Chapter 11

Behavioral Neuropsychology with Children

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INTRODUCTION

As noted by Gaddes (1981), the realization that there is an overlap between neurology and learning is not new. He asserts that the famous English neurologist Hughlings Jackson suggested that there should be a recognition of both mind and body as early as 1872. Indeed, Gaddes (1981) attributes the current concepts of learning disabilities to research by neurologists in the nineteenth century who began the exploration of the complex relationship between language and neuroanatomy.

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CHILD NEUROPSYCHOLOGY, VOL. 2

More recently, there has been an explosion of interest in brain–behavior relationships. In addition to the striking illustrations of the cross-cultural validity of neuropsychological data (Luria, 1966; Reitan & Davison, 1974) the applications of neuropsychological knowledge in the schools (Hynd & Obrzut, 1981) have contributed to this trend. Clearly, there is the potential for the study of brain–behavior relationships to be of great relevance to the practice of psychology with school-aged children.

Given this background, it would appear that the integration of neuropsychology to learning would be most appropriate. It is of interest that some efforts along these lines have already been accomplished. A specialty that integrates the principles of behavior therapy with neuropsychology has developed. It has been referred to as *behavioral neuropsychology*. It is expected that this area of clinical and research interest will prove of value to psychologists and educators involved in behaviorally oriented intervention with school-aged children who have learning problems related to neuropsychological functioning.

The intent of this chapter is to review this new area of development and to examine supporting clinical and research evidence. In order to realize this objective, it would seem appropriate to clarify what is intended by an integration of behavior therapy and neuropsychology. At present, the new field has been termed *behavioral neuropsychology* by Horton (1979). Administratively, a specific interest group under this name was founded in 1978 at the Association for Advancement of Behavior Therapy (AABT) meeting in Chicago, Illinois and has continued to be active in AABT since that time. A tentative definition has been proposed. It follows:

> Behavioral Neuropsychology may be defined as the application of behavior therapy techniques to problems of organically impaired individuals while using a neuropsychological assessment and intervention perspective. This treatment methodology suggests that inclusion of data from neuropsychological assessment strategies would be helpful in the formulation of hypotheses regarding antecedent conditions (external or internal) for observed phenomena of psychopathology. That is, a neuropsychological perspective will significantly enhance the ability of the behavior therapists to make accurate discriminations as to the etiology of patients' behaviors. Moreover, the formulation of a cogent plan of therapeutic intervention and its skillful implementation could, in certain cases, be facilitated by an analysis of behavior deficits of higher cortical functioning. (Horton, 1979, p. 20).

This definition may be somewhat arbitrary. Moreover, the preceding definition makes a number of assumptions regarding neuropsychology and behavior therapy that are controversial (Hynd, 1981; Sandoval & Haapanen, 1981).

The remainder of this chapter is devoted to the specific application of behavioral neuropsychology with children. These aspects are organized into four sections. The first is concerned with theoretical issues and at-

tempts to make a distinction between traditional and contemporary behaviorism. The second section focuses on treatment planning and includes the Lewinsohn model for intervention with the brain-injured. Basic behavioral neuropsychology guidelines (Horton & Wedding, 1984) that deal with topographical organization of human neuroanatomy and a brief discussion of basic child neuropsychology profiles, based on the work of K. Hartlage (1975), are presented. The third section selectively reviews the existing empirical research on the application of behavioral methods with two populations (i.e., learning disabled and brain damaged). The fourth and final section serves as a summary statement but also includes some speculations about the future directions that behavioral neuropsychology with children may take.

THEORETICAL ISSUES

Behavioral Issues

As previously mentioned, two major conceptual concerns relative to the blending of behavior therapy and neuropsychology are discussed. The first theoretical issues to be considered are reconciliation of neuropsychology and its subject matter of inferred variables with traditional behaviorism and its concept of the "black box." The second theoretical issue that is discussed is how contemporary concepts of behavioral assessment and treatment can be integrated into behavioral neuropsychology. These comments are relatively concise; however, more elaborate discussions can be found elsewhere (Horton, 1979, 1981).

The traditional behavioral model is sometimes characterized as viewing the human mind as a "black box." There is a time-honored theoretical view within traditional, including radical, behaviorism that the sum total of human behaviors can be adequately explained in terms of observed stimulus–response paradigms (Watson, 1913). This perspective asserts that the behavior of human organisms can be accounted for without reliance on unobserved or covert factors (Skinner, 1938). This is of course a radical behaviorist position, which has been extensively described previously (Marr, 1984; Mozer, 1979).

