Life-Span Neuropsychology: An Overview

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Introduction

Perhaps the first thing to be done in a chapter on lifespan neuropsychology should be to define the term "lifespan." This is less easy that it would appear at first for these are multiple possible definitions. For sake of expeding in terms of this chapter the term "lifespan" should be considered to refer to the maximum potential time that an individual could live if he or she were to escape death from accidental injury or medical disease (Brody, 1985). This is, of course, different from the average age that a individual of a specific group is likely to live to.

Lifespan as could be expected varies with the species. Fruit flys can live but a few days and some turtles average over a century. While such infrahuman variation is of passing interest, the current focus of this chapter and indeed this book will be on human beings. There is general agreement among knowledgeable workers in this area that the maximum life potential is about 110 to 115 years (Brody, 1985). This is, of course, the end point of a skewed distribution and most human beings will not be called upon to exist for over a century. The more typical average if free from accidental injury or medical disease, would be a mean of 85 years (Fries, 1980). To some one aged 18 this appears to be an infinity of time, to some one aged 80 it appears all too short.

Now that the question of lifespan has been addressed, some attention should be devoted to the larger context of developmental psychology. One way to look at developmental psychology would be to describe it is the study of age-related cognitive, emotional and behavioral intraindividual change over the lifespan (Baltes,

Reese & Nesselrode, 1977). In terms of the framework of developmental psychology the causes of development might be described as involving two interacting systems. These are biological aspects (i.e., maturation) and environmental factors (i.e., learning) (Baltes, 1987) with both influencing age-related changes in persons.

The various periods of age-related development can be divided many ways. Not least of course was Shakespeare's seven ages of man ("sans teeth, sans eyes, sans every thing"). Less poeticly, others would describe infancy toddlerhood, early childhood, childhood, adolescence, young adulthood, middle age, the young-old and old-old. Which exact age corresponds to which period is as least partly a matter of personal bias. Also, others would divide, subdivide and conceptualize the periods of the lifespan in other equally appropriate ways.

Similarly the various domains of intraindividual development may be conceptualized in a variety of ways. While certainly, most categorizations would include cognitive, emotional and behavioral processes, other areas could be added. For example physical development should be considered. Moreover, others would wish to add social development, personality structure adaption and memory age-related changes.

It might be a verred that development is not entirely an age-related process. While certainly, many conceptions of development have focused on trends toward a state of maturity and general age-related phases, it would be fair to say these conceptions are dated. More contemporary views place emphasis

upon the role of the individual as a participant and partner in the developmental process (Baltes, 1983). Put another way the person's behavior interacts with his/her biological systems and environment in a reciprocal fashion (Featherman & Learner, 1985). For example, how long one will live can be modified to a degree by the history of one's parents' (i.e., heart attacks at age 50), one's dietary practices (i.e., too much fat), and personal safety practices (i.e., wearing seat belts) and where one lives (i.e., down town in a large city). All of these factors, and many others that aren't mentioned can affect one's developmental status throughout the lifespan. Moreover, the factors can reflect interaction, and bidirectional influences in multiple ways.

It would probably be fair to say that the Developmental Psychology framework has been expanded over the years. Generally speaking, when one thought of Developmental psychology in the 50's and 60's one thought of the nature-nurture question and the ages that young children developed specific skills. The focus was on childhood and adaption to adulthood. Little consideration was given to those over age 30.

In the 70's and 80's, factors such as the changes in demographics of the United States population (Horton, 1982) have demonstrated the clear limitations of a childhood focused framework of Developmental Psychology (Neugarter, 1969). Rather, the field of Developmental Psychology now encompasses the entire lifespan (Baltes, Reese & Lipsitt, 1980). Along with this paradigm shift has come a focus on lifespan changes that are multidirectional and multidimensional (Baltes & Nesselrode, 1979).

This means that age-related change can go in any direction and can include abilities and behaviors from a number of categories.

