Skill reacquisition after acquired brain injury: A holistic habit retraining model of neurorehabilitation

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Abstract. Persistent cognitive, emotional and behavioral dysfunction following brain injury present formidable challenges in the area of neurorehabilitation. This paper reviews a model and practical methodology for community based neurorehabilitation based upon:

1. Evidence from the “automatic learning” and “errorless learning” literature for skills relearning after brain injury;
2. A widely applicable task analytic approach to designing relevant skills retraining protocols;
3. Analysis of organic, reactive, developmental, and characterological obstacles to strategy utilization and relearning, and generation of effective therapeutic interventions; and
4. Procedures for (a) promoting rehabilitative strategy use adapted to acute and chronic neurologic losses, (b) an individual’s inherent reinforcement preferences and coping style, (c) reliant on naturalistic reinforcers which highlight relationships to functional goals, utilize social networks, and (d) employ a simple and appealing cognitive attitudinal system and set of procedures.

This Holistic Habit Retraining Model and methodology integrates core psychotherapeutic and learning principles as rehabilitation process ingredients necessary for optimal facilitation of skills retraining. It presents a model that generates practical, utilitarian strategies for retraining adaptive cognitive, emotional, behavioral and social skills, as well as strategies for overcoming common obstacles to utilizing methods that promote effective skills acquisition.

Keywords: Neurorehabilitation, holistic rehabilitation, cognitive rehabilitation, traumatic brain injury, habit retraining

1. Introduction

Persistent cognitive, emotional, behavioral and social dysfunction following brain injury present formidable challenges in the field of neurorehabilitation. Traditional treatments provided by clinical psychology and psychiatry, special education, physical rehabilitation, and related fields have proven inadequate for addressing these persisting sequelae and their associated disablement [44,65]. As a result, specialized cognitive rehabilitation services have been designed with the goal of minimizing cognitive and behavioral impairments and improving functional behaviors.
Schutz and Trainor [65] recently reviewed the status of cognitive rehabilitation as a neurorehabilitation treatment paradigm. They suggest that there has been a shift from the original meaning as a paradigm of complex, sophisticated, and integrated interventions, to more recent poorly conceptualized, compartmentalized and largely ineffectual service modalities. Based on considerable empirical support for treatment efficacy for the former “holistic” programs, they proposed a new definition. Cognitive rehabilitation is defined as a systematic, theory-based program of “integrated didactic, experiential, procedural and psychosocial training activities” aimed at restoring “cognitively compromised adaptation, including decrements in interpersonal and vocational participation, self-awareness and self-determination.” (p. 546). They noted a central focus on psychosocial/emotional aspects of recovery, recognizing defective insight and consequent “dearth of adjustable motivation” as major rehabilitation obstacles. They recommended that all mediational processes, including wanting, feeling and thinking, are necessary targets of rehabilitation. They further elaborate that well-developed neurorehabilitation programs necessarily do the following: (a) combine systematic treatment of cognitive/behavioral deficiencies with psychotherapy and milieu therapy; (b) address many different impairments and disabilities, and; (c) strive to support participation, independence and self-managed adaptation to all aspects of life through use of adaptive strategies that represent durable adaptive systems that are used in the real world.

In the present paper, a model of holistic neurorehabilitation that addresses persisting brain injury sequelae and disablement is examined, along with illustrative methodology. This model conceptualizes many brain injury sequelae in terms of disruption of previously established hierarchical and interdependent habits that underlie all efficient, adaptive living skills. The Holistic Habit Retraining (HHR) model and methodology of neurorehabilitation [32, 35–37, 39, 40, 42, 44] is based upon the following:

1. The “automatic learning” and “errorless learning” literature and evidence supporting efficacy of this methodology for skills relearning after brain injury [26];
2. A task analytic examination of acquisition of relevant behavioral habits as a model for constructing skills retraining protocols;
3. Analysis of organic, reactive, developmental, and characterologic obstacles and facilitators of strategy utilization; and
4. A procedure that (a) promotes rehabilitative strategy use adapted to individual’s neurobehavioral losses, inherent reinforcement preferences, and coping style, that is (b) reliant on naturalistic reinforcers which (c) highlight relationships to functional goals, (d) utilize social networks, and (e) employs a simple and appealing cognitive attitudinal system and set of procedures that maximize motivation.

