The Effectiveness of Perceptual Training and Educational Psychosocial Counselling in the Adjustment to Visual Impairment

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ABSTRACT

The Effectiveness of Perceptual Training and Educational Psychosocial Counselling in the Adjustment to Visual Impairment

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Adjustment to visual impairment is a long and difficult process and it is important to develop methods to facilitate that process. In this study, the effects of perceptual training and psychosocial counselling on adjustment were evaluated in 99 elderly subjects, 49 of whom were visually impaired. Three visually impaired groups (perceptual training, individual counselling and group counselling) participated in 5 weekly intervention sessions while another group served in a control condition. Repeated-measures MANOVAs compared performance among the groups on 3 perceptual and 4 psychosocial measures. Perceptual measures consisted of Reading Recognition, Best Eye Acuity and the Frostig Figure Ground Test of Visual Perception. The four newly devised psychosocial measures included Activities, Beliefs, Expectations and Self Report Questionnaires. Overall, the interventions were successful in improving visual functioning. Perceptual training improved figure-ground discrimination, distance acuity and near acuity, but not the psychosocial measures. Individual counselling also improved the 3 perceptual measures. Both individual and group counselling improved one of the psychosocial measures, which evaluated knowledge and misconceptions about sight loss. Interviews conducted 3 to 6 months later indicated that all 3 intervention groups maintained their post-intervention levels of functioning. Three conclusions were drawn from the study. First, individual or group counselling reduced the negative cognitive-affective changes often associated with visual loss. Second, increasing the awareness of sensory discrepancy through perceptual training

facilitated adaptation to visual impairment. Finally, individual education and counselling, by increasing awareness of sensory discrepancy, improved perceptual performance without actual perceptual training.

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STATEMENT OF THE PROBLEM

Visual loss is a condition that many people encounter as they enter their later years. It is estimated that more than 20% of the population over the age of 65 eventually have to deal with a visual impairment that interferes with and compromises a formerly satisfying lifestyle. Basic vision research, using various rearrangement paradigms, has been investigating the adaptability of the human visual system for over a century. The findings of this vast research body, however, have not been linked to situations where visual loss is permanent, resulting from a medical condition.

There is evidence from the rearrangement literature to show that human vision is adaptable under certain conditions. This literature has important implications for both researchers and clinicians in the field of visual impairment, whose common goal is to understand and improve the ability to use residual vision. The findings from low vision research may, in turn, serve to further the theoretical understanding about the plasticity of the visual system for basic vision scientists. The present study investigated the possibility that residual visual ability can be improved in elderly individuals who have undergone sight loss.

It was the premise of this thesis that perceptual training to improve utilization of remaining visual capacity, as well as education and counselling to offset the loss of a previously intact and dependable sensory system, would help visually impaired individuals adjust to visual changes that result from disease and the aging process. Effective use of residual vision requires an individual to detect and locate elements in the visual field, to segregate objects from their background, to recognize or identify objects, and to read the written word. Psychological adjustment to visual loss requires that the individual maintain positive and constructive attitudes about his/her ability to resume a productive and satisfying lifestyle.

If perceptual training and counselling can directly improve visual perceptual skills, there is clearly an inherently valuable potential for increasing the functional independence of visually impaired individuals. Furthermore, should such interventions be effective in altering perceptual capacity, the contribution of the processes to a theoretical understanding of perception and its plasticity would also be of considerable scientific interest. This study has investigated both the roles of perceptual learning and counselling in the improvement of visual and psychosocial factors of adjustment in elderly visually impaired adults.

Clinical observations and results from work with visually impaired adults have suggested that the improvement of deficient perceptual skills may aid in the process of adjustment to visual loss. From a theoretical point of view, however, an old but unanswered question in the field of perception regarding the plasticity of the human visual system persists. Psychologists, for over a century, have questioned the capacity of the perceptual system to adapt under visual rearrangement conditions and yet the answers have been elusive. Typically, in this realm of research, a subject is observed while wearing a device that displaces, inverts or otherwise distorts the visual field. Visual and perceptual-motor responses are recorded and changes in visual or perceptual-motor behaviour resulting from the distortion are interpreted as evidence for adaptation.