For example, intellectual ability could serve to illustrate this point. Earlier, Developmental Psychology conceptualizations viewed intellectual ability as increasing until about age 16. More recent lifespan developmental psychology conceptualization, have posited a differential age-related course of development where some intellectual related abilities may continue to increase as one because older (Schaie, 1979((i.e., vocabulary skills as measured by the same named subtest of the Wechsler Adult Intelligence Scale-Revised) but others may decline (i.e., psycho-motor speed as measured by the Diget-Symbol subtest of the Wechsler Adult Intelligence Scale-Revised). To a degree, this followes Cattell's (1971) conceptualization of crystallized versus fluid intelligence. The clear trend is to move from models such as Havinghurst and Piaget, which are childhood focused, to others such as Erikson's which are more lifespan oriented. But even Erikson's model fails to account or the wealth of complexity contained in Lifespan Developmental Psychology. The notion of bidirectionality and reciprocal influences makes earlier age-related models less applicable as it introduces the idea of individual self-influences on development.

Therefore, Lifespan Developmental Psychology moves from a fixed to a multidetermined model. Rather, than a single factor (i.e., age) causing development to progress at a steady pace, this new model is open to all sorts of interaction effects. These include, among others, the individual's own active role in his/her

development as well as historical/societal influences (Baltes & Nesselroade, 1979). It is clear that a proper model of lifespan and developmental psychology would have to include all of these factors (i.e., age-related, individual, historical-social) within of biology and environment to make even a reasonable pretence of comprehensiveness. At this point, the focus of the chapter will shift to consideration of neuropsychological factors.

Historical Context

Ebinghaus, the famous memory researcher, had described psychology as having a long past, but a recent history. Neuropsychology is quite similar in that, although interest in the brain/behavior relationships has been with us for quite some time, organized methods to elucide the relationships have only been extensively developed in the last half century (Benton, 1989).

European Contributions

Recorded instances of human beings attempting to study brain/behavior relationships on an observational basis can be dated as early as 2000 B.C. (Walsh, 1978). Interestly, in early times persons believed a brain injury on one side of the body resulted in ipsilateral dysfunction. Apparently,the earliest brain scientists observed individuals who were hit on one side of the head and noted sensory-motor impairment on the same side of the body. This apparently was the result of contre-coup injuries which involved contralateral control of cerebral functions. Initially, misconceptions about the nature of mental lifemade efforts to explore the functional organization of the human brain quite difficult. Luria (1966) described the situation as follows;

> "Many generations of research workers have given their attention to the problem of the brain as the seat of complex mental activity and to the associated problem of the localization of functions in the cerebral cortex."

Nevertheless, the source of these problems has depended not only on the development of technical methods of studying the brain, but also on the various conceptions of mental processes predominant at any particular time. For this reason, endeavors to localize cerebral cortical functions were, for a long time, restricted to futile attempts to "fit" the abstract concepts of what was then contemporary psychology into the material structure of the brain.

The first person to identify the brain as the organ of higher mental functions was Hippocrates in the fifth century, B.C. After this hopefull start, however, there was little progress. Galen, for instance, in the second century, developed the notion that the cerebral spinal fluid in the cerebral ventriculus was the seat of all complex mental functions. Along the same conceptual lines, Descartes (1686 cited in Luria 1966) identified the pineal gland as the location of the soul. By contrast, Willis (1664 cited in Luria 1966) thought the corpus striatum was the actual seat of higher neuro-cognitive abilities. Others advocated the corpus callosum. Of course, all of these initial hypotheses ultimately proved inadequate to the task before them. Luria (1966) described these developments as follows;

"The attempts to find one single area of the brain to account for all mental processes proved futile." If one cannot

find a single brain area that would account for all higher neuro-cognitive abilities, then perhaps the converse would be true (i.e., would it be possible to find specific areas of the brain that would subsume a certain class of mental functioning). This, of course, is the rationale for the localization perspective. Simply put, the localization perspective is that a single area of the brain subsumes a particular type of mental activity. To a certain extent, this sort of view marked a time when the science of neuropsychology was in its infancy.

