficiencies in voice characteristics (e.g., hisses, sibilants, nasal quality).

Following this, one recording of each of the 24 stimulus words was selected for the master tape from which the stimulus tapes were produced. Three adult judges selected which recording of a stimulus to use based on the following criteria: (1) clarity, (2) uniformity of speech pattern, and (3) uniformity of sound level.

Selected words were then duplicated the number of times each appeared in the practice set and the first series of either version of the task. Words were ordered in the manner shown in Appendix B, for the School Stimuli Version of the task and in Appendix C, for the Play Stimuli Version (see Appendixes B and C). So that exactly 1.5 seconds would occur between the presentation of one word stimulus and the next, the sound technician cut and spliced the stimulus words with a 19 by 3 centimeter of paper leader tape.

The tape was then run through an MXR, dBxII Format noise reduction unit to reduce ambient noise, and the sound level for each stimulus word was adjusted within a range of two decibels from 0.00 so that each word would sound equally loud to the human ear.

The final phase of the tape preparation involved duplicating the first series of the task list three times, and splicing a 19 by 3 centimeter of leader tape between each series so that the presentation of the first stimulus word in a new series would occur 1.5 seconds after the last stimulus word in the previous series. This meant that there was no interruption of the task between series presentations.
As a last step each of the four sets of stimulus words, Practice-School Stimuli Version, Practice-Play Stimuli Version, Task-Play Stimuli Version, were reproduced from the master tape onto a separate TDK 60 low-noise cassette tape.

Procedures

Thirty children from each classification group, LD, NA, and HA, were randomly assigned to either the School Stimuli Version condition or Play Stimuli Version condition of Experiment 2. A total of 89 children participated in the experiment, one less than planned, due to the attrition of one LD child in the School Stimuli Version condition. The practice period for either version of the task took approximately one minute, with the actual task running approximately sixteen minutes. Children were administered the task individually by the experimenter.

As each child was brought to the room where the task was given, the child was asked to make himself/herself comfortable in the chair in front of the experimental equipment. The experimenter then handed the child the earphones, instructed the child to put them on, and assisted the child in making them fit properly.

Following this, the experimenter gave the directions for responding to the task:

Listen carefully. When I start the recorder, you will hear words one at a time. You are to press the key in front of you every time you hear the word test (or toy, depending on which condition the child was assigned to). Don't press for any other word and always press it when you hear the word test/toy.

In order to make sure the child understood the directions, the experimenter then said, "Do you think you can remember what to do?" The
experimenter answered any questions the child had, and said, "I'm going to let you practice a little."

Pointing to the response key, the experimenter said, "First press the key down for a bit. Don't hit it too quickly or hold it for too long." If the child hit the response key correctly, the experimenter said, "Yes, that's fine." If the child did not hit the response key in the manner instructed, the experimenter said, "No, like this," demonstrating the correct way, and then asked the child to try again.

Next the experimenter said, "Now I'm going to let you practice with the recorder on." While turning on the recorder, the experimenter said, "Press the key every time you hear the word test/(toy)." If the child failed to respond at once to any of the five significant stimuli on the practice list, the experimenter cued the child by raising her eyebrows or pointing to the response key.

After the practice list was presented, the experimenter turned off the recorder and said, "Now, do you think you understand what you're to do?" Questions asked by the child were then answered, and as the recorder presenting the stimuli was turned on simultaneously with the recorder which recorded the child's responses, the experimenter repeated the directions: "Press the key every time you hear the word test/(toy). Don't press it for any other word and always press it when you hear the word test/(toy)."

During the course of the actual task presentation, the experimenter sat at a table or desk removed from the view of the child. After the task ended, the experimenter got up, turned off the recorder, and assisted the child in removing the earphones. While rewinding the
presentation tape, the experimenter informally attempted to engage the child in conversation about the task. No attempt was made to ask each child the same questions, and those asked depended in large part on the child's willingness to answer them. Nevertheless, questions asked by the experimenter tended not to vary greatly from the following. (1) "How do you think you did?" (2) "Was it hard?" (3) "Did you miss any?" If the child said "Yes," (4) "How many?" and (5) "How did you happen to miss those?" If the child said "No," (6) "How did you happen to get them all right?" (7) "Was it hard to keep listening all that time?" (8) "What did you do to keep yourself listening, to keep your mind from wandering or thinking of something else?" (9) "Was it fun?"

In conclusion, each child was asked if he or she had any questions. The experimenter answered the child's questions, thanked the child for his/her help with the study, and asked the child not to tell other participating children about the task.

Experimental Hypotheses and Questions

Experimental Hypotheses

Based on the results of Experiment 1 and the attentional tasks developed to address the second conceptual hypothesis of the study, the following experimental hypotheses:

Hypothesis I. Learning disabled children in the school task condition will make significantly more total errors than learning disabled children in the play task condition.
Hypothesis II. There will be no significant difference in the total errors made by normal achieving children in the school task condition and normal achieving children in the play task condition.

Hypothesis III. There will be no significant difference in the total errors made by high achieving children in the play task condition.

Hypothesis IV. Learning disabled children in the school task condition will make significantly more total errors than normal achieving children in the school task condition.

Hypothesis V. There will be no significant differences in the total errors made by learning disabled children in the play task condition and normal achieving children in the play task condition.

Hypothesis VI. There will be no significant differences in total errors made between normal and high achieving children in either the school or play task conditions.

Questions

In order to more fully understand the effects of the experimental conditions on the different subgroups, the following questions were asked:

Question I. Is the trend of performance across the four trials the same for all six subgroups?

Question II. Between the six subgroups, what differences exist, if any, in types of errors made, i.e., omission, commission, late response?
Results

In Experiment 2 the measure used to evaluate sustained attention was total errors. Total errors consisted of omission, commission, and late response errors summed over each of the four task trials. Table 7 presents the means and standard deviations for total errors according to Classification Group, learning disabled, normal achieving, and high achieving, and Type Task, School Stimuli Version and Play Stimuli Version (see Table 7).

As in Experiment 1, results of an analysis of variance are presented first in order to provide an overall picture of the effects of the experimental conditions on the dependent measure. The repeated measures ANOVA for the present experiment reveals the effects of Classification Group and Type Task on (1) overall attention performance and (2) attention performance over trials.

As in Experiment 1, two-tailed t-tests were used to evaluate the orthogonal comparisons called for by the hypotheses of the experiment. However, while the groups in Experiment 1 were equal in size, one group in the present experiment was short a subject, therefore, instead of Newman-Keuls tests, the Scheffé method, which is less affected by unequal group sizes, was used to perform the post hoc and nonorthogonal comparisons.

Repeated Measures Analysis of Variance and Associated Follow-up Tests

Total errors were analyzed using a 3 X 2 X 4 (Classification Group X Type Task X Trials) analysis of variance with repeated measures on
Table 7
Means and Standard Deviations for Total Errors

<table>
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<tr>
<th>Classification Group</th>
<th>Type Task</th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
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<td>Play Stimuli Version</td>
<td>Total Version</td>
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<td>29</td>
<td></td>
</tr>
<tr>
<td>Normal Achieving (NA)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>1.73</td>
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<tr>
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<td>4.22</td>
<td>4.22</td>
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<td></td>
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<tr>
<td>High Achieving (HA)</td>
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<td>M</td>
<td>0.20</td>
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</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>4.20</td>
<td>4.41</td>
<td>4.30</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>9.56</td>
<td>7.73</td>
<td>6.56</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>45</td>
<td>45</td>
<td>89</td>
<td></td>
</tr>
</tbody>
</table>
the last factor. Results of the ANOVA are summarized in Table 8 (see Table 8).