Simply put, a traditional behaviorist would argue that variables that are not observable as stimulus–response actions are not useful to explain behavior. It is important to remember that *inferred variables*, that is, variables that may not be observed (i.e., "black box"), are disregarded as valueless by many traditional behavior therapists. There are some behavior therapists, however, who would postulate that there are legitimate

inferred variables in the functional analysis of human behavior (Mahoney, 1974).

At this point, it is important to reconsider that inferred variables come in two varieties: intervening variables and hypothetical constructs (Craighead, Kazdin, & Mahoney, 1976). Moreover, the differences between these two types of inferred variables are straightforward. Somewhat oversimplified, *intervening variables* are conceptual abstractions because they exist only in theory. A thought, of course, would be an example of an intervening variable. At present, it is impossible to directly observe thoughts; nevertheless, they are used to explain human behavior (*e.g.*, "I won't think about today, for tomorrow is another day."). Hypothetical constructs are quite different. Again grossly over simplified, *hypothetical constructs* have a physical substitute or a process substitute, which, while unobservable, from time to time can be verified if particular efforts are taken. As observed by Horton (1981).

> Hypothetical constructs in neuropsychology tend to have physiological referents and can, if so desired, be verified. If a child evidences certain characteristics, it might be postulated that there is damage to the right parietal lobe. In this case, our hypothetical construct is based on our knowledge of the brain–behavior relationship and can be verified through neurosurgery" (*p.* 368).

The main point of the preceding statement is that neuropsychological data may be considered as hypothetical constructs. Because neuropsychological data are hypothetical constructs, they are in a different class of events than the intervening variables. Therefore, it can be argued that there are theoretical grounds for the inclusion of neuropsychological data in an enlarged behavioral paradigm (Horton, 1979). While the ultimate test is of course empirical, still it should be clear that neuropsychological factors cannot be dismissed on the grounds that they are unscientific or inaccessible to measurement.

At this point, the second conceptual concern is considered. In a few words, the concern is, "How do contemporary views of behavioral assessment and treatment blend with behavioral neuropsychology?" From the outset, it should be recalled that contemporary behavior therapy has been marked by debate over the role of cognitive factors (Wolpe, 1973; Beck & Mahoney, 1979). While this is not the place to review this debate, it should be remembered that there is at least some willingness to use inferred variables as legitimate concepts in the functional analysis of human behavior (Mahoney, 1974). Moreover, contemporary behavior therapy is characterized by evolving clinical acumen. Part of that increased sophistication is seen in improved behavioral assessment techniques. Some would say, for instance, that behavior therapy is, to a large measure, defined by the techniques used. Hayes and Zettle (1980) have ob-

served that some would classify techniques like self-monitoring as behavioral, while holding that a MMPI was non behavioral. It might be argued, however, that such a distinction is artificial and arbitrary, not to mention nonempirical.

In a seminal paper, Hayes and Zettle (1980) outlined a more progressive conceptual paradigm. The basis of their argument rests on the distinction between *conceptual* ("how to talk about doing X") and *technical* ("how to do X") dimensions of behavioral assessment and treatment. As these authors stress, the most rational guideline is to use the conceptual rather than the technical dimension when making clinical decisions about behavioral assessment and treatment. That is to say, if a technique or procedure can be talked about in terms of behavioral principles and is empirically testable, then it could be classified as behavioral. In the viewpoint of this perspective, who originated the technique or the topographical details of the procedure is not the criterion for judgment. Rather, relying on the conceptual dimensions of behavioral assessment and treatment, the crucial point is to view the antecedents and consequences of a behavior in order to deduce the intended purpose of the action. Listing the physical details is an assessment only to the degree that it enables one to understand the intended purpose of the behavior of interest.