Drawing an analogy between clinical sight loss and experimental rearrangement conditions, where distorting lenses are worn for short periods of time and then discarded, is a challenging task. Artificially induced visual rearrangement, which temporarily inverts or displaces vision or simulates central scotomas, is in many ways simply not analogous to a medical condition of permanent visual loss. Thus, it is difficult to apply findings from basic vision research to clinical problems. However, both experimental and clinical situations involve visual processes and this underlying, common factor provides a logical starting point for proposing this coalescence. As suggested by Kohler (1962), although knowledge about the physiological basis of vision is abundant, little is known about the process of vision. Investigating adjustment to sight loss provides a new context for examining some aspects of visual processes, including possible common adaptive mechanisms.

ADAPTATION RESEARCH

Addressing both the real clinical issue of learning to adapt to medically related sight loss and the theoretical issue of the adaptability of the human visual system requires the establishment of a common perceptual framework. This structure might be best constructed by utilizing theories of visual perception that emphasize the perceiver's role in information processing. Such a perceptual model would include the concepts of learning, thinking, and memory, so that perception is viewed as active and constructive.

Further, for clarification purposes, adaptation, in the context of a visual impairment study and in the context of adaptation research findings would have to be uniformly defined. It would be important to clarify, for example, that adaptation refers in both cases to an endstate or outcome, rather than a process in response to sensory discrepancy. That is, adaptation is a change in perception that is ongoing or persistent, and is measured by a reduction or elimination in behavioural errors in response to sensory discrepancies. As stated by Welch (1978), a distinction between two separate processes in perceptual change must be made, that is, between the immediate tendency to normalize and the more gradual adaptation that is investigated in visual rearrangement experiments. Thus, the immediate effects of perceptual rearrangement including visual capture (Hay, Pick, & Ikeda, 1965), the Gibson effect (Gibson, 1933), figural after-effects (Köhler & Wallach, 1944) or deliberate attempts at visual-motor corrective behaviour, would not be considered to be adaptation.

In perceptual rearrangement experiments, adaptation generally involves pre-exposure to the stimulus under normal conditions, followed by exposure to visual rearrangement, and post-exposure to the original condition. Two kinds of variables are generally analysed: (1) the reduction effect which involves a measure of the decrease in the number of errors under displacement conditions and (2) negative aftereffect which measures performance when the displacement device has been removed. The most widely accepted kind of evidence for adaptation is found in measures of negative aftereffect. In this situation, the change in behaviour is less likely to be either the result of a conscious attempt to correct visual motor errors or a change in felt position that has simply become automatic (Welch, 1978). However, visual impairment presents a different set of circumstances. For research purposes, the permanent visual rearrangement condition necessitates the use of a measure of adaptation which would be analogous to a reduction effect, taken after an intervention period.

A crucial point, often neglected in the perceptual literature, and of relevance here, is the distinction between perceptual adaptation and perceptual-motor coordination changes. Perceptual adaptation implies the concomitant occurrence of visual-motor adaptation; perceptual-motor changes, however, do not necessarily imply an alteration in visual perception. This point was illustrated almost a century ago in experiments where Stratton (1897a,b) eventually adapted completely to visual motor discrepancies after wearing inverting goggles for extended periods of time, but only occasionally was he able to see his world as upright again.

Early Work in Perceptual Adaptation

The first studies were long-term efforts that investigated the effects of inverting the observer's visual world on spatial perception and adaptation (Stratton, 1896; 1897a,b). He observed that during his visual inversion experiments, initial motor coordination was so poor that he often closed his eyes and proceeded using only touch and memory cues. When his eyes were open, he claimed that visual information alone was useful for mobility. It seemed also that there were proprioceptive changes as Stratton began to see his limbs in the position dictated by visual information. Whether or not visual adaptation actually took place over the course of the experiment is not clear, although Stratton reported that at times his arms and legs appeared to be in their natural position.

