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MUSIC THERAPY IN THE REHABILITATION OF TRAUMATICALLY BRAIN-INJURED PERSONS: PROPOSAL FOR THE APPLICATION OF AN ECOLOGICAL MODEL FOR THERAPEUTIC INTERVENTION
presented by

Rosemary Therese Sargeant Faiver

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Major professor

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# MUSIC THERAPY IN THE REHABILITATION OF TRAUMATICALLY BRAIN-INJURED PERSONS: PROPOSAL FOR THE APPLICATION OF AN ECOLOGICAL MODEL FOR THERAPEUTIC INTERVENTION

By

Rosemary Therese Sargeant Faiver, R.M.T.-B.C.

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# MUSIC THERAPY IN THE REHABILITATION OF TRAUMATICALLY BRAIN-INJURED PERSONS: PROPOSAL FOR THE APPLICATION OF AN ECOLOGICAL MODEL FOR THERAPEUTIC INTERVENTION

By

Rosemary Therese Sargeant Faiver

Each year, 400,000 to 700,000 persons nationally suffer head injuries as a result of accident or abuse. Rehabilitation of these persons is acquiring greater recognition as knowledge of the brain and its capacity for adaptation is better understood.

An overview of the literature pertaining to music therapy with brain-injured persons, neurological aspects of right-hemisphere dominance for musical/nonverbal tasks, and issues in families with handicapped members is provided. An ecological model for intervention is proposed which demonstrates an integration of these three areas.

There has not been a large amount of documented clinical work in music therapy with this population. Since no injured person is an isolate, s/he needs to be viewed in terms of the various systems with which s/he must interface, e.g., family, health care personnel, community service agencies. The ecological framework offers a tool to facilitate inclusion of the multiplicity of factors affecting the rehabilitation of the patient. Use of this model may assist the

music therapist in developing methods of therapeutic intervention with head-injured patients. Implications for policy and practice are presented.

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1988

In loving memory of

Edward A. King, M.S.W

d. October 4, 1987

Sister Mary Charboneau, I.H.M.

d. April, 1985

Beatrice Paolucci, Ph.D.

d. October 1983

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If I may paraphrase the words of Roger Sperry, researcher in split-brain theory: *My left brain cannot find the words for all that my right brain feels.*

# PREFACE

> However autonomous our soul, it is indebted to an inheritance worked upon from all sides -- before ever it came into being -- by the totality of the energies of the earth: it meets and rejoins life at a determined level.
>
> Teilhard de Chardin (1957, p. 59)

The evolution of our species depends on man's ability, individually and collectively, to reach his full human potential. When any one person suffers an insult to that potential, it affects the whole. Yet, as I see it, the effect is not only negative in the loss imposed on one member of our species, but also positive in the challenge which that loss presents to each of those remaining to find an alternative way to make a higher quality of life accessible to the injured person. Our responsibility to each other calls upon us to develop ways and means to create new methods of communication and responses to life. When one's ability to seek that for himself has been lessened, he becomes dependent on others to find ways to help him return to, and perhaps even exceed, his previous capacity to function as a human being.

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## INTRODUCTION

> Traumatic head injury (TBI)[1] is an insult to the brain, not of a degenerative or congenital nature, but caused by an external physical force, that may produce a diminished or altered state of consciousness, which results in impairment of cognitive abilities or physical functioning. It can also result in the disturbance of behavioral or emotional functioning. These impairments may be either temporary or permanent and cause partial or total functional disability or psychosocial maladjustment.
>
> National Head Injury Foundation[2] (1986, p. 1)

Each year approximately 18,000 to 20,000 persons in Michigan become disabled by traumatic brain injury, according to the Michigan Head Injury Alliance (MHIA, 1988), a figure that reaches 400,000 to 700,000 persons nationally (*Journal of Neurosurgery*, 1980). The National Safety

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[1] TBI: Traumatic Brain Injury. The term *traumatic head injury* will be used interchangeably with *traumatic brain injury*, *closed-head injury*, and *neurologic impairment*, and is most often abbreviated as *TBI*. Although in the reviewed literature the term *TBI* is sometimes equated with *stroke* or *cerebrovascular accident (CVA)*, in this paper it is generally used as defined by the NHIF (1986).

[2] This definition was adopted by the Executive Committee of the Board of Directors of the National Head Injury Foundation on February 22, 1986.

Council (1987) estimates that a head injury occurs, on the average, every 16 seconds in the United States. Nearly 140,000 persons die annually from head injuries in this country (MHIA, 1988). Over 750,000 head injuries each year require hospitalization (Barrer and Ruben, 1984), and 50,000 to 90,000 persons annually are left with intellectual and behavioral deficits that preclude a return to normal life (MHIA, 1988). These statistics probably represent an underreporting because many TBIs are undetected.

Two-thirds of all persons sustaining head injuries are under the age of 30. Young men between 15 and 24 years of age are more than twice as likely as women to suffer head injuries because they are typically more involved with high-risk transportation and sports activities. The elderly and infants are at high risk of head injury due to falls. Of the one million children who sustain head injuries each year, some are victims of child abuse. About 165,000 children will be hospitalized and one in ten will suffer moderate to severe impairments (MHIA, 1988), ranging from a period of post-traumatic amnesia from which one can recover to a persistent vegetative state (coma).

Head injuries are the number one killer of persons under the age of 44. They kill more Americans under the age of 34 than do cancer, heart attack and stroke combined. As many as 1.8 million Americans now have disabilities resulting from moderate to severe head trauma. This is three

times the prevalence of disability from cerebral palsy, ten times more than spinal cord injury, and forty times more than muscular dystrophy (MHIA, 1988).

Because so many of the victims of TBI are young, the number of potential years of life lost is great, as also is the number of potentially useful and active years of life lost for those who survive. Of all the persons who suffered head injuries just between 1970 and 1974, 926,000 still require medical treatment today, according to MHIA. Even larger numbers are found in subsequent years. Considering that a majority of head injuries occur to persons between the ages of 18 and 25, it is predicted that each victim will require an average of 40 years of some level of medical and other treatment or support, and the cost of that caring will total an estimated four million dollars or more over the remainder of the victim's life after the acute care hospitalization.

While traumatic head injuries claim the lives of more people than many other diseases combined, the number of persons who survive is increasing. The use of seat belts and motorcycle helmets has greatly increased the chances for survival of persons who would otherwise have died from head injuries and other trauma sustained in motor vehicle accidents. Goldstein (1986), a biologist at the National Institute of Health in Bethesda, Maryland, said that there is a critical four- to eight-hour period of time immediately after an accident in which the brain cells are not yet dead.

The wide dissemination of modern life support technology for use at the scene of an accident, the highly advanced medical-surgical management of care for trauma victims, and the availability of helicopter transport from the scene of the accident to a trauma center with medically trained personnel en route, all combine to reduce the critical time lapse during which additional brain cell damage could occur.

## Rationale for This Study

Researchers do not yet know if there is an end point in the rehabilitation of the traumatically brain-injured patient beyond which they can no longer hope to achieve any further success. Since success is a relative term and the potential of the human brain is limitless as far as is known, it seems appropriate to explore every means that can be imagined for rehabilitating the injured person.

Since each individual is unique prior to head trauma and is uniquely impaired by that trauma, it is necessary to consider a wide variety of individualized therapeutic and rehabilitative programs. As knowledge grows of what is possible for the head-injured person, so also does the variety of professionals who become involved in their rehabilitation. Among these are music therapists, as will be discussed later; however, in only a few cases of which the author is aware have their efforts been described and the

results been documented in the literature. This is largely true among other professions as well.

Given the small amount of documentation on which to model treatment, music therapists are generally not prepared to work with the specific needs of this growing population. Understandably, because rehabilitation of head-injured persons is yet in its embryonic stage, it is not usually possible for therapists to be well-enough prepared through their academic curriculum to work effectively in this area. Therefore, what literature there is needs to be compiled from the technical journals and other publications of the various disciplines and synthesized so that it becomes available to the music therapist. Typically, literature is highly compartmentalized within each discipline so that it is not easily available. The practicing music therapist cannot necessarily be expected to have access to existing materials, or time to undertake the search currently needed in order to locate them. It is the intent of this study to help make this process easier. Much of the available knowledge can be pooled and used to develop a helpful model for further research and treatment of the head-injured client.

In the literature reviewed by this author, there was no description of a clearly elaborated model or framework for use of music therapy in the rehabilitation of neurologically impaired clients. The contextual approach, here inter-changeably referred to as an ecological framework, ecosystem

framework, or family ecological framework, can facilitate the incorporation of relevant factors into the patient assessment for use in whatever treatment plan is developed by the music therapist and other professionals.

In addition to having access to the research that has been done, it would be of great value to the practicing clinician to be aware of other sources of needed information. For example, it would be useful to have a list of the journals in which one is most likely to find the ongoing research with head injuries or with music and the brain, or of the types of professionals who are most likely to be keepers of the particular information desired. This paper begins to provide such a listing and can assist future research by facilitating the creation of a data base essential to that research.

In view of the above, the purpose of this thesis will be to provide:

1. a review of the literature that has proven to be helpful in the acquisition of information pertaining to research on closed-head injuries, music therapy with closed-head injuries, the response of the brain to musical stimuli, and the ecological framework and its use with families with handicapped members;
2. a listing of types of professionals who, and organizations which, are most likely to have the kinds of information needed by clinicians and

researchers working with closed-head injuries;

3. a definition of terms specific to the fields of music therapy, neurology and family therapy, as they are relevant to this research;
4. a description of the ecological framework and its application to music therapy with closed-head injuries; and
5. recommendations for future research with music therapy and closed-head injuries.

# CHAPTER II

## REVIEW OF LITERATURE

The review of literature will comprise four principal categories:

1. music therapy studies with brain-damaged patients,
2. transition studies,
3. brain studies which support the use of music with brain-damaged patients, and
4. family studies.

The music therapy studies will be presented in chronological order, since there are too few to categorize on any other basis. The transition studies serve to link the literature dealing specifically with clinical applications of music therapy to the literature which more directly discusses the neurological aspects of musical function. The studies pertaining to the brain will include those which have some bearing on receptive or expressive musical capacity, its relationship to speech functions, and its role in communication. The studies relating to the family are divided in such a way as to give first an overview of the ecological model and then to show how that has been applied to families

with handicapped members.

## Music Therapy Studies with Brain-Damaged Patients

Consistently throughout the academic history of music therapy there has been an expressed need for an organized body of knowledge and a set of verifiable hypotheses that will give direction to practice and research (Graham, 1969). This paper is intended as a partial response to that need, specifically in the area of music therapy with traumatically brain-injured persons.

The earliest known examples of the use of music with brain-injured persons were undertaken by Schneider (1954) who presented a brief resumé of ten case studies with children. Schneider discussed the brain-damaged child as one who, before, during or after birth, has received some injury to, or suffered an infection of, the brain, which usually results in varying degrees of neuromotor impairment, mental retardation, and atypical emotional behavior. Diagnoses and general characteristics were described. There were ten subjects, five male and five female, ranging in age from 8 to 19 years. Included within the total group were two boys and three girls diagnosed on the basis of neuro-motor involvement as athetoid, and three boys and two girls diagnosed as evidencing varying degrees of spasticity. All of the children evidenced some form of atypical speech. The

degree of mental retardation of eight of the children placed them at an age level of one to ten years, based on several psychological examinations. One child was considered to be of average intelligence and one of above-average intelligence. Etiology of the brain damage specific to each subject was not discussed. A control group was not included in this study.

The study was concerned with the observable effects of music on the total behavior of each child while listening to recorded instrumental music and while performing simple motor tasks to the accompaniment of this music. The effects of different types of recorded music under different sequences of presentation were studied in relation to the child's overall behavior of the day. The actual motor tasks were not described in detail; the reader is told only that they were performed with music as a background framework which seemed to this author to provide orientation in time and space and, therefore, structure to the activity. Schneider's work with these patients was based on Altshuler's isomoodic or "iso-" principle (1945). This principle suggests that, by matching the music to the patient's present level of tension or relaxation as the starting point, the therapist can then gradually, by altering the music, move the patient into the desired structured state of relaxation facilitated by the music. Children diagnosed as spastic responded best to stimulative music, while those children diagnosed as athetoid responded best to sedative music.

Schneider concluded that music can be used with patients who have similar diagnoses to improve motor control, enhance various psychological processes, and influence emotional behavior by inducing a state of relaxation which allows them to be receptive to the task at hand. Schneider stated, however, that, although each child benefited from music in quite similar ways, therapy should continue to use a patient-specific approach.

Fields (1954) discussed the use of music as an adjunct to medical treatment with adult brain-damaged patients. It appears that the patients were generally classified as having cerebral palsy, with no further clarification or definition of brain damage. Treatment was directed specifically toward an increase in motor coordination which can be demonstrated and measured objectively.

Of the four patients discussed by Fields, three had been assumed to have reached their final plateaus of efficiency, for which reason other therapies had been terminated. The fourth was considered unsuitable for occupational therapy because of the extensive nature of the disability, but was retained in physical therapy for attempted training in ambulation. The individual circumstances of these four patients, therefore, eliminate, to a large degree, a discussion of the value of music when used concurrently with other treatment.

In Fields' study, the use of music was focused less upon its value as a stimulus to effect emotional changes,

than as a stimulus to promote muscular activity and coordination. Music was used to determine its value: (a) as a changing stimulus, (b) as a stimulus to subcortical activity, (c) as a security-inducing device, and (d) as a timing element necessary in coordinated activity. Manipulation of pitch, rhythm, intensity, timbre and form in music was studied to determine methods for its application to meet the problems presented by the disabilities of these patients. Two features of music were described that make it different as a stimulus from other stimuli, such as the direct verbal command to activity. One of these features was that music, correctly selected for the individual patient, may be varied in intensity to overcome a sluggish stage of the reflex. Another feature is the infinite variety of change possible in the pitch, rhythm, tempo and style of music, thus avoiding the dulling of a reflex that can occur with an unchanging stimulus.

The ages of the patients in this study were 20, 24, 24, and 52. One was male. The physical disabilities ranged from mild hemiplegia to severe quadriplegia. The neurological symptoms included spasticity, athetosis, rigidity, ataxia, and tremor, as well as speech, auditory and visual defects. The range of IQ was reported to be between 70 and 110. Psychological characteristics due to organic pathology, as listed by Fields, were: (a) distractibility, (b) disassociation (sic), (c) perseveration, and (d) reversal field tendencies.

Fields believed it was impossible to employ control groups with brain-damaged patients as no two subjects are exactly alike. Therefore, the treatment value was determined by quantitatively measurable factors such as any increase in motor coordination over previous attempts by that particular patient. An increase in the number of fingers used, or any increase in range of motion, was a measurable indication of success. The degree of relaxation and reduction of tension was determined by a reduction of "overflow" motion in some patients, and by an increase in the use of an extremity.

What is lacking in the study is a clarification of the nature and etiology of the damage to the brain in each of the subjects. This becomes a significant piece of information when attempting to do comparative studies, for example, between a person who has suffered a cerebral thrombosis (stroke) and someone who has survived an automobile accident where there is considerable contra-coup damage (i.e., damage to the brain on the opposite side of the point of impact to the head). For this reason, careful research design which would control for relevant variables is essential. Such design should include a control group, preferably randomly assigned, so that important threats to validity may be effectively minimized, including history, maturation, selection and interaction (Campbell and Stanley, 1967; Cook and Campbell, 1979). To make comparison groups more homogeneous or to facilitate use of statistical methods for controlling

certain variables, it will be necessary in future research to identify and document patient and treatment characteristics which could affect the outcome.