The Holistic Habit Retraining (HHR) neurorehabilitation model represents a methodology for continuing neurorehabilitation that integrates psychotherapeutic strategies with rehabilitation training as necessary ingredients for the rehabilitation process. HHR aims to reduce the complexity of conducting psychotherapy with persons with acquired neurological disorders as well as identifying and facilitating accomplishment of meaningful individual rehabilitation goals through optimal learning procedures. HHR accomplishes this by simplifying and integrating the processes and methods of interdependent goal accomplishment in psychotherapy & rehabilitation. At the heart of this model is the design and presentation of practical, utilitarian strategies for retraining adaptive cognitive, emotional, behavioral and social skills. This includes strategies for overcoming common obstacles to utilizing methods that promote effective habit acquisition.

2. Rehabilitation and the Holistic Habit Retraining (HHR) model: Rehabilitation is relearning

Rehabilitation is the Systematic Process of Removing Obstacles to Independence & Accessing Opportunities for Achievements of Desired Goals in the areas of Love, Work and Play! The Purpose of Rehabilitation is to Change Fate!

– M.F. Martelli, PhD & the Obstacle Busters ABI Cope Group, circa 1994 –

Adaptive behavior is reliant on intact central nervous system (CNS) function. The ability to learn and store information and execute tasks related to that behavior is dependent on intact brain cells. Damage to brain cells that occurs in acquired brain injury (ABI) can diminish or delete the stored knowledge and adaptive behavioral habits that sustain important human abilities. Despite the fact that damage to brain cells can impair adaptive behavior and habits, the ability to reorganize and support re-learning is seldom erased [16].
The highly evolved capacity of the human CNS to support learning is the hallmark of our species. While the behavior of many animals is controlled primarily by instincts, human behavior is driven by complex learning and a network of complex behavioral habits that are established over the lifespan. From birth on, human behavior is predominantly shaped by learning. Through the construction of a sequence of hierarchically arranged habits with more complex learning built on top of more basic learning, everyday functioning becomes an increasingly sophisticated network of habits. The complex behaviors that make up the average person's everyday behaviors are performed efficiently and automatically because of the establishment of a hierarchy of habits acquired through incremental learning. In recognition of the critical role of behavioral habits to human function, William James, the father of American Psychology, referred to them as the flywheel of society [20].

Neural plasticity is the mechanism that underlies the capacity of the human CNS to convert repeatedly performed behaviors into habits. This enables the learning of complex behaviors that can be performed automatically whereupon important adaptive functions like concentration, energy and effort are freed up to address other tasks. However, damage to neural tissue can weaken, degrade, or erase some of the most basic acquired habits of adaptive living. Everyday abilities and routines can be seriously disrupted, and any semblance of efficiency can be lost as some of the interdependent components of automatic behavior disrupt behavioral routines. Previously automatic behavior that had been performed easily or thoughtlessly can require an enormous amount of effort and conscious control subsequent to brain injury.

Although important prior learned habits may be seriously degraded or even erased, newly learned habits can usually be developed as replacements. Importantly, the primary requirements for both learning and relearning are becoming increasingly understood. Emotional state, attitudes and expectancies constitute important variables for learning and some of the most important variables for relearning [44,77]. Emotions and attitudes can both promote and guide re-establishment of new habits, or interfere with their development. Negative expectancies regarding learning, including expectations for only a relatively effortless return of previous automaticity, or a belief that only children can or should learn, will undermine relearning. Attitudes can facilitate or contaminate relearning and fertilize or poison rehabilitation.

In the HHR model, three primary and essential ingredients for relearning and rehabilitation are emphasized. These three basic components, the 3 P's of rehabilitation, involve the Plan, Practice and a Promoting attitude [44]:

- **Plan**: The plan component is a prescriptive rehabilitative strategy and design for stepwise progress toward relearning a deficient behavioral skill. These are derived from thorough functional task analyses. Functional task analyses are the most relied upon building block of relearning in the HHR model. This involves breaking seemingly complex tasks down into simple component steps, and putting them into a checklist that can be followed in a list wise fashion. More specific, concrete, and conspicuous plans or prescriptions for successful task completion are more likely to be effectively utilized [22].

- **Practice**: The practice or repetition component is the habit manufacturing process stage. It involves structured, consistent and repeated trials of practice, conducted over many weeks to months. It is the cement for learning that makes complex, challenging and cumbersome or boring tasks more automatic and effortless. With practice and repetition, even complex tasks become automatic and habitual. That is, a habit, or our automatic robots, can perform many tasks for us without special effort, energy, concentration, memory, or other cognitive demands.