The instances where the aforementioned conceptual perspective of behavioral assessment and treatment are applied, some implications of behavioral neuropsychology are evident. Using a conceptual criterion allows neuropsychological assessment devices such as the Halstead–Reitan Neuropsychological Test Battery, the Luria–Nebraska Neuropsychological Battery, and the Kaufman Assessment Battery for children to be considered as behavioral assessment instruments and therefore suitable to include in a database to plan and evaluate behavioral treatment. Failure to imply such a perspective would constitute the problem of limiting the efficacy of behavior therapy: That is to say, only techniques (such as self-maintaining sheets or fear surveys) that were originated by self-identified behavior therapists would qualify as behavioral. If one's goal is a clinically relevant science (Hayes & Zettle, 1980), then the advantages of the conceptual criterion of behavioral assessment and treatment appear to far outweigh any possible disadvantages. As observed by Horton (1981):

> Whether or not such a blend of neuropsychology and behaviorism proves a potent addition to the current professional arsenal of concepts and techniques of school or other applied psychologists, remains an empirical question, which in the best tradition of behaviorism should be objectively tested. (p. 369)

In such a manner, the neuropsychological perspective would be, if provided the necessary basis of empirical evidence, integrated into an enlarged and clinically sophisticated contemporary behavioral paradigm.

Neuropsychological Issues

In planning behavioral interventions for neuropsychologically impaired children, several additional issues should be considered. The development of appropriate treatment strategies depends on an appreciation of both the developing brain and the typical effects of neural dysfunction on children's behavior.

An area that is often overlooked but provides considerable information on these issues is the animal literature on developmental neuropsychology. According to Miller (1984), there are several conclusions that may be drawn after reviewing these findings. These include the following:

1. Regardless of intervention, a specific recovery pattern is to be expected.
2. Developmentally immature subjects show both behavioral and neural resiliency (plasticity?).
3. Overlearned skills tend to be less disrupted.
4. Intervention, especially when initiated close to the time of injury, will probably influence its outcome.

Thus, there is strong support, according to Miller (1984), for indicating that some recovery will occur regardless of posttrauma experience or intervention. Nevertheless, both pre- and postmorbid variables have a significant impact on the outcome of the perceived behavioral deficit. Presumably, the implication for treatment planning includes careful behavioral analysis of premorbid skills with immediate intervention to be initiated after the behaviorally disrupting event.

Another factor that should be considered in the development of behavioral interventions with children includes an understanding of predisposing factors as well as the common sequelae of brain injury. According to Klonoff, Crockett, and Clark (1984) epidemiological and natural-history data gathered at the University of British Columbia provides some answers to these issues. Their findings include the following:

1. Boys have a higher predisposition than girls to central nervous system injury.
2. There is a poor relationship between medical history and predisposition to head injury, although a significant relationship between environmental factors and brain injury does exist.
3. The sequelae of brain injury in younger children includes emotional and personality changes, while the sequelae for older children children

includes headaches and dizziness, as well as learning and memory difficulties.

While the gender findings may not have an important bearing on treatment programming, the relationship between environment and head injury has strong implications for planning. Specifically, treatment planning should take into consideration environmental factors such as actual physical environment as well as family structure in order to minimize future occurrences of neural impairment, as well as to maximize the generalizability of the office- or institution-based treatment program. Finally, an understanding of expected sequelae is an important addition (often the primary or only source of information) to appropriate and comprehensive neuropsychological assessment.

The development of most treatment programs hinges on the acceptance that neuropsychological injury produces neuropsychological impairment and that the role of the neuropsychologist is to provide either restitution of desired behavior (Buffery, 1976) or amelioration (Miller, 1978) of undesirable behavior. Underlying this assumption are the beliefs that neural trauma results in behavioral deficits and that a lesion in a specific location results in behavior directly reflective of the impaired structure. This simplistic approach, as seductive as it may appear, is inappropriate and results in an incomplete understanding of neural and behavioral reorganization or reintegration.

Whether complete (restitution) or partial (amelioration) recovery is the goal, the intent of treatment is to work directly on deficits. Reynolds (1981), among others, has proposed that a more robust approach would be to focus on the assets of the child, rather than on the deficits. Strategies capitalizing on the child's best-developed processing approaches will yield more effective results than focusing on the amelioration, for example, of the deficits produced by the neural impairment. Another issue relative to this approach is the assumption discussed earlier that accepts the belief that specific lesions produce specific behavioral deficits. The complexity of the brain as well as the lack of understanding of most specific structures of the brain (often due to limited technological sophistication) makes this belief invalid. A more appropriate approach would be to consider that a specific lesion should be interpreted behaviorally as what can the rest of the brain do in the absence of that specific structure. Considering both of the preceding arguments, then the approach that appears best suited for the treatment of the developing brain would be to focus not on the deficits (alone) but on the assets as a way to maximize treatment efficacy and to more accurately understand the rehabilitative process.

