A Critical Analysis of Occupational Therapy Approaches for Perceptual Deficits in Adults With Brain Injury

Maureen E. Neistadt

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Research about occupational therapy interventions for adult perceptual deficits is needed to examine the relative efficacy of different treatments and to scrutinize the theoretical assumptions underlying those treatments. The former purpose relates to providing optimal services to consumers; the latter, to advancing the knowledge base of the profession. Both of these purposes can be achieved if research questions are derived from the assumptions underlying treatments. This paper delineates those assumptions and suggests some research questions and strategies with which to test them.

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Occupational therapy for adults with perceptual dysfunction secondary to brain injury often includes perceptual retraining (Holzer, Stiasny, Senner-Hurley, & Lefkowitz, 1982; Hopkins & Smith, 1983; Prigiano, 1986; Siev, Freishtat, & Zoltan, 1986; Trombly, 1983; Van Deusen, 1988; Wahlstrom, 1983). Occupational therapists use a variety of approaches for this retraining, and different authors have categorized these approaches differently (Abreu & Toglia, 1987; Neistadt, 1988; Siev et al., 1986; Trombly, 1983). Only two of these categorizations—Trombly’s and mine—are based on the common assumptions underlying different treatments, and neither has fully explicited the assumptions underlying the classifications. Identification of the assumptions underlying our treatments can help us to identify pertinent questions for efficacy research.

This paper will (a) delineate all of the assumptions of my previously proposed remedial and adaptive classification of perceptual treatment approaches (Neistadt, 1988), (b) examine occupational therapy’s perceptual retraining literature to see which assumptions underlie different treatments, and (c) suggest some assumption-derived questions for future research. General approaches to perceptual retraining will be explored first, followed by approaches to retraining constructional deficits as a specific example of approach applications.

Classification

Occupational therapy treatment techniques for perceptual deficits fall into two general categories: adaptive and remedial. Adaptive, functional occupational therapy approaches, such as the developmental, adaptive skills, occupational behavior, and rehabilitation treatment paradigms (Hopkins & Smith, 1983), promote adaptation of and to the environment to capitalize on the client’s inherent strengths and situational advantages. These approaches provide training not in the perceptual skills of functional behavior but in the activity of daily living behaviors themselves.

Remedial approaches, such as perceptual-motor training (Abreu, 1985), sensory integration (Ayres, 1972), and neurodevelopmental treatment (Bobath, 1978), seek to promote the recovery or reorganization of impaired central nervous system functions. Perceptual-motor training focuses on perceptual functioning specifically, whereas sensory integration techniques address the sensory processing upon which perceptual discriminations are based. (Sensory integration was not developed for clients with frank brain lesions and so is not applicable, in its entirety, to this population. Some sensory integration techniques, however, can be used cautiously with adults with brain injury [Fisher, 1989].) Neurodevelopmental treatment deals...
with proprioceptive and kinesthetic perceptions as they relate to functional movement patterns. These approaches provide training in the perceptual processing components of functional behavior with perceptual drills or specific sequences of sensorimotor exercises. The common assumptions underlying the adaptive and remedial treatment categories are listed in Table 1.

**Literature Review**

**General Approaches**

Occupational therapy's perceptual retraining literature includes descriptions of both adaptive and remedial approaches. Siev et al. (1986), for instance, described four perceptual treatment approaches for adults: (a) sensory integration, (b) transfer of training, (c) functional training, and (d) neurodevelopmental. Three of these approaches—sensory integration, transfer of training, and neurodevelopmental—can be classified as remedial because their underlying assumptions match the remedial assumptions outlined above.

