

---

# Hawaii Neuropsychology Program Gets Results: The Nuts and Bolts of Neurotraining

James Craine PhD\*

*Anecdotal reports from Hawaii's Neuropsychology Services reveal severe brain impaired clients have significant improvement in functions suggesting considerable recovery is possible, and contradicting the "irreversibility" of brain injury. Hawaii's Neurotraining program uses assessment techniques to map brain functions targeting deficits, evaluation to determine specific strategies to regain impaired functions, and stimulation exercises to retrain the brain with the basic cognitive skills necessary to learn.*

## Introduction

Here in Hawaii, the State Department of Health's Neuropsychology Service devised a program designed for the purpose of treatment and rehabilitation of patients with brain lesions. This program required a basic set of assumptions and directions to be used in neurotraining, the name given to the program.

This is a structured program aimed at the remediation of cognitive deficits resulting from brain insults. In order to implement the program, it was necessary to detail a series of "working principles" derived primarily from clinical practice, observation, and considerable trial-and-error effort.

Due to the widespread belief in the permanence and irreversible nature of brain damage, a great deal of pessimism has existed generally concerning the potential of environmentally based strategies for inducing recovery following injury to the central nervous system. As a result, much of the rehabilitation efforts with these patients have been limited primarily to efforts to help the individual compensate for the effects of the injury and to adjust to the limitations imposed by his deficits. Neurotraining is especially interested in detailing the deficits as revealed by tests, but not to help the

individual compensate for them or adjust to them but rather so that the assessment can zero in on the deficits as a target for the retraining program.

## Neuropsychology Assessment: Diagnosis

Even if the Neurotrainer knows that specific sensory or motor or other neuropsychological deficits are due to a specific lesion in the brain, the primary question asked by the client is what can be done about his persistent disabilities.

## Specification of Deficits

It is time to reverse the current conclusions involving the irreversible debilitating consequences of brain damage. For Neurotraining it is necessary to target the deficits, as this is the area where the individual is hurting the most and is especially in need of help. This is the area where he or she is at the most disadvantage when compared with others who are not impaired.

## Specification of Strengths

It is also important to take special note of each of the strengths that are revealed from the extensive testing process. The Neurotrainer can use the strengths to praise and encourage the client and also may be able to bridge the strengths to the deficits if this proves to be feasible.

## Developing a Neurotraining Program: What Is Neurotraining?

Neurotraining is the systematic application of psychological and neurological principles for the purpose of enabling individuals to overcome the deficits that result from central nervous system dysfunction.

## Aim at Deficits

First, Neurotraining is training aimed at specific deficits. This means the intent is to work directly with the most impaired areas for each patient. In other words, training in the areas where the person hurts the most and was at the greatest handicap. With each deficit spelled out in clear behavioral terms, it is easier to design effective training programs for the person being trained.

It is worth pointing out that to make a comprehensive list of the various deficits is not the same as attempting to specify the location in the brain of the lesions for a patient who is diagnosed with brain dysfunction. For training purposes, the primary concern is with the gap in individual performance, the behavioral deficits, rather than

\*President  
Hawaii Institute of Neuropsychology  
Former head of Neuropsychology Services (retired) Former  
Chief Psychologist (Hawaii State Hospital. Organized and  
ran the Neuropsychology retraining program. Designed and  
copyrighted test for localizing brain injuries.

with the location of the specific lesions of the brain. This satisfies the need to be able to say, for example, that an individual has great difficulty with new learning in the auditory-verbal area or that visual-spatial memory is notably weak. These are the behavioral deficits and as such are the focus of the neurotraining program.

Although there is a definite relationship between the physical status of the brain and the performance of the individual, neurotraining intends to deal with the actual performance of the individual and to make use of the brain model only as it has further meaning in terms of the current performance of the individual patient. If careful attention is paid in the determination of the specific deficits for each patient and if the training activities are carefully structured on the basis of these deficits, then it is clearly possible to promote considerable recovery within the brain damaged population.

### **Making Use of Activities as Brain Exercises**

The idea of using exercises for the brain is to make use of the ability of the brain to improve with stimulation. The name of this "game" is stimulation, and Stimulation, and **Stimulation**. The human brain has been called the adaptive organ because it is through the brain that everyone is able to adapt to changes in the environment. The adaptation comes about by means of the learning process which is controlled by the brain. In order to bring about these changes, there is a need for heightened stimulation. The neurotraining program becomes the means to provide the precise kinds of stimulation needed.