TREATMENT STRATEGIES

Lewinsohn's Model

With his associates at the University of Oregon Neuropsychology Clinic, Lewinsohn had done important clinical and research work (Lewinsohn, Dancer, & Kikel, 1977; Blasgow, Zeiss, Barrera, & Lewinsohn, 1977) on the remediation of memory deficits in brain-damaged individuals. In the course of this work, Lewinsohn and his colleagues have developed a useful paradigm for clinical work with brain-damaged individuals, which could be well applied to work with children. Essentially, it involves four steps, as follows:

1. General assessment of neuropsychological functioning
2. Specific assessment of neuropsychological functioning
3. Laboratory evaluation of intervention techniques
4. In-vivo application of intervention techniques (after Glasgow et al., 1977).

Basically, the first step requires the use of standard neuropsychological assessment devices. For example, in the case of Ms. J., Glasgow et al. (1977) administered the Wechsler Adult Intelligence Scale (WAIS) and the Halstead–Reitan Neuropsychological Test Battery (HRNB) after an intake interview. Interestingly, this woman, who had received a concussion in an automobile accident 3½ years earlier and complained of school-related memory problems, earned a WAIS full-scale IQ of 114 and a Halstead Impairment Index of .25. The purpose of the first step, as seen in this case, is to obtain normative psychometrics and a global view of the client's–patient's neuropsychological functioning. Clearly, a hypothesis-testing approach is avoided at this stage, although, presumably, hypotheses about the client's brain functioning are derived after completion of this general assessment.

The second step is to examine in detail the specific parameters of the problem. In the case of Ms. J., selections from a reading-skills training program of the aforementioned presentations and narrative were used to elucidate the actual dimensions of her semantic memory functions. To a degree, this step is very similar to a behavioral assessment of neuropsychological-impaired child. Whether the approach is psychometric (as with the HRNB) or open-ended (e.g., Luria), the goal is to focus on the deficits (and assets) in order to better understand the goals of the treatment plan.

In the third step, specific intervention techniques are introduced in the context of a controlled (or laboratory) setting. In the case of Ms. J., oral rehearsal and a study organization strategy were selected. After the dem-

onstration of intervention effectiveness, then generalization efforts can be initiated. Clearly, intervention strategies (whether focusing on deficits or assets) are developed from the data gathered during the first two steps of the intervention.

In the fourth and last step, application of the successful laboratory intervention to the real-world problem is accomplished. In the case of Ms. J., this involved her applying the PQRST technique to her academic performance problems. Evaluation of the in vivo application was assessed by self-monitoring of negative and self-critical thoughts that were directly stimulated by her memory performance and also by her self-rating of recall of newspaper articles, immediately, 24 hours, and 7 days after reading. A final measure of outcome was Ms. J remaining in school and enrolling for an increased number of credit hours.

Thus, it can be seen that Lewinsohn's paradigm provides a general framework for conceptualizing the longitudinal aspect of clinical behavioral therapy with the brain injured. The general framework and specific evaluation, as well as specific intevention and generalization, provides a robust model for the behavioral intervention of children with brain injury. It should be kept in mind that while the WAIS and HRNB were used in this illustration, there is no reason that this should always be the case. Rather, general assessment should be taken to imply that use of any quantitive (as well as qualitative) neuropsychological measuring devices is acceptable. Indeed, it is possible to contemplate the use of neuropsychological devices in this context with no conceptual difficulties. In order to elucidate the exact parameters of the adaptive behavior deficits secondary to brain injury, it might be expected that considerable manipulation of stimulus–response dimensions will be necessary.

In order to illustrate some of the issues presented, it would be desirable to discuss some of the conceptual issues involved in the Lewinsohn model, particularly Steps 2 and 3. To a degree, these conceptual issues are overlapping with some recent thinking in behavioral assessment. The particular framework is drawn from the work of Goldfried and Davidson (1976). Essentially, when considering variables associated with maladaptive behavior, Goldfried and Davidson (1976) discuss four types. These are as follows: (1) stimulus antecedents, (2) organismic variables, (3) response variables, and (4) consequent variables.