It is difficult to ascertain the relative importance of visual, motor and proprioceptive factors in Stratton's descriptions. Perhaps it can be said only that visual perception may have been altered, and that the contribution of motor activity cannot be ruled out at least as a pre-condition to adaptation. Almost a century later, not much more can be stated definitively about many of the more recent experiments, the majority of which have been concerned with prismatic distortions. There is abundant evidence to suggest that changes in perceptual-motor coordination occur in most rearrangement conditions, including prismatic displacement, inversion, curvature, shape, and depth studies. There are, however, only a few experiments to support the idea of purely visual changes in adaptation, such as the Innsbruck studies by Kohler (1964) with wedge prisms and investigations by Taylor (1962) with reversing spectacles.

Welch (1978) suggests that these findings may be explained by the fact that exposure periods in these experiments were time-limited and partial adaptation cannot occur in inversion or reversal situations. Adaptation occurs either totally or not at all. He states further that where visual adaptation did take place, such as in the Stratton and Kohler experiments, subjects were highly motivated, highly informed and physically very active.

Perceptual Plasticity, Direct Perception and Adaptation

A number of researchers were most concerned with the implications of visual adaptation for the development and plasticity of the visual system (Held, 1955; Held & Bossom, 1961; Kohler, 1962; 1964; Lackner, 1978; Pick & Hay, 1966). Held (1965), in particular, postulated that a single neural mechanism underlies three important processes: the development of sensorimotor control, maintenance in later life, and adaptation to changes in visual input.

Interestingly, Held's approach seems to rule out the idea of an error-correcting mechanism as a feasible explanation for adaptation, because it would not explain how sensorimotor coordination originally develops in the young. It cannot be expected that an infant can correct for errors without any prior knowledge of visual spatial relationships (Held, 1965). Empirical support for this position was provided by Held and Gottlieb (1958), using a technique in their hand-eye coordination experiments that produced adaptation in the absence of error recognition by the subjects. Held's findings are noteworthy in view of the fact that he certainly supported the idea of active perceptual learning in the observing organism, which presumably involves some sort of error correction. The idea of error corrective feedback in perceptual adaptation has received considerable support elsewhere (Cohen, 1966; Welch, 1969, 1971; Welch & Rhoades, 1969). Kohler (1962) suggested that in adapting to artificially induced visual distortions, the visual system is reacting in a normal, predictable way; that is, the same mechanism that responds to natural visual input recognizes and adapts to these situations.

Gibson (1950; 1966) represents an opposing view regarding the nature of perceptual development and the plasticity of the visual system. He suggested that the information required for basic perceptual experiences is entirely provided in the "ambient optic array" and that transformations are automatically processed by pre-programmed structures, or invariants, in the visual system. No active learning is needed by the organism for these fundamental perceptual processes. Rather, the observer will directly perceive a given object or scene based on information provided by the retina. Gibson's theory of direct perception has been the subject of numerous discussions, particularly by Gyr (1972; 1979), and in recent years has undergone renewed consideration for its theoretical value. Many theorists, however, have disagreed with Gibson's direct ambient array approach to visual perception. They argue for a behavioural model wherein visual perception is learned, thus advancing the idea of central processing in perceptual adaptation.

Active and Passive Perceptual Learning

Interest in central processing was accompanied by a revival of support for Helmholtz's (1876) idea of efference as the important information source in distinguishing self-initiated from environmentally produced stimulation. Von Holst (1954) proposed a reafference model, suggesting that what is necessary for adaptation to occur is self-produced movement or reafferent stimulation. In order to regain proper visual-motor coordination in response to changing patterns of stimulation, the perceiver must consider the visual consequences of self-produced movement. Exafference, on the other hand, is stimulation produced by the external environment. All movements of the eye (efference) are recorded for comparison with reafferent information and these efferent copies are stored in the central nervous system. The organism can distinguish between eye movement and externally produced movement by the presence or absence of an efferent copy. If the input matches the stored copy, then the information is self-initiated; if not, then there is a perception of motion in the external world.