It is common knowledge that individuals tend to lose functions and abilities through lack of use or because of restriction of stimulation. If there is injury to the brain, from whatever cause, ability to adapt and to learn can be slowed or completely halted. However, it is possible to gain or regain functions and abilities with the aid of properly administered stimulation. Because it becomes a learning process, it is possible to structure training activities in such a way as to promote recovery of function.

The function of neurotraining is to stimulate in the direction toward which the learning or the relearning needs to occur. Because the brain is the adaptive organ the individual will be capable of making changes in behavior in response to changes in the environment. It is essential, however, that the stimulation be carefully planned and as specific and precise as possible.

It is apparent that the environment acts to stimulate individuals constantly and continually. This is not generally a program of planned stimulation, however, and may indeed be quite haphazard. Neurotraining is able to intervene in such a manner as to control the environmental presentations to provide a special kind of training called "programmed stimulation". This is where neurotraining enters into the picture. The central nervous system, even with a brain in a pathological condition, is not a closed system but is continuously reacting to external influences and continues to be affected by external events. If the individual is able to perceive stimulation, it would follow that he is also susceptible to changes in his behavior as a consequence of the changes in his environment. It is on this basis that it is possible to structure neurotraining activities in order to promote recovery of function.

### **Need for Numbers**

In order to provide the intense amount of stimulation that is

needed to achieve improvement in brain functions, an extensive resource of exercises of all types is available. The one essential that all of these exercises have in common is that they are able to make use of numbers to indicate progress in each exercise. From the very beginning, a requirement was made to quantify all of the activities in order to keep track of the progress and thus be able to draw graphs of the results. It is in this manner that Neurotrainers are able to know when each of the pre-chosen criteria have been reached.

Quantification can be a score in terms of number of seconds to complete a task or the number of blocks piled on a stack or the number of items remembered or whatever else the criteria might happen to be. The essential point is that numbers are applied to the tasks so that a score can be kept of the activities. The clients sometimes complain that it does them no good to reach a criteria point because as soon as they succeed, a new criteria is set and thus the task is made more difficult for them. They are correct. The increase in the level of expectations is the method used to encourage clients to improve and make progress.

Frequently, clients will not realize the extent of the progress they have made over time. However, when the Neurotrainer can show them the graphs and point to the score achieved six months earlier, then they can appreciate their progress. The use of numbers for this purpose is invaluable.

### **First Things First**

"We must learn to crawl before we walk and must learn to walk before we can run." This simply states that there is a developmental order involved in new learning. Relearning follows the same order of progression. The idea is simply that the completion of development of one stage is essential and is a prerequisite to the development of the next stage. It would be foolish to disregard this natural order of human learning and development in the neurotraining program.

In the training situation, it is necessary to recognize the importance of the hierarchical aspect of learning, both in describing and specifying a client's deficit and in structuring the goals of the training activities. As a matter of course, developmentally earlier tasks are trained first and these in turn are used to structure later more complex kinds of activities. In this way the stages of neurotraining attempt to recapitulate the stages of normal development that are followed in the growth of an individual or in the normal learning of a skilled behavior.

Observation of children at play reveals that they are continually doing something in their games that will prepare them for the next kind of activity that they are going to be doing next week or next month or next year. In the final analysis, all of these activities prepare them for life as an adult and it appears to be a natural order of progression. So once again Neurotrainers must keep this in mind when working with clients who have brain damage so as to provide them with the proper order of activities in order to lay a solid foundation.

It is even possible that a mature patient who has had abilities severely impaired may well have to start some of his training at a level that a four-year-old child would find appropriate. The client may make objections as to the level at which he may have to start a particular exercise as he thinks it is ridiculous for a grown person to be practicing a task that a young child can do. However, it may be essential that practice be completed at this level before it is possible

to progress to more difficult levels. One consolation is that the adult will probably be able to progress much faster than the child at the same task.

The importance of proper levels of training cannot be minimized. If the mastery of a prior level is not complete before the next level is presented to the client, he may well have some difficulty with this next level and with all succeeding levels simply because there is something missing in his repertoire. It is also possible that neglect of the proper developmental sequence of learning may be why there have been so many failures in the past in attempting to retrain brain damaged patients. If there is a failure to initially work with a patient at a level well within his grasp and then a failure to carry him progressively through more complex stages of development in the proper sequence, it may become difficult or impossible for the brain damaged patient to reestablish a functional system.