- **Promoting attitude**: The promoting or facilitating attitude component represents the fuel for mobilization and persistence of effort that is prerequisite for sustaining the repeated practice necessary for establishing reliable skills learning. Sustaining motivated practice over numerous repetitions and a progressive series of increasingly challenging sequences is required to achieve automaticity in performance of adaptive task sequences and behavioral habits. This is especially true in more challenging situations and where skills require longer training periods. This promotional attitude building component fosters continued practice through; (a) shaping of incremental expectancies; (b) reinforcement for incremental gains; and (c) adaptive reinterpretation and redirection of any significant residual negative emotion. Anger, frustration, depression, fear, pessimism, feelings of victimization, self pity, hopelessness and/or low grade chronic despair may be left over from the early post-injury experience of being confronted by overwhelming deficits [44].
The HHR model posits that the greatest obstacle to learning or relearning is the diversion of energy away from sustained, adaptive goal directed activity and toward inactivity or debilitating activity. Some of the most potent habit relearning “poisons”, or rehabilitation debilitating attitudes, are depression, anger and resentment, feelings of victimization, fear, and inertia. These obstacles both direct energy away from relearning and inhibit it. These common catastrophic emotional reactions following brain injuries represent significant internal obstacles that must be removed as barriers before the very challenging process of relearning can be optimally engaged [32,35–37,39,40,42,44,49,50].

3. The catastrophic reaction

Three central postulates of the HHR model are: 1) significant emotional reactions frequently follow neurological injuries; 2) These reactions often exert persistent negative influences on post injury adaptation; 3) Formal treatment of these reactions is frequently required in order to optimize rehabilitation. Early post injury, an individual’s discovery of traumatic loss of functional abilities and accustomed aspects of the self can be overwhelmingly devastating. The sudden loss of limb function, the inability to stand or control one’s bowels, difficulty expressing a need or understanding another’s speech or intentions, or inability to remember previous events can produce a powerful reaction characterized by acutely intense despair and distress. This response, which has been observed and described most clearly after left hemisphere cerebrovascular accidents (CVA) or other neurologic insults, has been referred to as the “catastrophic reaction” [15]. Kurt Goldstein observed that in patients with left-herisphere CVA’s, when faced with “unsolvable tasks”, states of ordered behavior could “decompensate into catastrophic reactions” showing all the characteristics of “acute anxiety”. Goldstein interpreted this reaction as the individual struggling to cope with the challenges of the environment and his/her own changed body. Goldstein argued that an individual could not be divided into “organs” or “mind” and “body”. Rather than tissue damage, he defined disease as a changed state of adaptation with the environment. This early biopsychosocial conceptualization posited that “healing” came from adaptation to conditions causing the new state of person-environment interaction, and not through “repair”. Importantly, catastrophic or related reactions do not occur only in the context of left hemispheric lesions but may reflect a host of situational, personological, or other biomedical factors. Many post injury syndromes reflect problems in adaptation and coping with persisting injury sequelae. Miller [49,50] has described “neurosensitization syndromes” to summarize empirical and theoretical work in the area of post traumatic disability syndromes characterized by long-term demoralizing disability. Persistent postconcussion syndrome, chronic pain, posttraumatic stress disorder, depression, and other syndromes share many common pathophysiological mechanisms and are hypothesized to develop as the result of progressively enhanced sensitivity or reactivity of the central nervous system (CNS). A primary mechanism in the perpetuation of disability in these disorders is an avoidance of stimuli that evoke anxiety and emotional distress. Because these syndromes are frequently comorbid, they can create vicious cycles of impairment and reduced quality of life.

Recent research on constraint induced movement therapy (CIMT) [28,70–72] offers evidence indicating that a significant portion of disability is explained by “learned non-use” [71]. This concept is similar to Seligman’s learned helplessness model of depression and coping [67]. Failure and punishment for use attempts early post injury can permanently suppress future efforts after acute organic damage resolution and return of potential for cerebral reorganization and retraining and regrowth for body part use. CIMT and other emerging research [16] provide empirical support that neurologic disability is an adaptational phenomenon and that learning following injury can suppress rehabilitation. Moreover, this suppression can be reversed through relearning to produce significant improvements in human function even many years after injury.