Later investigations supported the von Holst findings and also indicated that compensation for errors in displacement experiments depended upon response-produced stimulation from the recipient. Held (1961) hypothesized the presence of a central correlation comparator that matches afferent information and efferent copy. Taylor (1962) suggested that the conscious experience of perception occurs as a result of a series of learned response tendencies that are stored centrally as readily activated engrams.

Eventually, the question of adaptation to rearranged visual input evolved mainly into a debate involving the role of active and passive perceptual learning in the observing organism. The Innsbruck experiments by Kohler (1962; 1964) set the stage for elaborate attempts to clarify the role of active learning. Kohler (1964) concluded from his investigations using prisms and inverting mirrors, which were worn for weeks and months at a time, that for adaptation to take place, active movement is necessary. He also reported that non-visual factors, such as head-spectacle versus eye movements affected the severity of visual distortions. Thus, it was crucial to study non-visual contributors, in this case kinesthetic activity, to determine the sources of varying retinal stimulation in the perceptual situation.

Finally, it was suggested that only self-produced active movement, resulting in reafferent stimulation, contributes to visual adaptation (Held, 1964, 1965; Held & Bossom, 1961; Held & Freedman, 1963; Held & Hein, 1958, 1963; Held & Rekosh, 1963; Held & Schlank, 1959). Festinger and Canon (1965) further suggested that active movement was not essential, as long as a record of efferent impulses was available. What was needed was a central readiness to activate the efferent signal; that is, visual information has to be supplemented by non-optical information, in order for accurate perceptual-motor behavior to occur. This is crucial to the situation of visual impairment when visual information may not be available and other sources have to replace or substitute for missing information.

Singer and Day (1966) reported findings which they claimed contradicted some of the results obtained by Held and his collaborators. They found adaptation under both active and passive conditions. Taking the findings from many years of research into account, the consensus among researchers seemed to be that adaptation can occur in the absence of active movement (Baily, 1972a,b; Foley & Maynes, 1969; Mather & Lackner, 1980; Moulden, 1971; Pick & Hay, 1965). However, it was also generally agreed that active movement is an important facilitator in the adaptation process. Because of its emphasis in the adaptation literature, the active-passive paradigm is also a factor of importance for studies in visual impairment.

The Proprioceptive Hypothesis

A different approach to the adaptation problem was taken by Harris (1965) who suggested, first, that the visual system is not as flexible as often claimed and, second, that it is not the visual sense, but the perceived position sense or felt position of a body part, that compensates in visual rearrangement experiments. What occurs is more than simply a change in motor habits; there are perceptual modifications in the kinaesthetic spatial system. Specifically, the proprioceptive hypothesis predicts that there will be a change in the felt position of the adapted body part relative to the rest of the body. Harris also suggested that self-produced movement might well be considered a necessary part of the process or a pre-condition in adaptation.

The proprioceptive hypothesis, in addition to providing an alternative "endstate" explanation to adaptation, helped to explain the superiority of active over passive learning in many experiments. The availability of proprioceptive information depends mainly on information from muscle spindles in the observer. According to Lackner (1977), in a passive situation, there is a loss of fine resolution due to the lesser contribution from the muscle spindles, and therefore sensory discordance is less accurately registered. However, during self-produced movement there is heightened accuracy of proprioceptive information, which produces more adaptation. This explanation also implicitly suggests that when sensory discrepancies occur, information, attention, and awareness are important variables in the adaptation process.