In the sensory integration and neurodevelopmental approaches, the therapist provides controlled vestibular, tactile, proprioceptive, and kinesthetic stimulation to promote normal central nervous system processing of sensory information. Theoretically, because perceptual motor behaviors are performed in response to the nervous system's interpretation of sensory inputs, normal sensory processing should help the client to make more normal perceptual-motor responses. In the transfer of training approach, the therapist uses activities like puzzles and pegboards to provide practice in the perceptual skills judged to be needed for those activities. The client practices those skills that have been impaired by their brain injury. Improvement in deficit skills is assumed to transfer to other activities requiring that skill. Because all tasks require the use of more than one perceptual skill, however, it is difficult to know exactly which perceptual skills are being trained with any given treatment activity or which skills a client is actually using to accomplish functional activities. The expectation of improvement and transfer of skills implies that tasks used in this approach force the brain to repair or reorganize itself to effect a successful behavioral response to the perceptual tasks.

The functional approach could be classified as adaptive, because its underlying assumptions match the adaptive assumptions outlined above. In the functional approach, perceptual retraining is included in activities of daily living training. Clients are taught, in the process of such training, how to compensate for whatever perceptual deficits they may have by changing their approaches to functional tasks to take maximum advantage of intact perceptual skills.

Abreu and Toglia (1987) described a cognitive rehabilitation model that views perception from an information processing perspective. This model can be classified as remedial because its assumptions match the remedial assumptions outlined above. In this model, the perceptual process involves (a) sensory detection; (b) analysis; (c) hypothesis formation, that is, comparing the analysis with prior experiences and relating it to the overall purpose and goal of the activity; and (d) response. Responses can be data-driven, which are direct responses to external stimuli, or conceptually driven, which proceed from internal expectations of incoming data.

Treatments in the cognitive rehabilitation model is "designed to ameliorate deficiencies along the continuum of the perceptual system" (Abreu & Toglia, 1987, p. 443) by emphasizing the cognitive strategies that underlie the performance of a variety of tasks in different environments with different body positions and active movement patterns. Strategies are defined as organized sets of rules that operate to select and guide the ability to process information. Treatment strategies include having clients plan ahead, control their speed of response, check their work, and scan from left to right. These strategies can be emphasized with computer games, gross motor tasks, group activities, games, and crafts. The goal of treatment is to improve the client's ability to handle

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**Table 1**

**Common Assumptions of the Adaptive and Remedial Treatment Approaches**

<table>
<thead>
<tr>
<th>Adaptive Approach</th>
<th>Remedial Approach</th>
</tr>
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<tbody>
<tr>
<td>The adult brain has limited potential to repair and reorganize itself after injury. Intact behaviors can be used to compensate for impaired ones.</td>
<td>The adult brain can repair and reorganize itself after injury. This repair and reorganization is influenced by environmental stimuli.</td>
</tr>
<tr>
<td>Adaptive retraining can facilitate the substitution of intact behaviors for impaired ones.</td>
<td>Perceptual and sensorimotor exercises can promote brain recovery and reorganization.</td>
</tr>
<tr>
<td>Adaptive activities of daily living provide training in functional behaviors.</td>
<td>Perceptual and sensorimotor exercises provide training in the perceptual skills needed for those exercises.</td>
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<tr>
<td>Training in specific, essential activities of daily living tasks is necessary because adults with brain injury have difficulty generalizing learning. Functional activities require perceptual skills. Perceptual adaptation will improve functional performance.</td>
<td>Remedial training in perceptual skills will be generalized across all activities requiring those perceptual skills.</td>
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<tr>
<td></td>
<td>Functional activities require perceptual skills. Perceptual remediation will improve functional performance.</td>
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</table>
increasing amounts of information by developing efficient mental strategies and an efficient behavioral repertoire. This model, then, seeks to stimulate improvement in the central nervous system's perceptual processing capabilities.

Abreu and Toglia (1987) also discussed other treatment approaches for adults with perceptual deficits. They named these the functional, sensory integration, and perceptual-motor training approaches. This categorization corresponds to Siev et al.'s (1986) functional training, sensory integration, and transfer of training categories, respectively.

Trombly (1983) discussed neurophysiological and compensatory approaches to perceptual retraining, which correspond to remedial and adaptive approaches, respectively. In the neurophysiological category, Trombly listed such techniques as sensory retraining and visual scanning training. Under compensatory education, she listed backward chaining for specific functional activities and structuring of the environment as techniques.