Later, in a paper published by Obaldia and Best (1971), the subject of music and brain damage was approached from an educator's point of view. Their definition of brain damage concerned those problems associated with personality disorders, learning disabilities and various forms of emotional instability that might interfere with learning in the traditional classroom. The brain damage seemed to be congenital in nature. They presented ten case studies of children between the ages of ten and fourteen with an IQ ranging from untestable to 133. Personality profiles were taken from school records which indicated a history of brain damage since birth. The research focused on improvement in one or more of the following areas: (a) environmental behavior (school, home and community); (b) academics (formal school-learning characteristics); (c) human relations; and (d) self-assurance, self-confidence and self-respect. These appear to represent various aspects or dimensions of resocialization. Since the subjects were already at a high level of motor and speech functioning, it was not necessary to use music as a facilitator in these areas, although individual improvements were made. Without exception, however, dramatic and positive behavioral changes in each of the subjects were reported which, according to the authors, were the result of being involved with music.

Other factors which should be considered, but which were not discussed, include: (a) the level of expectation for client performance on the part of the educator doing the study, which was perhaps higher and more positive than that of the classroom teacher; (b) the added individual attention inherent in the case study method; and (c) the emphasis on the process of enjoying music according to one's own ability, instead of in a manner competitive with another's ability. Though the authors of the study did not address these issues, this writer suggests that these be important considerations in determining the relationship between overall behavior and reinforcement through music. Care should be taken concerning cause and effect implications.

The actual music techniques employed were very simple, using the piano, bongo drums and Spanish guitar. Achievement of rhythmic ability and melodic ability had already been established, though they were at a very elementary level. With the use of the three named instruments, each of the subjects was given a two- to three-measure excerpt of music to learn. Each excerpt was taken from a musical selection to be performed in ensembles of two or three members. The task was to provide each subject an opportunity to learn music individually and then to play that music learned as part of the ensemble.

The results of the study initiate additional and continuing questions. By definition, these subjects differ from the types of subjects referred to specifically in this

thesis. Though the subjects in the study by Obaldia and Best are categorized as brain damaged, the nature of their disorder does not coincide with those whose injury was incurred later in life as the result of a direct insult to the brain. How much can we hope to retrieve or reconstruct if it was not there in the first place? Does the person who suffers a traumatic injury to the previously healthy brain stand a better chance of rehabilitation to a normal level than do those with similar lesions who have carried their injuries since birth? If yes, why? If not, what are we able to generalize from our studies of brain-damaged persons with differing etiologies?

Observing that the neurologically impaired child often seemed to develop functional understanding of musical concepts more readily than concepts in other areas, Pirtle and Seaton (1973) devised a study to investigate musical experiences designed to develop specific musical concepts. The purpose was to observe the effect of music on the neurologically impaired child's improvement in spatial, temporal and ordinal concepts and in his ability to relate these concepts to their verbal symbol.

The study was undertaken at the Institute of Logopedics, a residential center for the habilitation of communicative disorders. Fifteen pairs of children with mental ages of six years or younger participated in the study. Actual chronological age ranged from 4 to 12 years. All of the children selected for the project participated in music

classes twice a week, daily classroom activities, individual speech therapy three times a week, art programs, and physical education programs. All had hearing sensitivity for pure tones and speech that fell within normal limits, and none had complicating motor disabilities.

According to Pirtle and Seaton, there are no standardized musical perception tests available to evaluate essentially speechless children. The researchers, therefore, designed a test of musical development and two corresponding language tests. The first, a vocal integration test, was used to investigate the development of aural concepts in a non-musical situation. The second, a verbal comprehension test, was employed to examine the child's ability to transfer aural concepts to spatial, ordinal, and temporal concepts. The tests were designed to provide the children with a means of response not dependent on ability to verbalize, such as playing a drum, making appropriate motions, or indicating a choice between two diagrams or pictures. Five subtests were devised, one for each basic conceptual area of music: melody, rhythm, harmony, expression, and form. The assumption was that for each conceptual area of music there exists a corresponding conceptual area of language.

The purposes of the language test were: (a) to test comprehension of concepts taught in a musical context when presented in a non-musical situation, (b) to determine the degree of conceptualization attained within each area, and (c) to provide a means of measuring the effect of musical

experiences on verbal comprehension.

The purpose of the experiment was to determine if music could facilitate the development of auditory memory and conceptual understanding in the neurologically impaired child and thereby enhance the child's ability to develop a language and increase appropriate social behavior. There was a positive correlation between the use of music and the development of the desired skills.

An operant definition of the term *neurologically impaired* was not provided. It is assumed from the context that these children were impaired since birth severely enough to require institutionalization. It is also surmised, from the types of expected responses implied in the test, that the children were capable of at least a moderate level of physical and mental functioning prior to the study.

Boyle (1985) studied the use of music in operant procedures for the comatose patient. Her purpose was to determine whether the use of music as a contingent reinforcer would increase the frequency of specified motor behaviors of vegetative comatose patients in response to verbal experimental directions. Coma is defined as those states in which cognitive functions are diminished and the patient is unresponsive to all outside stimuli (Posner, 1978). The vegetative state denotes a state in which the essential component is the absence of any evidence of a functioning mind which is either receiving or projecting information, in a patient who has long periods of

wakefulness (Jennett and Plum, 1972). Boyle briefly discussed the standardized procedures that have been developed for testing responsiveness of the comatose patient to external stimuli. The Glasgow Coma Scale (Teasdale & Jennett, 1974; Teasdale, Murray, Parker, & Jennett, 1979) was used to examine the best eye-opening, verbal, and motor responses occurring in given time periods. The Munich Coma Scale (Brinkmann, von Cramon, & Schulz, 1976) used additive scales to rate susceptibility to stimulation and reactivity. Stimulation in these testing situations refers to use of electrical, tactile, acoustic, and optic devices. Reactions to this set of stimuli include motoric, mimic, orientating or communicative responses. These procedures do not measure operant responses but rather the application of technology to the experimental analysis of behavior to test the responsiveness of comatose patients.

The patients in Boyle's study were considered comatose. A distinction was made in the study between the "vegetative state" of the coma patient and the "vegetative state" of profoundly retarded individuals. While they are similar in their lack of responses, their conditioned reinforcers may be different. Without special reinforcement conditioning procedures, only primary reinforcers generally are viable for many profoundly retarded individuals. Comatose patients, however, have had many conditioned reinforcers prior to trauma. Primary reinforcers (e.g., food) are often difficult to use with comatose patients because of the

involvement of mechanized life-support systems and the patient's tentative and often precarious condition.

Music was selected as a contingency because it seemed suited to the limitations of the patients while simultaneously tapping their potential to be controlled by conditioned reinforcers from their own unique histories. Music can be non-intrusive, unobtrusive, easy to administer, less likely to produce satiation, and less likely to create resistance from caretakers, medical personnel, or members of the patients' families.

Three case studies were described. All three subjects were diagnosed as comatose. Dependent variables were established based on the patients' present ability to respond. Procedures involved standard direct observation techniques.

In a more recent study, Lucia (1987) extended the definition of head injury to include persons who have suffered a cerebrovascular accident (CVA), also referred to as a stroke. The study was an overview of selected literature of the last 40 years related to rehabilitation of persons with closed-head injuries, the function of the cerebral hemispheres in music, and the function of music in speech and motor development.

Rehabilitation planning for TBI and CVA patients needs to be patient-specific. Following this rationale, the study drew on the literature of head-injury rehabilitation to recommend that current information be acquired in the following functional areas in anticipation of establishing

treatment goals:

1. Speech and Language Deficits (dysphasia, dysarthria, or dyspraxia);
2. Visual Field or Auditory Defects
3. Hemiparesis
4. Motor Incoordination/Restriction (affecting balance, motor planning, range of motion, or muscle strength and endurance)
5. Behavioral Disturbance (short attention span, distractibility, affective lability)
6. Memory Deficits
7. Psychological Factors (depression, motivation, self-image). (p. 34)

According to the literature on the neurological components of music perception and performance, aspects of speech and music function have been found in both cerebral hemispheres. This, in part, addresses the questions concerning brain function and site-specific anatomical function of the hemispheres. Patients with aphasia were the subjects in many of the studies cited. Remaining and/or damaged cognitive language or motor functions were assessed, in part, via the evaluation of the patients' music perception and performance.

Of significance to the clinician using a music-based rehabilitation program is the inclusion in Lucia's paper of music therapy clinical examples. Using the Melodic Intonation Therapy (discussed later in this chapter) which is based on the principles of speech prosody and brain

plasticity, Lucia developed a Music Therapy Vocal Skills Group for head trauma patients. Music therapy strategies were designed to utilize preserved right brain functions for singing, an automatic, non-propositional speech skill that is thought to precede functional speech recovery. The techniques involved a gradual withdrawal of melodic facilitations toward rhythmic chanting and question-answer responses with rhythmic and content structuring. Additional efforts were made to promote rehabilitation of dysarthric and dyspraxic elements, such as breath capacity and efficiency of respiration-phonation patterns, articulation errors caused by inappropriate rhythm or speed, and preparatory motor planning for articulatory movements.

The music therapy assessment used by Lucia focused on determining the preserved music skills in the patient as well as on the degree of deficit in the above-described areas. Items of the assessment were outlined as follows:

1. ability to match pitch
2. singing range
3. breath capacity while singing/chanting
4. attention to musical task
5. automatic recall of melody and words of premorbidly learned songs/proverb chants
6. respiration-phonation patterns while singing/chanting
7. syllabic production rate and rhythm during singing/chanting

8. oral apraxic interferences while singing/chanting. (p. 36)

Visual field deficits and alexic elements were assessed to determine the value of visual cues such as large-print song charts, regular-size print song sheets, or directives to follow mouthing cues of the therapist.

The study did not indicate how many patients were in the group. The patients met for music therapy one time per week for a 40-minute session. All patients were involved simultaneously in individual and/or group speech therapy at least three times per week. Selected patients also received individual music therapy sessions. Patients with hemiplegic involvement also participated in a group occupational therapy upper-extremity exercise program during which singing of familiar songs was part of the exercise routine in one of five daily sessions per week. It was not indicated whether any of the patients had sessions overlap in such a way that they might have been in the Music Therapy Vocal Skills Group, individual music therapy and the music-facilitated occupational therapy group.

## Transition Studies

Before discussing the brain studies and studies of families with handicapped members, this author has chosen four works that function as transition pieces between music

therapy on the one hand and medicine, neurology and family therapy on the other. It is humbling to realize that the most profound insights into what the music therapy profession can contribute to the rehabilitation of traumatically brain-injured persons have not always come from within the profession.

In 1945, Altshuler, a physician, musician, and director of group music therapy at a psychiatric hospital, presented the concept of identifying musically with the mood or tempo of the mental patient. This concept was referred to as the "iso-" principle. Once the therapist has equated the music to the mood or tempo of the patient, it then becomes possible to move the patient to the desired mood or tempo by altering the music.

The process begins with music in which there is a predominance of rhythm because of its strong appeal at the instinctual primitive level. Rhythm, with its stress, duration, and pause, exercises a specific physiological and psychological effect different from that of melody. Melody is apprehended as an entity and exercises an entirely different effect from rhythm. Melody is followed by harmony "which integrating effect can be linked with cerebellar influences" (p.53).

The next music used is intended to capture the mood of the patient and then, supported by music, help the patient to shift into the emotional mood desired. Pictorial associative music is then played to stimulate imagery and

associations. Recall of past experiences is thus facilitated. This can be of benefit for both the psychiatric patient for whom this method was initially intended, as well as for the traumatically brain-injured. While similar goals may be achieved, the purposes vary. According to Altshuler, "music leaves not only a 'memory' in the mind but in the emotional sphere, movements and muscles" (p. 53). The traces left by music are more easily recalled because it is "more firmly implanted in his system. Calling up of past experiences means bringing back into the mind . . . the basic realities" (p. 53). If it is true that these bits of realities "bridge the mental patient's mind with the outer world" (p. 53), and that repetition of the appropriately selected music clarifies that reality, then it is presumed by this author that the same might hold true for the patient who has suffered a traumatic brain injury.

Altshuler was careful to emphasize the importance of tone color inherent in musical instruments and its effect on patients. This author concurs that tone color as well as musical preference and the patient's musical history all are factors to be considered in determining the projected benefits for a particular patient.

In 1973, Martin, Sparks and Helm presented a new form of language therapy that has been used successfully with aphasic patients who had severe, long-term, stable defects and for whom other forms of therapy had failed. It is termed *Melodic Intonation Therapy (MIT)* and it involves

embedding short phrases and sentences in a simple, non-linguistically loaded melody pattern. Therapy progresses through several levels. The first level of therapy involves unison singing of the sentence by the patient and the therapist, as in operatic recitative. The program then progresses eventually to repetition of the sentence in normal speech prosody. As the aphasic patient improves, the melodic aspect of the program is gradually diminished, and confrontation questions are introduced. If the patient has difficulty at this stage, s/he is then directed to revert temporarily to an intonational response.

Three case studies are presented of right-handed patients for whom other therapeutic approaches had failed. All three patients had good language comprehension but considerable expressive difficulty. After involvement with Melodic Intonation Therapy, the expressive language ability was significantly improved.

In an article solicited by the editor of the *Journal of Speech and Hearing Disorders* to discuss Melodic Intonation Therapy, Berlin (1976) described the physiological aspects of the brain in relation to MIT. Based on the disconnection syndromes and insights to date on the pathways from one portion of the brain to other association areas (Geschwind, 1972), Berlin described a hypothetical patient with a lesion in or around Broca's area (left hemisphere) who might be a good candidate for MIT. If the right hemisphere is dominant for interpretation of nonverbal acoustic processes like

music, then it is possible that MIT could activate the right hemisphere in some way to control motor speech gestures. Although primary auditory areas of the brain are not connected transcallosally, Berlin points out that, once information flows from the primary area outward, it reaches auditory association areas; Wernicke's area projects to Broca's area via the arcuate fasciculus. "While the left and right primary auditory areas do not interconnect the corpus callosum, it is clear that association areas do connect transcallosally. There is a presumed one-way right-to-left transcallosal route for speech input to the brain", according to Berlin (p.299). He hypothesized that, in a patient with a lesion such as the one described above, information from left auditory association areas necessary to generate and monitor proper motor commands cannot reach Broca's area through the arcuate fasciculus because the supposed lesion disrupts posterior-anterior access. It is possible, however, that posterior-anterior interaction might occur by way of a remote route; that is,

> transcallosal communication at Wernicke's area with its homologue on the right side can permit posterior-to-anterior connection via the intact arcuate fasciculus on the right to the homologue of Broca's area on the right side. From here, information can either be routed back cross-callosally to the pre-Rolandic areas, by-passing the damaged Broca's area, or the right hemisphere can itself attempt to control some of the motor gestures being made. To activate left-to-right hemisphere paths, one might be forced to translate the task into a nonverbal acoustic or melodic behavior. (p. 299)

Thus, Berlin concluded, good candidates for MIT have intact left pre-Rolandic motor areas but lack input from a damaged Broca's area.