This new method to use psychology to understand the structure of the brain appeared to be a fruitful scientific strategy. The most dramatiz single advance was that demonstrated by the work of Paul Broca. In April of 1861, Paul Broca presented at a meeting of the Paris Anthropological Society, the brain of a patient who had been unable to speak when he had been alive. The patient's brain had been available after his death and inspection of the patient's cerebral cortex very clearly showed that a lesion in the posterior third of the interior frontal convolutions of the left hemisphere. Broca related that the patient's aphasia was neither a loss of memory or motor disfunction. Rather, the aphasia was attributable to the brain lesion. Broca hypothesized that articulated speech rose from the specific brain area that was missing from the patient whose brain Broca had examined after the patient's death. Moreover, Broca suggested the portion of the cerebral cortex that was not there, was actually a center for the mode of speech.

The major contribution of Wernicke parallels that of Broca. For example, in 1874 Wernicke demonstrated a clinical case of the brain a patient who had a deficit in speech comprehension during his life. The brain of the patient was found to have a lesion in the posterior third of superior temporal gyrus of the left hemisphere. Careful observations had demonstrated that the patient had not had any motor speech difficulties, and, therefore, Wernicke (Luria, 1966) postulated that there was a center for the sensory images of speech which distinct from a center for motor speech abilities. Wernicke, of course, believed the area for sensory images of speech resided in the posterior third of the cerebral temporal gyrus of the left hemisphere.

The important observations of Broca and Wernicke were a major advance in the study of higher neuro-cognitive abilities. In a way that is difficult to overemphasize, they laid the basis for the current day concepts of receptive and expressive aphasia. On the other hand, however, there was another school of thought which had different conceptualizations of higher mental function than the localizationist group. Perhaps one of the major figures in this opposing school was Flourens. Flourens, in an impressive body of work, was able to present experimental evidence that contradicted the localization position. This point of view was titled "equipotentiality." He theorized that loss of function is dependent to a greater degree on the amount of brain tissue impaired, than exactly where the lesion is. By corollary, if sufficient cortical control is intact, then the functions of any missing brain tissue might be taken over. The equipotentiality

movement in the work gained considerable momentum from the work of Kurt Goldstein. Goldstein worked with brain injured veterans of World War I (Horton & Wedding, 1984). His work demonstrated that concrete thinking is often associated with the brain injured person's cognitive processes.

Essentially, however, both Localizationist and Equipotential conceptualizations of higher mental processes would prove inadequate to account for the full range of neuro-cognitive abilities. The later Integrationist's solution owe a great deal to two Preeminent. These were the famous English neurologist, Thomas Hughlings Jackson and A. R. Luria, the famous Russian neurologist/ neuropsychologist.

It is interesting to note that although Jackson was a contemporary of Broca, his ideas were little appreciated during his life time. Only after the passage of time did the schientific community appreciate Jackson's contributions to Neuropsychology. Jackson was also famous for his studying of epileptic fits on a localized basis. For example, specific motor seizures, even to this day, are known as Jacksonian. Jackson postulated that human behavioral functions have a complex vertical organization. It is of utmost importance to realize that Jackson postulated that single functions could be simultaneously represented at three separate divisions of neurophysiological organization. Jackson, for example, would make a very definite distinction between the "localization of a symptom" and the "localization of a function".

Luria further developed Jackson's views. For example, Luria saw the human brain as being made up of three distinct blocks, and

each section subserved separate and distincy basic functions. These would be, for example, a unit for regulating tone or wakening; a unit for obtaining, processing and storing information, a unit for programming, regulating and verifying mental activity (Horton & Wedding, 1984). Essentially, higher cognitive processes may involve certain sections of all three units at various points in time of the performance of any specific behavior.

American Contributions

Perhaps first American to make significant contributions to neuropsychology was Karl Lashley. He was clearly espoused Equipotentiality and performed a number of studies to support that school of thought. Further conceptual contributions in America were made by Roger Sperry. His work involved the examination of human beings who had undergone a particular operation known as a commissurotomy. All of these individuals had been operated on becasue of controlled epilepsy. Sperry, with students such as Michael Gazzaniga and Jerry Levy were able to demonstrate the unique potential of each cerebral hemisphere in these patients. This important work resulted in Sperry receiving the Nobel Prize in 1982.