The HHR model recognizes that the initially experienced acute distress and catastrophic reactions following injury usually become less conspicuous over time and often reach some level of resolution. However, residual effects can also persist and become more subtle or concealed. Catastrophic emotional reactions can be maintained or recapitulated through continued confrontation of injury related deficits and continued requirement for compensatory efforts that are difficult, unsuccessful or result in chronic anxiety, frustration and/or resignation [18,35,37,44,59,60]. These emotions can easily subvert goal directed activity, energetic efforts and progress leading to feelings of powerlessness, helplessness and being overwhelmed by the cha-
The HHR model postulates, as its most critical tenet, that persistent catastrophic emotional reactions are a frequent impediment to adaptation that must be resolved in order to optimize rehabilitation. Further, considerable anecdotal and observational data and unpublished case reports collected by the authors, along with emerging research reports in related areas [63,70–72] indicate that the gains that can follow resolution of the catastrophic reaction, when combined with potent retraining strategies, can convert into impressive improvements in functional status and adaptation even many years post injury.

The proposal that persistent emotional distress must be reduced in order to improve functional adaptation is a common theme in post traumatic disorder treatment. Miller [49,50] observed that the same classes of psychotropic medications are usually the first treatments for most of these disorders, while psychotherapy is usually the treatment of choice. Dubovsky [7] described that the post injury psychotherapy relationship "splints" neurophysiological regulatory mechanisms and provides a repeated corrective stabilization that eventually allows normal functioning. In the system of holistic "neuropsychotherapy" developed by Ben Yishay [4], psychotherapy is central to the rehabilitation process. Prigatano [59,60] also strongly articulated the importance of psychotherapy for facilitating post injury adaptation. In the HHR model, resolving the persistent catastrophic emotional reaction is posited as an integral and necessary part of the rehabilitation training process.

The rationale and method for resolving the persistent catastrophic reaction in the HHR model is derived largely from the research literature on learning [64], cognitive-behavioral psychotherapy, and coping with anxiety, especially procedures involving graduated exposure and cognitive restructuring [46]. Resolving persistent catastrophic emotional reactions involves three integrated HHR components:

1) Confronting deficits in an incremental manner in order to prevent being overwhelmed by distressful emotion, through graduated exposure.

2) A supportive conceptual framework and rehabilitation methodology that fosters hope and includes self-instruction to reinforce graduated successes in very incremental stages that progress toward desired goals.

3) A rehabilitation methodology that emphasizes errorless learning and task analyses, as described below. This simultaneously simplifies reacquisition and habitualization of many basic adaptation skills while minimizing anxiety and distressful emotions that are associated with hopelessness and failure.

In the HHR methodology, Graduated Exposure (GE) is an important behavioral anxiety reduction procedure that involves slowly and incrementally increasing a patient's exposure to a feared or distressful situation [46,62,68]. It has been applied by the first author for successfully reducing disruptive levels of specific post injury anxieties across a wide range of persistent symptoms [3,33–40,43,73,78,79].

Critical to the HHR methodology is the intention to promote learning through calming the CNS and decreasing the significant anxiety and negative emotional states which are consistently shown to be highly disruptive to performance and learning [53]. The envisioning of a progressively more desirable future is a guiding principle and "psychoemotional magnet" in HHR that pulls persons toward their goals. Incremental movement toward desired goals is accomplished to the extent that a person focuses on the vision of a desirable future, breaks expectancies and goals into small, progressive steps, and develops habits that facilitate persistent and stepwise, goal directed efforts. Patterns of interpreting events and expectancies of rehabilitation progress represent predictions of the future. Habitual patterns of expecting failure or dissatisfaction, or mistreatment, and habitual patterns of becoming depressed, angry, fearful and/or resigned are energy depleting debilitative habits that reinforce disability and failure.