Stimulus antecedents are considered as demands, often environmental. These demands and their perception determine the strategy and success of the coping process (Lazarus & Folkman, 1984).

On one hand, this category refers to the various neuropsychological abilities that need to be assessed. However, to just think of neuropsychological abilitites in the classic sense of memory, abstraction, and concept

formation would fail to do this category justice. Also, as outlined by Goldfried and Davidson (1976), a therapist must consider expectations, attributions, and self-reinforcement standards to maximize treatment efficency.

In this category, the focus is on the residual response abilities. To cite an oversimplified example, if a brain-damaged individual is unable to comprehend verbal stimuli, it is futile to expect him or her to answer the telephone. Goldfried and Davidson (1976) make the point that assessment of response variables should include situation-specific samples of the behavior under study, as well as data concerning its duration, frequency, intensity, and magnitude.

It is the sine qua non of behavior therapy that consequences influence behavior (Skinner, 1981). Basically, the reinforcing or punishing consequences of actions play a role in determining whether or not the particular action will increase in frequency. Various parameters such as immediacy, type, content, and ratio of reinforcement to response are of critical importance for behavior initiation, increase, maintenance, and generalization. In this context, it might be well to consider the classical distinction between ability and performance. Just because a brain-damaged individual fails to perform an action does not mean that he or she is incapable of performing the action. It could be that the person simply does not want to perform the action because he or she is receiving more reinforcement for doing some other sort of action, as in secondary gains, for example.

At this point, consideration is devoted to treatment planning. It would be fair to observe that at this point in the development of behavioral neuropsychology treatment, planning for children is most appropriately labeled an art rather than a science, in large part due to the lack of data-based information. Also, it should be noted that this presentation focuses on general considerations in treatment planning. More detailed discussion of specific training strategies of neuropsychological deficits are available in other sources (Golden, 1981; Luria, 1963; Miller, 1984). The general consideration discussed includes (1) self-efficacy, (2) personality × treatment interaction, (3) resources, and (4) intrusiveness to setting.

Bandura (1969) has advanced that an individual's perceived effectiveness is an explanatory mechanism for therapeutic behavioral change. Put another way, all behavior-change methods that are successful work by creating and strengthening a person's conviction of personal effectiveness. This individual belief in self-effectiveness determines activities children engage in, as well as the amount of and persistence of effort in the presence of aversive experiences. Essentially, four sources of data shape self-mastery beliefs. These are successful personal behavioral performance, observed successful performance of others, states of physiologi-

cal arousal, and verbal persuasion. Previous research by Bandura (1969) and his associates has demonstrated that successful personal behavioral performance appears to be the most influential variable for radical modification of self-efficacy beliefs. Implications for treatment planning are straightforward.

Essentially, whenever possible, successful in vivo performance should be the focus of therapy with the brain-damaged child. Of course, with the brain-injured and inattentive child, often providing prompt and salient feedback is a difficult proposition. Wherever possible, assistance devices or techniques to provide self-effectiveness feedback should be used. To a large degree, motivation for change is a function of both the reward or reinforcement to accomplishing an action or task and also the probability by which the child assesses his or her likelihood of accomplishing the action or task successfully (i.e., motivation = reinforcement × subjectively assessed probability of success). Thus, it can be seen that influence of personal beliefs is a crucial process in treatment and must not be neglected.

With respect to personality × treatment interaction, this refers to patient–client characteristics that potentiate certain therapeutic methods. For example, Goldfried and Davidson (1976) note difficulties with patients who are "brighter and more psychologically sophisticated" in reporting actual behavioral samples. In addition, these authors mention the great importance of knowing client's–patient's personal standards for self-reinforcement. In many cases, a major criteria for treatment planning is the ability to make quick progress. Early success has a major effect on building sustained motivation through the self-efficacy mechanism alluded to earlier.

With respect to resources, this refers to environmental characteristics of the treatment setting (medical center and/or community and/or home) as well as either personal qualities or skills of the therapist(s). For example, the availability of family to serve as mentors and therapists is quite important. Also, knowing the limits of the child's situation both at home and at school prevents the construction of an unrealistic treatment plan.