While certainly many additional important conceptual contributions have been made by Americans in experimental neuropsychology, nevertheless, perhaps the most important recent contributions have been in the clinical area. For example, Ward Halstead the neuropsychologist at the University of Chicago Medical School, was most important for his body of research which

lent itself later to the development of a battery of clinical neuropsychological tests. That was not Halstead's initial intention. Rather, Halstead attempted to make a theoretical contribution in terms of his theory of biological intelligence. Biological intelligence according to Halstead involves those unique human abilities which are dependent upon an intact cerebral cortex. Halstead postulated that the frontal lobes in human beings were responsible for the ability to adapt to the demands of living in the everyday world. His work attempted to identify specific psychological tests which would capture these abilities.

A Halstead Doctoral student, Ralph M. Reitan, was able to refine, extend and modify Halstead's initial tests into a psychometric test battery that has proven to be of paramount importance in neuropsychology. Essentially, Reitan took Halstead's tests and standardized and validated them for the purpose of identifying brain lesions in human beings. Reitan also modified Halstead's procedures and added other standardized psychological tests to a battery of procedures so that the total collection of behavioral tests would be particularly helpful in terms of identifying particular types of neuropathology in addition to the single question of brain damage - yes or no. Reitan is perhaps the single most important figure in neuropsychology today (Hartlage & Telzrow, 1982).

Another important contributor to neuropsychology has been Charles J. Golden. Golden essentially expanded a series of test procedures developed by Luria, standardized and validated them for the purposes of identifying brain dysfunction. Golden's work, The

Luria-Nebraska Neuropsychological Battery has been cross-validated a several of times and has proved to be an important contribution to neuropsychology (Horton & Wedding, 1984).

Diagnostic Issues

While diagnostic issues have for sometime been the major focus of neuropsychology the categorization systems of neuropsychopathology have been little examined. For example, when neuropsychological pioneers such as Ralph M. Reitan, and Arthur Benton, set-up their neuropsychology laboratories at the Departments of Neurology at the Indiana University Medical Center and the University of Iowa Medical Center, respectively, the contribution of the neuropsychologist was solely diagnostic. At that point in time (i.e., 1950's and 1960's), prediction regarding the patients behavioral competencies, treatment recommendations and actual treatment itself by the many neurological diagnostic procedures carried the risk of mortality. Then and now no one has died from a neuropsychological evaluation. With the diagnostic role well established, neuropsychology would profit from attention to the classification system of organic mental disorders and its possible revision.

Organic Mental Syndromes and Disorders as Defined by DSM-III-R

The development of the Diagnostic and Statistical Manual (DSM) by the American Psychiatric Association has been the culmination of a number of efforts in working for increased diagnostic accuracy. It is recognized quite clearly that at present, psychiatric and psychological diagnoses of mental syndromes and disorders is an inexact science. Thus, the

classification of them is actually a work in progress. Reflecting this, the Diagnostic and Statistical Manuals are subject to ongoing revision. There was, of course, the first one in 1962, a second in 1966, the DMS-III first made its appearance in 1968, DSM III-R, which basically encompasses some minor revisions to DSM-III, was published in 1987. DSM-IV is currently in preparation for publication in the 1990's. Despite considerable skepticism and suggestions for alternate assessment systems, (Miller, Bergstrom, Cross, and Crube, 1981; Smith and Kraft, 1983) DSM III-R is considered at this point to be the most widely used diagnostic system for clinical work in the United States.

The basic trend in terms of diagnosis of organic mental disorders has been one of increased specification. In the initial system of classification, there were essentially two categories of brain damage, i.e., acute or chronic. In the first revision, the variable of psychotic or non-psychotic, acute or chronic, organic brain syndrome was introduced. In DSM-III there was a greater specification of number of types of organic mental disorders and there was a clear distinction between syndrome and etiology. Also, DSM III separated clinical syndrome, personality types and medical problems into Axis I, II, and III respectfully. This three-way classification has many advantages. Syndromes can appear relative to the behavior without regard to etiology, whereas a disorder directly implicates a specific type of neuropathology. It is important to keep in mind that DSM-III-R will allow an Axis I diagnosis to be made on behavioral grounds, (i.e., in cases where the etiology of brain dysfunction is

unclear,) this is important as in a considerable percentage of cases definitive diagnosis of neuropathology is only available after the pateint's death. For anyone that has ever been confronted with a behaviorally disordered patient in an emergency room or screening area, such a system of classification has some obvious strengths.