The "Five Commandments of Rehabilitation" [32,35,39,40,42,44] were developed through examination of the successful adaptive attitudes of rehabilitation patients who despite poor prognoses made remarkable progress. These serve as a primary prescription for countering the catastrophic emotional reactions that block optimal rehabilitation achievement. They include (1) making accurate comparisons, (2) learning new ways to do old things, (3) building oneself up, (4) employing positive self-coaching, and (5) viewing rehabilitation as a series of small steps each requiring celebration. These commandments, and some illustrative explanations that are typically given to patients, are included in Table 1.
The prescribed attitude “antidotes” captured in the “Five Commandments of Rehabilitation” are the essence of the “medicines” that interrupt the rehabilitation “poison” cycles. Energy tends to be self-propagating in a cyclical fashion. Given negative expectancies and hopelessness, more energy is expended nonproductively. This depletes and redirects limited energy and resources away from allocation toward adaptive relearning and rehabilitation accomplishments. A habitual depressive response to physical losses can reduce activity, prevent adaptive relearning, and lead to increased depression by depletion of brain chemicals associated with positive mood and energy [46,50]. Ongoing depression, in turn, leads to poorer progress, more negative expectancy and confirmation of reasons to be depressed.

The “Five Commandments” represent a cognitive behavioral prescription for a more positive vision of a gradually improved future necessary for planning and successfully practicing compensatory cognitive and behavioral strategies. Simultaneously, they help inoculate persons against depression, anger, and other destructive emotion. This ensures that energy and motivation will be available for the persistent pursuit of desired goals, with each step of progress adding momentum for continued hope, self-efficacy, energy, and continued effort. With the addition of potent learning strategies like task analyses, errorless learning strategies, and scheduling to help promote routines, energy is increasingly protected and positively allocated through adaptive interpretations and expectancies. In a cyclic fashion, energy fueling consistent repeated practice turns these rehabilitation promoting strategies into incremental successes and increasingly automatic habits. These produce continued achievements and energy that strengthen the adaptive interpretations and expectancies that strengthens adaptive energy.

To summarize, any behavior that is structured and consistently repeated will eventually become a habit. The HHR model promotes both the activity and attitude routines that will mobilize energy for practicing potent learning strategies that will help shape patient efforts toward their important goals.
4. Functional task analyses

A task analytic examination of relevant behavioral habits is the model for constructing skills retraining protocols in HHR. Task Analysis is a learning procedure based upon breaking any task, chore, or complex procedure into single, simple, and logically sequenced steps. It typically includes recording the steps in a Checklist [22]. The checklist guides task performance by checking off each sequential step as it is completed. Task analyses simplify and optimize task initiation, sequencing, completion and follow-up, and make previously formidable or impossible tasks much easier. Performing a Task Analysis and generating a checklist to guide behavior assists in errorless learning in persons with a wide range of neurocognitive difficulties [32, 35-37, 40-42, 44].

A growing body of research is consistently demonstrating the effectiveness of errorless training methods across a range of disorders [1, 17, 21, 23-26]. This evidence further demonstrates its relative superiority versus traditional training procedures for persons with significant memory problems following brain injury and disease [6, 8, 14, 24, 26, 29, 47, 64, 65, 69, 74], and for persons with executive impairments [23, 57, 45].

Task analysis checklists are also especially useful in countering performance and learning difficulties associated with fatigue [41, 48, 54]. The disruptive effects of fatigue can be mitigated by reducing the demand for, and energy consumed by, reasoning, problem solving and effort associated with planning, organizing and having to recall, make decisions, sequence and prioritize appropriate steps for a task. They provide an errorless learning format, especially when supplemented with any needed direct instruction or supervision. The checklist represents the support that ensures: (a) a simplified learning process; (b) successful task completion; (c) learning of only correct and successful learning procedures; (d) a reduced number of competing memory traces and elimination of frustration and distressful emotional reactions; these can be especially inhibitory to memory and learning performance in persons with brain injury, disease and/or dysfunction.

Task analyses can be beneficial for both basic and complex behaviors. Most importantly, Task Analyses facilitate re-establishing the efficient routines that make up normal everyday human behavior and activity. When the procedures assisted by Task Analyses are repeated consistently, they eventually become automatic and habitualized. Samples of task Analyses are included in Table 2.

To reiterate, in the HHR model, the ingredients for rebuilding automatic habits are the 3 P's: Plan, Practice, and Promotional attitude. These components of rehabilitation represent a formula for removing obstacles to continually increasing independence while achieving incremental progress toward recovery of important functional life skills.