> The intact left motor strip might receive transcallosal command from an intact right Broca's homologue, activated by MIT. A more remote possibility is that motor areas of "good candidates for MIT" have simply been disconnected from an intact Broca's area on the left, but can still receive input via a pathway from left Broca's area to the right Broca's homologue, and then back to left Rolandic areas transcallosally; this path may be activated by exaggerated vocalic intonation. (p. 299)

Clinicians often employ methods with clients without fully understanding why. Berlin cautioned that proof for such preliminary hypotheses should await pathological material. This author feels that, by being aware of the theories upon which research is based, productive observations can be made that can contribute to the knowledge which will ultimately confirm or deny hypotheses. It was suggested by Geschwind (1972) that it is possible to predict the sites of brain lesions on the basis of the type of language disorder. This points up the need for careful observation and documentation, as well as open-minded interaction among disciplines. Berlin affirmed this when he concluded that "these principles should remind us of the importance of seeking alternate modalities or combinations of access routes for our communication-handicapped patients" (p. 300).

The efforts by Judd (1979), a neuromusicologist,

represent a comprehensive approach to the study of the relationship between brain damage and music, and provide an appropriate transition from the literature on music with head injuries to the scientific studies and neuropsychological literature on head injuries. Judd offered a review of *Music and the Brain* (by Critchley and Henson, 1977) and discussed the potential benefits of studying music from a biological perspective. The reader is then given an understanding of the alexias through a neurological description of their known causes. There follows a discussion of the conclusions drawn in the last one hundred years from the literature on studies concerning the alexias. Judd pointed out the difficulty researchers have had in attempting to determine the nature of cerebral specialization. In more recent years, researchers have made an effort to approach the questions concerning cerebral specialization in less problematic terms. Studies are likely to refer more to stimulus properties and behavioral requirements than previously. Shifting the perspective and weighing the new information against what is already known increases the likelihood of refining the knowledge of brain function. Instead of talking about music centers in the right hemisphere or word centers in the left hemisphere, investigators are attempting to determine the stimulus and task demand properties which typically engage the activity of different parts of the brain. The efforts seem to be cyclical in that research goes as far as it can in one direction, then must

seek verification from another direction. Ideally, enough investigators will be involved from many perspectives so as to make an ongoing synthesis of information possible. This enables the theorist to approach application, and the clinician to function with understanding.

Judd further referred to an area which has long been of interest to this writer. That is, what happens to the theories of hemispheric specialization when they are applied to populations who possess reading skills different from those skills which dominate the literature, such as in Oriental cultures? Does the left-to-right orientation to the written word in English affect the overall perceptions, attitudes, and responses to life in general? Does the presumption of left-hemisphere dominance prevail because of a cultural bias toward a language made up of letters and numbers which are read from left to right? The relative preservation of number and symbol reading in some alexic patients from a Western culture may reflect a relative sparing, e.g., of the ideographic or semantic reading system demonstrated in Japanese aphasics. This speculation awaits confirmation in non-aphasic alexic Japanese patients, but it is an intriguing hypothesis. What effect does an ideographic versus semantic reading system have on an approach to problem-solving in terms of the hemisphere allowed to be dominant in that context? Will musical or nonverbal responses, that is, the use of the right hemisphere or the integrative functions of both hemispheres, differ because of

a cultural (left-to-right or right-to-left) orientation to the written word?

Judd applied a constructive skepticism, taking a careful look at the assumptions that have sometimes been made based on studies which lack clarification in their design. He took the position that little is really known about the relationships between music and the brain, primarily because of the great complexity of each which is often overlooked. Frequently the literature refers to a "musical activity" performed by a patient without acknowledging music's tremendous diversity. In Judd's words, "attempts to define music, or worse, assumptions that it has been defined, probably limit attempts to study and propagate it. It may be that it is music's diversity that accounts for its existence and allows it to survive and flourish." This author feels that the same may be said for the brain. Perhaps, if the brain were so simple that humans could understand it, humans would be so simple that they could not.

Observations by Luria (1947/1970) suggest that there may be reason to pursue questions such as these. It was determined that, in patients from a Western culture, the critical region responsible for recognizing phonemes lies in the secondary zones of the left temporal lobe, which are intimately connected with other parts of the brain's speech area. Patients with lesions in this region "cannot distinguish *b* from *p* or *t* from *d*, and they may write *'pull'*

instead of *'bull'* or *'tome'* instead of *'dome'*. Moreover, they may make unsuccessful attempts to find the contents of the sounds of words they try to write" (p. 71). What is interesting about Luria's observations is that they do not hold true for Chinese patients with severe injury to the same acoustic region. They do not have similar difficulty, presumably because their writing is based on ideographs instead of on words that call for the coding of phonemes. That suggests to this writer that communication difficulties arising as a result of lesions in specific areas of the brain are perhaps a function of the cultural context as much as of the lesion itself. Considering this may offer new insights into the functional outcome of the brain-injured patient. It is functional outcome that partially defines the success of rehabilitation for the TBI patient. And the perception of the achievement of a particular quality of life is also determined by the value placed on the functional outcome achieved. Therefore, if quality of life is defined in part as the level of one's ability to function within society, and if the ability to function within society is also in part determined by the ability to communicate, then communication, and not only the recognition of phonemes, becomes the goal.

## Brain Studies which Support the Use of Music with Brain-Damaged Patients

Botez & Wertheim (1959) studied expressive aphasia and amusia in a right-handed patient with a right frontal lesion. A complete examination of the musical functions was performed one year post-injury. The patient was a 26-year old farm hand who had played the accordion since he was nine years of age and played the accordion in a band prior to the time of the injury. Before his illness he used to sing and play dance music and folk songs. He had never attended a music school and had had no musical training.

The clinical examination revealed intonational disturbances, a pitch change in his voice, and the inability to sing or to play the accordion. The prosodic quality of human language gives to speech various shades of sense by means of stress, pitch, and rhythm variations. The prosodic quality of this patient's speech was such that stress (which depends on the amplitude of vocal emission) was distributed explosively, without any relation to the sense of the sentence. The pitch (which depends on the frequency of the sound) was of a remarkable monotony. The interval between the higher and lower sound emitted by the patient while speaking never exceeded a minor third. In normal speech this interval should not be less than a fifth and at most an octave (Grammont, 1947). Regarding rhythm, the patient omitted the normal pauses between successive words,

prolonging the last syllable of a word and thus making a transition to the following word. The dysphasic element of speech was evident in the condensation of words.

The authors developed a battery of 45 tests designed to investigate musical functions. The battery is based upon a precise classification of human subjects according to their musical aptitudes and training, an element which has been lacking in the research literature. The critical attitude of the patient to his own performance was considered important; therefore, the battery was designed to distinguish the receptive (gnosic) element from the productive (praxic) one.

This patient, however, was an "empiric" musician who ignored musical notation and had no theoretical musical knowledge. Consequently, there were a series of tests that could not be applied: *solfeggio*, musical dictation, transcription, nomination of the musical intervals, decomposition of chords, "time-beating" movements, and more. The battery was outlined as follows:

I. Receptive and Mnesic Components
   - A. Tonal, Melodic and Harmony Elements
   - B. Rhythmic Element
   - C. The Agogical and Dynamic Elements

II. Productive Component
   - A. Singing and Whistling Tests
   - B. Instrumental Tests

These elements were further defined in detail in the

battery.

Particular focus was given to the dysphasic troubles and expressive amusia of this patient. An analysis of the musical dysfunctions showed disturbances of the rhythmic sense and praxic disturbances. *Rhythmic dysfunction* was demonstrated by the fact that the patient lagged behind when singing with accompaniment, and by the lack of definite rhythm in spontaneous production. The authors considered the possibility that this implied a dysgnosic phenomenon, as suggested by the inability to reproduce the given rhythms. They felt, however, that "rhythmic sense is a function of superior integration, the limits of which are considerably larger than the range of the musical functions" (Botez & Wertheim, 1959, p. 197).

According to the authors, studies by Luria (1947/1970), Kreindler & Fradis (1957), and Pavlov (1951) showed that the correlation between the fundamental processes of higher nervous activity, which are excitation and inhibition, are determinants for the quality of rhythmic reproduction. It is possible, however, that a rhythmic disturbance also has an apraxic origin. This disturbance is evident when rhythms are attempted without a melodic support. The same rhythm is produced correctly when it is bound to a musical sound or integrated into a melody. This is called the facilitation phenomenon. There is a significant analogy relevant to the field of music therapy between this phenomenon and another which has been described in some dysphasic patients who can

pronounce complicated words and sentences distinctly and correctly when they are sung. The major difficulty for this patient was to abstract the rhythm, to dissociate it from the melodic element of music.

Musical dyspraxic phenomena were evident in the case study by Botez and Wertheim (1959). The spontaneous vocal production and reproduction showed intonational and rhythmic deficiencies. There was, however, no agnosic component and no receptive disturbance.

Other observations made by these authors may prove to be of some clinical value. As this patient tried to reproduce separate sounds, he made a systematic transposition to the superior or inferior fourth. This never occurred when facilitated by a melody. The authors called this *vocal transpositional apraxia*, as the characteristic element is the performed transposition. No explanation is yet determined for this phenomenon.

Through many variations of testing musical function, the patient's receptive skills appeared intact while expressive skills did not. He was unable to perform requested dynamic variations because of his inability to control the strength (amplitude) of the emitted sound. He was, however, able to perceive variations in the performance of another. Response to agogical changes (tempo variations, *accelerando*, *ritardando*) was similar.

The intonational deficiencies were more evident in ascending passages of a melody than in descending ones.

This may not be of unusual significance to the head-injured person as the same is typically true in vocalization patterns within the normal population. The exaggeration of the phenomenon in brain-injured persons, however, emphasizes the difference and draws attention to the realistic difficulties involved in rehabilitation. From the motor and praxic point of view, the strain of the neuromuscular apparatus of phonation increases in the ascending scale.

Praxic disturbances were evident in the difficulty involved in bimanual activity. The patient was not able to play the accordion with two hands at once and was not able to accompany himself on the accordion while singing, something he had previously been able to do. He was, however, able to accomplish each of those tasks one hand at a time. In addition, a totally chaotic "accompaniment" on the accordion did not induce the slightest vocal tonal deviation.

Much of the literature has implied a right hemisphere dominance for musical function. Botez and Wertheim (1959) cited several authors (Henschen, 1925; Henschen, 1926; Nielsen, 1946; and Feuchtwanger, 1930) who indicated that the center for vocal singing is the pars triangularis of the third frontal convolution, a region which is left-sided in right-handed people. This emphasizes the discussion concerning the connection between the "minor" hemisphere and the musical functions.

Bever and Chiarello (1974) further analyzed musical

function, not so much as a specific location in the brain, but from the perspective of the nature of the musical task to be performed. The perception of melodic contour, for example, is a Gestalt phenomenon best undertaken by the right hemisphere which processes information holistically. The analysis of the structure of a tone sequence, on the other hand, is undertaken best by the left hemisphere which is dominant for analytic processing. Further, whether or not a musical presentation is apprehended holistically or analytically is largely determined by the level of musical sophistication of the listener. Generally, according to this study, the more musically sophisticated the listener, the more analytical the response; the more musically naive the listener, the more Gestalt the response. Gates and Bradshaw (1977) further confirmed the basis for accepting the representation of musical functions in both hemispheres. Studies by Wertheim (1963, 1969) clarified these functions into receptive and expressive amusia in the brain-damaged patients. He suggested that receptive amusia corresponds to a lesion in the dominant hemisphere, while a lesion in the minor hemisphere may cause expressive amusia.

Geschwind (1972) provided a summary of the classic studies concerning speech disorders and the organization of the human brain. According to this study, the obstruction or rupture of blood vessels in the brain was the third leading cause of death in the United States. Aphasia, which is a disturbance of language resulting from damage to the

brain, is a common aftereffect for those who survive such cerebral traumas.

A Frenchman, Broca, published the first of a series of papers in 1861 on language and the brain, and was the first to point out that damage to a specific area of the brain results in disturbance of language output (Geschwind, 1972). The portion he identified, lying in the third frontal gyrus of the cerebral cortex, is now called Broca's area. This area is adjacent to the portion of the motor cortex which controls the muscles involved in speech production. Damage to the motor cortex in one hemisphere does not cause paralysis of these muscles because most of these muscles can be controlled by either side of the brain.

In 1865, Broca made another contribution to the knowledge of language and the brain. Drawing conclusions from eight case studies, he reported that damage to specific areas of the left hemisphere led to disorders of spoken language. Destruction of corresponding areas in the right side of the brain did not affect language abilities. Rarely is there an exception. Unilateral control of certain functions is called cerebral dominance.

Examining the hypothesis that aphasia might be the result of muscle paralysis, Geschwind negated this possibility by noting that a person with aphasia of the Broca type, who can utter at most only one or two slurred words, may be "able to sing a melody rapidly, correctly and even with elegance" (p. 76).

Wernicke was an unknown with no previous publications when, in 1874 at the age of 26, as a junior assistant in the neurological service in Breslau, he published a paper on aphasia (Geschwind, 1972). He described damage at a site in the left hemisphere outside Broca's area that results in a language disorder differing from Broca's aphasia. In Broca's aphasia, speech is slow and labored. Articulation is crude. Small grammatical words and the endings of nouns and verbs are omitted, so that the speech has a telegraphic style.

Wernicke's aphasia, however, is quite different. The patient may speak very rapidly, preserving rhythm, grammar and articulation. Speech may sound normal, but it is abnormal in that it is devoid of content. The patient with damage to Wernicke's area also suffers from a paraphasia, which can be of two kinds: verbal paraphasia and literal or phonemic paraphasia. Verbal paraphasia is the substitution of one word or phrase for another, sometimes related in meaning ("knife" for "fork") and sometimes unrelated ("hammer" for "paper"). Literal or phonemic paraphasia is the substitution of incorrect sounds in otherwise correct words ("kench" for "wrench").

Another difference between these aphasic patients and those with Broca's aphasia was noted by Wernicke. A patient with Broca's aphasia may have an essentially normal comprehension of language. A patient with a lesion in Wernicke's area can suffer a severe loss of understanding, even though

hearing of nonverbal sounds and music may be fully normal. Because of this, it is possible to predict the sites of brain lesions on the basis of the type of language disorder.

Questions of hemispheric asymmetry and the implications for rehabilitation are carefully considered. In the study by Geschwind of 100 human brains it was noted that there were striking asymmetries. The area studied was the upper surface of the temporal lobe, which is not seen in the intact brain because it lies within the depths of the Sylvian fissure. The asymmetrical area was the planum temporale, an extension of Wernicke's area. This region was larger on the left side of the brain in 65 percent of cases, equal in 24 percent, and larger on the right side in 11 percent. Wada (Geschwind, 1972) later confirmed those tests by studying a series of brains from infants who had died shortly after birth. The apparent genetic determination for the asymmetries of the brain offers a new insight into the search for an answer to the "nature or nurture" question concerning such things as handedness. It raises questions regarding the plasticity of the brain and its implications for therapy. For example, since the asymmetries of the brain seem to imply a hemispheric dominance for particular functions, how does one account for the apparent recovery of language function in some cases? It seems that some capacity for speech function exists in the right hemisphere, for although the left hemisphere is dominant for speech for most left-handers, right-handers with a strong family history for

left-handedness show better speech recovery after injury than people without left-handed inheritance. This kind of information is valuable from the researcher/professional point of view. In time it may prove to have very tangible implications for rehabilitation potential for the traumatically brain-injured person.