With the significance level for $F$ values resulting from the ANOVA set at .05, significance was found for the main effect of Classification Group, $F(2,83) = 14.59, p < .001$. No significant difference was found for the main effect of Type Task, $F(1,83) = 0.05, p > .05$. And, while a tendency for the classification groups to respond differentially to the tasks was suggested by the $F$ value for Classification Group X Type Task, the level required for statistical significance was not reached, $F(2,83) = 2.56, p = .08$.

As can be seen in the bottom half of Table 8, results of the repeated measures ANOVA did not reveal a significant difference for Trials, $F(3,249) = 0.33, p > .05$, indicating that significantly more total errors were not made as a function of time on task. In addition, the Trials X Classification Group, $F(6,249) = 0.87, p > .05$, and Trials X Type Task, $F(3,249) = 2.05, p > .05$, interactions were not significant. However, significance was found for the higher-order Trials X Classification Group X Type Task interaction, $F(6,249) = 2.89, p < .01$.

The effects associated with the two significant $F$'s were investigated further. With the significance level set at .10, a post hoc Scheffe test applied to the means for the Classification Group factor indicated that the learning disabled children made significantly more total errors ($M = 8.93, SD = 8.72$) than either the normal achieving ($M = 2.80, SD = 4.22$) or high achieving ($M = 1.33, SD = 2.51$) children,
Table 8
Repeated Measures
Analysis of Variance for Total Errors

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between Subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification (C)</td>
<td>2</td>
<td>117.02</td>
<td>14.59*</td>
</tr>
<tr>
<td>Task (T)</td>
<td>1</td>
<td>0.40</td>
<td>0.05</td>
</tr>
<tr>
<td>C X T</td>
<td>2</td>
<td>20.51</td>
<td>2.56a</td>
</tr>
<tr>
<td>Error between</td>
<td>83</td>
<td>8.02</td>
<td>--</td>
</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trials (Tr)</td>
<td>3</td>
<td>0.97</td>
<td>0.33</td>
</tr>
<tr>
<td>Tr X C</td>
<td>6</td>
<td>2.59</td>
<td>0.87</td>
</tr>
<tr>
<td>Tr X T</td>
<td>3</td>
<td>5.08</td>
<td>2.05</td>
</tr>
<tr>
<td>Tr X C X T</td>
<td>6</td>
<td>8.57</td>
<td>2.89**</td>
</tr>
<tr>
<td>Error within</td>
<td>249</td>
<td>2.97</td>
<td>--</td>
</tr>
</tbody>
</table>

*p < .001
**p < .01
*a p = .08
p < .10, while the latter two groups did not significantly differ from one another, p > .10.

The findings relating to the Classification Group effect are complicated, however, by the significant higher-order interaction effect which indicates that the performance of at least two of the subgroups was differentially affected by the unique combination of the classification group to which they were assigned, the type of attention task they were given, and the specific trial at which their performance was evaluated. Further study of the three-way interaction effect was therefore required in order to accurately interpret the effects of the experimental conditions on the performances of the various groups of children.

To assist in clarifying the nature of the three-way interaction, the pattern of mean total errors over each of the four trials was graphically illustrated according to Classification Group and Type Task (see Figure 3). Inspection of the graphs strongly suggests that during the first half of the experiment the results were as predicted.

The graph for the learning disabled subgroups indicates that for Trials 1 and 2, the learning disabled children showed regular and expected differences across the school and play task stimuli--children in the school task condition making more total errors than children in the play task condition. By the third trial, however, the graph reveals a partial reversal of the effect--total errors decreasing for children in the school task condition, while increasing for children in the play task condition. And, by the fourth trial, the reversal
Figure 3. Total error score means over the four trials by subgroups.
appears complete—children in the school task condition now actually making fewer total errors than children in the play task condition.

As expected, subgroup differences over trials between the normal achieving subgroups or between the high achieving subgroups were not as dramatic as those shown by the learning disabled subgroups. Although the graph for the normal achieving children indicates that over the first three trials normals in the school task condition made fewer total errors than normals in the play task condition, and then on the last trial reversed their position by making slightly more errors, the total number of errors made by either subgroup was still relatively small.

Similarly, the graph for the high achieving children shows that relatively few total errors were made by either subgroup of high achievers. However unlike the normal achieving subgroups, and in sharp contrast to the learning disabled subgroups, the performance patterns of the high achieving subgroups appear to parallel one another across the trials. Examination of Figure 3 reveals an almost errorless performance over each trial for high achieving children in the school task condition, while an equally consistent performance, although with slightly more errors per trial, can be seen for high achievers in the play task condition.

Since the graphs of the significant higher-order interaction suggested that the learning disabled children responded differentially to the two tasks over the first but not second half of the experiment, and inasmuch as the normal achievers and high achievers seemed to be fairly consistent regardless of task or trial, statistical analyses of
the interaction effect were separately performed for data from the first and second halves of the experiment. One analysis of variance was used to analyze the data from Trial 1 + Trial 2 (the first half of the experiment), while the second ANOVA was used to analyze the data from Trial 3 + Trial 4 (the second half of the experiment). Results of the two ANOVA's are summarized in Tables 9 and 10 (see Tables 9 and 10).

The pattern of differences observed in the graphs were verified by the results of the analyses. With the significance level set at .05, analysis of variance results for the first half of the experiment yielded, a significant Classification Group effect, $F(2,83) = 8.88, p < .001$, and, more importantly, the expected interaction effect for Classification Group X Type Task, $F(2,83) = 6.30, p < .005$.

Given the significant interaction effect for Classification Group X Type Task, the main effect for Classification Group was not further analyzed. The significant interaction effect was further analyzed using $F$-tests for simple main effects. Results of the $F$-tests indicated that while the classification groups did not significantly differ in total errors made on the Play Stimuli Task, $F(2,41) = 1.05, p > .05$, they did significantly differ in total errors made on the School Stimuli Task, $F(2,42) = 10.03, p < .001$.

In order to determine which of the classification groups differed from one another a Scheffé follow-up test was applied to the means for the School Stimuli task. The results indicated that the learning disabled children ($M = 5.00, SD = 6.58$) made significantly more total
Table 9
Analysis of Variance Results
Over First Half (Trial 1 + Trial 2)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification (C)</td>
<td>2</td>
<td>43.89</td>
<td>8.88*</td>
</tr>
<tr>
<td>Tasks (T)</td>
<td>1</td>
<td>1.05</td>
<td>.21</td>
</tr>
<tr>
<td>C X T</td>
<td>2</td>
<td>31.15</td>
<td>6.30**</td>
</tr>
<tr>
<td>Error</td>
<td>83</td>
<td>4.94</td>
<td></td>
</tr>
</tbody>
</table>

*p < .001  
**p < .005

Table 10
Analysis of Variance Results
Over Second Half (Trial 3 + Trial 4)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification (C)</td>
<td>2</td>
<td>75.40</td>
<td>10.54*</td>
</tr>
<tr>
<td>Tasks (T)</td>
<td>1</td>
<td>3.69</td>
<td>.52</td>
</tr>
<tr>
<td>C X T</td>
<td>2</td>
<td>1.23</td>
<td>.17</td>
</tr>
<tr>
<td>Error</td>
<td>83</td>
<td>7.16</td>
<td></td>
</tr>
</tbody>
</table>

*p < .001  
**p < .05
errors than either the normal achieving (M = 0.60, SD = 0.99) or high achieving (M = 0.13, SD = 0.35), \( p < .10 \); while the mean total errors for the normal and high achieving children did not significantly differ, \( p > .10 \).