With respect to intrusiveness to setting, this refers to economic, cultural, and social barriers to treatment. For example, aversive therapy procedures are often quite effective but are often seen as intrusive, in that they violate certain commonly held expectations regarding preferred methods of treatment by the parents and lay public. Conversely, the use of self-monitoring procedures, because they are relatively innocuous might be seen as minimally intrusive. To a large extent, the point is that, at least on a surface level, psychological interventions must deal with the issue of parental and lay expectations.

In summary, careful behavioral analysis and subsequent behavioral treatment intervention for neuropsychologically impaired adults using the Lewinsohn models appears readily transferable to children. Notwithstanding the limitations of complex interaction, such as plasticity (Bigler & Naugle, 1985), this approach provides a basic yet robust framework from which to launch a successful behavioral neuropsychological program for children.

Behavioral Neuropsychology Guidelines

The generation of suggestions for the behavior therapy of children with learning disabilities or brain damage is a difficult task. While in no way meaning to provide a complete answer, some guidance might be gained from consideration of basic neuroanatomical parameters. Meier (1974) described the neurocortex as exemplifying three primary dimensions. These are (1) left to right, (2) front to back, and (3) top to bottom. More specifically, the left-to-right dimension has been termed *laterality*, the front to back dimension has been described as *caudality* while the top-to-bottom dimension has been termed *dorsality* (Horton & Wedding, 1984). These terms are used in a unique manner in the context of this discussion. Moreover, the terms were chosen for ease of behavioral expression rather than an attempt to precisely identify microneuroanatomy. Also, the following suggestions make the assumption of fairly circumscribed and localized mental impairment. In addition, it might state that some of these guidelines are postulated on the basis of clinical findings. As emphasized in a later section of this chapter, additional research is needed.

Laterality

As noted by Horton and Wedding (1984):

> On a clinical level, hemispheric specialization can provide a model for treatment planning. The two cerebral hemispheres process information in different ways. Assuming right handedness, the left hemisphere is logical and language oriented while the right hemisphere is intuitive and concerned with spatial aspects of stimuli. (p. 216)

Given these two modes of hemispheric mental asymmetrical functioning (see also Glass, in press), there are implications for the selection of therapy–remediation tasks and the therapeutic management of learning-disabled and structurally brain-damaged children. Hardage (1975) and others (Boder, 1973; Denckla, 1979; Mattis, French, & Rapin, 1975; Pirozzolo, 1979, 1981) have eloquently argued that there are subtypes of reading disability and that a neuropsychological assessment is crucial for the adequate differential diagnosis and resulting recommendations for

appropriate educational intervention. While it is clear that there is evidence supporting the existence of multiple different subtypes of reading disability (Denckla, 1979), there is some consensus (Boder, 1973; Pirozzolo, 1981) that the two most common subtypes present with auditory–linguistic and visuospatial elements (Pirozzolo, 1981). In order to illustrate these subtypes and to also provide an example of the power of a conceptualization of lateralization with respect to possible emotional correlates, suggested educational intervention and prognosis examples of three basic neuropsychological profiles for children drawn from the work of Hartlage (1975) are presented in Table 1.

It should be noted that Hartlage identifies type I children as typifying left-hemisphere dysfunction, type II children are exhibiting right hemisphere dysfunction, and type III children are characterized as having generalized cerebral dysfunction syndrome. While this categorization, like many attempts to relate research to clinical practice, represents an oversimplification of the actual clinical situation, it does provide an initial attempt at rational intervention procedures.

Caudality

As observed by Horton and Wedding (1984)

> *Caudality* refers to localization within the anterior–posterior dimension. There is some agreement that the frontal lobes involve the planning, execution, and verification of behavior while the posterior sections are involved with the reception, integration, and analysis of sensory information. (p. 219) (emphasis added).

As earlier noted by Luria (1966), whether or not the prefrontal regions of the cerebral cortex have sustained substantial impairment is of great clinical importance. Others have, of course, eloquently described the behavioral effects of frontal lobe lesions and the resulting affective and psychosocial consequences (Struss & Benson, 1984). There is clear consensus that compromised frontal-lobe functioning can reduce the degree of novel problem solving a patient may be able to perform. Consequently, individuals with frontal-lobe impairment often show deficits in self-management skills. Luria (1966), for example, has observed that when a brain-injured soldier of World War II had suffered impairment that included the frontal lobes, the prognosis for returning to independent function was dismal. Horton and Wedding (1984) have suggested that a brain-damaged patient with intact frontal lobes will often demonstrate more successful behavior adjustment than a patient with frontal-lobe impairment even, in cases where the nonfrontal-lobe-impaired patient may show a higher degree of overall brain damage on objective indices of neuropsychological functioning.