Ross (1988) called for clinicians to test brain-damaged patients routinely for the ability to process affective language. He proposed that language functions are lateralized according to the behavior itself, e.g., affective versus linguistic, and not according to the physical/acoustic carrier that expresses the behavior. Thus, he hypothesized that the right hemisphere plays a privileged role in the modulation of prosody at the sentence level (intonation, fundamental frequency) in all speech production. This is in contrast to the hypothesis that the right hemisphere plays a role in imparting emotional-affective modulation of speech, but is not critical to implementation of normal intonation modulation in nonaffective contexts.

A point of interesting consideration to this author is the acoustic consequence of right-brain lesions on the voice of tone and monotone language speakers. It poses a different possibility for brain organization if the manipulation of fundamental frequency in tone languages, such as Mandarin Chinese and Taiwanese, is intimately tied in with word meaning. In contrast, in nontone languages such as English, only the intent of words, not their semantic representation,

can be altered by intonation. Music therapy might play a quite different role with a head-injured patient depending on the cultural context of the speaker and the learned linguistic orientation. Ryalls (1988) would seem to suggest that clinical observations must not only take into account the presence or absence of coherent speech but also its affective content. Clinical testing of Melodic Intonation Therapy, for example, should document both neutral and emotional contexts if the researcher is to refine his/her diagnostic insights.

Studies concerning the precise location within the cerebral hemispheres for musical tasks do not offer specific conclusions for the functional application of music therapy to the rehabilitation of the traumatically brain-injured person. But what they do offer is an affirmation of musical activity as a human process analogous to speech and cognition. Indeed, this author undertook this research with some questions concerning the practical implications for therapeutic intervention with music for TBI patients. There are, after all, persons who claim to be atonal or for whom music has never held any significant place in everyday life. Given the common tonal, harmonic, and rhythmic elements of speech and music, and the potential for music to act as a vehicle for the expression of affective thought, it seems that music is as much a part of the human phenomenon as talking and thinking. Whether it is enjoyed or to what depth it is pursued is dependent on the individual. And the

extent to which music can be used in the rehabilitation of the traumatically brain-injured patient is most likely also dependent on the neurological and aculturated receptivity of the individual. But its role in the functional outcome of rehabilitation appears to be more vital than previously thought.

## Family Studies

This section is divided into two subparts. In the first subpart, there is a discussion of the history of the development of the ecological approach in biology and sociology. In this approach, the living organism and its environment are viewed as an ecosystem. The perspective which takes into consideration the interactions which occur within the ecosystem is referred to as the ecological framework. In the second subpart, a more specific focus is placed on the environment, internal and external, of families who have a handicapped member. By becoming cognizant of the level and quality of support available to the patient through the family, professionals can be more sensitive to the implications of demands they place on the family and patient for rehabilitation.

## Ecological Framework

In 1868, Haekel, a German biologist, is credited with coining the word *Oekologie* for a science he proposed to study: life's relationship to the environment (Clarke, 1973). He did not pursue it but went on to develop other life sciences. In 1892, Swallow, a New England chemist, christened the term *Oekology* and used it to describe the interdisciplinary environmental science she had worked to develop.

The origin of the German word *Oekologie* can be traced to the Greek word *oikos* which means house. *Oek-* stands for every man's house or environment, and *-logie* is derived from the Greek *logos*, meaning *science* or *word*. According to Swallow, Oekology was the "science of the house". Historically, this concept has been used not only in the biological sciences, but in sociology as well. The ecological approach was introduced into sociology in the 1920s by Park and Burgess. This concept has also been used in such disciplines as geography, anthropology, psychology, and human ecology (Goduka, 1987).

*Webster's New World Dictionary* (1978) gives two definitions of ecology. The first one has a biological base and the second has a sociological base. The first definition is: "the branch of biology that deals with the relations between living organisms and their environment" (p. 442). The second definition is: "the study of the relationship and

adjustment of human groups to their geographical environment" (p. 442). In each there is an emphasis on the relationship of the living organisms or human groups to their environment. In the second, also, the significance of the definition lies in its inclusion of the idea of adjustment as well as relationship. For families who need suddenly to adjust to a handicapped member, as is the case when someone suffers a traumatic brain injury, adaptation skills are both critical and apparent.

Odum (1962) refined this definition in an effort to make it more concrete. According to him, ecology is the study of the structure and function of an ecosystem, that is, the study of the structure and function of nature. By structure is meant the composition of the biological community, the quantity and distribution of the non-living materials such as nutrients, and the physical matter. By function is meant the rate of energy, matter and information flow through the ecosystem.

Incorporating the concept of ecosystem into the definition of ecology, Odum brought it to a more tangible level. It is easier to talk about relationships once they are seen within the context of an ecosystem. This ecosystem could be that of the patient, his/her family, or the medical institution, for example. The term *ecosystem* was formally proposed by Tansley (1935) to describe "the whole system including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment"

(p. 299). His definition encompasses all of the components of an ecosystem, organic and inorganic, biomass or habitat. All of these are regarded as interacting factors which, in a mature ecosystem, are in appropriate equilibrium or homeostasis. It is through this interaction that the system is maintained.

As discussed by Tansley (1935), the term *ecosystem* includes the whole idea of dynamic interaction, exchange, or interdependence between an organism (O) and the environment (E). "Eco-", from which "ecology" is derived, means environment. The concept of *system* comes from a general systems model. It is conceptualized as a set of components which act with and upon one another to bring about a state of balance, interdependence or wholeness (Havelock, 1971). Therefore, the term *ecosystem* is intended to imply an interacting, interdependent complex of organisms which, ideally, maintain an equilibrium among components of and within a specific environment.

In the rehabilitation of the traumatically brain-injured patient, for example, it is necessary to evaluate the patient's physical, cognitive, and social-emotional domains. These form a system of individual development. These domains are interdependent and act with and upon one another to help bring about the rehabilitation of the patient. In addition, this personal ecosystem must interface with the multiplicity of factors which make up the environment or larger ecosystem which, in turn, influences

the responses of the patient. The totality of the environment in which a patient functions and which has some bearing on his/her responses and decision-making process comprises the ecosystem of the patient: for example, the socio-economic status of the patient or his/her family, the area of residence, the home environment and the type of family structure (e.g., closed or open). These factors all have some effect on the availability of resources and the ability to be receptive to these resources needed for rehabilitation.

Specifically, resources include personal, family and environmental aspects. *Personal* resources or attributes include interpersonal competence, intelligence, attractiveness, and coping skills (Melson, 1980). The *family* as a group provides a varying store of such resources as stability, cohesiveness, and trust. Finally, the *environment* in which the family functions furnishes additional resources and incurs additional costs.

The ecosystem view of the individual within the family considers the family environment to be composed, not only of family members with their reciprocal relationships, but also family members within settings. Bronfenbrenner (1979) contended that the study of human behavior as previously conceived is really the study of development-out-of-context. The model originally developed was for the observation of sub-human species and was limited to the immediate, concrete setting containing the living creature and focused on one or, at most, two beings at a time in only one setting. The

understanding of human needs, however, requires the examination of multiperson systems of interaction that are not limited to a single setting. It must take into account aspects of the environment beyond the immediate setting containing the person. For the patient, the environment extends beyond the hospital and beyond the family, and may indeed have some influence on his/her rehabilitation.

The ecological framework here presented is intended to build context into the research model at the theoretical, empirical, and clinical levels. In a proposed expansion and subsequent convergence of the naturalistic and experimental approaches, Bronfenbrenner offered several definitions of substantive focus. Among these, this author has selected four.

The first of these approaches is from the perspective of the *microsystem*, defined as a "pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics" (p. 22). This is the immediate setting of the patient and includes the TBI patient, then possibly the family, medical personnel, home, and hospital, where the patient can readily engage in face-to-face interaction.

The second definition is that of the *mesosystem*. This comprises the "interrelations among two or more settings in which the developing person actively participates" (p. 25), for example, home, hospital, church or work, and is

perceived to have a given role.

The third, the *exosystem*, refers to "one or more settings that do not involve the developing person as an active participant, but in which events must occur that affect, or are affected by, what happens in the setting containing the developing person" (p. 25). For the TBI patient, this might be a spouse's or parent's place of employment. The rules within that setting, for example, which govern the ability to take time off to care for the handicapped member, have a significant bearing on the decision-making process of the family regarding the patient.

And the fourth perspective chosen for inclusion here is that of the *macrosystem*. This includes "consistencies, in the form and content of lower-order systems (micro-, meso-, and exo-) that exist, or could exist, at the level of the subculture or the culture as a whole, along with any belief systems or ideology underlying such consistencies" (p. 26). At this level, realities such as the current political ideology governing the country and the attitudes toward legislation for the handicapped are likely to affect choices. Though differing values may be evident between systems at the microsystem level, there is generally an overarching set of values at the macrosystem level which affect the manner in which individuals function in their microsystems.

The reason for analyzing these systems becomes more apparent when looked at in terms of a simultaneous mutual

influence. Instead of an action and a reaction, it is more accurately described as a transaction. Changes within any of the systems will have an effect on other systems. "An ecological transition occurs whenever a person's position in the ecological environment is altered as the result of a change in role, setting, or both" (Bronfenbrenner, p. 26). Living systems are open or permeable, information-exchanging, dynamic, and engage in a communication process by which human systems and environments interconnect.

## Families with Handicapped Members

Overall, the literature on rehabilitation after an injury has been client-centered as opposed to family-centered. If the interactive ecological model is realistic, the relative success of rehabilitation is directly correlated to the level and quality of support available to the patient through the family. The family's ability to provide that support is dependent on a variety of factors, such as pre-trauma coping skills, open communication with the medical care system, support from extended family members, and availability of resources such as time, energy, or money. It is, therefore, the family's ability to adapt, to allow the injured person's needs to alter and shape the perception of what matters, that determines, positively or negatively, what the outcome of the crisis will be.

Kübler-Ross (1983) spoke of the confusion, guilt, absence of information, fear of irritating those medical personnel whom the families will need for help, anger and helplessness that families experience when confronted with a child or a spouse suffering a head injury. It is as though the health care providers' only goal for the patient is to keep him/her breathing at all costs. Family members are often kept uninformed. Yet they are the ones who, ultimately, must live with the outcome of those initial post-trauma hours. Medical advancements have created serious ethical dilemmas. The answer to these dilemmas is not simple, it is not final, and it is not solely the domain of the physician or medical staff.

Future research needs to discuss quality of life, but not as an absolute. The comatose patient's life is not predictably of less value because s/he does not respond. Without in any way attempting to diminish the pain, the anger, and the tragedy of "losing" someone to a head injury, the potential for growth and cohesiveness within the patient's family as a result of the crisis should not be overlooked.

Kübler-Ross (1983) alluded to the more gentle side of tragedy in a saying:

> Should you shield the canyons from the windstorms,
> You would never see the beauty of their carvings.
> (p. xix)

Brown and McCormick (1988) did a study on family coping strategies following traumatic head injury. Often, they

felt, the family was presumed not to have the ability to "understand." For this reason, family members were not informed or consulted frequently enough to elicit their participation in decision-making. Lack of understanding for the grieving and adaptation process the family needed to go through tended to magnify their difficulties and interpret them as weaknesses. Brown and McCormick suggested that, by addressing the needs of family members in this situation, it is possible to nurture their strengths. Research with ten families having a head-injured member identified areas of need. To each of these needs, the authors addressed a specific recommendation. They paraphrased McCubbin and Patterson (1982) when they said that it is essential, if there be a serious commitment to families with a head-injured member, to adopt the perspective that families are an integral part of the rehabilitation team. Milz (1985) said researchers and clinicians are wise to pay attention to the families who have been living with a brain-injured member. In most cases, they have made it their life's business to learn everything there is to know about head injuries. Professionals often view the patient from one perspective, but the families interface with many perspectives every day. They live the experience and they have much to teach professionals.

Fortier and Wanlass (1984) proposed a five-faceted model of a family crisis. Each facet is described in terms of its effects upon the modalities of behavior, affect,

sensation, interpersonal relations, and cognition. On a behavioral level, the family may need to provide immediate care for the handicapped person, arrange transportation to treatment, alter previous methods of scheduling time, and meet new financial needs. On the affective level, the family members begin working through feelings of grief, anger, guilt, helplessness and isolation. On a physical or sensory level, somatic symptoms may arise as a result of the stress of the crisis experience. On an interpersonal level, the family may have to deal with labeling or stereotyping, a sense of isolation from others, handling "helpfulness" and advice from friends, and providing support for other family members. On a cognitive level, the family is called upon to assimilate technical information about the disability and to deal with the impact of the diagnosis on established values and expectations.

By understanding how family members work through the stages of crisis resolution, the reasons and places for therapeutic intervention become clearer. The therapist is better able to recognize important symptoms and accept certain "abnormal" behavior as normal in the context of the crisis. With such knowledge, the therapist is more prepared to implement appropriate intervention methods. Crisis resolution involves reconciling the "loss" of the family member with the inclusion into the family of a new, now-handicapped member. Kübler-Ross (1969) proposed six stages of grief: (a) denial and isolation, (b) anger, (c) bargaining,

(d) depression, (e) acceptance, and (f) hope. Closely paralleling these, Bristor (1984) outlined a holistic model for grieving when confronted with the inclusion of a handicapped member into the family. The model detailed four important factors that affect an individual's reaction to loss: (a) degree of attachment, (b) the change the loss causes in the day-to-day routine, (c) the manner in which stress is usually handled and the individual's ability to cope, and (d) the individual's support system and whether or not family and friends give the individual permission to grieve.

When Altshuler (1945) first applied the "iso-" principle to the mental patient, he intended it to bring the patient from what was presumed to be a distorted view of reality into the reality which actually existed around him/her via the use of music. Use of the "iso-" principle concept with head-injured patients and their families has its value not in moving them away from the reality they perceive, as is sometimes necessary with mental patients, but in helping them to accept the reality they perceive. Another value lies in helping them to recognize the implications of their reactions to the loss, to understand the cause of their feelings, and ultimately to accept the reality as it is. To this end, Bristor (1984) suggested that there are eight areas which the family needs to explore: (a) initial awareness of the loss and its immediate meaning; (b) acceptance of a range of emotions as

normal; (c) freedom to express feelings and to cry, and to encourage this for men as well as women and children; (d) inclusion of children in the grieving process; (e) importance of friendships; (f) value of support groups; (g) need for time for oneself; and (h) benefits of counseling.

While a focus is rightfully on the gains to be made through rehabilitation of the patient, the professionals need also to be aware of the loss to the family incurred by the injury. Demands for support of the patient's rehabilitative needs must interface with the family's need to grieve.

Even while the grieving and rehabilitative process is going on, new methods of coping are most likely needed. For most, the experience of having suddenly to adjust to a handicap is one they have never had before, and for which there is little way to prepare. Schilling, Gilchrist and Schinke (1984) refer to a definition of coping as problem-solving efforts made by an individual when the demands of a given situation tax adaptive resources. The authors separate these efforts into personal coping and social support. The first deals directly with coping mechanisms which can help family members with the daily demands of caring for the handicapped person. The second enables families to maintain a sense of "normalcy" by continuing to interact with other persons in addition to the handicapped member.