Scheffé tests were further used to compare the performance of each of the various groups across the school and play task conditions. Results indicated that learning disabled children in the school task condition (M = 5.80, SD = 6.58) made significantly more total errors than learning disabled children in the play task condition (M = 2.14, SD = 2.18), \( p < .10 \). However, while the means show that (1) normal achievers in the school task condition (M = 0.60, SD = 0.99) made fewer total errors than normal achievers in the play task condition (M = 2.27, SD = 2.63), and (2) high achievers in the school task condition (M = 0.13, SD = 0.13) made fewer total errors than high achievers in the play task condition (M = 1.20, SD = 1.70), neither difference was found to be significant (\( p > .10 \), in each case).

Results of the ANOVA performed on data from the second half of the experiment (Trial 3 + Trial 4) provided additional verification of the relationships observed in Figure 3. With the significance level set at .05, only the main effect for Classification Group was found to be significant, \( F(2,83) = 10.54, p < .001 \).

As expected, a Scheffé follow-up test applied to the classification group means indicated that during the second half of the experiment, the learning disabled children (M = 4.90, SD = 2.70) made significantly more total errors than either the normal achieving (M = 1.37, SD = 2.54) or the high achieving children (M = 0.67, SD = 1.06),
p < .10, regardless of type task. The normal achieving and high achieving children did not significantly differ from one another, p > .10.

Results of Comparisons for Hypotheses

Reported below are the results of comparisons for the hypotheses of Experiment 2. Two-tailed t-tests were used to evaluate the orthogonal comparisons, while Scheffe tests were used to evaluate the non-orthogonal comparisons. The significance level for t-tests was .05. As recommended by Scheffe (1959), the significance level for Scheffe tests was .10.

Hypothesis I. Learning disabled children in the school task condition will make significantly more total errors than learning disabled children in the play task condition.

Although, as predicted, the learning disabled children in the school task condition made more total errors (M = 10.67, SD = 9.62) than the learning disabled children in the play task condition (M = 7.07, SD = 7.55), the difference was short of statistical significance, t(26.3) = 1.12, p > .05.

Hypothesis II. There will be no significant difference in the total errors made by normal achieving children in the school task condition and normal achieving children in the play task condition.

As expected, t-test results did not reveal a significant difference between the normal achieving children in the school task condition (M = 1.73, SD = 4.07) and normal achieving children in the play task.
condition (M = 3.87, SD = 4.22), t(28) = 1.41, p > .05.

**Hypothesis III.** There will be no significant difference in the total errors made by high achieving children in the school task condition and high achieving children in the play task condition.

Results of the t-test indicated a significant difference, t(14.5) = 2.74, p = .02, contrary to expectation. High achieving children in the school task condition (M = 0.20, SD = 0.41) made significantly fewer total errors than high achieving children in the play task condition (M = 2.47, SD = 3.18).

**Hypothesis IV.** Learning disabled children in the school task condition will make significantly more total errors than normal achieving children in the school task condition.

As predicted, results of a Scheffé test indicated that learning disabled children in the school task condition (M = 10.67, SD = 7.07) made significantly more total errors than normal achieving children in the school task condition (M = 1.73, SD = 4.07), p < .10.

**Hypothesis V.** There will be no significant differences in the total errors made by learning disabled children in the play task condition and normal achieving children in the play task condition.

As predicted, results of a Scheffé test between the total error means of the learning disabled children in the play task condition (M = 7.07, SD = 7.55) and the normal achieving children in the play task condition (M = 3.87, SD = 4.22) failed to reveal a significant difference, p > .10.
Hypothesis VI. There will be no significant differences in total errors made between normal and high achieving children in either the school or play task conditions.

As predicted, a Scheffe test applied to the means of the normal achieving children in the school task condition (M = 1.73, SD = 4.07), normal achieving children in the play task condition (M = 3.87, SD = 4.22), high achieving children in the school task condition (M = 0.20, SD = 0.41), and high achieving children in the play task condition (M = 2.47, SD = 3.18) failed to reveal significant differences, p > .10.

Results Related to Questions

Question I. Is the trend of performance across the four trials the same for all six subgroup?

The Within-subjects section of the analysis of variance summarized in Table 7 was used to help evaluate Question I. As indicated in the table, a significant Trials X Classification Group X Type Task interaction was found indicating that the trend of performance across the four trials was not the same for all six subgroups.

Figure 4 presents a graph of mean total errors for the six subgroups over the four trials (see Figure 4). Visual analysis of the graph reveals that learning disabled children in the school task condition have the highest and most divergent pattern of total errors across trials. Statistical analyses with the Scheffe test confirm a significant lack of parallelism between the pattern of the learning disabled children in the school task condition and the patterns of the five other subgroups (p < .10). While learning disabled children in the
Figure 4. Total error score means over four trials according to classification group and type task.
play task condition also seem to display a divergent pattern from that of the normals and high achievers, their pattern was not found to differ significantly ($p > .10$). Significant differences among the two normal and two high achieving subgroups were also not found ($p > .10$).

**Question II.** Between the six subgroups, what differences exist, if any, in types of error made, i.e., omission, commission, late response?

Total error scores were derived from three broad categories of errors, namely, omission, i.e., failure to respond to the significant stimulus prior to the onset of the next stimulus, commission, i.e., a response to a nonsignificant stimulus, and late response, i.e., a response to a significant stimulus coincident with the onset of the next stimulus. Table 11 presents the means and standard deviations for the three types of errors according to Classification Group and Type Task (see Table 11).

In order to determine whether there were any differences in types of errors made among the six subgroups, a 3 X 2 (Classification Group X Type Task) multivariate analysis of variance was conducted, with the dependent measure being omission, commission, and late response errors summed across the four trials of the task. This analysis indicated that there were significant differences among Subject Classification Group, $F(6,160) = 6.17, p < .001$, but no significant difference for either Type Task, $F(3,81) = 0.66, p > .05$, or the Classification Group X Type Task interaction, $F(6,160) = 0.92, p > .05$.

Separate univariate analyses were used to study the significant Classification Group effect. These analyses indicated that significant
Table 11
Means and Standard Deviations for Omission, Commission and Late Response Errors According to Classification Group and Type Task

<table>
<thead>
<tr>
<th>Group</th>
<th>Task</th>
<th>Omissions</th>
<th>Late Responses</th>
<th>Commissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD</td>
<td>School</td>
<td>5.00</td>
<td>0.60</td>
<td>5.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.97)</td>
<td>(1.12)</td>
<td>(7.77)</td>
</tr>
<tr>
<td>LD</td>
<td>Play</td>
<td>3.86</td>
<td>0.64</td>
<td>2.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.74)</td>
<td>(0.93)</td>
<td>(5.98)</td>
</tr>
<tr>
<td>NA</td>
<td>School</td>
<td>0.67</td>
<td>0.00</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.98)</td>
<td>(0.00)</td>
<td>(3.59)</td>
</tr>
<tr>
<td>NA</td>
<td>Play</td>
<td>2.27</td>
<td>0.20</td>
<td>1.40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.76)</td>
<td>(0.41)</td>
<td>(2.10)</td>
</tr>
<tr>
<td>HA</td>
<td>School</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.26)</td>
<td>(0.26)</td>
<td>(0.26)</td>
</tr>
<tr>
<td>HA</td>
<td>Play</td>
<td>1.27</td>
<td>0.33</td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.33)</td>
<td>(0.62)</td>
<td>(1.73)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2.17</td>
<td>0.30</td>
<td>1.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.32)</td>
<td>(0.70)</td>
<td>(4.56)</td>
</tr>
</tbody>
</table>

Note. Standard deviations are shown in parentheses below their respective means.
differences occurred between the learning disabled, normal achieving, and high achieving groups for all three types of errors. Univariate F values were 13.74 for omission errors ($p < .001$), 4.71 for commission errors ($p < .02$), and 4.97 for late response errors ($p < .01$).