The organic mental syndromes are divided into, six major categories. These are as follows;

1. Delirium and Dementia
2. Amnestic Syndrome and Organic Hallucinosis
3. Organic Delusional Syndrome, Organic Mood Syndrome, and Organic Anxiety Syndrome
4. Organic Personality Syndrome
5. Intoxication and Withdrawal
6. Organic Mental Syndrome (not otherwise specified)

Delirium and Dementia are Organic Mental Syndromes in which mental impairment is global. The dividing line between them usually is based on the occurence of a clouded consciousness or disorders of attention which are present in delirium, but not dementia. Perhaps a simple way to understand dementia is that is appears to be an absence of normal intelligence. In Amnestic Syndrome and Organic Hallucinosis relatively selective areas of cognitive ability have been compromised. The Amnestic Syndrome referrs to impairment of short-term and long-term memory, although, clearly, the history of the syndrome is one which has focussed on impairment short-term memory and, in Organic Hallucinosis the hallucinations are the cardinal feature. Organic

Delusional Syndrome, Organic Mood Syndrome, and Organic Anxiety Syndrome are syndromes where various aspects resembling schizophrenia, mood disorders or anxiety disorders exist from organic causes. The diagnostic difficulty is to identify in which cases there is or is not an organic component. Organic Personality Syndrome is a syndrome that is organic in nature and in which the personality is primarily affected. It is important to realize that this category first came into being in order to accommodate the frontal lobe impaired patient. Many characteristics of the syndrome are typical of impairment of the frontal cortex.

Intoxication and Withdrawal Syndromes are clearly related to substance disorders. It is important to realize that these disorder, are related to either taking in, or failure to take, a substance which a person is using for psychoactive purposes. The last category, Organic Mental Syndrome - not otherwise specified, is essentially an eclectic category for other organic mental syndromes that could no be diagnosed previously. It is, of course, realized that there could be multiple organic mental syndromes existing in the same person; that is to say, a person could have Organic Personality Disorder at the same time as, he or she is an Intoxication Syndrome, etc.

Developmental Orientation to Diagnosis

It would appear clear that different sorts of neuropsychological disorders will occur at different points in development. For example, there are a set of disorders which are usually first evident in infancy, childhood or adolescence. Of

this set of disorders, those which are usually diagnosed by neuropsychologists are the Developmental Disorders and the Disruptive Behavior Disorders. Developmental Disorders include Mental Retardation, Pervasive Developmental Disorders (i.e., Austistic disorder), Specific Developmental Disorder (i.e., Academic Skills disorders, Language and Speech disorders, Motor skills disorders, etc.) Disruptive Behavior Disorder (it Attention-Deficit Hyperactivity Disorder, Conduct Disorder, etc.)

Similarly, as persons are, there is a set of disorder that usually arise in later years (i.e., senium and presenium). These include Primary Degeneration Dementia of the Alzheimer's type, Multi-Infarct Dementia and Dementia due to neurodegeneration diseases such as Pick's and Jakob-Creutzfeldt. Clearly, these disorders are age-related.

Conceptualization of Life-Span Neuropsychology

In the hopes of contributing to conceptual clarity, the following brief definitions are proposed. It is, of course, realized that numerous authors may have their own specific usage of terms. Such practices, of course, makes it difficult to communicate. For the purposes of ease of communication, the following definitions are proposed and advanced. It is admitted that they are, to a degree, arbitrary, and that other authors, may define the terms somewhat differently. The first definition offered will be that of neuropsychology.

In the context of this chapter, the definition, advanced by Meier (1974), will be favored;

"Neuropsychology is the scientific study of brain/behavior relationships." This definition, of course is not without limitations. For example, there are other subfields within neuropsychology that have developed over the years (Horton, Wedding, & Phay, 1981). Moreover, there are a number of other areas of scientific study, such as speech pathology, physiological psychology, (Meier, 1974), rehabilitative medicine and occupational therapy, among others which could have been included, but were not.