Wahlstrom (1983) recommended a perceptual retraining program of sensory integration, positioning according to neurodevelopmental treatment principles, and perceptual retraining with puzzles, pegboards, and games for all clients with head injury, except those experiencing confusion. For confused clients, Wahlstrom recommended a functional approach of self-care training to address perceptual deficits. The former recommendation is clearly remedial; the latter, adaptive.

Constructional Deficit Approaches

Constructional skill is the ability to articulate parts into a single entity or object (Benton, 1979). This skill is considered essential to drawing, both with and without a model; matching blocks, sticks, or shapes to a model; building blocks, sticks, or shapes from a model; and performing functional activities, such as dressing or setting a table. The successful performance of these activities requires the integration of (a) visual perception, (b) motor planning, and (c) motor execution (Banus, 1971; Benton, 1979; Fall, 1987; Lezak, 1983; Strub & Black, 1977). Constructional impairment in adults has been associated with bilateral brain lesions (Critchley, 1953; Strub & Black, 1977), with lesions to either cortical hemisphere (Benton, Hamsher, Varney, & Spreen, 1983; Black & Strub, 1976; Costa & Vaughan, 1962; Critchley, 1953; Goodglass & Kaplan, 1979; Hecaen & Assal, 1970; Piercy, Hecaen, & de Ajuriaiguerra, 1960; Strub & Black, 1977), with posterior hemispheric lesions (Benton et al., 1983; Black & Strub, 1976), with frontal lobe lesions (Luria & Tsvetkova, 1964), with corpus callosal lesions (Gersh & Damasio, 1981; Graf-Radford, Welsh, & Godersky, 1987), and with subcortical lesions (Agostoni, Colletti, Orlando, & Tredici, 1983). Some degree of impairment in constructional skill could, therefore, be expected in nearly all adults with brain injury.

All of the occupational therapy literature relative to constructional deficits offers remedial treatment recommendations exclusively. That is, treatment is directed at relieving the deficit rather than at accentuating the client's other strengths to compensate for the deficit.

Siev et al. (1986) suggested having the client with constructional deficits practice simple copying or construction tasks, "assuming that improvement on one task will transfer to similar tasks" (p. 44). For simple copying, they recommended having the client draw designs in a clay board rather than with paper and pencil to provide additional proprioceptive and kinesiesthetic input. Recommended construction tasks include (a) block designs with the designs in Frostig's teacher's book (Frostig & Horne, 1973), Koh's block designs (Arthur, 1947) on the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1955) or Wechsler Intelligence Scale for Children (WISC) (Wechsler, 1949), or parquetry block designs, where the client copies a design made by the therapist; (b) matchstick designs where the client copies an arrangement made by the therapist; (c) pegboards where the client copies a pattern made by the therapist; (d) connecting dots with a design in Frostig's workbook (Frostig & Horne, 1973); (e) pegboards, blocks, or parquetry blocks where the client converts a two-dimensional paper pattern to a three-dimensional one; and (f) puzzles, beginning with large four-piece puzzles of single objects or persons familiar to the client.

These recommendations clearly derive from Siev et al.'s (1986) transfer of training approach, which is remedial, not adaptive. In addition to the assumptions outlined above for the remedial approach, there are several others inherent in these proposed activities. One is that materials developed for perceptual training in a pediatric population, for example, Frostig's workbooks (Frostig & Horne, 1973), are appropriate for training with adults. This assumption is grounded in an assumption that adult recovery from central nervous system trauma recapitulates the ontogeny of early development.

Yet another assumption derived from the recapitulation of ontogeny idea is that the stimuli provided to an adult recovering from central nervous system trauma should follow a developmental sequence. For example, because children can accurately draw circles, squares, triangles, and diamonds at ages 3, 4, 5, and 7 to 8 years respectively (Henderson, 1986; Rand, 1973), adults with constructional deficits should be asked to copy simple shapes in that order. In this scheme, circles would be regarded as the lowest level.
of difficulty and diamonds as the highest level in copying simple two-dimensional shapes.

