Since the 1950s, some form of perceptual retraining has been included in most occupational therapy programs designed for adults who have perceptual problems stemming from brain injury (Hopkins & Smith, 1983). Some therapists focus on specific retraining of perceptual skills (Anderson & Choy, 1970; Gregory & Aitken, 1971; Holzer, Stiassny, Senner-Hurley, & Lefkowitz, 1982; Wahlstrom, 1983); others choose to incorporate their treatment into functional tasks, like dressing (Trombly, 1983). Common retraining tools include block designs, parquetry blocks, and pegboards.

Perceptual retraining is derived from the following set of assumptions: (a) The performance of functional activities depends on perceptual skills; (b) perceptual deficits will lead to deficits in functional performance, (c) remediation of or compensation for perceptual deficits will improve functional performance; and (d) occupational therapy treatments for perceptual deficits will effect improvements in perceptual skills and, consequently, in functional performance. Research in perceptual retraining to date has focused primarily on the second assumption and has shown a correlation between perceptual deficits and impaired functional performance (Baum & Hall, 1981; Bradley, 1982; Gregory & Aitken, 1971; Kaplan & Hier, 1982; Mitcham, 1982; Taylor, 1968; Warren, 1981). Researchers have also tried to establish more precise tests of perceptual dysfunction in adults (Fox & Harlowe, 1984; Harlowe & Van Deussen, 1984; Santa Clara Valley Medical Center Occupational Therapy Department, 1983; Van Deussen & Harlowe, 1987). Relatively little research has been done, however, to address the other three assumptions underlying occupational therapy perceptual treatments.

To provide the best possible care to rehabilitation consumers, therapists need to do more clinically based research to address these assumptions. Goals of such research could include (a) defining occupational therapy perceptual interventions more precisely, and (b) investigating the efficacy of different occupational therapy approaches to perceptual problems. This article will contribute to establishing research designs for the latter goal by exploring the current research on the effectiveness of perceptual remediation and offers suggestions for future research.

Literature Review

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 in order to capitalize on the client's inherent strengths and situational advantages. These approaches provide training not in the skills on which functional behavior depends, but in the activities of daily living (ADL) behaviors themselves. Direct training in functional activities requires very little abstract generalization and transfer of learning and is, therefore, particularly useful with a brain-injured population—a population that is prone to concrete thinking. Numerous outcome studies have shown functional skills training to be effective in improving self-care and community skills for adults with a variety of neurological disabilities (Colvin & Korn, 1984; Feigenson et al., 1981; Forer & Miller, 1980; Neistadt, 1987; Neistadt & Marques, 1984; Panikoff, 1983; Shillam, Beeman, & Loshin, 1983). These functional outcome studies have not, however, used experimental designs to compare functional training with other treatment modalities. Some of these studies (Panikoff, 1983; Shillam et al., 1983) have looked at training effects with an acute rehabilitation population; their results could, therefore, be partially due to natural recovery of their patients. Others have used long-term (Neistadt, 1987; Neistadt & Marques, 1984) or progressive neurological (Feigenson et al., 1981) patient populations where natural recovery was less likely to contribute to positive training outcomes.

Remedial treatment seeks to improve functional abilities by retraining specific perceptual skill components of behavior with tabletop perceptual drills and/or specific sequences of sensorimotor exercises. This approach assumes that perceptual and sensorimotor exercises can promote recovery of central nervous system (CNS) function or generation of new performance strategies (Abreu, 1985; Farber, 1974; Hopkins & Smith, 1983; Trombly, 1983). This assumption is supported by research that suggests plasticity of mammalian central nervous systems (Bach-y-Rita, 1981; Buell & Coleman, 1979; Goldman, 1976, 1977; Hecaen & Albert, 1978; Loy & Milner, 1980; Raisman & Field, 1973), and a human potential for recovery of CNS functions (Finger & Stein, 1982; Walsh & Cummins, 1976).

The research literature about remedial training has not unequivocally shown functional carryover from such training. Some experimental studies have demonstrated a change in specific cognitive, perceptual, or academic skills as a result of focused retraining in perceptual and cognitive processes but have failed to show improvement in self-care activities secondary to such training (Carter, Howard, & O'Neil, 1983; Gordon et al., 1985; Riddoch & Humphreys, 1983; Weinberg et al., 1979). Carter et al. (1983), for instance, failed to measure changes in functional status and trained their clients on tasks that were similar to the study's pre- and posttests. The purpose of this study was to determine whether a focused cognitive skills remediation program could help stroke patients regain visual scanning, visual-spatial orientation, and time judgment skills. Thirty-three acute stroke patients were pretrained with three tasks: (a) letter cancellation, (b) visual-spatial matching, and (c) estimation of 1 minute. Patients were randomly assigned to either an experimental group (n = 16) or a control group (n = 17); the groups were comparable as to age (average 72 years), sex, pretest scores, medical condition, side of brain damage, and functional status as measured by the Barthel Index.