Inspection of the data as well as Duncan's multiple range tests (alpha = .05) showed that the learning disabled group made significantly more of each kind of error than either the normal achieving or high achieving groups, which did not significantly differ from one another.

**Summary of Results**

**Analysis of variance results.** In summary, the repeated measures ANOVA and associated follow-up tests performed on a measure (total errors) of sustained attention showed that the performance of the learning disabled children was influenced by the unique combination of the type of task they were given, School Stimuli or Play Stimuli Version, and the specific time at which their performance was examined, after Trials 1 and 2 or after Trials 3 and 4. More specifically, the results indicated that while the normal achieving and high achieving children maintained rather consistent sustained attention regardless of task or trial, the learning disabled children were influenced by both. On the first half of the task the learning disabled children in the play task condition performed as well as normal and high achieving children in the play task condition, although learning disabled children in the school task condition failed to perform as well as normal and high achievers in the school task condition.
The differential effects of task type was indicated by the results from the first half of the task. While the performance of the normal and high achieving children, regardless of task conditions, was remarkably stable throughout the course of the experiment, learning disabled children in the play task condition performed as well as normal and high achievers during the first half of the task (Trials 1 and 2), but significantly poorer than both groups during the second half (Trials 3 and 4).

The differential effect of trials was shown by a comparison of the results from the first half of the task with results from the second half.

A comparison of the findings of the ANOVA’s for the first and second halves of the experiment indicate the effects of the trials. During the first half of the task (Trials 1 and 2), learning disabled children in the play task condition performed as well as normal and high achievers, but significantly poorer than both groups during the second half (Trials 3 and 4). The performance of normal achieving children and high achieving children, on the other hand, was remarkably consistent over all the trials, regardless of task conditions.

Results of comparisons for hypotheses and questions. Results of comparisons for the hypotheses of Experiment 2 are summarized in Table 12 (see Table 12).

Results related to the first question of the experiment indicated that the trend of performance for all six subgroups was not the same; learning disabled children in the school task condition had the highest
<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>a priori method (2-tailed t-test)</th>
<th>post hoc method (Scheffé)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. (not supported) LD's in the school task condition did not make significantly more total errors than LD's in the play task condition.</td>
<td>$t(26.3) = 1.12, \ p &gt; .05$</td>
<td>--</td>
</tr>
<tr>
<td>II. (supported) NA's in the school task condition did not make significantly more total errors than NA's in the play task condition.</td>
<td>$t(28) = 1.41, \ p &gt; .05$</td>
<td>--</td>
</tr>
<tr>
<td>III. (not supported) HA's in the school task condition made significantly fewer total errors than HA's in the play task condition.</td>
<td>$t(14.5) = 2.74, \ p = .02$</td>
<td>--</td>
</tr>
<tr>
<td>IV. (supported) LD's in the school task condition made significantly more total errors than NA's in the school task condition.</td>
<td>--</td>
<td>$p &lt; .10$</td>
</tr>
<tr>
<td>V. (supported) LD's in the play task condition did not make significantly more total errors than NA's in the play task condition.</td>
<td>--</td>
<td>$p &gt; .10$</td>
</tr>
<tr>
<td>VI. (supported) There were no significant differences in the number of total errors made by NA's and HA's across the school and play task conditions.</td>
<td>--</td>
<td>$p &gt; .10$</td>
</tr>
</tbody>
</table>
and most divergent pattern of errors, while learning disabled children
in the play task condition also appeared to display a divergent pattern
from those of the normal and high achieving subgroups, their pattern
was not found to differ significantly.

Results related to the second question of the experiment indicated
that learning disabled children, regardless of condition, made more
errors of all kinds, i.e., omission, commission, and late response,
than were made by either the normal achieving or high achieving sub­
groups combined.
CHAPTER VI

DISCUSSION OF THE RESULTS

In this chapter a discussion of the results from Experiment 1 will be followed by a discussion of the results from Experiment 2. The findings from both experiments will be considered in terms of the social behavioristic analysis of the sustained attention deficit of learning disabled children presented in Chapter III, and in relation to the findings from other studies.

Experiment 1

In Experiment 1 a questionnaire was developed in order to compare the attitudes of learning disabled, normal achieving, and high achieving children on two sets of words, one school-related and the other play-related. Three experimental hypotheses were formulated in order to investigate the first of two conceptual hypotheses proposed in Chapter III, namely, that learning disabled children differ from normal achieving children in their emotional-motivational personality characteristics, with learning disabled children having a less positive attitude toward school-related stimuli. Also addressed by the experiment were four exploratory questions.

Experimental Hypotheses

Because learning disabled children, by definition, have a history of school learning failures and normal children do not, the first
prediction of the study was that learning disabled children would express a less positive attitude toward the school-related words of the questionnaire than would normal achieving children. This prediction was supported.

The second prediction of the study was that there would be no difference between learning disabled and normal achieving children in attitudes expressed toward the questionnaire's play-related words. Since the academic problem of learning disabled children would not necessarily be expected to extend into the area of play, it seemed reasonable to expect that the learning disabled children would not differ from the normal achieving children in attitudes expressed toward the play-related words. This prediction was also supported.

Following the line of reasoning stated above, the third prediction of the study was that learning disabled children would express a less positive attitude toward the school-related words of the questionnaire than toward the play-related words. This prediction, too, was supported.

Beyond providing support for the three experimental hypotheses of the study, these results yielded information relevant to a number of other concerns. First, the finding that learning disabled children expressed a significantly different, i.e., less positive, attitude toward the school-related words than toward the play-related words provided empirical support for the questionnaire's validity as a measure of two separate and distinct classes of stimuli, school and play.

Second, the findings relating to the hypothesis that learning disabled children would have a significantly lower total rating score
for the School Word Set than normal achieving children supported the earlier findings of Guthery (1971), who found educationally handicapped children to express a more negative attitude than normal children on all three dimensions of the Burks’ School Attitude Survey: (1) attitude toward teacher, (2) attitude toward school in general, and (3) attitude toward academic subjects.

Third, and most importantly, the findings relating to all three experimental hypotheses provide support for the social behavioristic view, proposed in Chapter II, that learning disabled children may be conceptualized as having deficit and/or inappropriate attitudinal responses to school-related stimuli—an emotional-motivational personality characteristics usually present in normal achieving children.

**Exploratory Questions**

In order to make specific predictions regarding the performances of normal achieving and high achieving children on the attentional tasks used in Experiment 2, Experiment 1 posed four exploratory questions designed to yield information about the attitudes of normal achieving and high achieving children toward school- and play-related stimuli.

The concern of the first question was in determining whether there would be a difference between normal achieving and high achieving children in attitudes expressed toward the school-related words of the questionnaire. Results relating to this question indicated that there was not a difference.

Since no previous theoretical or empirical evidence was uncovered to support a prediction that normal achieving and high achieving
children would differ in their attitudes toward school-related stimuli, such an hypothesis was not made. Nevertheless, it is interesting to speculate why the high achieving children—who were selected on the basis of having achieved more academic success than normal achieving children—did not express a more positive attitude toward the school-related words than normal achieving children.

At least three possible explanations for the no difference finding may be suggested. The obvious conclusion is that normal achieving and high achieving children do not differ in their attitudes toward school-related stimuli. Their differences in achievement may not be related to attitudes but rather to other, non-attitudinal factors such as intelligence, study habits, and/or parental demands.