TABLE 1

Basic neuropsychological profiles for children[a]

	Type I child	Type II child	Type III child
Neuropsychological profile	Comparatively lower WISC-R verbal than performance IQ score, with consistently lowered language ability (i.e., depressed, ITPA and PPVT scores) relative to perceptual-motor skills (i.e., Bender-Gestalt or VMI)	Comparatively lower WISC-R performance than verbal IQ and consistently lowered perceptual-motor ability relative to language skills	No consistent pattern of WISC-R; strength and weakness or clear superiority of either language or perceptual-motor abilities and skills
Neurological syndrome	Left hemisphere dysfunction	Right hemisphere dysfunction	Generalized cerebral dysfunction
Emotional correlates	Reserved, tentative, and uncertain of self-efficacy	Impulsive and uncritical of personal performance	Restless, irritable, and hyperactive
Educational intervention	Whole work or look-say reading programs and perceptually oriented instructional modes	Linguistic and aural instruction modes	Extreme structure and special placement
Prognosis	Persistent problem during academic career (after third grade) but relatively good adjustment in nonacademic pursuits	Difficulty in early school grades (K–2) but tend to do better in later elementary grades (3–6) with generally successful academic career	Little ultimate academic success

[a] From Hartlage (1975). Reprinted by permission.

In terms of therapeutic applications with children, the role of cognitive behavioral treatment strategies appear to have significant potential. For example, Meichenbaum (1977) has developed the use of self-instructional therapy to develop self-contracts with children who exhibited difficulties

with impulse control. Adaptation of self-instructional therapy and developmentally appropriate verification, such as the turtle technique (Schneider & Robin, 1976), are worthy of detailed study in this population.

Dorsality

Dorsality refers to the top-to-bottom dimension of the neuroaxis. There is theoretical work (MacLean, 1973) to suggest that there are interactions among evolutionally distinct layers of neuronal tissue. The clinical implication is that the depth of brain impairment could have great relevance. It should be freely admitted that at present, the knowledge of brain–behavior relations, relative to dorsality, is not adequate to generate many meaningful treatment suggestions for impairment to developing brains.

CONCLUSIONS

As earlier outlined, recent decades have seen exceptional growth in the neurosciences. New diagnostic technology and dramatic conceptual insights have set the stage for even more impressive progress in the coming years. This chapter has been focused on the prospects of a particular subfield of the neurosciences—behavioral neuropsychology. Specifically, we were interested in the application of this subfield to the cognitive, affective, and behavioral problems of children who are suspected of being organically impaired.

In an attempt to provide a summary of the chapters, the following comments are proposed. First, there is ample evidence that behavioral methods are effective with brain-injured and learning-disabled children. Second, there is a wealth of data supporting the diagnostic and prognostic value of neuropsychological assessment techniques with brain-injured and learning-disabled children despite the fact that it has not been elucidated. These studies form a mature body of research literature and are well accepted by experts in child development and pediatric neurology. Third, treatment validity is an area that will require much additional research. There is minimal data supporting the use of neuropsychological assessment instruments to select behavioral treatment methods. With few exceptions, the mass of data is at a case study level. Clearly, the great need is for the conceptualization and execution of well-controlled and methodologically sophisticated research.

It would appear straightforward that the ultimate worth-assessment of behavioral neuropsychology with children will rest on its ability to make significant contributions to the amelioration of cognitive, affective, and

behavioral problems of children who are suspected or confirmed to have organic brain impairment. Of crucial importance will be the issue of appropriate interface with traditional systems of socialization and educational attainment. The expectation and hope is that this chapter will have been of some value in the challenge to alleviate emotional distress and to promote academic accomplishments with children who have suffered or who are presumed to have problems in learning that are neuropsychologically based.

> . . . it is clear that much additional work will need to be done in order to effectively integrate neuropsychology and behavior therapy with school-aged children. At the same time, there is some cause for cautious optimism. Initial efforts on both conceptual and research fronts have demonstrated significant promise. Whether or not this promise will be fulfilled is a question only the future may answer. (Horton, 1981, p. 371).

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