Conventional therapies were provided to both groups; the experimental group received additional treatment on a one-to-one basis for 30 minutes per day, 3 days per week for 3 weeks. This treatment involved paper-and-pencil visual scanning and visuospatial matching tasks, simple cuing procedures, positive reinforcement, and immediate feedback. At the end of 3 weeks, retesting was done with the pretest procedures. A Mann Whitney-U test on both groups' improvement scores revealed that the experimental group's overall improvement was significantly higher than that of the control group (p < .005). The authors concluded that their cognitive skills remediation program was effective in improving thinking skills for acute stroke patients.

Other remediation studies have failed to demonstrate a statistically significant difference in functional outcomes between remedial and traditional, more adaptive approaches. Logigian, Samuels, Falconer, and Zagar (1983), Lord and Hall (1986), and Stern, McDowell, Miller, and Robinson (1970) used matched groups of stroke patients to compare the functional outcomes of traditional and sensorimotor approaches to therapeutic exercise. None of these studies found a significant difference in self-care outcomes between the two groups.

Taylor, Schaeferrer, Blumenthal, and Grisell (1971) compared motor and perceptual/cognitive retraining techniques. Seventy-eight patients with right cerebrovascular accidents and an average age of 58.5 years were given ADL and hemiplegica recovery stage evaluations and a perceptual, cognitive, and motor functions (PCMF) battery. The latter was composed primarily of tests from Ayres's Southern California Sensory Integration Tests (SCSIT) (Ayres, 1972), with number concept and Benton's Three-Dimensional Constructional Praxis tests (Benton & Fogel, 1962) included.

Subjects were randomly assigned to either a control group (n = 21) or an experimental group for
treatment \((n = 26)\). The two study groups were statistically comparable as to age, sex distribution, elapsed time between stroke onset and admission, and their ADL and PCMF scores. The control program was directed at motor deficits and included procedures like passive range of motion, proprioceptive neuromuscular facilitation (PNF), and manipulation tasks. The investigators used pegboards and parquetry block patterns as their manipulation tasks. The experimental program focused on perceptual and cognitive deficits and included procedures like visual tracking, manual form perception training, and assembly tasks.

Both groups showed the same amount of improvement in all ADL categories, significant at the \(p < .01\) level, regardless of the treatment program. Similarly, both groups showed comparable improvement in 26 of the 28 PCMF variables. Factor analysis of evaluation results showed that ADL variables were relatively independent of the perceptual and cognitive functions as measured by the PCMF battery; the PCMF battery was found to be reliable. The investigators concluded that, until functional skill was achieved, treatment directed at perceptual and cognitive deficits was not any more effective in facilitating recovery than traditional methods of practicing motor tasks.

One weakness of this study, however, was that the motor control program included activities (parquetry blocks and sensorimotor techniques [PNF]) that have strong perceptual retraining components. The authors were also unclear about the exact nature of the general rehabilitation program in which these patients were involved.

Two outcome studies have shown an increase in function following total rehabilitation programs that have included perceptual retraining regimens (Anderson & Choy, 1970; Scherzer, 1986). It is difficult in these studies to determine the specific contribution of perceptual retraining techniques to the general outcomes of the rehabilitation programs in which they were used. Additionally, these studies, like the functional treatment outcome studies, did not use experimental designs. Anderson and Choy (1970), for example, reported a 10% increase in the number of clients achieving relative independence in daily activities upon discharge from a rehabilitation center 1 year after perceptual retraining techniques were incorporated into the center’s program. However, a chi-square analysis of their data yielded a low level of statistical significance \((p > .025)\). Additionally, no demographic information was given on the clients, so it is impossible to rule out a change in level of impairment in the client population as an explanation for any trend toward change in independence patterns upon discharge. Clients were also not divided into control and experimental groups.

Diller and Weinberg (1977) found greater functional improvement in patients receiving a structured remediation program for hemi-inattention than in a control group of patients receiving occupational therapy for eye-hand skills. These researchers carefully attended to the stimulus parameters of their training tasks. For example, they identified four main features of letter cancellation tasks that influenced the tendency of their patients to ignore letters in the left visual field: locus of stimuli, anchoring, pacing, and density. They used these carefully documented observations to generate treatment procedures for their clients. This precision in developing treatment protocols is not yet evident in the occupational therapy literature on perceptual retraining; perceptual activities are suggested but only very general guidelines are offered for their use. This contrast in specificity of treatment guidelines may account for the differences seen between the two treatment conditions in this study.