A second possible explanation is that the two groups of children, normal achieving and high achieving, differ in their attitudes toward school-related stimuli, but not on the dimensions measured by the questionnaire used in the present experiment. Stated more specifically, although the questionnaire developed for the present study provided a sufficient basis for discriminating between the school-related attitudes of learning disabled and normal achieving children, it may not have contained items (or words) that could reflect possible attitudinal differences between normal achieving and high achieving children. Such items, for example, might relate to attitudes toward school success, e.g., getting an "A", being the "smartest" in class, and/or academically-related subjects beyond the basic skills level, e.g., science, literature, foreign affairs.
A third possible explanation for the lack of difference finding is that the sample of normal achieving children may have been biased. It may be recalled from Chapter IV that school district policies precluded a truly random sampling procedure. Thus, (1) teachers were asked to identify potential subjects for the normal achieving and high achieving groups of the study on the basis of their academic performance in the classroom; (2) children were then required to obtain parental permission; and (3) from the pool of those receiving parental permission, samples were randomly selected.

One indicator that the resulting sample of normal achieving children may have been biased comes from an analysis of the achievement test scores available on approximately half of the children in both the normal achieving and high achieving groups. The analyses indicated that the children in the high achieving group were indeed high achievers, with mean scores in reading and arithmetic for the group falling in the 80th to 90th percentile ranges. However, the mean achievement scores for children in the normal achieving group were in the mid-60th percentile range, suggesting that their achievement, although not as high as those of the high achieving children, was in the high range of average.

That the selection procedures may have resulted in a biased sample of normal achieving children is not inconsistent with other studies which have relied on teacher judgement in order to select pupil participants. As a number of investigators (e.g., Gallagher, 1975) have indicated, when asked to make decisions regarding the academic abilities of their students, teachers tend to be influenced by other
criteria such as how cooperative the student is and how hard he or she tries. It is suggested that these kinds of students, while achieving within the average, albeit high average, range may be more likely than other normal achieving children to express positive attitudes toward school on a questionnaire such as the one developed for the present investigation.

The concern of the second question of the experiment was in determining whether or not there would be a difference between normal achieving and high achieving children in attitudes expressed toward the questionnaire's play-related words. Again, no theoretical or empirical evidence was found upon which to base 2 prediction that there would be a difference; and none was found.

The third and fourth questions of the experiment were interested in determining whether normal achieving and high achieving children would express a significantly different attitude toward school-related words than toward play-related words. The results relating to the questions indicated that both groups of children expressed a more positive attitude toward the play-related words; however, these differences were not significant in either case.

Unanticipated Outcomes

Experiment 1 also yielded some unanticipated results. One finding that was not anticipated was the variability of the learning disabled group on the school-related words of the questionnaire. Although the learning disabled children were found to differ significantly from the normal children in their attitudinal response to the school-related words, the wide range of their scores and the magnitude of the standard
deviation, indicated that the learning disabled children tended to be more heterogeneous in their attitude than either the normal achieving or high achieving children, with some LD's expressing attitudes directly comparable to those expressed by normal and high achieving children. While this finding was not anticipated in the present experiment, it is not inconsistent with the results of other studies which have revealed learning disabled children to be remarkably heterogeneous on a number of factors (Torgesen, 1978; Wong, 1979b). Moreover, the finding is also consistent with the present conception of learning disabilities which suggests that not all learning disabled children evidence every deficit and inappropriate behavior incorporated into the social behavioristic framework developed in Chapter II; rather the behaviors incorporated into the framework are problems that learning disabled children, as a group, show relative to non-learning disabled children.

The second unanticipated finding of the experiment was that even though the learning disabled children expressed a less positive attitude than the normal achieving children toward the school-related words of the questionnaire, their responses, like those of the other two groups of children, were positively skewed (see Table 3, Appendix D). One possible explanation for this finding may be that the children, including those identified as learning disabled, were responding to a desire to please the investigator and/or present themselves favorably, phenomena that have been observed in adults participating in experiments or responding to self-report questionnaires (Anastasi, 1968). A second possibility is that the children, particularly the learning
disabled children, had a response bias toward the ubiquitous happy face used on the questionnaire to indicate the most positive attitude toward an item. It is relevant to note that the children in the experiment seemed particularly fascinated by this aspect of the questionnaire, often identifying it as "the happy face."

Although it was not unexpected that some of the school-related, or for that matter play-related, words would be responded to more favorably than others, the third unanticipated finding of the experiment was associated with the particular ratings each words would receive. Of most interest in this regard were the attitudes expressed by the learning disabled children toward the school-related words of the questionnaire. A subjective comparison of the words that were responded to most favorably with those responded to least favorably suggested that the less positive attitude that learning disabled children expressed relative to normal achieving children may be linked to a deficit or inappropriate attitude toward stimuli which relate specifically to academic tasks and subjects that may cause them difficulty, e.g., test, work, spell, read, math, rather than to a deficit or inappropriate attitude toward stimuli which are less clearly associated with their school learning problems in that they are related to learning in general, e.g., learn, grade, book, think, or to academic tasks which they have probably already mastered, e.g., add.

Experiment 2

Experiment 2 compared the sustained attention performances of learning disabled, normal achieving, and high achieving children on two
versions of the Continuous Performance Test, one which used school-related words as task stimuli and the other which used play-related words. Six experimental hypotheses were formulated in order to investigate the second of two conceptual hypotheses developed in Chapter III, namely, that differences between learning disabled and normal achieving children in their emotional-motivational personality characteristics can be used to explain their performance differences on tasks typically used to measure sustained attention. Also addressed by the experiment were two exploratory questions.

Experimental Hypotheses

The results relating to four of the six experimental hypotheses tested by Experiment 2 supported the second of the two conceptual hypotheses developed in Chapter III. A discussion of the findings which did not provide support for the conceptual hypothesis will follow a consideration of the findings that were supportive.

Supportive findings. Because learning disabled children almost always perform less well than normal achieving children on versions of the Continuous Performance Test composed of school-related stimuli, and since the learning disabled children in Experiment 1 expressed a less positive attitude than the normal achieving children toward a set of school-related words, the fourth experimental hypothesis of Experiment 2 predicted that learning disabled children would perform less well than normal achieving children on a version of the CPT which used school-related words as task stimuli. This prediction was supported.
The fifth experimental hypothesis of the experiment predicted that there would be no difference between learning disabled and normal achieving children on a version of the CPT composed of play-related words. Since Experiment 1 indicated that learning disabled children and normal achieving children did not differ in their attitude toward a set of play-related words, and in accord with social behaviorism's A-R-D theory which indicate that a child's behavior is, at least in part, determined by the nature of his or her attitudes toward the stimuli in a situation, it seemed reasonable to expect that learning disabled children would not differ from normal achieving children in their performance on a version of the CPT which used play-related words as task stimuli. This prediction, too, was supported.

Also in accord with A-R-D theory, since the normal achieving and high achieving children in Experiment 1 did not differ from each other in attitudes expressed toward either a set of school or play-related words, the sixth experimental hypothesis of Experiment 2 predicted that there would be no significant performance differences between the children on either version of the Continuous Performance Test, the one composed of school-related words or the one composed of play-related words. This prediction was supported.

Again in accord with A-R-D theory, since the normal achieving children in Experiment 1 did not express a significantly different attitude toward a set of school-related words than toward a set of play-related words, the second experimental hypothesis predicted that they would perform equally well on either version of the Continuous
Performance Test, school stimuli or play stimuli version. The results also supported this prediction.

Non-supportive findings. Hypothesis I was the first of two experimental hypotheses which yielded results that were not predicted. The prediction of this hypothesis was that learning disabled children would perform more poorly on a version of the CPT which used school-related words as task stimuli than on a version which used play-related words.

In accord with A-R-D theory, and since the learning disabled children in Experiment 1 expressed a less positive attitude toward a set of school-related words than toward a set of play-related words, this seemed a reasonable prediction to make. The results relating to the hypothesis, however, did not support the prediction. Although learning disabled children in the school task condition made more total errors than those in the play task condition, the difference was short of statistical significance.