For the purpose of this chapter to provide clarification, a number of subfields of neuropsychology will be defined. These will include the following: Clinical Neuropsychology, Experimental Neuropsychology, Behavioral Neuropsychology, and Life-Span Neuropsychology. It is hoped that the advancement of these definitions will promote conceptual clarity.

Clinical Neuropsychology

Two hallmarks of Clinical Neuropsychology are that Clinical Neuropsychology focusses on the assessment of higher cortical functions in humans, and, also, that the methods of assessment in Clinical Neuropsychology are objective psychological tests which meet the recognized American Psychological Association standards of validity, reliability, and standardization.

Experimental Neuropsychology

By contrast to the clinical focus of Clinical Neuropsychology, the focus of Experimental Neuropsychology is to "...discover fundamental principles of brain/behavior relationships, regardless of practical application" (Davidson,

1974). The differences between Experimental Neuropsychology and Clinical Neuropsychology mirror the differences between Experimental psychology and Clinical Psychology. Simply put, one focuses on clinical applications and has a practical orientation, while the other is concerned largely with theoretical issues regardless of the practical applications of the moment.

Behavioral Neurology

Quite simply, Behavioral Neurology is concerned with the clinical application of scientific knowledge to brain/behavior relationships. But the method of approach lends itself more to that method used in bedside neurological examinations than the tools and methods of psychology. The focus of 19th century European neurology based on case study applications forms the conceptual basis for Behavior Neurology (Meier - 1974). By contrast, Clinical Neuropsychology is much more oriented towards a psychometric approach.

Behavioral Neuropsychology: A relatively recent addition to the various subareas of neuropsychology is that of Behavioral Neuropsychology. Horton, in 1979 has offered a definition of Behavioral Neuropsychology. It is as follows;

> "Essentially, Behavioral Neuropsychology may be defined as the application of behavioral therapy techniques to problems of organically impaired individuals while using a neuropsychological assessment intervention perspective."

Behavioral Neuropsychology quite clearly combines the areas of Clinical Neuropsychology and Behavior Therapy. Like Clinical

Neuropsychology, Behavioral Neuropsychology has a rather straight forward, applied focus. In contrast to Clinical Neuropsychology, however, Behavioral Neuropsychology is both quite clearly focussed on treatment rather than assessment and also is quite definitely looking toward theories of learning for models upon which to develop treatment approaches. These models of learning, in terms of their practical applications, are subsumed under the areas of behavior therapy and behavior modification.

Life Span Neuropsychology

Perhaps the most recent addition as a subfield of Neuropsychology is that of Life Span Neuropsychology. Essentially, Life Span Neuropsychology investigates clinically related neuropsychological issues while using a developmental approval. Neuropsychological performance is conceptualized as being under the influence of both organic and environmental variables. Some of the environmental variables, as well as some the organic variables, change systematically as the human ages. The purpose of Life Span Neuropsychology is to explore these systematic changes as they relate to clinical neuropsychological issues (the contributions of Michael Franzen and Lawrence Hartlage in producing this definition are gratefully acknowledged).

The reason for developing the focus of Life Span Neuropsychology, is the near total neglect of applied neuropsychological issues, studies, and procedures involving individuals at either end of the life span continuum. The increased success and contained progress is increasing the survival rates of infants with neuropsychological deficits

combined with the increased longevity in geriatric age segments combine to make emphasis on applied neuropsychology on these age groups, the most dynamic and rapidly expanding area in neuropsychology.

Life Span Neuropsychology and Other Specialties:

It is important to understand the role and function of the various specialties in order promote stronger working relationships. The major health care specialties to be considered will, in turn, include neurology and neurosurgery, psychiatry, rehabilitation medicine, pediatric/gerntology, clinical psychology, and health psychology. Two educitonal specialties which also warrent discussion are school psychology and vocational education.

Neurology and Neurosurgery

These specialties have always been intrically related to neuropsychology. It is important to realize that these disciplines, even unto themselves, are not static entities. Neurology, quite clearly over the years, has moved away from a appreciation of higher cortical functions and has moved toward a greater focus on the peripheral nervous system. While this is not to imply that there are not still behavioral neurologists in practice, and that many of these behavioral neurologists make important contributions to neurology. Nonetheless, the majority of contemporary neurologists are those that see their interests associated with the spinal cord.