What decision, then, should a well-informed occupational therapist make about the efficacy of remedial versus adaptive approaches? The answer is that no definitive decision can be reached because all of the relevant studies have failed to examine several variables that could be significant to research and treatment outcomes. Those variables include exact definition of the perceptual disorder, standardized assessment of changes in ADL status, length and frequency of treatment sessions, length of total treatment regime, type of treatment (individual vs. group), therapist’s style, stimulus parameters in perceptual retraining techniques, feedback parameters, client’s attitude, degree of the client’s involvement in the treatment process, social support systems available to the client, and the client’s central nervous system processing style. All of these variables exist in every occupational therapy treatment session and, therefore, need to be considered in a careful research design.

**Research Issues**

**Exact Definition of Perceptual Disorder**

The remediation studies mentioned above did not specify the exact nature of their subjects’ perceptual disorders. In the Carter et al. (1983) study, for instance, a client could have performed poorly on the pre- and postperceptual tests due to hemineglect, figure–ground deficits, spatial perception problems, or any combination of these. Without information about the subjects’ patterns of errors, no conclusions can be drawn about what perceptual problems the test scores indicated. Taylor et al. (1971) performed more specific testing, but used some tests (SCSIT) that had not been standardized on adults, and they did not match their subjects for exact configurations of perceptual deficits. Different perceptual syndromes may
respond to different remediations; future researchers will not be able to sort this out without precise definitions of the exact perceptual problems they are treating in their efficacy studies.

**Standardized Assessment of Changes in ADL Status**

Though the functional results of any treatment are of paramount importance to occupational therapy, the efficacy studies discussed here vary widely in how they measure that outcome. Diller and Weinberg (1977) did not use any rating scale; they reported their functional outcomes in nonspecific descriptive narratives. Anderson and Choy (1970), Taylor et al. (1971), and Panikoff (1983) all used ADL evaluations that had been developed in their settings. Shillam et al. (1983) used a portion of a standardized tool, the Klein-Bell ADL Scale. Carter et al. (1983) used another standardized instrument, the Barthel Index, but did so only at the beginning of their study in order to match subjects for functional level. Greater use of standardized ADL instruments across studies would broaden the applicability of individual studies and create a more uniform data base about perceptual treatments.

**Length and Frequency of Treatment**

In current occupational therapy practice, length and frequency of treatment sessions and length of the total treatment regimen are often set according to the availability of third-party payment and the time limits imposed by therapist's and client's schedules. There has been no systematic examination of the effects that different session lengths and frequencies might have on treatment outcomes for the patients. None of the research studies noted above have used this factor as an independent variable. Researchers have found positive training effects with treatment sessions of varying lengths and frequencies and in treatment regimens of varying lengths. Weinberg et al. (1979) and Diller and Weinberg (1977) saw positive results after training periods of 1 hour each day for a 1-month period; Carter et al. (1983) found improved visuospatial skills after 30-minute sessions given 3 days per week for 3 weeks; Neistadt and Marques (1984) saw improvements in independent living skills following a 1-hour-per-day, 5-day-per-week, 6-month program. Are there minimal and optimal session lengths and frequencies for different diagnostic groups and for different age and functional levels?

**Type of Treatment**

Most of the research on perceptual retraining has focused on one-to-one treatment situations. However, 60% of occupational therapists in all areas of practice currently conduct treatment in groups of two or more; sensorimotor/sensory integration and ADL groups are two types of groups frequently used (Duncombe & Howe, 1985). Do group and individual treatments affect treatment outcomes differently? Zentall, Falkenberg, and Smith (1985), working on perceptual retraining with hyperactive and normal young adults, speculated that their procedure of testing their subjects in matched pairs provided social stimulation, competition, or increased motivation that modulated overall differences between their experimental and control groups. Are there optimal group sizes for adaptive and remedial treatments?

**Therapist's Style**

How much does a therapist's style of interacting with a client influence the outcome of treatment? Educational research has shown that positive expectations from a teacher or authority figure can markedly influence the performance of students (Rosenthal, 1966). Although later studies have criticized this finding, more recent work suggests that therapists' instructional styles can influence treatment outcomes on cognitive tasks (Tickle-Degnen & Rosenthal, 1986) and patient's participation in the treatment (Pelosoquin, 1983). Is the quality of the therapeutic relationship more important than the type of treatment modalities used? Research from psychiatry and psychology suggests an affirmative answer to this question (Truax & Mitchell, 1971), but occupational therapists should study this issue further in relation to their interventions with perceptually impaired adults.