5. Application of HHR principles and strategies

A case study that illustrates an early application of the HHR model is that of JF. JF was a 39 year old woman who was seen 2.5 years status post craniotomy for resection of a very large pituitary adenoma. The tumor and surgery produced complete blindness, an amnestic syndrome and numerous vegetative-metabolic disturbances. This former architect showed especially severe memory problems. She was unable to recall the route out of the bathroom in the house in which she grew up having returned home to be taken care of by her parents (even after living there for 2 years post surgery), and was only able to conduct over learned activities of daily living with assistance. She had just been discharged from the state school for rehabilitation of the visually impaired due to inability to show any benefit from training. She had been deemed incapable of new learning by virtually all health and rehabilitation professionals, who recommended that her elderly parents institutionalize her. JF was admitted for assessment of capacity to benefit from rehabilitation in a transitional living program for persons with brain injury. This was offered as a last resort in the hopes of altering permanent disability and avoiding need for institutional care. While admitted, she was seen for a more focal and supportive approach to memory rehabilitation screening. Previously unable to demonstrate recall of any new information after 10 to 20 seconds, her memory was assessed in a relaxed atmosphere, in a non confronting manner during a birthday party and discussion invoking her more intact remote memory. Numerous repetitions of the examiner's name were conducted while recall was subsequently prompted after one minute with calming self talk, humor and the following repeated phrases: "Patience, persistence, coax it out gently, build yourself up, don't beat yourself up... if it comes it will come in calmness and that will be okay, and if it doesn't, that's very, very good too, because you persisted without quitting and you have the best persistence I've ever seen," along with lots of support, encouragement and instruction in calming, paced breathing.
### Table 2

Task analysis samples

<table>
<thead>
<tr>
<th>TA Sample: Single Tasks</th>
<th>TA Sample: Daily Activity Trainers</th>
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</thead>
<tbody>
<tr>
<td>'Making A Bed' &quot;Cheatlist&quot;</td>
<td>DH's Daily Plan Checklist</td>
</tr>
<tr>
<td>1. Strip sheets, blankets and pillow cases</td>
<td>MORNING</td>
</tr>
<tr>
<td>2. Put blankets and pillows on table</td>
<td>- Wake 6:00 AM to the Alarm Clock</td>
</tr>
<tr>
<td>3. Take break</td>
<td>- Take Medication</td>
</tr>
<tr>
<td>4. Get sheets and pillow cases from closet</td>
<td>- Make Bed</td>
</tr>
<tr>
<td>5. Put on fitted sheet</td>
<td>- Shower</td>
</tr>
<tr>
<td>6. Put on top sheet, evening it out</td>
<td>- Get Dressed</td>
</tr>
<tr>
<td>7. Put on blankets and tuck in corners</td>
<td>- Comb Hair</td>
</tr>
<tr>
<td>8. Put pillow cases on pillow</td>
<td>- Make and eat breakfast</td>
</tr>
<tr>
<td>9. Put comforter on bed</td>
<td>- Clear, rinse, stack breakfast dishes (for pm wash)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>TA Sample: Daily Habits &amp; Routines</th>
<th>TA Sample: Daily Activity Trainers</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT's Initiative/Energy Retrainer</td>
<td>MORNING</td>
</tr>
<tr>
<td>MORNING</td>
<td>- Wake 6:00 AM to the Alarm Clock</td>
</tr>
<tr>
<td>- Wash Face</td>
<td>- Take Medication</td>
</tr>
<tr>
<td>- Shave</td>
<td>- Make Bed</td>
</tr>
<tr>
<td>- Apply medication to face if needed</td>
<td>- Shower</td>
</tr>
<tr>
<td>- Brush Teeth</td>
<td>- Get Dressed</td>
</tr>
<tr>
<td>- Comb Hair</td>
<td>- Comb Hair</td>
</tr>
<tr>
<td>- Dress before “morning” nap</td>
<td>- Make and eat breakfast</td>
</tr>
<tr>
<td>- Check finger nails &amp; toe nails; trim when needed</td>
<td>- Clear, rinse, stack breakfast dishes (for pm wash)</td>
</tr>
<tr>
<td>- Check hair length and get a haircut as needed</td>
<td>- Wipe counter, table stovetop if needed</td>
</tr>
<tr>
<td>- Shower and wash hair</td>
<td>- Feed animals</td>
</tr>
<tr>
<td>- Perform an Activity/Chore (Choose from Menu)</td>
<td>- Brush teeth</td>
</tr>
<tr>
<td>- Check Schedule (e.g., M, W, F = Y; Tues = RedX)</td>
<td>- Gather items to take for the day</td>
</tr>
<tr>
<td>- Check your appearance before leaving the house</td>
<td>- Leave house at 7:00; go to Grandma's</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>AFTERNOON</th>
<th>REHAB CENTER</th>
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<tbody>
<tr>
<td>AFTERNOON</td>
<td>MORNING</td>
</tr>
<tr>
<td>- Fill Out Chart (Behavioral Activity Monitor &amp; Points)</td>
<td>- Arrive between 7:30-8:00 Am by van</td>
</tr>
<tr>
<td>- . . . etc.</td>
<td>- Follow Morning Schedule (In Rehab SchedBook)</td>
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<tr>
<td></td>
<td>- Lunch at 11:30, Take medication</td>
</tr>
<tr>
<td></td>
<td>- Follow Afternoon schedule</td>
</tr>
<tr>
<td></td>
<td>- Leave for Grandma's between 3:30-4:00</td>
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<table>
<thead>
<tr>
<th>EVENING: PREPARE FOR THE NEXT DAY</th>
<th>LATE AFTERNOON</th>
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<tbody>
<tr>
<td>EVENING: PREPARE FOR THE NEXT DAY</td>
<td>LATE AFTERNOON</td>
</tr>
<tr>
<td>- Eat Dinner</td>
<td>- Dinner at Grandma's &amp; take medication</td>
</tr>
<tr>
<td>- PRN (PowerRelaxationNap; Use Tape)</td>
<td>- Home between 6:00-7:00PM</td>
</tr>
<tr>
<td>- Engage in Evening Activity</td>
<td>- Get mail, read &amp; sort; put bills on microwave</td>
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<tr>
<td>- . . . etc.</td>
<td>- . . . etc.</td>
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<tr>
<td></td>
<td>RELAX/Free Time</td>
</tr>
<tr>
<td></td>
<td>Prepare for Bed</td>
</tr>
<tr>
<td></td>
<td>- Floss/Brush Teeth</td>
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<tr>
<td></td>
<td>- Wash Face</td>
</tr>
<tr>
<td></td>
<td>- Shave</td>
</tr>
<tr>
<td></td>
<td>- Put away clothes (in hamper or drawer/closet)</td>
</tr>
<tr>
<td></td>
<td>Pick &amp; lay out clothes to wear for the next day</td>
</tr>
<tr>
<td></td>
<td>Set Alarm for 6:00 AM</td>
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</table>