It is interesting to reflect that the initial validation of psychological tests to discern the effect of brain lesions could

only have been accomplished with the active assistance of neurosurgeon. At this point, with precise neurological procedures for imaging, there is less of a need for neuropsychologist to aid in the preoperative localization assessment. Presently, the role of the neuropsychologist has been one of dealing with the patient post-operatively as well as focusing on ecological issues such as function rather than on structure.

Psychiatry: Clearly, the last few years have shown increasing interest of psychiatrists in neuropsychological testing. There is great promise in terms of neuropsychologists collaboratively working with psychiatrists in developing better assessment tools, and the treatment programs for functionally impaired and organically impaired psychiatric patients.

Rehabilitative Medicine: This is perhaps one of the areas where neuropsychologists throughout the life span can make impressive contributions. The role of the behavioral scientists in rehabilitation is one which is clearly on the assent. Among other areas, head injury is certainly one in which there is a clear mandate for neuropsychologists to aid in the selection of treatment and its skillful implementation.

Pediatrics/Geriatrics: These two medical specialties are, perhaps the opposite ends of the lifespan spectrum. Essentially, one definition of pedictrics is the application of medical knowledge, skill and technique to the problems children and adolescents (Whitesell, 1989). In a very similar vein, Geriatrics might be seen as the application of medical knowledge, skill and techniques of the probelms of aging (Butler, 1979). With respect

to neuropsychology, the application to pediatric problems is well established in the subfield of pediatric neuropsychology (Hartlage, 1986). The pediatric neuropsychologist has a well established role with terms of assessing and treating developmental learning disorders and attentional problems and the sequelae of various medical conditions.

On the other hand, and quite surprisingly, neuropsychology in geriatrics is still in it's toddlerhood. By contrast, it could be said there is a young adulthood (or at least childhood) of neuropsychology in pediatrics. In geriatrics neuropsychologists have begun to develop a role in term of assessing age associated disorders in which cognitive decline is a key characteristic (i.e., Alzheimers and Multi-Infarct Dementia). Future efforts might be devoted to increasing the utilization of neuropsychology is developing rehabilitation programs for the cognitively impaired elderly.

Clinical Psychology: At this point, although clinical psychology has often provided an umbrella for neuropsychology it appears that other subdisciplines are currently working to subsume important sections of what had been the clinical psychologist's domain. Neuropsychology, Health Psychology, Clinical Child Neuropsychology, Lifespan Neuropsychology are all establishing particular areas of expertise in the delivery of applied services. Health Psychology as noted, otherwise, some have suggested a working definition of Health Psychology would be "psychology applied to medical complications and specialties" (Horton & Puente, 1986). Neuropsychology under that sort of definition

would clearly be considered as the branch of psychology that most clearly interacts with problems of neurologically impaired patients.

Quite clearly in school psychology there is an expanding emphasis in terms of the neuropsychological assessment of school children who may have developmental disorders. In addition to children who might have difficulties with reading, mathematics, writing and spelling, there has also been some attention at least on initial stage being paid to the neuropsychological assessment of children with various syndromes of mental retardation.

Vocational education: Identifying a person for the proper vocational position has become more and more complicated. There has been an increased interest in the use of neuropsychological test procedures to assess people both for new positions and also to make determinations about their ability to continue. Among other position, airline pilots and nuclear power plants workers have been persons for whom careful assessment of mental abilities on an ongoing basis might be seen as clearly in the public interest. Why medical schools fail to use neuropsychological tests in the selection of surgeons is an unanswered question.

Emerging Trends and Life-Span Neuropsychology

Education and Training: Dr. Manfred J. Meier through his chairmanship of the International Neuropsychological Society's and Division 40 of the APA task force on education, accreditation, and credentialling has made major contributions to the development of models for the education and training of neuropsychologists. Unfortunately Dr Meier's impressive contributions in terms of

conceptual insights have not been implemented to the degree that their brilliance would seen to suggest. However, these guidelines address training that is generic in nature. Unfortunately, life-span issues haven't been addressed. Little attention has been devoted to taking into consideration many important developmental issues. One could only hope that in the coming years more time, energy and resources would be devoted to these efforts.