The magnitude of the needs of the brain-injured person

requires that family members often must act as therapists. Harris (1984) pointed out that it is important for the professional to go beyond teaching family members behavioral skills and recognize that such training occurs within a family context. Unless there is sensitivity to the impact of behavioral interventions upon family functioning, such training may prove disruptive rather than helpful to the family as a whole. Mealia (1976) raised concerns that some behavioral approaches to clinical problems required a narrow scope of treatment and felt that this failure to be aware of the broad impact of one's interventions could lead to a deterioration in the family unit. Recognizing this, Harris (1984) thought it best to approach families with handicapped members from a family systems viewpoint instead of from the viewpoint of only one member or from the viewpoint of the handicapped person. From this perspective, it is important to stress that the environment is not viewed as the cause of the problem. Rather, family issues are seen as likely to arise from, or be intensified by, the unusual stress of unexpectedly having to incorporate a handicapped person into the family.

There are only a few conceptual frameworks designed to help clinicians differentiate families in disequilibrium from those families who are stressed but coping well. Longo and Bond (1984) did a review of the research literature to identify measures of successful family functioning along with models of practice to promote healthy family

adaptation. Two issues were addressed: (a) potential dysfunction, and (b) potential adaptation. Does the stress of having a handicapped family member necessarily result in dysfunction of the family and/or family members? And are there alternative ways of conceptualizing this clinical problem without using models for intervention based on impairment as an expected outcome? The implications are predictable. If the assumption is that dysfunction is a normative pattern in families with handicapped members, it is conceivable that some clinicians may expect to find problems in these families where none exist. For example, a normal denial stage may be inaccurately assessed and clinical intervention strategies may be non-productive and even dangerous, rather than realistically supportive and reassuring.

Kazak and Marvin (1984) discussed the differences, difficulties, and adaptation styles in families with handicapped members. One of the unexpected findings in the analysis of families where there was mother-child "overinvolvement", with the father peripheral to the day-to-day parenting subsystem, was the lack of marital dissatisfaction. Rather than reflecting a family structure in which the father was peripheral to the family as a whole, this experience could reflect a structure in which the father is very central to the spouse subsystem, and peripheral only to the day-to-day parenting subsystem. It was pointed out that the importance of such a distinction can be seen when

viewing families within a family system model.

Sherman and Cocozza (1984) gave yet another perspective on the kinds of decisions requiring the use and evaluation of coping and adaptive skills within families. The decision to seek out-of-home placement for the handicapped member is affected by a number of factors: client characteristics as well as other situational factors such as family characteristics, stress on families, and social supports and community services. While it is often true that the more disabled a person is, the more likely the family is to seek out-of-home placement, it is not always true. Because of the difficulties encountered during the period of crisis around the diagnosis, families frequently turn to persons outside the family for advice and support, and are sometimes greatly influenced by these advisers. The decision to institutionalize may be a direct result of professional or medical advice and not a function of client disability, family stress, or inability to cope. Professionals need to be cognizant of the potential role they play, not only in the physical rehabilitation of the client but also in the nurturing of the appropriate support system for the client.

Evolving out of the discussion of these issues, which represent a portion of the kinds of issues families with handicapped members must address, is an appropriate concern for the implications for policy-making and clinical practice. Bubolz and Whiren (1984) discussed the linkages between values, resources, and decisions in the various

parts of the total family ecosystem. While the focus is on the varying systems (micro-, meso-, exo-, and macro-) of the patient and his/her family, the clinician also needs to look at the differing levels of influence s/he exercises within the rehabilitative schema. The authors proposed an ecological systems model as an appropriate vantage point from which to look at the family as a microunit of society and as an environment and source of resources for all its members including a handicapped person. The expectation is that clinicians make a consistent effort to keep it all in perspective. While the handicapped person is at times an all-consuming focus of attention, s/he is not, or might not be, the only point of focus.

The ecological systems model, or ecosystems model, is based on a systems perspective, a unifying holistic model which focuses on the interrelationships and feedback processes between components of a system (Buckley, 1967). A basic tenet of this approach is that a change in any part of the system, such as the loss of a family member or the addition of a handicapped member to the family, affects the system as a whole and its other subparts. This creates the need for a system-adaptation rather than simply attending to a single part of the system. Based on the general systems concept of "wholeness", it is presumed that as segments of the family system or the environment change, the state of equilibrium of the ecosystem will be disrupted necessitating counterbalancing or elaborating changes.

According to Bubolz and Whiren (1984), in an ecosystem model of the family the following assumptions are made:

1. Any alteration in the flow of energy, matter, information, and other resources through the family system requires adaptive change.
2. Supplies of human energy -- physical and psychic -- are limited.
3. Behavior of individual family members creates stress, which requires additional energy inputs by other family members or from external supports, as well as energy input for obtaining these supports.
4. Undue energy demands create "energy sinks" -- where adaptive, creative behavior may no longer be possible -- resulting in still greater stresses on the family. (pp. 7-8)

The microunit of the family cannot operate indefinitely with extremely high energy expenditures. It can do so repeatedly for brief periods if the resource base and capital goods (savings, knowledge, kinship, and friendship support) are adequate. However, as was shown in Chapter I of this thesis, persons with traumatic brain injury may, on the average, live another 40 or so years beyond the time of the injury. The ongoing demands on material and psychic energy, as well as other resources of the family, can exhaust the resources. Again, difficult moral/ethical judgments and decision-making dilemmas must be confronted by families and other societal units. If family resources are depleted in caring for the handicapped members, other family members may be deprived. Society as a whole is then

affected. But society is also affected if families strive to develop the nurturant and caring capacities of the non-handicapped, which in turn asks of society that it develop a way of supporting the families in that effort.

Following are some of the implications for policy and practice quoted and adapted from Bubolz and Whiren (1984). These stem from, and are more accessible because of, the use of an ecological model.

1. The total family unit must be considered in the development of a plan and program for a handicapped member so that decisions are made which are most likely to produce the greatest benefits or least costs to all members of the family.

2. "Appropriate support and services must be provided to the total family unit. Healthy children whose lives are inextricably altered by the presence of a handicapped family member may inadvertently be placed at developmental risk in the family's attempts to cope with a crisis producing member" (p. 11).

3. The issues of longevity of the seriously handicapped need careful examination in the development of policies and programs for care of the handicapped. What responsibility do siblings have in this regard?

4. "The total energy needs of the family must be considered in establishing external systems of support. . . . Additional energy flow into the family in goods, money, or

labor should be *at least equal* to the energy sink generated by the presence of a handicapped member. [Therefore], . . . the inputs and the energy sink would be higher than normal but the outputs from the family would remain normal in quality and quantity" (p 11).

5. "Easily accessible information retrieval systems and advocacy systems need to be established," such as the National Head Injury Foundation and state and local chapters, so that patients and families "can receive the kinds of information and service inputs they need for caring for the handicapped member" (p. 11).

6. "An ecological model should be used in the design and implementation of delivery systems for community programs for the handicapped" (p. 11). The focus of assistance should be on the holistic nature of the needs of the handicapped person and his/her family.

7. Placement of the handicapped person needs to be carefully evaluated, whether that placement be with the handicapped person's family or with a community agency. Are these persons going into microunits in which there may not be sufficient energy or resource base for the maintenance of the group and appropriate outputs into the community by other family members?

8. Adoption of handicapped children, as far as this author knows, has not been discussed for the traumatically brain-injured person. It may be, however, a sensitive, though difficult option based on the value system and energy

needs of the family of the handicapped person. Variations of this possibility are already in use such as foster care and respite care.

9. Education of the public into an awareness of the psychological, physical, ethical and economic dimensions of the family systems of the handicapped needs to be emphasized.

# CHAPTER III

## PROPOSED INTERFACE OF BRAIN INJURY AND MUSIC THERAPY WITHIN AN ECOLOGICAL FRAMEWORK

Through various therapeutic modalities over the years, many treatment possibilities have been explored with different populations. Verbal and non-verbal approaches have been utilized. Treatment has focused on the individual patient as well as on the environment in which the patient is receiving treatment. In some instances, the families have also been included in treatment. These and other avenues have served to create a background from which to gain insights into what has proven to be beneficial with specific populations and what has not. During earlier years, treatment efforts focused on developmental and psychological disorders. In more recent years, medical science has added the traumatically brain-injured patient to its list of those who can potentially be helped. Without discounting past experiences in therapy, but recognizing the ever-evolving insights and technical capabilities available to clinicians today, the music therapist needs to assess and choose carefully those forms and aspects of therapeutic intervention which are likely to be most beneficial in treating this

population.

The new health paradigm has been gradually shifting away from the concept of institutionalizing those who need the assistance of the medical profession. The insurance system, while it has not resolved the issues of recuperation and rehabilitation, has forced health care professionals to grapple with cost-effectiveness and alternative means of support. As a result, there is added impetus to make use of whatever human resources may be available to the patient. One way to determine the type and level of available resources is through the use of an ecological model. This can be expressed as a visual tool which is easily accessible to both the client and the therapist.

## Rationale for Use of an Ecological Approach

The traumatically brain-injured patient is generally in need of multiple interventions by a variety of treatment professionals. These can include physicians, surgeons, psychiatrists, neuropsychologists, speech therapists, physical therapists, occupational therapists, and recreation therapists. They also include social workers, nurses, laboratory personnel, technicians and educators. Most will interact directly with the patient at some time. Family members and significant others provide the emotional and financial support which determine in varying degrees the

potential for, and actual outcome of, rehabilitation for the patient. The music therapist will not likely be the sole nor the primary therapist for the typical TBI patient, and therefore must be able to interface effectively with other professionals, personnel and family members. Those involved with the TBI patient will be called on to absorb and interpret essential and relevant information from multiple sources, each often with its own brand of technical language.

In Chapter I, it was noted that, in a careful search of the literature concerning the use of music therapy in the rehabilitation of persons with closed-head injuries, no clearly elaborated framework or model which takes in the multiplicity of factors concerning the patient had been developed. A *single-discipline* model draws on the theory, principles and practice of music therapy, identifies a need, and attempts to provide a beneficial and therapeutic intervention to the head-injured victim. The relationship is direct between the therapist and the client, and the focus is on the specific goals attainable through the medium of music therapy. However, if the single-discipline approach ignores or affords only limited communication with other health care personnel or family of the patient, it would not likely be efficient or effective. The extensive time period involved in rehabilitating a TBI patient requires that there be a built-in means of communication that can span time as well as numbers of systems involved.

Considerable improvement in communication supportive to

the therapeutic process is possible with an *interdisciplinary* approach, wherein the various care providers act as a team, having a greater or lesser degree of structure. In this model, each treatment professional shares information, treatment goals, and progress notes with all the others. There must be some effective means for joint decision-making in terms of treatment priorities, coordination and continuity of care, and conflict resolution when indicated. The purpose of such an interdisciplinary structure is to ensure that the care is not unduly fragmented and that the patient derives optimum benefit. Often, however, there is a dominant discipline within the agency or within some other support system which imposes aspects of its own theoretical and practical structure on the other disciplines. For example, the interdisciplinary approach frequently begins and ends within the hospital setting. Treatment takes place within the hospital and with a necessarily narrow focus. Schedules revolve around hospital staff, and the support system for rehabilitation comes from within the medical facility. It is an appropriately concentrated effort at certain levels of recovery.

Each contributor in the interdisciplinary approach maintains a vantage point unique to a particular discipline, yet the boundaries of separate theoretical frameworks are expanded to include concepts borrowed from other disciplines. One difficulty is that only those concepts which pose no serious challenge to the others or which involve no

major language difficulties can be received or welcomed. Further, and of most significance to this thesis, in the interdisciplinary approach, the interfaces between conceptual frameworks of different disciplines are sometimes ignored, and, as a result, the interfaces between the systems represented by the various disciplines are ignored (Auerswald, 1968).

Building upon the recognized strengths of the interdisciplinary approach, the ecological framework can offer additional advantages. It is a contextual approach which takes into account the total environment in which the patient actually lives and functions, including the resources, the stressors, and all of the subsystems. It is to be distinguished from the concept of an artificially created therapeutic environment[3] which is designed to maximize the positive influences on the patient long enough to enhance his/her ability to become stabilized at a level receptive to the development of appropriate coping mechanisms. A possible difficulty with this approach is that the coping mechanisms are generally directed toward adaptation to the artificially created environment, thus, in effect, teaching the client to be a good patient. The ecological model considers the real environment of the patient as it is,

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[3] As in the technique known as *milieu therapy*.

recognizing that emotional and financial resources, both positive and negative, will come from the internal and external environment as it exists for that patient.

In the ecological model, coping skills and programs for rehabilitation are developed which take into account what resources are available or possibly available for that particular patient. Knowing this increases awareness of the consequences of the decisions made on behalf of the patient. The ecological framework is used to structure the gathering, processing, and utilization of information relating to the patient, the patient's family, and the various therapies and professional disciplines. The framework would thus enable and foster information exchange among all members of the system, and would encourage thoughtful and comprehensive goal setting with appropriate input, not only from the professionals, but also from the family of the patient and, when possible, from the patient as well.

For these reasons, the ecological model enhances the potential for consistency and continuity of care, as the various care providers are familiar with, supportive of, and reinforcing of one another's efforts. According to Howard (1986), there are seven factors which must be present throughout treatment in order to facilitate the best possible response from the TBI patient. Treatment must be (a) structured, (b) consistent, (c) repetitious, (d) specific, (e) practical, (f) reinforced, and (g) meaningful to

the patient. If the communication is open and consistent among team members, that, as well as these seven factors, becomes a valuable resource for the patient involved in rehabilitation.

A major contribution of the ecological approach is that it changes the vantage point of all participants. Instead of each viewing the patient from the narrow perspective of one discipline, the starting point becomes the system as a whole. The model focuses on the interrelationships and feedback processes among components of a system (Buckley, 1967), that is to say, on the holistic nature of the problem of the individual or family needing attention.

The following is a proposed model of an ecological framework for the use of music therapy with the traumatically brain-injured patient. Its purpose is to demonstrate the interface and energy flow between the patient and each "system" and among the systems themselves. More specifically, its purpose is to illustrate how interventions of a music therapist may be purposefully integrated into the rehabilitative process.

## Proposal for an Ecological Model

The utilization of an ecological model to assess the head-injured patient requires a focus on the complex ecological system which includes the TBI patient, his/her family,

their total environment, and the transactional relationships within that environment. Specifically, the ecological system of the patient, as the source of nurturance, stimulation, and support that must be available for the successful rehabilitation of the patient and the survival of the family unit, becomes the point of focus.

In order better to visualize these resources which are embedded in a complex mass of interrelated data, a model has been devised. It is intended for use by the professional as an interviewing and assessment tool with the TBI patient and his/her family. Its use helps the family of the head-injured patient, the health care personnel, and perhaps eventually the patient to assess the quality of the life space of that patient and family. Stress and conflict are recognized as part of the environment of any living system, but it is also recognized within the ecological view that a balance must be achieved between stress and support, between demands and resources, when considering the potential for success in the rehabilitation of the TBI patient. This model assists the therapist to assess the implications of the rehabilitative demands on the patient and the family and to gauge whether they have an excess of resources, whether they are already stressed, or if they are without support. In addition, this kind of analysis helps the family think through the implications of having a head-injured member and what impact a TBI patient with all his or her needs, demands, and requirements may have on the balance currently

being maintained in the family's ecological system.