On this occasion, after approximately 5 minutes of supportively coached persistence of effort, JF demonstrated her first documented successful recall of new information. Her second documented recall was that her memory had actually functioned and that she had been able to eventually recall something, even though she couldn't recall what it was. Despite these promising accomplishments, JF's overall progress was judged insufficient to justify continued residential rehabilitation treatment. Nonetheless, her elderly parents refused to institutionalize her and continued to care for her in their home. Over the next two years, she was seen twice weekly in an outpatient neurobehavioral “Cope” group, and once to twice a week for tutoring from a humorous and friendly ex-patient volunteer. Her mother and volunteer were instructed in use of repetition (e.g., “Three-Peat” – a timely term in the early 90’s when the Chicago Bulls had won three consecutive NBA championships) and association as memory enhancement strategies, and “tiny step” expectations with positive shaping and liberal praise, as reinforcers of continued hope and efforts. With this scant treatment, JF slowly showed increasing recall for more and more information. Increasing social activities were especially facilitative as they seemed to
reawaken this previously very gregarious woman and fuel slow but incremental gains in new memory. Notably, JF contributed to the development of the “Five Commandments of Rehabilitation” by offering inspirational one liners, coined or borrowed from Sunday television preachers, during outpatient group attendance. At four years post injury, despite strenuous resistance to even stronger advocacy, she was re-accepted at the state school for the visually impaired for a one week evaluation for ability to benefit from a typing recording device. She amazed the staff with her ability to learn the basics of Braille and the use of a Braille typewriter that also served as a compensatory memory device. Two years later, she was typing 60 words a minute and had learned to use adaptive text-voice equipment and was working a volunteer job and applying for more competitive jobs with the support of a job coach.

Per the HHR model, JF’s case is conceptualized in terms of the suppression of memory by the underlying catastrophic emotion experienced every time she attempted to recall information. JF was undoubtedly sensitized to distressful emotion by her blindness, her repeated confrontations with it due to amnestic syndrome, and her punishing failures with every memory effort. JF could not be expected to endure the continued distress that accompanied repeated failed recollection efforts without hope for success. However, when recollection efforts were incremented for a single, simple piece of socially relevant information and persistent recollection effort was strongly supported through emotionally calm talk, a discovery occurred. It was learned that she did retain at least some memory storage ability – that is, she demonstrated slow but intact storage and retrieval capacity only after five minutes.