One possible explanation for the no difference finding begins with an analysis of the performance trends of the learning disabled children across trials. As reported in Chapter V, over the first half of the task, the performances of the learning disabled children were as expected: Learning disabled children in the school task condition made significantly more total errors than those in the play task condition, indicating that the task stimuli affected their sustained attention performance in the predicted way. Over the last half of the task, however, total errors decreased for the learning disabled children in the school task condition while increasing for those in the play task condition. Taken together, the analyses showed that although task
stimuli had an initial effect on the performance of the learning disabled children, this effect extinguished as a function of time on task.

The above analyses, however, only indicate that a significant difference between learning disabled children in the school and play task conditions was not found since the effect of task stimuli did not continue over the last half of the task. Why the effect extinguished requires clarification. In what follows, A-R-D theory will be used in an attempt to explain why the sustained attention performance of the learning disabled children changed over the course of the task in ways that were not predicted.

As indicated earlier in the dissertation, A-R-D theory suggested that how a child behaves will be a function of the child's emotional-motivational personality characteristics as well as what stimuli are presented in a situation and how they are presented. While the present study focused on the attitudes of the different groups of children toward the stimuli presented on the two versions of the Continuous Performance Test used in this experiment, what was not addressed was their attitude toward other stimuli in the situation, in specific, the nature of the Continuous Performance Test task apart from the stimuli composing it.

In order to understand what the attitudes of the different groups of children may have been toward the CPT, it may be helpful to consider the following. First, in Chapter IV it was indicated that children taking part in the experiment were asked a number of questions relating to the task and their performance on it. One of the questions asked was whether the task was fun. In general, the responses of the children
to this question indicated that they did not consider the task fun. High achieving children often called the task "easy" or "a little boring," normal achieving children usually called it "easy" and indicated they thought they did "o.k.," while learning disabled children often said they "got tired," but that the response box was "fun." It is interesting to note in this regard that as a group the learning disabled children expressed more interest in the experimental equipment than either the normal or high achieving children. Several LD's commented on the earphones and/or played with the response box—often during the course of the experiment. Perhaps the most convincing evidence in support of the idea that the sustained attention performances of the learning disabled children were affected by their attitude toward the CPT comes from an admission from one of the learning disabled children: "I got tired listening to all those words, but it was real fun pressing that key." Parenthetically, it is interesting to note that this particular child made a number of errors of commission.

At any rate, the view proposed here to explain the findings relating to Hypothesis I is that the sustained attention performance of the learning disabled children was affected by their attitude toward the stimuli composing the particular version of the CPT they were given, as well as by their attitude toward the CPT, apart from the stimuli composing it.

While a formal measure of the attitude of learning disabled children toward the CPT was obviously not taken in the present study, if the attitude of the learning disabled toward the CPT was more positive than their attitude toward the school-related words used as task
stimuli and less positive than their attitude toward the play-related words used as task stimuli, then the learning disabled children would show just the results found. To be more specific, if the school-related words of the task have a less positive value for the children than the CPT and the play-related words have a more positive value, the task stimuli would have their effects immediately, as in the first half of the task. Over the trials, however, the performances of the children would be expected to change. In the absence of reinforcement or punishment, the stimuli to which the children had attended would extinguish in both directions, positive and negative. In common-sense terms, the learning disabled children would become bored with the play-related words, as presented by the CPT; while the school-related words, being relatively less attended to already, would be avoided less.

The second of the two experimental hypotheses that was not supported by the results of Experiment 2 was Hypothesis III. Since Experiment I did not show high achieving children to express a significantly different attitude toward the school-related words than toward the play-related words, and in accord with A-R-D theory, it was predicted that the high achieving children in the school task condition would not perform significantly differently than those in the play task condition. Contrary to expectation, the high achieving children who took the school stimuli version of the CPT performed better than the high achieving children who took the play stimuli version.

There are at least two possible explanations for this finding. The first possible explanation is that the attitudes of the high achieving children did not affect their sustained attention performances on the tasks. However, since the high achieving children in the
school task condition performed significantly better than those in the play task condition, and since the tasks did not differ except in terms of the type stimuli presented, school or play, this explanation does not seem plausible.

The second possible and more plausible explanation offered is that high achieving children do differ in their attitudes toward school and play stimuli; however, not on the dimension(s) assessed by the questionnaire used in Experiment 1. That the children performed better on the version of the task which used school-related words as task stimuli may indicate the particular importance they place on performing well on tasks that are viewed as more school-related than play-related.

Support for this explanation may be gleaned from the behavioral observations of high achieving children during the experiment. As reported previously, although a number of high achieving children viewed the task as "easy" or "a little boring," they nevertheless performed well on the task. A few of the children reported that they used a strategy to help them attend to the task. One boy, for example, pretended the response box was a detonator and the significant stimulus word a signal to use it. Other high achieving children made the task more challenging for themselves by pressing the response key as quickly as possible following the presentation of the significant stimulus word.

**Summary of findings.** Given the design of the study, the results relating to the fourth and fifth experimental hypotheses probably provide the most relevant as well as the most convincing evidence in support of the conceptual hypothesis investigated by Experiment 2.
Taken together, the findings from the fourth and fifth hypotheses demonstrated (1) that when LD's and normals differed in their attitudinal responses to the task stimuli, there was a corresponding difference between their sustained attention performances; and (2) that when there was no difference between LD's and normals in their attitudinal responses to the task stimuli, there was no difference between their sustained attention performances.

The results relating to the second experimental hypothesis, which predicted that normal achieving children would perform equally well on either version of the CPT also lent empirical support to the conceptual hypothesis investigated by the experiment, as did the results relating to the sixth experimental hypothesis which predicted that there would be no difference between the normal achieving and high achieving children on either version of the CPT.

The failure to find a significant performance difference between learning disabled children in the school and play task conditions as predicted by Hypothesis I, and the finding of a significant difference between high achieving children in the school and play task conditions contrary to Hypothesis III posed the problem of having to provide a more adequate account of the relationship between attitudes and sustained attention than provided by the conceptual hypothesis developed in Chapter III and investigated by the present experiment.

In attempting to explain the findings relating to the first experimental hypothesis, it was suggested that it is possible that the attitude of the learning disabled children toward other stimuli in the
experimental situation, i.e., the nature of the CPT apart from the
stimuli composing it, was affecting their performance.

In attempting to explain the findings relating to Hypothesis III,
it was suggested that it is possible that the attitude of the high
achieving children toward their academic performance affected their
performance.

**Exploratory Questions**

In order to more fully understand the effects of the experimental
conditions on learning disabled, normal achieving, and learning dis­
abled children, two exploratory questions were formulated by the second
experiment.

The first question was concerned with determining whether the
trend of performance across the four trials of the task would be the
same for all six subgroups of children, learning disabled, normal
achieving, and high achieving, school and play task conditions.

The findings related to the question indicated that the trend of
performance was not the same for all groups, and that the trend for
learning disabled children in the school task condition was the most
deviant.

While no specific hypothesis was made with respect to the perform­
ances of the different groups over the trials of the two tasks, it is
relevant to note that none of the groups appeared to exhibit the kind
of performance decrement typically found in other studies with learning
disabled and normal achieving children (Grassi, 1970; Grais, 1971;
Kupietz, 1976; Sykes et al., 1973).
One possible explanation why the normal and high achieving subgroups failed to show a decline in performance as a function of time may be that the task was too easy for them. It may be recalled that Grais (1971) did not find a performance decrement for either the LD's or normals on the "X" version of the task used in her study, a version which, as in the present study, involves attention to but a single significant stimulus and is thus viewed as simpler than versions of the CPT which require attention to a two-sequence stimulus.