**Stimulus Parameters**

The careful work that researchers like Diller and Weinberg (1977) have done in defining stimulus parameters of treatment tasks and in measuring clients' performance should be extended to the work of occupational therapists. Taylor et al. (1971), for instance, did not report any structured protocols for administering and measuring their perceptual retraining procedures. Anderson and Choy (1970) give only general guidelines for implementing their perceptual retraining program. This imprecision in research is reflected in current clinical practice. Perceptual tasks, like the assembly of parquetry block designs from two-dimensional patterns, are frequently used in occupational therapy clinics in a fairly random way. Careful examination of that task reveals several stimulus parameters that could be systematically graded in difficulty for a client: (a) presence or absence of color in the pattern card, (b) degree of internal detail in the pattern card, and (c) number of diagonals in the pattern card. In addition, this task can be done either by matching individual blocks directly onto the pattern card or by replicating the pattern onto a table without...
the benefit of matching; these two response modes make very different perceptual demands on the client. At present, usually no systematic data are kept about clients' performance on the parquetry block task. Performance of this task could be measured by the time needed to complete patterns, by level of pattern difficulty done within a set time period, or by the process the client uses to achieve the task.

More precise, systematic approaches to perceptual tasks need not negate occupational therapists' emphasis on the individual styles, interests, and needs of their patients. Western, scientific, reductionist thought tends to separate precision and feeling, but this dichotomy is artificial and unnecessary. The client can have the benefit of his or her therapist's careful observations and caring when the emphasis in treatment is on the process, rather than on the outcomes, of the client's performance (Milberg, Hebben, & Kaplan, 1986).

**Feedback Conditions**

Feedback conditions also need to be examined as determinants of treatment outcome. In their perceptual and cognitive retraining program, Carter et al. (1983) provided continuous reinforcement, immediate feedback, and ongoing cuing. Are these procedures more effective than intermittent reinforcement with a neurologically impaired population? Does this feedback have to be given on an individual basis, or could it also be effective when given to a group?

**Client's Attitude and Involvement**

The role of the client's attitude in the treatment process also needs to be further examined. Gordon et al. (1985) suggested that additional research is needed on the interplay between the client's mood and perceptual functioning. The client's motivation is a major concern in all rehabilitation settings, and therapists are continually searching for ways to improve their clients' participation in treatment. Does the client's attitude toward treatment and setting have a greater effect on outcomes than the particular modality used? Currie-Gross and Heimbach (1980) have found that adults with physical disabilities who live in the community and feel controlled by their environment report greater problems in functional skills than those with a sense of personal causation and control. Do certain clients recover no matter what treatments they receive?

Clients' attitudes are probably partially determined by their degree of involvement in the treatment process. In previous studies, my colleagues and I (Neistadt & Marques, 1984, and Neistadt, 1987) have found improvements in the initiative of long-term rehabilitation clients who were encouraged to take active control of their treatment programs. Can either adaptive or remedial techniques be effective if the client is essentially a passive recipient?

**Social Support Networks for Clients**

The importance of the social support system available to the client also needs to be researched more fully. Gordon et al. (1985) reported that patients who returned to social environments that encouraged involvement in community activities and intellectually active pursuits like reading were more likely to maintain or improve their perceptual gains. Other, related research has shown social networks to be important mediators of stress ("Social ties," 1980); the links between stress, health, and information-processing abilities have been well established.

**Processing Style of the Central Nervous System**

The information-processing style of clients with neurological deficits also bears more careful investigation. Mazzucchi, Visintini, Magnani, Cattelani, and Parma (1985) have found that, in response to perceptual tasks, epileptic patients show patterns of electrical activation that differ from those of normal controls. Do our assumptions about hemispheric specializations for certain types of information processing hold true across all neurologically impaired populations? Or do we need to examine each client individually as a single case study?

**Conclusion**

Baum (1987) has written that "the terms safe and effective connote a public expectation about health and medical services in this country" (p. 144). Health care consumers, she added, think that "the safety and utility of procedures and techniques should be established by scientific research" (p. 144). An examination of the efficacy of practices like perceptual retraining in clinically based outcome studies is a beginning response to these consumer pressures. The relevance of such studies to clinical practice depends, in part, on how carefully occupational therapists examine the multiple variables clinicians work with every day.

Most of the variables discussed here would be independent variables in any research study. Those that relate to the measurement of ADL and perceptual functioning could be both independent subject criteria and dependent outcome variables. Some of the variables discussed are inherent in any occupational therapy treatment process. Others, such as an exact definition of perceptual disorders, are specific to perceptual retraining, but they are all treatment variables. Perceptual retraining occurs in conjunction with, not in isolation from, these variables; perceptual retrain-
ing outcomes are dependent on these treatment variables. Therefore, they should be included with more traditional demographic variables like sex, age, and diagnosis in the design for any efficacy study of perceptual retraining. Perhaps a checklist of treatment variables in the early stages of research planning would help investigators define their perceptual treatment conditions more fully. Only through such efforts can occupational therapists assure high-quality, cost-effective treatment to their clients who have perceptual deficits.

Acknowledgments

I thank Sharon Cermak, EdD, OTR, FAOTA, whose assignments and readings for her Perceptual Deficits class prompted this article. Her knowledgeable insights and the questions she raised have been invaluable.

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