Abreu and Toglia (1987) have argued against assumptions of a developmental sequence:

One must also caution against applying any theory or technique that was designed for children to an adult population without extensive modification. The recovery of cognitive-perceptual function after brain damage cannot simply be described as a recapitulation of an ontogenetic sequence. The neurological organization, activation, and inhibition of the brain varies according to age.

In addition, an adult has acquired a fund of knowledge based on prior experience, which is stored in long-term memory. This fund of knowledge inevitably affects thinking and perception. Techniques that were designed for a young developing brain and emphasize acquiring new skills may not be easily applied to a brain that has already acquired such skills.

Another assumption of Siev et al.’s (1986) constructional treatment recommendations is that evaluation materials are appropriate for treatment. The use of evaluations (e.g., block designs from the WAIS and WISC) for treatment invalidates those tools as evaluations by providing specific test practice to clients. The use of remedial tasks that are similar to those used in reliable and validated evaluations, however, does help ensure that the tasks used for training are targeting the deficit perceptual skill tapped by those tests.

Tickle-Degnen and Rosenthal (1986) also described a remedial regimen for constructional deficits that involves training on variations of the WAIS block designs. Again, treatment tasks are kept as close as possible to evaluation tasks.

Bouska, Kauffman, and Marcus (1985) also proposed a remedial approach to constructive deficits. They suggested that visual analysis synthesis and visuoconstructive skills be trained simultaneously because they are often used in the way during task performance. Visual analysis skills include (a) an analysis of similarities and differences; (b) an understanding of the relationship of parts to one another; (c) reasoning; and (d) deduction about the nature of visual stimuli.

Bouska et al. (1985) said that visuoconstructive treatment should follow developmental considerations, progressing from “horizontal to vertical to oblique lines, from two-dimensional to three-dimensional designs, and from tasks with common objects to tasks involving abstract designs” (pp. 581–582). The tasks that can be varied along these parameters include simple puzzles; dot-to-dot tasks; drawing from memory or copy; copying two-dimensional block designs; copying three-dimensional designs; assembling woodwork projects, toys, or motors; sewing from a pattern; organizing kitchen or library shelves; and setting a table. “The key to effective visuoconstructive learning is, however, not the task itself, but rather how carefully the therapist organizes it and monitors performance” (Bouska et al., 1985, p. 582).

The therapeutic techniques that Bouska et al. (1985) suggested to organize and monitor these tasks for a client are saturation cues and backward chaining. The former involves the presentation of controlled verbal instruction on task analysis and sequence and the presentation of cues on spatial boundaries. The latter involves the progress of clients from perceptual tasks that are nearly complete (e.g., all but a few blocks left out of a block design) to perceptual tasks that are incomplete (e.g., none of the blocks placed in the client’s design). The therapist gradually reduces the number of steps necessary for task completion to increase the challenge to the client.

Once again, developmental sequence assumptions underlie this remedial approach. Unlike Siev et al. (1986) however, Bouska et al. (1985) included functional activities in their therapeutic task repertoire. The aim of treatment, however, is not to provide training in the tasks themselves, but to train the perceptual processes required for those tasks. This activity analysis approach to remedial task selection is more flexible than reliance on evaluation-type tasks but carries with it an assumption that occupational therapy activity analyses are accurate, reliable, and objective. Unfortunately, there is no standardized approach to occupational therapy activity analysis for adults with neurological dysfunction. Consequently, therapists often disagree about which perceptual and cognitive skills are needed for any given activity (Rabeideau, 1986).

Najenson, Rahmani, Blazar, and Averbuch (1984) described a remedial approach to constructional deficits that is more structured than the ones reviewed above. The general purpose of their training is to “broaden the patient’s capacity to handle information and transform it into purposeful actions” (p. 327). Training is expected to lead the client to a systematic search for information, a process that can be generalized across tasks. Clients are trained to see the structure of things and the relative roles of object attributes.

The treatment program is divided into three levels, which progress from elementary to complex and from concrete to more abstract tasks. The amount of information to be processed for successful completion of the therapeutic task also increases across the levels.