The focus of an ecological model is on the life space, that is, the ecological system, of the patient and family. Within this format the family members can feel comfortable and non-defensive and at the same time begin to see themselves as part of a system capable of supplying a support base.

In developing an ecological model for use with the TBI patient, the EcoMap, which is an interviewing and assessment tool, is used in order to provide a gross evaluation of the life space of the patient (Hartman, 1981). The EcoMap may be sketched on a plain piece of paper or may be constructed by filling in a blank EcoMap as pictured in Figure 1. It was decided by this author that for the family under stress and unlikely to have had experience with the EcoMapping process, the simple, structured model would be used first because the process may be easier to learn by following the structured map.

The circles represent the systems involved with the family and patient and thus begin to introduce them to the systems approach to problem solving. Most circles are initially the same size to allow those participating in the process to place their own value on them; however, the size and placement can vary. Value can be implied by the size of the circle, the distance from the smaller circles to the central circle of significance, or the variations in the lines drawn between them. This type of assessment tool is

Name _____

Date _____

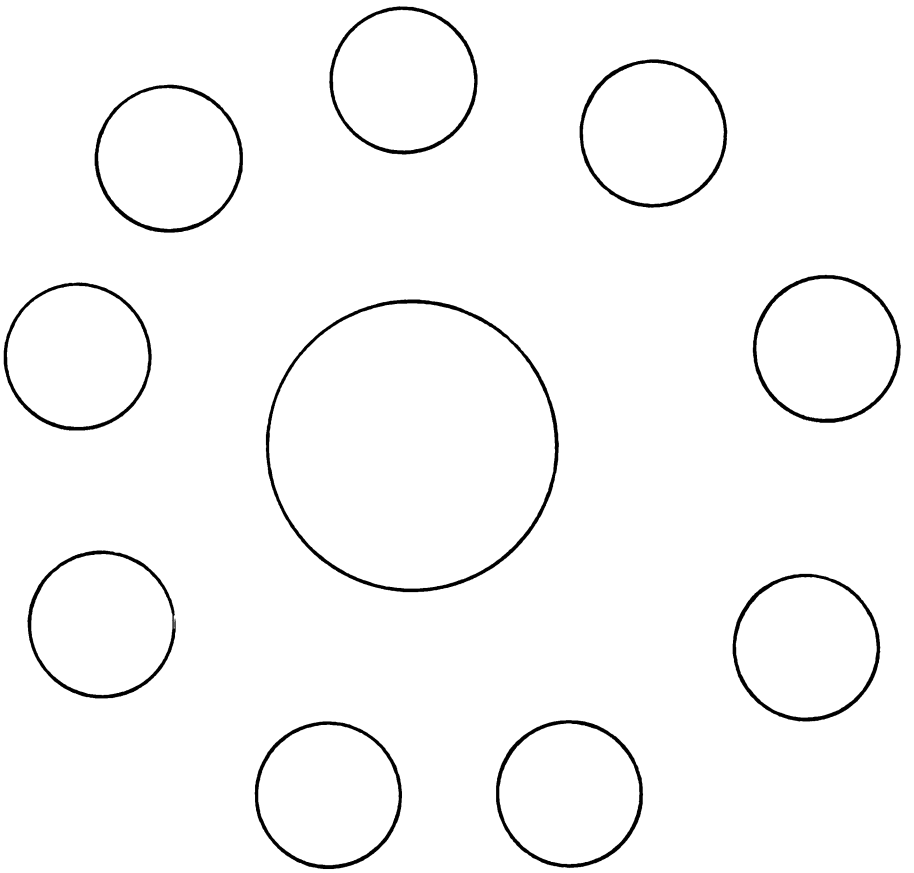


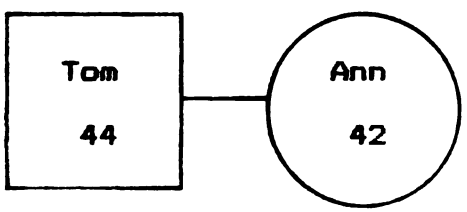
Figure 1. EcoMap I

This is a blank map which is intended to provide an introduction to the systems approach.

flexible and family members should be encouraged to make their own evaluations.

Figure 2 suggests possible ways to vary the size and distance of the circles and to fill them in. The tool is a flexible one and is intended to be specific to the particular family and patient in question. Therefore, it will probably be helpful for the therapist applying the tool to make suggestions. People are often unaware of themselves as part of a system. As such, they are also unaware of the interactions taking place between systems or the control they themselves might be able to exercise over the influences in their lives. Persons in crisis may tend to look for support from inappropriate sources and not recognize the resources which may now appropriately provide support. When one considers the number of words it would take to discuss and explain this network, the usefulness of pictures becomes more evident.

Figure 3 deepens the understanding of the effect of the TBI patient's injury on the family. Members of the household are depicted as follows: a woman is indicated by a circle; a man by a square; a married couple as follows:



Name _____

Date _____

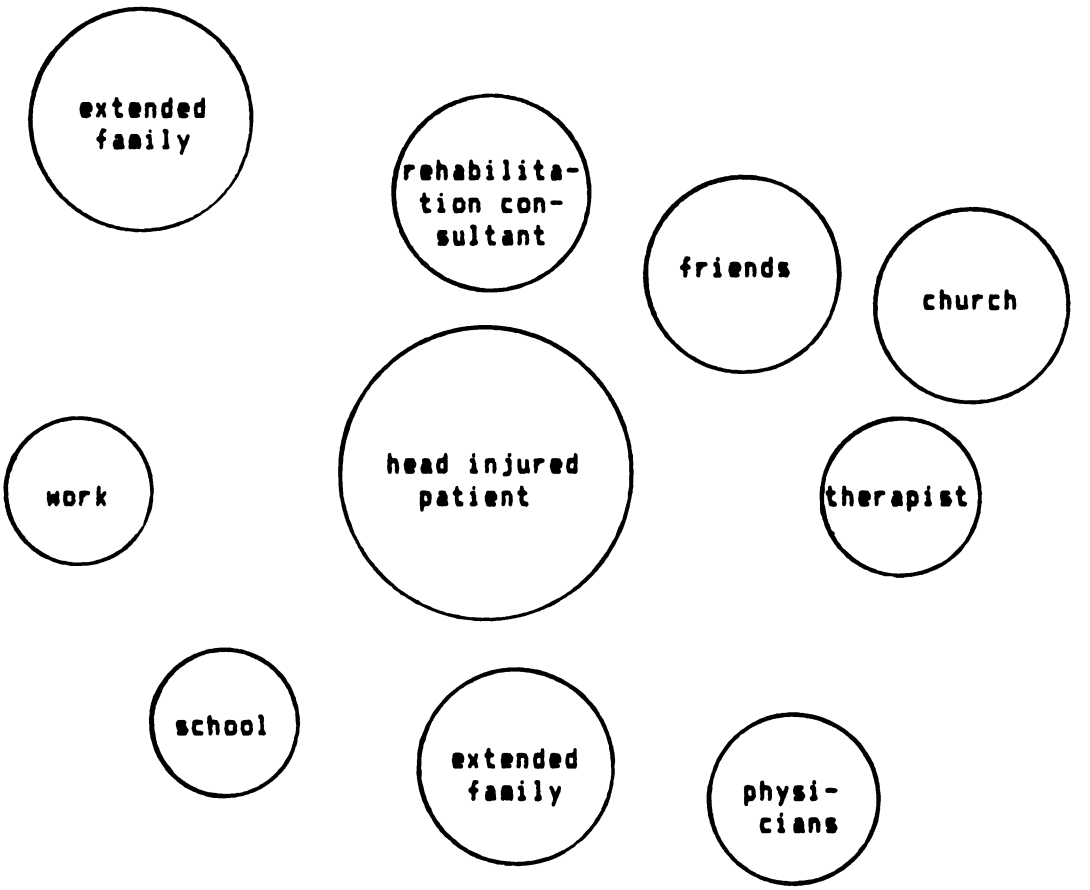



Figure 2. EcoMap II

Fill in connections where they exist.

Indicate the nature of connections with a descriptive word or by drawing different kinds of lines; _____ for strong, -------- for tenuous, ======== for stressful.

Draw arrows along lines to signify flow of energy, resources, etc. --> --> -->.

Identify significant people and fill in empty circles as needed.

Name _____
Date _____

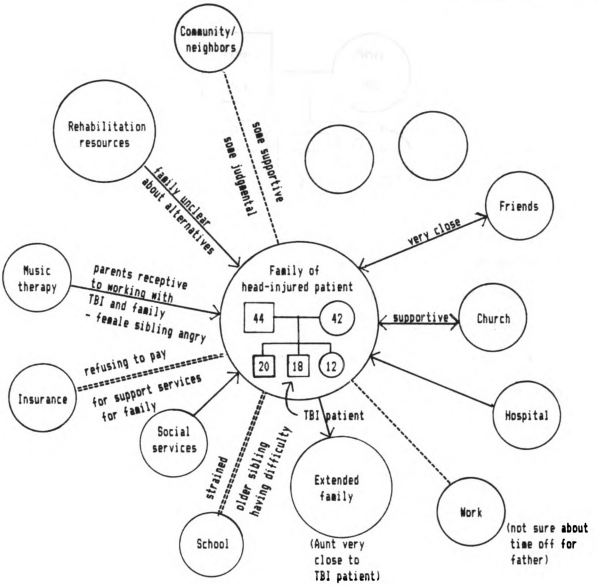
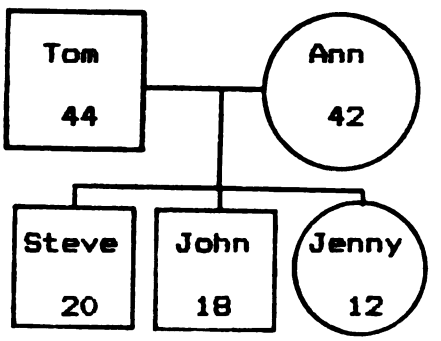



Figure 3. EcoMap III

This type of model gives family, patient, or professional the opportunity to describe systems they see as significant, as well as strength of connection between and among the systems.

Children and siblings are connected to the diagram of the parent like this:




Ages are written in, giving the reader a better sense of the patient's possible role within the family. Additional information on genograms can be found in Hartman, 1981.

Connections in the following figure are intended to portray the total family group's relationship with various systems in the environment. Three kinds of lines for *strong, tenuous,* and *conflicted* relationships are an effective shorthand for a quick, objective assessment of relationships. For a more thorough evaluation, however, it would be useful to have the family or patient offer a word most descriptive of their interpretation of the type of line chosen (Figure 3).

Finally, the last model presented (see Figure 4) is designed to show the complexity of the interfaces between and among the micro-meso-exo-macrosystems of the patient and family. Connections are drawn from the family as a whole as well as from the individual family members. Not all

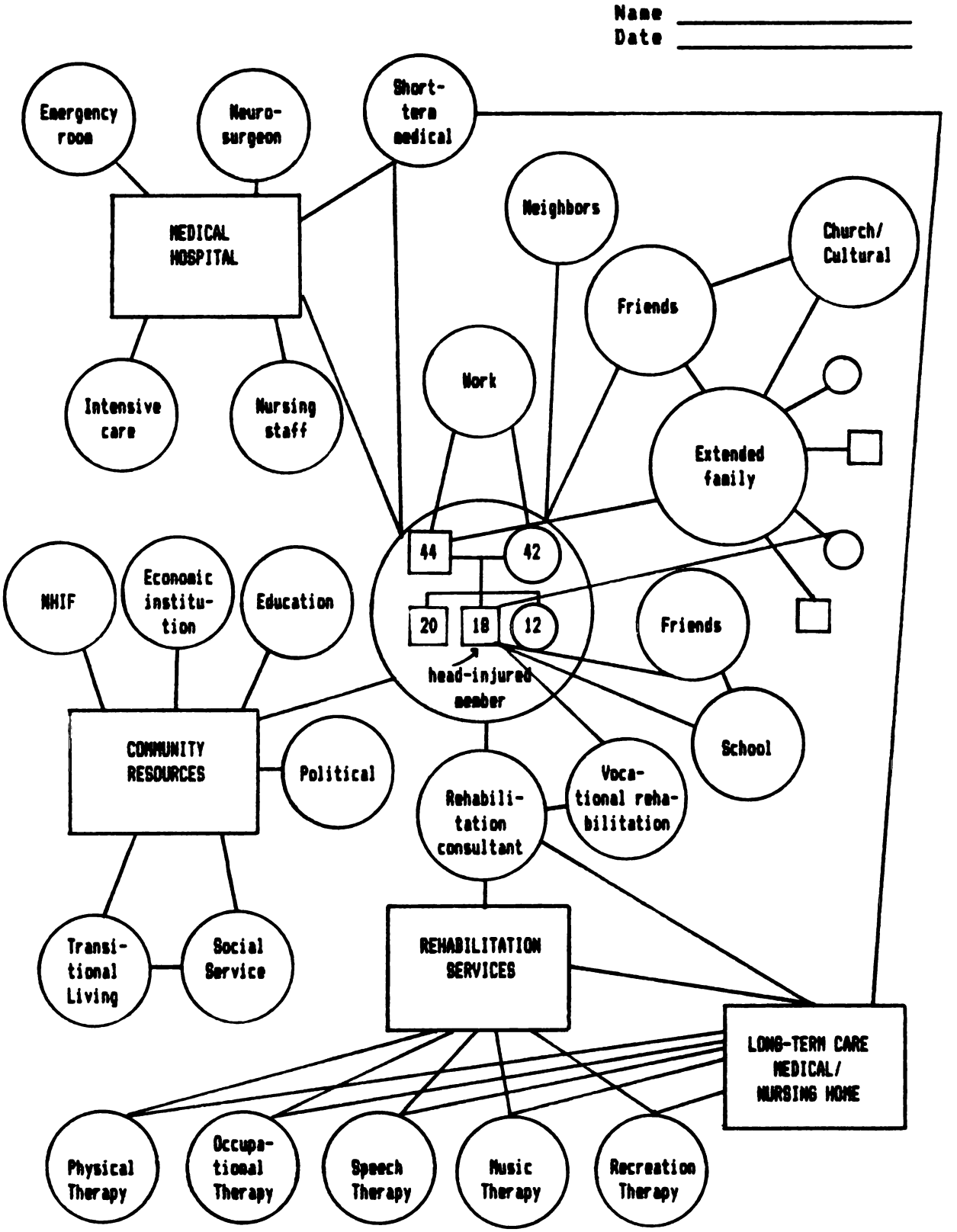



Figure 4. EcoMap IV

possible lines have been drawn, but only enough to suggest possible interfaces which affect the TBI patient. Larger, overarching systems are depicted by squares, while smaller circles indicate the multiple systems with which the patient and family are required to interact more directly. It should be possible for the professional or other individual to find him/herself in the diagram and identify lines of communication that will most likely enhance the rehabilitation of the patient. Such a model helps the professionals to realize that the patient and the family must interface with many people each day where the rehabilitation of the patient is concerned. Hopefully, this will highlight areas of support as well as areas of weakness.

Figure 4 was developed for the purpose of showing that many systems interface with the system of the patient and family. Varying lines were not used only because of the great variety of possibilities. It is important to note that connections can be strong or weak, strenuous or nurturing. Agencies that exist in theory as support systems can at times add to the stress, e.g., insurance companies or political institutions. And other systems which play a minor role for one patient may be a tremendous source of support for another such as extended family or church affiliations.