### **Learning to Learn**

In a sense, neurotraining is seen as a process through which a patient with brain damage learns how to learn. It is almost as if he has forgotten how to learn and does not know how to start. Thus the training process is one designed to teach him how to learn.

The emphasis and procedures of neurotraining focus upon the learning process itself rather than upon any specific content area. There are times when brain damaged patients appear to lack the capacity to benefit from specific training programs such as high school, college or trade school simply because they are unable to absorb the training as it is presented to them.

Neurotraining carefully starts each client at a level where he can succeed in whatever the task might be and then only gradually presents an increase in the difficulty of the task so that he begins to realize, over time, that he is capable of learning. This kind of training is laying the groundwork so that the individual will be able to proceed, if he desires, with more specific training, perhaps at school or in a vocation. Neurotraining prepares the client to learn from these educational or vocational efforts by providing him with the basic cognitive skills necessary to learn.

## **The Nuts and Bolts of Neurotraining Program**

### **Provide Constant Personal Attention**

Neurotraining works best on a one-to-one level. The complexities involved in the retraining of brain functions require that a program is developed to meet the specific needs of the client. Maximum benefit from such a highly individualized program can best be achieved through the personal attention given to clients in a one-to-one setting.

The personal attention given creates an environment where the client is free to express his/her feelings, both negative and positive, to the trainer. This interaction can provide valuable insight to the client and will produce direct feedback for the trainer on the effectiveness of the training. As a result, the Neurotrainer can respond immediately to an individual's needs, both as a client and as a person.

Neurotraining is thus seen as a dynamic, ongoing, changing, and developing process rather than a monotonous, dull, and cut-and-dried series of practice sessions.

Although the requirements of one-to-one training may seem to be an extravagant use of manpower, the uniqueness of this process

makes it a necessity. Fortunately, some additional special advantages accrue because clients will tend to respond more positively to such an environment in which they do not have to compete with anyone else for attention or for results. In addition, the personal attention helps to generate enthusiasm and helps in developing and maintaining motivation.

### **Provide constant and Systematic Feedback**

Neurotraining requires the active involvement of both client and trainer. It is essential that the client be continuously informed of the progress being made, the purpose of the exercises, and the achievement of sub-goals along the way. An effective way to involve clients in the process is to tell them the scores they make in each of their exercises and to frequently show them their graphs so that they can understand and identify with them. Most clients become quite interested in this process and frequently want to record their current scores on the graphs. This active involvement should be welcomed and encouraged in order to stimulate motivation. It is apparent that progress is usually quite slow and laborious in this kind of training and the Neurotrainer continuously needs to fight against client discouragement and depression. Appropriate regular feedback about the client's method of performance, and the unique aspects of each activity needs to be communicated, because this is one of the primary keys to successful learning. Clients often fail to recognize the positive improvements being made, but with proper use of feedback can be kept informed regularly.

### **Provide maximal stimulation**

Whether the objective is to improve motor functions, memory, sensory perception, communication, or other high level central nervous system functioning, the aim must be achieved through means of stimulation. The best gain from time spent results from a maximum amount of stimulation that is properly presented and coordinated.

The brain responds to any and all types of stimulation; thus any stimulation in general will be of benefit to the brain as a whole but for Neurotraining purposes the stimulation should be precise. This is especially important in order to focus upon some highly specific brain functions. In neurotraining, the stimulation (1) should be prolonged and intensive through repetitive practice and (2) should consist of multi-modal stimulation and integration whenever possible.

It is not sufficient in this kind of training merely to make the stimulation available and expect to see achievement of goals. The client needs repeated stimulation on a regular basis in order to reconstruct and/or bolster the impaired function. The behavior, and thereby the function, must be continually produced until it is so readily available that it overcomes compensatory behavior and thus is used in everyday life.

Essentially, unselected stimulations occur naturally as life in general offers constant stimulation. This natural stimulation often plays an important role in so-called "spontaneous recovery" of brain functions after impairment. This recovery is often far from complete, however, and in order to be effective the stimulation should be repetitive for as long a period of time as necessary.

Stimulation should be as specific as needed for a given function and should be as intense as the client can accept without undue

discomfort. This kind of stimulation is possible in neurotraining through a precise mapping of deficits, a careful selection of exercises, and hours of expertly monitored repetitive practice.