Level 1 is the most elementary level. Its purpose is to enable the client to transfer simple perceptual models into motor acts, that is, to reproduce visual-perceptual designs. The procedures used in this level are (a) copying simple forms and (b) reproducing “simple designs compounded of clearly distinct parts which readily match the constructional pieces that have to be placed on the model” (Najenson et al., 1984, p. 330). Having a client place matchsticks on a
two-dimensional representation of a matchstick design is an example of this type of constructional activity.

In Level 2, the client is trained for more demanding constructional tasks, that is, tasks with more components. Procedures used in this level are (a) “reproduction of a model requiring counting (of dots) and accurate location of compounding parts” (Najenson et al., 1984, p. 330) (e.g., dot-to-dot design copying and replication of pegboard designs); (b) “reproduction of models outside them, first with pieces readily matching the parts of the model, and then with pieces that have to be put together to obtain the compounding parts of the model” (Najenson et al., 1984, p. 330) (e.g., reproducing matchstick designs from a two- or three-dimensional model, first with matchsticks that match the size of the model lines and then with the same size matchsticks cut in half; (c) “copying of more complex forms such as a cube and reconstruction with cubes” (Najenson et al., 1984, p. 330); and (d) reproduction of block designs.

In Level 3, the most demanding level, the client is expected to follow a given plan to make constructions with plastic interlocking blocks of various sizes. In this system, the client would progress to a higher level only after demonstrating competence in the preceding level.

Najenson et al. (1984), like Siev et al. (1986), have chosen tasks that are used in evaluations of constructional deficits. They have not, however, referenced their sequence of difficulty to an ontogenic sequence; they have, instead, chosen to ground their system in adult information processing theories, as have Abreu and Toglia (1987).

Research Questions and Strategies

The assumptions underlying the remedial and adaptive approaches suggest several general research questions about the neuropsychological mechanisms underlying recovery, treatment activities, and the relationship between perception and function. Each of these questions, provided below, would require a specific research strategy.

Can specific treatment activities improve perceptual skills? One could research this question by examining perceptual test outcomes of adaptive and remedial treatments and by interviewing clients about their approaches to perceptual tests before and after rehabilitation.

Can specific treatment activities improve functional performance? Efficacy studies that examine carryover into functional activities from adaptive and remedial treatments would address this question.

Is there a relationship between perceptual and functional skills? Correlational studies that examine the functional abilities of adults with perceptual deficits and the functional abilities of adults with exceptional perceptual skills would help answer this question.

The research strategies needed to address the above questions fall into three major categories: (a) outcome studies about adaptive and remedial treatments, (b) correlational studies about the relationship between perceptual and functional skills, and (c) collaborative studies with neurologists using PET scanners to assess metabolic changes in the brain during the course of rehabilitation. Although some research has already been done in the first two categories, more is needed. Controlled experimental studies comparing adaptive and remedial approaches would be helpful. Occupational therapy research on the relationship between perceptual and functional skills has focused on adults with perceptual deficits. Research with adults who have no perceptual deficits would expand our knowledge base beyond this deficit model and give therapists a more solid basis for perceptual task analysis. Therapists have not yet collaborated with neurologists to use PET scanning to supplement behavioral observations. Though this would be expensive, it would be one way to directly examine our assumptions about adult brain plasticity and response to treatment.

Conclusion

Both adaptive and remedial approaches to perceptual retraining, in general, are described and suggested in the occupational therapy literature, but more has been published on the remedial approach. In occupational therapy practice with adults, there is a similar emphasis on remedial approaches. Kunstaetter (1988) and I (Neistadt, 1986), in retrospective chart review studies about occupational therapy treatment modalities, found remedial techniques to be predominant in practice. It is hard to know whether this is theory informing practice or practice informing theory. Either way, we must examine the theoretical assumptions that underlie our practice with research that addresses questions derived from those assumptions. Only with such research can we as occupational
therapists critically examine both our theory and our practice, to provide the best possible services for our clients.

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References

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