> Use of an ecological model requires that we realize that policies, programs, and services for the handicapped and their families are directly related to the value we hold about equality of

> opportunity and access to resources, respect for life and human dignity, work, health and well-being, development of human potential, independence and justice. The model does not make it any easier to resolve and manage the complex decisions and problems related to caring for the handicapped and their familiies, but it can increase the awareness of consequences that may follow from the decisions we make. (Bubolz & Whiren, 1984)

The music therapist might begin using the model by drawing an EcoMap and placing him/herself in the appropriate relationship to the patient. The ecological model then becomes a way of thinking about a patient and accounting for significant components of his/her ecosystem. It is not intended to be mechanistically applied through a single tool. The EcoMap was selected as one clear means of expressing the ecological concept.

# CHAPTER IV

## SUMMARY AND RECOMMENDATIONS FOR RESEARCH

In this paper, an effort was made to develop a resource base which can facilitate research on the use of music therapy with the traumatically brain-injured patient. Several types of literature were reviewed in order to identify what forms of music intervention have been utilized with the head-injured population, to attempt a theoretical explanation for the efficacy of this intervention, and to describe an ecological framework. Suggestions for further research will be discussed.

### Summary and Discussion

This study has brought together the available theoretical and empirical foundation which supports the usefulness of music therapy with TBI patients. Sufficient evidence exists to suggest that music therapy is a valid intervention with this kind of patient, and that further research in this area is critically needed.

In addition, the study has described the value of

employing, as an overarching framework, the ecological or contextual approach within which information exchange is more readily facilitated. It is suggested that the ecological model will contribute to the beneficial integration of factors affecting the brain-injured client.

This thesis has, moreover, brought an abundance of useful information within ready grasp of the music therapist who is considering work with brain-injured patients. The study reviewed all of the known literature regarding the use of music therapy with persons who have experienced brain injuries. As noted, these are not carefully constructed studies and do not of themselves form a sound basis for generalizable conclusions. They do, however, suggest that an important beginning has been made. While these papers were mostly published in media readily available to the practicing music therapist, they are few in number and may be easily overlooked.

The study has also reviewed a representative portion of the literature on brain research insofar as it appears to provide a rationale for the possible beneficial use of music in rehabilitation of persons with closed-head injuries. In these cases, however, the articles are generally published in books or journals not typically within reach of the practicing music therapist nor are these materials, for the most part, familiar to those in the music therapy profession.

Finally, this study has described some of the literature in family ecology which may be helpful to the music

therapist in this highly complex area. Once again, this body of literature is not usually found in the library of a music therapy practitioner or of a university music therapy department.

Besides making available this review of relevant literature, a number of other resources are also provided. The terminology and technical vocabulary relating to neuropsychological, medical, and ecological disciplines can be confusing. To aid in managing the language specific to these professions, and to facilitate communication with other professionals, a glossary of terms is supplied in this study.

Appendix A gives a brief listing of informational and supportive resources for the traumatically brain-injured patient or for the family or therapist of a TBI patient. For a music therapist newly entering this field, this material may be of considerable assistance. The professional listings of Appendix B can be similarly useful.

Appendix C contains the principal components of the Rancho Los Amigos Hospital scale for rating levels of cognitive functioning. These levels range from fully comatose patients (no response) to those evincing purposeful and appropriate responses. This scale is highly useful and will be indispensable for the therapist-researcher in this area.

Finally, in addition to the index of published materials which were cited in the text of this paper, an extensive listing of related literature can be found in the general

reference section of the bibliography.

## Suggestions for Further Research

As a consequence of the literature review and the development of the model presented in this paper, a number of questions for continuing research have been generated. Among these are the following:

1. How can music therapy be of benefit to the traumatically brain injured client?
2. What functional outcomes can be expected as a result of music therapy intervention?
3. Is music therapy best employed in isolation or in conjunction with another discipline, e.g., speech therapy?
4. To what extent can music therapy be useful as a means of integration among various therapeutic interventions, supporting and reinforcing what other therapists do, and ensuring that human needs of the patient are not overlooked, affording, where appropriate, necessary relaxation and comfort?

In addition, the ecological model needs to be thoroughly field tested with professionals and families involved with TBI patients to assess its utility and applicability in this arena. Moreover field testing should be employed to

determine how best to adapt the ecological concepts to the needs of the music therapist.

## Experimental Research

The utility of music therapy with traumatic brain injuries should be carefully studied, since little more than anecdotal and conjectural information is presently available, although the theoretical basis for its efficacy appears to be in evidence in neurological and physiological research. Future studies with TBI patients should differentiate the diagnosis, precise location and type of lesion, nature and extent of functional deficit, pre-existing cultural characteristics and premorbid tastes, preferences, habits and skills. It may be that music therapy offers potential benefit to certain distinguishable types of TBI patients rather than to others. It may also be that use of specific music therapy tools and methods are more effective than others with this clientele. The presence or absence of previous or concomitant interventions by other therapeutic disciplines may be very relevant. To identify the separate and interactive influence of each of these factors, multivariate analysis of data will be required. Well-controlled studies can be designed with patients randomly assigned to experimental and control groups, following the appropriate protocols for conducting research on human

subjects.

An essential prerequisite for any serious studies of this type is the development of a comprehensive assessment instrument to use in gathering information on all parameters relevant to music therapy, including neurological, physiological, social, emotional, educational, familial, musical, and environmental data. The preparation and field testing of such an instrument will represent another opportunity for research. The assessment tool should prove helpful, not only to researchers, but to practicing therapists as well.

## Case Studies -- Family and Individual

This paper has described an ecological framework for the use of music therapy with TBI patients. Whether this approach is better under all or certain circumstances than such alternatives as the single-discipline approach or the interdisciplinary approach can be evaluated using the case-study method.

Use of an ethnographic research approach which allows for careful and thorough observation of a wide variety of characteristics of the individual, family, and environment of TBI patients can help to discover and assess the relative advantages of these approaches and can ascribe a plausible rationale. Case study methodology is particularly useful for explanatory, descriptive and exploratory purposes (Yin,

1984). It frequently can supply details which aid in understanding the phenomena under scrutiny.

## Practical and Clinical Applications

From the literature which has been reviewed (Chapter II), it is expected that music therapy will be found particularly useful with speech and motor impairments, in teaching relaxation skills, and in enhancing higher levels of cognitive and affective rehabilitation. There is no *a priori* reason to conclude that music therapy will not be of benefit in most remediable deficits of persons who have suffered closed-head injuries. Again, only through detailed patient classification and careful empirical research can one point with greater certainty to the relative utility of this discipline for these clients.

The patient will be the beneficiary if the therapists make effective use of the ecological model to enhance information exchange and to ensure that important processes are not overlooked. This approach, too, can and should be tested and refined.

Finally, it is contended by this writer that music therapy, properly applied, is integrative and can serve to help avert fragmentation and discontinuity of patient care. The basis for this assertion is that (a) music itself is integrative, (b) the involvement of left and right hemi-

spheres of the brain in the production and reception of music is an integrative process, and (c) the recommended ecological framework for the use of music therapy with TBI patients is essentially an integrative concept.

# GLOSSARY OF TERMS

## GLOSSARY OF TERMS[4]

### A. Neuropsychological Terms

ACALCULIA: inability to perform mathematical operations, recognize numbers, or count.

ACUITY: keenness of sensation.

AGNOSIA: loss of ability to recognize familiar people, places, and objects.

AGRAPHIA: loss of ability to express thoughts in writing.

ALEXIA: inability to read or recognize words.

ALEXIAS: disorders of reading ability:

*Alexia with agraphia*: characterized by marked disability in reading and writing at all levels, including reading aloud and silently, matching words to pictures, identifying letters, and writing spontaneously and to dictation.

*Alexia without agraphia*: characterized by marked impairment in reading ability with relatively well-preserved writing ability. Letter recognition and naming, although slow, are typically fairly well-preserved. Words are only poorly and slowly recognized, usually by spelling and sounding them aloud. Letter recognition is often facilitated by tracing the letter with the finger, or even with head or eye movements. Writing is well-preserved. However, patients often cannot recognize what they have written a few moments after they have written it.

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[4] Adapted from: Baker, 1988; Bannister, 1985; Campbell, 1981; Carpenter, 1978; Fincher, 1981; Freedman and Kaplan, 1967; Geschwind, 1972; Miller, Keane, & Saunders, 1978; NAMT, 1985; NHIF, 1986; Posner, 1978; Ross, 1981; Rowe, 1970; Swiercinsky, Price & Leaf, 1987.

*Anterior alexia*: accompanies Broca's or motor aphasia and is characterized by an incomplete disability in reading and writing. Letter naming, identification, and writing to dictation are poor, while word recognition, word-picture matching and word writing is better. Concrete words, especially nouns, are handled better than abstract and grammatical words.

AMUSIA: impairment of premorbid musical ability following brain damage, whether for perception or (re-)production of vocal or instrumental sounds.

ANOMIA: inability to name objects or recall individual names.

ANTEROGRADE AMNESIA: loss of memory for events and periods of time following an injury or traumatic event.

APHASIA: impairment, due to brain damage, in the ability to understand and produce language.

APRAXIA: loss of ability to carry out a purposive movement, the nature of which the patient understands, in the absence of severe motor paralysis, sensory loss, and ataxia.

APROSODIA: the various combinations of affective language disturbances, encompassing both production and/or comprehension of gestures and the affective components of prosody, caused by focal right-brain lesions.

ARCUATE FASCICULUS: a bundle of interconnecting fibers in the left hemisphere which serves as the nerve pathway from Wernicke's area to Broca's area. An utterance arises in Wernicke's area. It is then transferred through the arcuate fasciculus to Broca's area, where it evokes a detailed and coordinated program for vocalization. The program is passed on to the adjacent face area of the motor cortex, which activates the appropriate muscles of the mouth, the lips, the tongue, and the larynx.

ASTEREOGNOSIS: inability to recognize objects or shapes by feeling them.

ASYMMETRY: discrepancy in function or appearance between sides of organs.

ATAXIA: failure of muscular coordination; irregularity of muscular action.

ATHETOID: affected with athetosis.

ATHETOSIS: slow, repeated, involuntary, purposeless, muscular distortion involving part of a limb, toes and fingers or almost the entire body.

ATTENTION: ability for sustaining focus on task for a period of time to allow for coding and storing of information in memory.

ATTENTIONAL DEFICITS: behavior problems common after a head injury, and/or difficulty in concentrating.

AUTOAGNOSIA: disorientation to body parts.

COGNITION: the process of thinking, understanding, and reasoning.

COMA: those states in which cognitive functions are diminished and the patient is unresponsive to all outside stimuli.

CONDUCTION APHASIA: speech impairment caused by a lesion which disconnects Wernicke's area (adjacent to the cortical region that receives auditory stimuli) from Broca's area (adjacent to the cortical regions of the brain that control the muscles of speech). If the two areas are disconnected but intact, speech will be fluent but abnormal, and comprehension should be intact. Repetition of spoken language would be grossly impaired.

CONTRA-COUP DAMAGE: damage to the brain opposite the side of the head which was hit.

COUP DAMAGE: damage to the brain at the point of impact.

DISASSOCIATION: inability to conceptualize; concern with details rather than with the whole.

DISINHIBITION: loss of restraint or decrease in ability to stop oneself from saying or doing something that is typically undesirable.

DISORIENTATION: disturbance in recognition of person, place, and/or time and day.

DISSOCIATION: separation of an idea or desire from the main stream of consciousness and making it coconscious; the splitting of the personality into disunited parts.

DISTRACTIBILITY: the reaction to all stimuli available at one time, being unable to eliminate all but the essential stimuli.

DYSARTHRIA: imperfect articulation of speech due to disturbances of muscular control resulting from central or peripheral nervous system damage.

DYSGNOSIC: any anomaly of intellect.

DYSPHASIA: a disorder of the symbolic function of speech involved in the comprehension and expression of meanings by means of words.

DYSPRAXIA: difficulty or pain in performing any function.

EMOTIONAL LABILITY: intense fluctuation of emotions in response to experiences.

GLOBAL APHASIA: total aphasia, which results from massive destruction of the frontotemporal region of the left hemisphere.

GNOSIA: the perceptive faculty of recognizing persons and things.

GYRUS: a convolution of the cerebral hemisphere of the brain. Gyri are separated by shallow grooves (sulci) or deeper grooves (fissures).

HEMIPARESIS: muscle weakness of one side of the body.

HEMIPLEGIA: paralysis of one side of the body.

IMPULSIVITY: a behavioral trait, common following head injury, in which the individual acts or speaks without first considering the consequences.

INFLEXIBILITY: rigidity in thinking; overreliance on stereotypes; difficulty in recognizing alternative possibilities.

ORIENTATION: awareness of time (current day, month, and year), place (where s/he is), and person (who s/he is).

PERSEVERATION: the prolonged after-effect of stimuli, as distinguished from the purely psychological mechanism of perseveration due to anxiety, fear of proceeding to new experiences or other emoional factors. It is the overreliance on or repetition of a specific response or behavior to different tasks.

PHONEME: a family of closely related speech sounds regarded as a single sound and represented in phonetic transcription by the same symbol. There are 46 phonemes in the English language.

PLANTAR RESPONSE: contraction of toes upon irritation of the sole.

POST-TRAUMATIC AMNESIA: loss in memory for events related to a traumatic event and the period immediately following the trauma. (Same as ANTEROGRADE AMNESIA)

PROSODY: the science or art of versification (including the study of metrical structure or rhyme); a system of versification.

RETROGRADE AMNESIA: loss of memory for events and periods of time before an injury or accident.

REVERSAL FIELD TENDENCIES: a condition in which figure and ground relationships become confused. Background appears more prominent than foreground.

RIGIDITY: tenseness; immovability; stiffness; inability to bend or be bent.

ROLANDO'S AREA: motor area in the cerebral cortex. Rolando's fissure lies between the parietal and frontal lobes.

TONE: the normal degree of vigor and tension; in muscle, the resistance to passive elongation or stretch.

*Hypertonia*: abnormally increased tonicity or strength.

*Hypotonia*: abnormally decreased tonicity or strength.

*Spasticity*: continuous resistance to stretching by a muscle due to abnormally increased tension, with heightened dystendon reflexes.

TRAUMATIC BRAIN INJURY: an insult to the brain, not of a degenerative or congenital nature, but caused by an external physical force, that may produce a diminished or altered state of consciousness, which results in impairment of cognitive abilities or physical functioning. It can also result in the disturbance of behavioral or emotional functioning. These impairments may be either temporary or permanent and cause partial or total functional disability or psychosocial maladjustment.

TREMOR: shaking or trembling; an involuntary movement of a part or parts of the body resulting from alternate contractions of opposing muscles.

UNILATERAL NEGLECT: unawareness or inattention to one side of the body or the space or events occurring on one side of the body.

VISUAL ANOMIA: inability to name objects presented visually.

WADA PROCEDURE: a test to determine cerebral dominance for brain function. It is performed by administering fast-acting sodium amytal into one or the other of the carotid arteries.

WERNICKE'S APHASIA: a condition resulting in loss of content in speech although fluency may remain; caused by damage to Wernicke's area in the left temporal lobe.

## B. Hospital Equipment

ARTERIAL LINE: a catheter placed in an artery, used to monitor blood pressure in the arteries and to allow for access to arterial blood for laboratory studies.