JF’s ability to recall that her memory could work, given patient persistence and supportive coaching from a caring and empathic professional whom she liked, ushered in a hopeful expectancy that undoubtedly transformed her. The content for shaping this expectancy is now transcribed in the “5 Commandments”. The formula for delivery within the HHR model format is one that borrows from the knowledge of psychotherapy and personality change. In what is arguably the best scientific analysis of psychotherapy to date, Wampold [75] demonstrates that specific therapy techniques are not active in and of themselves, and are active only because they are a component of the healing context. The overwhelming conclusion of all major reviews of psychotherapy data [5,9–13,19,56,75] show that therapist relationship factors play a much more important role in influencing outcome than treatment approach-
es. Wampold [75] and many others recommend defining therapist competence by the quality of their outcomes. The HHR model adopts this same recommendation with regard to rehabilitationists, prescribes specific strategies for facilitating strong therapeutic relationships, and offers a model of rehabilitation delivery that can be summarized by the 3P’s: Relationship, Rationale and Ritual [40]. That is, a strong, positive and trusting therapeutic Relationship is required to facilitate emotional trust while calming anxieties and emotional distress, and inspiring hope and collaborative effort. A credible Rationale is required to offer a believable treatment model and procedure that is logically convincing and sets positive expectancies. Finally, a credible Ritual or methodology and procedural interventions that produces measurable successes and confirm expectations, hope and continued efforts is required.

Since the HHR model and methodology have been developed, refined and consistently applied in our clinical treatment, numerous other illustrative HHR case studies have been catalogued and are being written up. Some are included on the villamartelli.com disability resources webpage [31], including an interesting one involving rehabilitation of severe dorsolateral frontal lobe injury related initiation problems [41]. Although space limitations do not allow review or discussion of other case studies, or even many other specific HHR strategies, an instructive introduction to building rehabilitation protocols using the “3 P’s” approach is included on the villamartelli.com resources website [31]. The online protocol segments illustrate samples of application of task analytic derived, errorless learning based skills building protocols (the Plan), individually adapted reinforcement via a palatable cognitive attitudinal approach for countering inherent resistances to strategy utilization and practice, and promoting incrementally goal achievement and reinforcement from graduated successes (the Practice and Promotional attitude components). Complete protocols and a larger sample of illustrative adapted strategies can be downloaded from this website [31].

6. Conclusion

The HHR model of neurorehabilitation is a skills re-acquisition paradigm which postulates that primary learning function of the human CNS involves “habit” manufacturing – that is, converting repeated behaviors that are functionally adaptive into efficient and automatic habits. For example, it is adaptive to re-
member how to walk, so the sequences involved in walking are chained together in a task analysis that makes it automatic so that performance requires minimal thought and energy. The same conversion occurs when such habits as attentional focusing, memory, and multi-tasking are acquired and automated through chaining of the component steps. Through learning, internally incorporating the tasks that are involved in getting dressed, or remembering what to take with us when we leave the house, etc. are acquired as habits through natural task analysis that sequences behaviors as if we were learning automatic task inventories. The same is true for self control habits ranging from initiation and awareness to inhibition, which involve the very complex chaining of multiple tasks to produce the highest level executive skills habits.

Although HHR shares many features with other holistic neurorehabilitation models, it also provides a distinctive and unique approach. HHR is a parsimonious model that is relatively simple to understand and apply. It offers an uncomplicated and intuitively appealing model and methodology for devising and individualizing specific retraining protocols. Protocol templates have been developed for a broad range of relevant skills areas. Most importantly, HHR recognizes the powerful importance of psychotherapy, or neuropsychotherapy, synchronizing it with potent and compatible learning methods. It integrates psychotherapy as an inseparable part of the rehabilitation process. HHR empowers therapists and family members as agents armed with highly potent neurorehabilitation-specific learning and psychotherapeutic strategies. Finally, and ultimately, HHR aims to expand "neuropsychotherapeutic" rehabilitation beyond enhancing emotional adjustment and functional compensation to include promotion of neuroplastic based rehabilitation of cognitive, behavioral and physical capabilities.

References