### **Enter Training at the Proper Level**

Unless attempts are made to commence training at the proper level for each client, in accordance with current abilities, it is possible to lose the benefits gained from a well-conceived training plan. If training is begun at a level that is too easy, the client will not benefit from the experience and little or no progress will be made. Conversely, if it is started at a level that is too difficult, failure will be evident along with discouragement and possible loss of motivation. Again, no learning will result from the experience except that the client may decide that this is an activity to be avoided or that he cannot make progress in this area. This is why it is necessary to put special stress upon orienting training efforts so that the client can experience success but has to put out an effort to do so and is thus forced to work and "reach" in order to succeed.

There is a special technique called "a baseline" that can be used to commence training at the proper level. It is necessary to establish a baseline for each client and for each exercise used. This is achieved by first making a brief survey of the client's range of ability in each activity by sampling ability, first at a very easy level and then by progressing in a series of steps to a point of excessive difficulty.

When this is completed, which takes just a short amount of time, a clear picture of the client's range of ability for this particular exercise is mapped. Once there is an established baseline for an exercise, it is then easy to select a level at which to enter training for that activity which will insure success the major part of the time but will still have a high enough level of difficulty to cause some errors. Training can be commenced at this point with confidence because the client will have to work to achieve the established criterion for success.

### **Increase Difficulty in Small Increments**

Once training has begun, it is then necessary to insure that each selected task increases in difficulty in small steps and at regular intervals. This requirement seems to be necessary in order to force each individual to "Stretch" and to continue to improve while at the same time being careful not to impose too large a step, as this might cause failure.

Each training technique or activity must be capable of being calibrated in increasing degrees of difficulty. In addition, each step of increased difficulty will carry with it a criterion of success which will signal when to move to the next higher step. It is preferable that each step be relatively small so that the progression in difficulty from one to the next will not be too large. This particular point may often require close scrutiny because there will be times when the step upward seems to be small and orderly but a client will respond to it as if it were a very large and insurmountable barrier.

When a reaction of failure to be able to take the next step occurs, it may be necessary to backtrack and either make the step smaller or, if that is not practical, to break the activity down into two or three separate exercises. When proficiency has been gained in these separate parts, it should be possible to put the original activity back together again and find that the previous barrier is no longer seen to

be insurmountable. When properly done, learning occurs and orderly improvement and progress will result.

### **Insure Successful Endeavors**

It is of utmost importance that clients have success in their training experiences. Because training is in areas of specific deficits, this requirement may at times pose some rather challenging problems but it should always be observed. Although there is the popular saying, "We learn by our mistakes," this is not the kind of learning used in neurotraining; instead, emphasis should be on the positive rather than the negative.

Failure, in certain instances, may bring about the development of avoidance reactions. Because the training is in deficit areas, clients may already be inclined to try to avoid the activity. Life experiences frequently provide these failures and clients may often build elaborate ways of avoiding further failure in the area.

It is doubly important that successful experiences are provided when training in these deficit areas. As clients are lead through their exercises and they find to their surprise that they can succeed in these kinds of activities, it is very rewarding to them. Unless the efforts in the neurotraining exercises result in some measure of success, there will be little or no learning taking place and the learning that is achieved will certainly not be in the desired direction.

### **Insist Upon Overlearning**

It can be quite discouraging to discover that a seemingly well-learned skill can be quickly forgotten after a short period of disuse. When this occurs, it is quite probable that the learning process was terminated prematurely. The best way to guard against this happening is to insist that the skill be overlearned to the point that it becomes almost automatic. When this point is reached, disuse will not readily erase the skill as it will have become a permanent part of the individual's repertoire. It is for this reason that overlearning in neurotraining is an essential key to the process.

In the neurotraining program clients are working with deficits that will have to be restored and relearned. In effect, they are using substitute or weaker tools to achieve these goals. The learning is tenuous and needs to be very well consolidated, firmly established, and overlearned in order to become a permanent skill.

The periodic use of exercises in order to refresh the previous learning is also recommended. This will help to guard against the weakening or possible loss which may occur even in overlearned skills if these are not reinforced by regular use. In this way the newly restored skills can be utilized and maintained at peak efficiency.

### **Conclusion**

There is no question but that extensive gains can be made by those patients suffering from impairment of cognitive functioning, providing environmentally based strategies designed to encourage recovery are properly administered. Significant recovery from cortical dysfunction requires considerable time, involving months or even years and many helping hands. However, clients no longer have to accept arguments specifying the "irreversibility" of the cortical lesions. In addition, the experience with neurotraining suggests that considerably more recovery is attainable than has ever before been thought possible.