CATHETER: a hollow tube placed into a part of the body for the removal of fluids or to allow fluids to be introduced into the body.

CENTRAL VENOUS PRESSURE (CVP) LINE: a catheter that is threaded into the right atrium of the heart. The CVP reading directly reflects the right ventricular filling and diastolic pressure in the right atrium of the heart.

CHEST TUBES: tubes placed into the chest to drain fluid from the body.

ENDOTRACHIAL TUBE: a tube inserted into the trachea through either the mouth or nose to ensure an open airway.

FOLEY CATHETER: a catheter that has a small inflatable balloon on the end, usually inserted into the bladder. The balloon is inflated to keep the catheter in the bladder so that urine can be continuously drained into an external bag.

HALO: a metal ring used with patients who have spinal cord injuries to preserve proper alignment of the neck and spinal columns during healing.

INTRACRANIAL PRESSURE MONITOR: a monitor, inserted through the skull, that measures pressure of the fluid inside the brain and skull.

INTRAVENOUS (IV) LINE: a small catheter placed into a vein. It can be used to give a patient fluids, drugs, or blood, and can also be used to monitor venous blood pressure.

INTRAVENOUS BOARD: a board that is used to hold an extremity immobile so as not to dislodge an IV line.

NASOGASTRIC TUBE: a tube inserted through the nose into the stomach, through which to feed a patient or give medications. It is used if a patient is unconscious, has a severe jaw injury, or is unable to swallow.

RESPIRATOR/VENTILATOR: machines that either assist a patient with breathing or actually breathe for the patient by forcing oxygen into the lungs.

SPACE BOOTS: large, soft protective shoes used to support muscles and tendons during coma.

SWAN-GANZ CATHETER: a catheter that is threaded into the heart and wedged in a pulmonary arteriole. It is used to measure pulmonary artery pressure and pulmonary capillary wedge pressure, both good indicators of left ventricular function.

TRACTION: application of a pulling force to reduce, align, and immobilize fractures; to lessen, prevent, or correct deformity asociated with bone injury and muscle disease; and to reduce muscle spasms in fracture of a long bone or in back injury.

TRANSDUCER: a device that changes input energy of one form into output energy of another. For example, physiological energy of the heart beating is changed from beats to lines on a strip of paper that can be read.

VENTRICULOSTOMY: an operation that is performed to drain fluid from a ventricle of the brain to treat hydrocephalus.

## C. Medications

DANTRIM: relieves muscle spasms, cramping, and tightness of muscles.

DECADRON: a corticosteroid used to reduce inflammation and improve brain functioning through reduction of brain swelling.

DILANTIN: used to control or prevent seizures and convulsive disorders.

HALDOL: used to calm agitated, combative, anxious, or tense patients, usually during the relatively early stages of post-acute treatment.

LASIX: used to reduce excess water from the body and help reduce intracranial pressure, water in the lungs, or sluggish kidneys.

MANNITOL: used to decrease intracranial pressure by removing water from the brain.

MORPHINE SULFATE: used to reduce pain and to reduce bodily reflexes through sedation.

MYSOLINE: an antiseizure medication, often used if other similar-acting drugs fail to work.

NEMBUTAL: used to reduce intracranial pressure and reduce pain.

PAVULON: used to relax skeletal muscles to help keep the patient from struggling, usually while on a respirator.

PHENOBARBITAL: used to control or prevent seizures and convulsive disorders.

SLEEPING MEDICATIONS: a category of drugs used to assist in maintaining regular sleep/wake cycles: examples are Dalmane, Halcion, Restoril.

STEROIDS: a category of drugs used to reduce brain swelling.

TAGAMET: used to help prevent stomach ulcers to which hospitalized patients are prone.

TEGRETOL: an antiseizure medication that also affects impulsive behaviors.

VALIUM: used to reduce anxiety, tension, and muscle activity.

XANEX: an antianxiety medication to help reduce tension and muscle activity.

## D. Neurological Tests and Procedures

BEAM (BRAIN ELECTRICAL ACTIVITY MAPPING): a computerized analysis of background EEG activity, much more sensitive than conventional EEG, which is especially helpful in identifying abnormalities of early dementia or suspected brain damage from head injury.

CEREBRAL ANGIOGRAPHY: an injection of dye into an artery so that the vascular system of the brain can be studied through an x-ray. This procedure can detect aneurysms, tumors, or circulation problems.

CT SCAN (COMPUTERIZED TOMOGRAPHY): a computerized x-ray taken at different levels of the brain to yield a three-dimensional representation of the physical shape of the brain.

ELECTROCARDIOGRAM (ECG or EKG): an electrical measure of heart activity and heartbeat that is produced on a chart recording.

ELECTROENCEPHALOGRAM (EEG): an evaluation of electrical activity of the brain. Detects epilepsy, coma, and death.

MRI SCAN (MAGNETIC RESONANCE IMAGING): an instrument that develops images from biochemical operations of the brain, using a magnetic field.

MYELOGRAPHY: an injection of dye into the spinal sub-arachnoid space so that an x-ray of the spine can be taken. Can detect spinal cord tumors and disc problems.

NEUROLOGICAL EXAMINATION: an assessment of gross nerve functioning via reflexes and reactions, performed by a neurologist or neurosurgeon.

PET SCAN (POSITRON EMISSION TOMOGRAPHY): an instrument that records chemical activity in specific regions of the brain.

# APPENDIX A

## Informational and Supportive Head Injury Resources

# APPENDIX A

## INFORMATIONAL AND SUPPORTIVE HEAD INJURY RESOURCES

National Head Injury Foundation (NHIF)

Local or state associations of the NHIF

State Department of Vocational Rehabilitation (or private agencies)

Special programs for head-injured or learning-disabled persons offered through adult education or community colleges

Local family support groups

Rehabilitation agencies and hospitals for outpatient support programs and/or therapies

Local parks and recreational agencies that have programs for special groups

Local volunteer placement and clearinghouse agencies

Agencies and organizations providing day care programs

Schools and community colleges

University medical centers

University and clinical center libraries

Transitional living centers

Long-term residential centers

Traumatic Brain Injury Rehabilitation Services

# APPENDIX B

## Professional Listings

## APPENDIX B

## PROFESSIONAL LISTINGS[5]

COGNITIVE THERAPIST: one who practices cognitive behavior therapy, i.e., an active, structured, time-limited, and directive form of therapy, based on the belief that the way a person perceives and structures the world determines his/her feelings and behavior.

MUSIC THERAPIST: uses music to assist the patient in the restoration, maintenance, and improvement of speech and motor functions, as well as in mental, physical and emotional well-being.

NEUROLOGIST: a physician whose functions include evaluation of neurological status and medical management of brain disorder, after the emergency is past. The neurologist frequently follows the patient beyond the hospitalization period, especially for seizure control.

NEUROPSYCHOLOGIST: a psychologist who specializes in clinical evaluation of brain functions as reflected in behavior and emotions. The neuropsychologist may consult with other therapists and the family, and may conduct a variety of therapies to aid both the patient and the family with the psychological adjustment to trauma.

NEUROSURGEON: the physician who performs brain surgery and who coordinates the emergency trauma treatment of a brain-injured patient.

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[5] Adapted from: Swiercinsky, Price, & Leaf, 1987.

OCCUPATIONAL THERAPIST: assists the patient to use the body to accomplish the familiar activities of daily living. Responsibilities include evaluation and treatment for regaining the use of fingers and hands, eye-hand coordination, self-care skills, eating, bathing, and learning numerous other functional skills, and requires knowledge and application of how the brain directs the body to carry out practical tasks.

PHYSIATRIST: a physician specializing in physical medicine and rehabilitation who often takes over primary care when the patient moves into a rehabilitation facility, but may be called in to consult very early, particularly when other physical injuries are apparent. This physician usually directs and coordinates rehabilitation services in hospitals and is a specialist in the physical retraining of the body.

PHYSICAL THERAPIST: focuses on restoring purely physical use of the body to as high a level as possible. Teaches walking, posture, balance, endurance, strength, and coordination through a complex program of skillfully designed exercises consistent with the physical and neurological potentials of the patient.

PSYCHIATRIST: a physician specializing in mental health who is often called upon to evaluate problem behaviors and adjustment, particularly when psychotropic medications can be of benefit.

RECREATION THERAPIST: teaches the patient to make the most of leisure time, to enjoy relaxation, and to gain the necessary self-confidence for balancing work and play. The recreation therapist attempts to teach self-motivating skills so the patient can identify and use time satisfactorily.

REHABILITATION NURSE: a nurse who cares for the patient on a moment-by-moment basis and coordinates routine daily activities, including carrying out the doctor's medical management orders, attending to the patient's needs, and monitoring his or her physical and neurological health. This specialist is often the coordinator of several health and social services for the patient and family.

REHABILITATION PSYCHOLOGIST: a psychologist who specializes in evaluation of and counseling for adjustment to the physical and mental changes brought about by head injury.

RESPIRATORY THERAPIST: assists patients experiencing breathing problems, particularly those on respirators, in adapting to such equipment to achieve proper oxygenation of the blood.

SOCIAL WORKER: often the link between the patient/family and virtually all of the other care providers, as well as with the "outside world." The social worker may help resolve financial concerns, obtain rehabilitation equipment needed at home, provide emotional support for the family, and link the movement of the patient from facility to facility and eventually to home. The social worker is often the "case manager."

SPEECH AND LANGUAGE PATHOLOGIST: a specialist in restoring language and thinking or intellectual skills. Motor-speech, reading, hearing, and talking are retrained by involvement in graded programs, to strengthen conversational and other communication skills and to develop higher level cognitive skills. These goals are geared toward reintegration of the patient into the family and community.

# APPENDIX C

## Rancho los Amigos Scale

## APPENDIX C

### Rancho Los Amigos Scale[♣]

### LEVELS OF COGNITIVE FUNCTIONING

I. NO RESPONSE

Patient appears to be in a deep sleep and is completely unresponsive to any stimuli presented to him.

II. GENERALIZED RESPONSE

Patient reacts inconsistently and non-purposefully to stimuli in a non-specific manner. Responses are limited in nature and are often the same regardless of stimulus presented. Responses may be physiological changes, gross body movements and/or vocalization. Often the earliest response is to deep pain. Responses are likely to be delayed.

III. LOCALIZED RESPONSE

Patient reacts specifically but inconsistently to stimuli. Responses are directly related to the type of stimulus presented as in turning head toward a sound, focusing on an object presented. The patient may withdraw an extremity and/or vocalize when presented with a painful stimulus. He may follow simple commands in an inconsistent, delayed manner, such as closing his eyes, squeezing or extending an extremity. Once external stimuli are removed, he may lie quietly. He may also show a vague awareness of self and body by responding to discomfort by pulling at nasogastric tube or catheter or resisting restraints. He may show a bias toward

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[♣] Prepared by: C. Hagen, D. Malkmus, P. Durham, and K. Bowman, of Rancho los Amigos Hospital, Adult Head Trauma Service.

responding to some persons (especially family, friends) but not to others.

IV. CONFUSED-AGITATED

Patient is in a heightened state of activity with severely decreased ability to process information. He is detached from the present and reponds primarily to his own internal confusion. Behavior is frequently bizarre and non-purposeful relative to his immediate environment. He may cry out or scream out of proportion to stimuli even after removal, may show aggressive behavior, attempt to remove restraints or tubes or crawl out of bed in a purposeful manner. He does not, however, discriminate among persons or objects and is unable to cooperate directly with treatment efforts. Verbalization is frequently incoherent and/or inappropriate to the environment. Confabulation may be present; he may be euphoric or hostile. Thus gross attention to environment is very short and selective attention is often nonexistent. Being unaware of present events, patient lacks short-term recall and may be reacting to past events. He is unable to perform self-care (feeding, dressing) without maximum assistance. If not disabled physically, he may perform motor activities as sitting, reaching and ambulating, but as part of his agitated state and not as a purposeful act or on request necessarily.

V. CONFUSED, INAPPROPRIATE, NON-AGITATED

Patient appears alert and is able to respond to simple commands fairly consistently. However, with increased complexity of commands or lack of any external structure, responses are non-purposeful, random, or at best, fragmented toward any desired goal. He may show agitated bahavior, but not on an internal basis (as in Level IV), but rather as a result of external stimuli, and usually out of porportion to the stimulus. He has gross attention to the environment, but is highly distractible and lacks ability to focus attention to a specific task without frequent redirection back to it. With structure, he may be able to converse on a social-automatic level for short periods of time. Verbalization is often inappropriate; confabulation may be triggered by present events. His memory is severely impaired, with confusion of past and present in his reaction to ongoing activity. Patient lacks initiation of functional tasks and often shows inappropriate use of objects without external direction. He may be able

to perform previously learned tasks when structured for him, but is unable to learn new information. He responds best to self, body, comfort and often family members. The patient can usually perform self-care activities with assistance and may accomplish feeding with maximum supervision. Management on the ward is often a problem if the patient is physically mobile, as he may wander off either randomly or with vague intention of "going home."

VI. CONFUSED-APPROPRIATE

Patient shows goal-directed behavior, but is dependent on external input for direction. Response to discomfort is appropriate and he is able to tolerate unpleasant stimuli (as NG tube) when need is explained. He follows simple directions consistently and shows carry-over for tasks he has relearned (as self-care). He is at least supervised with old learning; [and is] unable to [function or must be] maximally assisted for new learning with little or no carry-over. Responses may be incorrect due to memory problems, but they are appropriate to the situation. They may be delayed to immediate [responses] and he shows decreased ability to process information with little or no anticipation or prediction of events. Past memories show more depth and detail than recent memory. The patient may show beginning immediate awareness of situation by realizing he does not know an answer. He no longer wanders and is inconsistently oriented to time and place. Selective attention to tasks may be impaired, especially with difficult tasks and in unstructured settings, but is now functional for common daily activities (30 min. with structure). He may show a vague recognition of some staff, has increased awareness of self, family and basic needs (as food), again in an appropriate manner as in contrast to Level V.

VII. AUTOMATIC-APPROPRIATE

Patient appears appropriate and oriented within hospital and home settings, goes through daily routine automatically, but frequently robot-like, with minimal to absent confusion, but has shallow recall of what he has been doing. He shows increased awareness of self, body, family, foods, people and interaction in the environment. He has superficial awareness of, but lacks insight into his condition, decreased judgment and problem-solving and lacks realistic planning for his future. He shows carryover for new learning, but at a

decreased rate. He requires at least minimal supervision for learning and for safety purposes. He is independent in self-care activities and supervised in home and community skills for safety. With structure he is able to initiate tasks as social or recreational activities in which he now has interest. His judgment remains impaired; such that he is unable to drive a car. Pre-vocational or avocational evaluation and counseling may be indicated.

VIII. PURPOSEFUL AND APPROPRIATE

Patient is alert and oriented, is able to recall and integrate past and recent events and is aware of and responsive to his culture. He shows carryover for new learning if acceptable to him and his life role, and needs no supervision once activities are learned. Within his physical capabilities, he is independent in home and community skills, including driving. Vocational rehabilitation, to determine ability to return as a contributor to society (perhaps in a new capacity), is indicated. He may continue to show a decreased ability, relative to premorbid abilities, in abstract reasoning, tolerance for stress, judgment in emergencies or unusual circumstances. His social, emotional and intellectual capacities may continue to be at a decreased level for him, but functional in society.

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