Support for the idea that the task was relatively simple for the normal achieving and high achieving children also comes from an examination of their mean error scores, which indicate that regardless of which version of the CPT the children were tested on, total errors made across trials were relatively few.

The second question of the experiment was concerned with determining whether the subgroups of children, learning disabled, normal achieving, and high achieving children, school and play task conditions, differed in types of errors made, i.e., omission, commission, late response. Results relating to this question indicated that the learning disabled children made more errors of all kinds than the normal achieving and high achieving children regardless of task condition. These results are consistent with the findings of Sykes et al. (1973).
CHAPTER VII

SUMMARY AND CONCLUSIONS

The major objective of the second part of the dissertation was to use concepts and principles of A-R-D theory, social behaviorism's theory of motivation, to investigate the role of motivation in the sustained attention problem of learning disabled children. In order to accomplish this, two experiments were conducted. In the first experiment, the attitudes of learning disabled, normal achieving, and high achieving children were compared on a questionnaire composed of a set of school-related words and a set of play-related words. In the second experiment, the sustained attention performances of learning disabled, normal achieving, and high achieving children were compared on two adaptations of the Continuous Performance Test, one composed of the set of school-related words employed in the questionnaire used in Experiment 1 and the other composed of the set of play-related words.

As expected in view of their history of failure in the classroom, the results of Experiment 1 indicated that the attitude of the learning disabled children toward the school-related words was significantly less positive than the attitudes of the other two groups of children finding consistent with the results from a previous study (Guthery, 1971). In addition, the results indicated that there was no significant difference among the three groups of children in their attitudes toward the play-related words.
Although not a major concern of the study, comparisons of the normal and high achieving children were also made on the questionnaire. The results indicated that the two groups did not differ in their attitudes toward either set of words; nor did either group show a significant preference for one set of words over the other. Along this line, it is relevant to note that the attitude expressed by the learning disabled children toward the school-related words was significantly less positive than their attitude toward the play-related words.

Based on the above findings, it was concluded that learning disabled children differ from normal and high achieving children in an emotional-motivational personality characteristic, namely, their attitudinal response to school-related stimuli. How this difference may affect their behavior was examined in the second experiment.

Experiment 2 yielded a number of different findings. Of particular importance to the concern mentioned in the previous paragraph were the findings which indicated that learning disabled children differed from normal achieving children on the school stimuli version of the CPT, but not the play stimuli version. These findings were considered to provide the most convincing support for the conceptual hypothesis tested by the experiment since the attitudes of the learning disabled children relative to the normal achieving children were found to be related to whether or not there was a significant difference between their sustained attention performance and the sustained attention performance of the normal achieving children.

The results relating to two other hypotheses were also viewed as lending support to the conceptual hypothesis investigated by the second
experiment. These hypotheses were Hypothesis II, which predicted that the normal achieving children would perform equally well on the school and play stimuli versions of the CPT since, in Experiment 1, they did not indicate an attitudinal preference for one set of words over the other, and Hypothesis VI, which predicted that the normal achieving children would perform equally well on either version of the CPT since Experiment 1 did not reveal an attitudinal difference between these groups for either set of stimuli.

The results relating to the remaining two hypotheses of the experiment, Hypotheses I and III, were not supportive of the conceptual hypothesis investigated by the experiment. Since the results relating to the preceding four hypotheses were supportive of a relationship between attitudes and sustained attention, the findings relating to Hypotheses I and III were not viewed as negating the conceptual hypothesis. Nevertheless, if an attempt was to be made to understand the nonsupportive findings, it was necessary to consider what other variables may have been operating in the experimental situation. The suggestion of A-R-D theory—that how a child behaves is a function of the child's emotional-motivational personality characteristics as well as what stimuli are presented in the situation and how they are presented—provided the basis for the following efforts to explain the findings relating to the nonsupportive findings.

In attempting to account for the lack of a difference finding between learning disabled children in the school task condition and those in the play task condition, it was suggested that the attitudes of the children toward the Continuous Performance Test apart from the
stimuli composing the task may have interacted with their attitudes toward the task stimuli, school-related or play-related. More specifically, it was suggested that the task stimuli may have had either a more negative attitudinal value (in the school stimuli case) or a more positive attitudinal value (in the play stimuli case) than the CPT, thereby initially directing the children's attending behaviors in the manner indicated by A-R-D theory. Over time, however, since the nature of the CPT is that neither reinforcement nor punishment is contingent on attending behavior, the effect of task stimuli extinguished and, as a result, attending to the play stimuli diminished as did the avoidance of attention to the school stimuli.

In an effort to explain why high achieving children in the school task condition performed significantly better than those in the play task condition, it was suggested that despite the lack of a difference finding for high achievers on the school-related and play-related words of the questionnaire used in Experiment 1, high achieving children differ in their attitudes toward school and play stimuli, but not on the dimension(s) assessed by the questionnaire. In specific, it was suggested that high achieving children may have performed better on the school stimuli version of the CPT than on the play stimuli version because they place a higher value on their performance on tasks which appear to be more school-related than play-related.

In conclusion, this research was viewed as providing support for the conceptual hypotheses that (1) learning disabled children differ from normal achieving children in their emotional-motivational personality characteristics, with learning disabled children having a less
positive attitude toward school stimuli, and that (2) differences between learning disabled and normal achieving children in their emotional-motivational personality characteristics, i.e., the relatively poorer attitude of learning disabled children toward school stimuli can help to explain the poorer performance of learning disabled children relative to normal achieving on tasks typically used to measure sustained attention, e.g., the conventional forms of the CPT.

In addition, the findings from four of the six experimental hypotheses tested in Experiment 2 were also seen adding support to the more general theory from which the second conceptual hypothesis was derived. To be specific, the findings from four of the hypotheses provide additional evidence in support of the basic principles of A-R-D theory which indicate that an individual's attitudes toward the stimuli in a situation in part determine how the individual will behave: if the stimuli elicit a positive emotional response, they will direct the person's approach behaviors whereas if they elicit a negative emotional response, they will elicit the person's avoidance behaviors.

That two of the six hypotheses of the study were not as predicted indicated that the conceptual hypothesis investigated by the second experiment did not provide a sufficient basis for explaining all of the effects of the experimental conditions. It is suggested, however, that both types of findings relating to the conceptual hypothesis, those in support and those which were contrary to prediction, yielded important information. The supportive findings were important in that they showed that the attitudes of learning disabled children toward task stimuli do have an effect on their sustained attention performance,
a finding that is of importance for a number of reasons including that it is one of the few findings which relate to the role of motivation in the sustained attention problem of LD children (see Table 3 for a summary of studies using the CPT prior to 1979 and Table 14, Appendix D, for a summary of studies using the CPT subsequent to 1979).