Certification, and Licensure: At present the clinical practice of a neuropsychologist in most states and providences of the United States and Canada, falls under the generic licensure umbrella of psychology. As far as known to the authors, there is not a specific licensure for a neuropsychologist, at present. With respect to credentialing the American Board of Professional Psychology (ABPP) has initiated a new specialty of neuropsychology as one of their specialties. Under the leadership of Dr. Meier, the American Board of Clinical Psychology (ABCN) has joined ABPP, and there are certification procedures available for individuals to obtain a diplomate in clinical neuropsychology. In addition a second board, the American Board of Professional Neuropsychology (ABPN) has also been constituted and that board also offers a diplomate in professional neuropsychology. However, specialization in specific areas of clinical neuropsychology (e.g., developmental) are not presently formally recognized.

Recent Developments: In recent years new concepts of subcortical brain damage have been introduced and are expected to make major changes in our current thinking. With an increased ability to image sections of the brain while it is actually in

operation one would expect a great elucidation of the role of subcortical brain structures. Rehabilitation and behavior management as earlier noted are emerging areas there has been an impressive increase in terms of the viability of the role of behavioral neuropsychologists in the area of head injury. Similarly, there has been an increase in terms of the efforts of neuropsychologists in school settings. One would expect that there would be increased efforts along these lines. The current trends in the treatment of head injury has been toward a greater reliance on behavioral approaches.

New Technology. This is perhaps one of the most exciting areas in terms of correlating neuropsychological tests with neurometric and radiological procedures. The array of neuroradiological procedures available is astounding. Perhaps more than any other Magnetic Resonance Imaging (MRI) appears at this point to provide the greatest advantage in terms of enhancement of various areas of the brain at the same time staying within the bounds of reasonableness with respect to cost. One expects that in the near future, the cost issue will be taken into account and controlled, and that even more dramatic representation of brain structure and function will be available.

New Populations: Relatively little has been done on neuropsychological toxicology; i.e., the identification and assessment of human neurotoxic syndromes. Such substances as lead, solvents, metals, drugs, pesticides and alcohol need to be further assessed and their implications for treatment considered (Hartman, 1987). Similarly, a number of medical disorders, such

as cancer and diabetes and a number of others, are currently being explored with respect to their neuropsychological implications. Moreover, there is increasing neuropsychologists to assess children below age six. This is an area that has received little attention, but in which there is great potential for contributions (Drotar & Strum, 1989).

Overview of this Book

The chapter of this book deals with many of these important issue. Dr. Danny Wedding will review the neurological disorders of old age. Dr. Richard Berg will discuss the need for screening instruments and will review specific screening batteries. Dr. Lawrence Hartlage will review neuropsychological assessment for children and adolescences. He will particularly focuses on developmental stages of neuropsychological abilities. Dr. Michael Franzen, by contrast, discusses neuropsychological assessment of older populations. Dr. Kathryn Kerr will deal with treatment issues in her chapter. She particularly focuses upon emotional concerns across the lifespan. Dr. Drew Govrier and his associates also examine treatment concerns but, by contrast, focus upon cognitive interventions. The concluding chapter by Dr. Franzen deals with methodological concerns. More specifically he described the use of single subject designs to assess the value of treatment over the life-span.

Conclusions

In the preceding sections, some major efforts were devoted toward conceptualizing Life Span Neuropsychology. Moreover, the historical context of life Span Neuropsychology was briefly

summarized. In addition, there was an attempt to describe some of the major organic related categories of DSM III-R. In addition, the relationship of Life Span Neuropsychology with other specialties was briefly reviewed. Finally, on a number of important trends in Life Span Neuropsychology were carefully looked over. As a result of this discussion, a number of conclusions appear to follow.

First. Life Span Neuropsychology is a promising discipline with a potential for great service to the very young and the elderly.

Second. Change is apparently the only constant that one can relay on.

Third. The degree to which Life Span Neuropsychology realizes its potential will be, to a large degree, related to its ability to adapt to change.

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