The results which did not support the conceptual hypothesis were also important in that they indicated how complicated the relationship between motivation and sustained attention is, even on a simple version of a laboratory task such as the CPT, and suggested the importance of considering the effects of other variables in future research, i.e., time on task, characteristics of the task apart from the stimuli which compose it, and other attitudinal characteristics of children, such as their attitudes toward school-related versus play-related tasks.
APPENDIX A

ATTITUDE QUESTIONNAIRE
1. math
2. toy
3. ride
4. spell
5. read
6. run
7. test
8. kite
9. grade
10. school
11. play
12. park
13. slide
14. add
15. game
16. think
17. skate
18. learn
19. bike
20. book
21. ball
22. work
23. word
24. swim
APPENDIX B

ORDER OF STIMULUS PRESENTATION FOR PRACTICE SET
AND SERIES I OF SCHOOL STIMULI VERSION
ORDER OF STIMULUS PRESENTATION FOR PRACTICE SET
AND SERIES I OF SCHOOL STIMULI VERSION

PRACTICE

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<td>7. school</td>
<td>12. work</td>
<td>17. grade</td>
<td>22. think</td>
</tr>
<tr>
<td>5. grade</td>
<td>10. grade</td>
<td>15. math</td>
<td>20. test</td>
<td>25. school</td>
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TASK

<table>
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<th>51. math</th>
<th>76. word</th>
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<td>52. math</td>
<td>77. learn</td>
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<tr>
<td>3. spell</td>
<td>28. add</td>
<td>53. work</td>
<td>78. word</td>
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<td>54. think</td>
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<td>33. think</td>
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APPENDIX C

ORDER OF STIMULUS PRESENTATION FOR PRACTICE SET AND SERIES I OF PLAY STIMULI VERSION
ORDER OF STIMULUS PRESENTATION FOR PRACTICE SET
AND SERIES I OF PLAY STIMULI VERSION

PRACTICE

1. run  6. toy  11. bike  16. run  21. toy
2. kite  7. ride  12. play  17. slide  22. game
3. toy  8. toy  13. run  18. bike  23. swim
5. slide 10. slide  15. run  20. toy  25. ride

TASK

1. toy  26. bike  51. run  76. swim
2. run  27. bike  52. run  77. ball
3. park  28. kite  53. play  78. swim
4. swim  29. slide  54. game  79. slide
5. run  30. ball  55. swim  80. swim
6. toy  31. slide  56. swim  81. toy
7. kite  32. toy  57. skate  82. skate
8. play  33. game  58. toy  83. slide
9. bike  34. run  59. swim  84. run
10. run  35. game  60. toy  85. game
11. run  36. slide  61. toy  86. ride
12. ball  37. run  62. park  87. ball
13. swim  38. toy  63. swim  88. ride
14. slide  39. skate  64. game  89. park
15. kite  40. ride  65. toy  90. ride
16. toy  41. bike  66. swim  91. kite
17. bike  42. toy  67. park  92. toy
18. ball  43. bike  68. park  93. ride
19. run  44. toy  69. ride  94. bike
20. bike  45. skate  70. game  95. park
21. play  46. skate  71. skate  96. kite
22. ball  47. skate  72. bike  97. park
23. ride  48. swim  73. skate  98. skate
24. game  49. ball  74. toy  99. bike
25. toy  50. skate  75. run  100. slide
APPENDIX D

TABLES
Table 13

Means and Standard Deviations for Attitude Questionnaire Items

<table>
<thead>
<tr>
<th>Item</th>
<th>LD</th>
<th>NA</th>
<th>HA</th>
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<tr>
<td></td>
<td>$\bar{X}$</td>
<td>SD</td>
<td>$\bar{X}$</td>
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<td>1. math</td>
<td>3.33</td>
<td>1.54</td>
<td>3.87</td>
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<td>2. toy</td>
<td>4.40</td>
<td>1.12</td>
<td>4.60</td>
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<tr>
<td>3. ride</td>
<td>3.87</td>
<td>1.13</td>
<td>4.27</td>
</tr>
<tr>
<td>4. spell</td>
<td>3.13</td>
<td>1.51</td>
<td>4.13</td>
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<td>5. read</td>
<td>3.27</td>
<td>1.39</td>
<td>3.80</td>
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<td>6. run</td>
<td>4.27</td>
<td>.88</td>
<td>4.40</td>
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<td>7. test</td>
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<td>1.46</td>
<td>3.60</td>
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<td>8. kite</td>
<td>4.40</td>
<td>.74</td>
<td>3.80</td>
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<td>9. grade</td>
<td>4.20</td>
<td>1.42</td>
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<td>10. school</td>
<td>3.27</td>
<td>1.39</td>
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<td>11. play</td>
<td>4.73</td>
<td>.59</td>
<td>4.73</td>
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<td>12. park</td>
<td>4.20</td>
<td>1.08</td>
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<tr>
<td>13. slide</td>
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<td>.88</td>
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<td>14. add</td>
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<td>15. game</td>
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<td>16. think</td>
<td>3.73</td>
<td>1.16</td>
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<td>17. skate</td>
<td>4.47</td>
<td>.83</td>
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<td>18. learn</td>
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<td>4.73</td>
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<tr>
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<td>.83</td>
<td>4.80</td>
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<td>1.21</td>
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<td>21. ball</td>
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<td>4.67</td>
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<td>22. work</td>
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<td>1.61</td>
<td>3.67</td>
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<tr>
<td>23. word</td>
<td>3.53</td>
<td>1.25</td>
<td>3.93</td>
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<tr>
<td>24. swim</td>
<td>4.73</td>
<td>.80</td>
<td>4.53</td>
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</table>
Table 14
CPT Studies with LD Children Subsequent to 1979

<table>
<thead>
<tr>
<th>Authors</th>
<th>Subjects</th>
<th>Task</th>
<th>Duration</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sostek, Buchsbaum, &amp; Rapoport, 1980</td>
<td>15 Hyperactives, 14 Normals (amphetamine/placebo)</td>
<td>Visual: Digits (6-4)</td>
<td>1.33 min.</td>
<td>Hyperactives, particularly the younger ones, made fewer correct detections and more false alarms than normals; both normals and hyperactives performed better under drugs, and performance of younger hyperactives was particularly improved; correct detections and false alarms were correlated.</td>
</tr>
<tr>
<td>Swanson, 1980; 1981</td>
<td>16 Learning disabled, 16 Normals</td>
<td>Visual: Letters (AX) Auditory: Letters (AX)</td>
<td>4.75 min. &amp; 9.50 min.</td>
<td>LD's made fewer correct and more false alarms than normals; there were no significant differences between auditory and visual performances; LD's showed decrement on auditory task, but not on visual task; normals showed decrement on visual task, but performed better over time on auditory task.</td>
</tr>
<tr>
<td>Werry, Aman, &amp; Diamond, 1980</td>
<td>30 Hyperactives (methylphenidate/imipramine/placebo)</td>
<td>Visual: Letters (X)</td>
<td>not specified</td>
<td>Methylphenidate reduced errors of omission and commission, response latency, and seat movement; Imipramine acted similarly, but was significant only in reducing errors of commission and seat movement.</td>
</tr>
</tbody>
</table>
Table 14 (Continued)

CPT Studies with LD Children Subsequent to 1979

<table>
<thead>
<tr>
<th>Authors</th>
<th>Subjects</th>
<th>Task</th>
<th>Duration</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dainer, Klorman, Salzman, Hess, Davidson, &amp; Michael, 1981</td>
<td>19 Learning Disabled</td>
<td>Visual: Letters (X)</td>
<td>Two 5.2 min. periods</td>
<td>LD's made more errors of omission and commission on both tasks; evoked potential differences were found for BX task: LD's showed a significantly smaller LPC to critical stimuli, but there were no differences for noncritical stimuli. Younger LD's made more errors of omission than older LD's on both tasks, and more errors of commission than older LD's on X task.</td>
</tr>
<tr>
<td></td>
<td>19 Normals</td>
<td>Visual: Letters (BX)</td>
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<tr>
<td>Michael, Klorman, Salzman, Borgstedt, &amp; Dainer, 1981</td>
<td>29 Hyperactives (methylphenidate/placebo)</td>
<td>Visual: Letters (X)</td>
<td>Two 5.2 min. periods</td>
<td>Hyperactives on placebos made more omission and commission errors, and displayed smaller LPC's than normals on both tasks. Methylphenidate ameliorated performances on both tasks and enlarged hyperactives' LPC's on X task. Older hyperactives did not display all the performance deficits, LPC differences, or drug differences displayed by younger hyperactives.</td>
</tr>
<tr>
<td></td>
<td>21 Normals</td>
<td>Visual: Letters (BX)</td>
<td></td>
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