Information, Attention, and Sensory Discrepancy

The field of cognitive psychology has long investigated the capacity of the human brain in information processing. Early researchers described a bottleneck theory of attention, wherein a limited flow of information can be processed at any given time (Broadbent, 1958; Treisman, 1964). Thus, when an individual has focused attention on a particular sensory or neural event, information flow from other sources is blocked. More recently, theorists suggest that the amount of information that can be attended to is, theoretically, unlimited in the active, searching human brain (Hirst, Spelke, Reaves, Caharack, & Neisser, 1980; Neisser, 1976; Neisser & Becklen, 1975). This is not to say, however, the individual can easily divide attention among different sources, as some researchers suggest. According to Neisser, we are programmed or structured so that we can fully attend to one source of information flow at a time and other information will be ignored, unless the skills or tasks involved are familiar and practiced, in which case the individual will be able to attend or respond to new stimuli or information. This line of thought has implications not only for adaptation research and the effects of sensory discrepancy, but as well for low vision research and perceptual training.

Information theories propose that the greater the sensory discrepancy, the larger the adaptation (Kornheiser, 1976; Lackner, 1977). When there is sensory input from only one modality, the observer has not enough information to suspect sensory conflict. When a proprioceptive task is added to a visual rearrangement condition, it is not the proprioception *per se*, but the presence of sensory conflict that alerts the observer to distortion or rearrangement.

An active condition provides more varied proprioceptive information than a passive condition and thus greater sensory discrepancy. Unfortunately, discrepant information is of no value if the "active" observer is not also actively tuned to recognize different sources of information. Thus, the concept of an active-passive contribution may be extended beyond the idea of proprioceptive clues generated from self-initiated kinaesthetic movement, to include cognitive efforts that attend to, make judgments about and act upon discrepant sensory information.

Several studies in perceptual psychology investigated the role of attention when spatial modalities are in conflict. Welch (1969) demonstrated that the after-effect, when a sensory displacement device has been removed, is greatest for the most clearly defined target and he emphasized the importance of distinguishing between different sources of information. The greater the number of sources to which the observer has access, the greater the adaptation. Cohen (1967) suggested that the subject will minimize sensory discordance by having the disregarded modality adapt. Using continuous and terminal displays, he showed that when the subject is able to view his/her hand while pointing (continuous display), the disregarded proprioceptive system adapts, and conversely, when the subject does not see his/her hand until the pointing is complete (terminal display), the disregarded visual system adapts.

A variant of this explanation is that the sensory modality perceived to be non-veridical adapts (Canon, 1970, 1971; Gyr, Willey, & Gordon, 1972). When there is discrepant information from two sensory sources, the organism will focus attention on one of those modalities. In the experiments by Canon (1970, 1971), subjects resolved the visual-auditory discordance by attending to perceived veridical visual information; consequently, non-veridical auditory localization adapted. Other subjects, who attended to auditory information, perceived the visual information to be non-veridical, and thus adapted visually. A group of researchers who elaborated on these experiments found that adaptation occurs only in the unattended modality (Kelso, Cook, Olson, & Epstein, 1975). Warren and Schmitt's (1978) findings suggested that instructing subjects to direct their attention to a particular modality is not enough; active behavioural responses to maintain attention are required.

An alternative to the directed attentional model (Canon, 1970, 1971; Kelso *et al.*, 1975; Lackner & Levine, 1978; Levine & Lackner, 1979) was proposed by Redding and his colleagues to more fully explain the role of attention in adaptation (Redding, Clark, & Wallace, 1985; Redding & Wallace, 1985a, b, 1987). These authors examined the demand structure of the task situation in determining perceptual outcome. They referred to sensory modalities as "guiding" or "being guided", depending on whether modality information is dominant or subordinate in a given situation.

Attention is defined by Redding and his co-workers (1985) as "the regulation of a limited-capacity, central-processing mechanism that comes into play when nonhabitual behaviour is required". The modality that will be attended and, therefore, defined as the guiding modality is situationally determined; the other modality adapts. Using this conceptual framework, these researchers reinterpreted Festinger's efferent readiness model, which suggests that discrepancies are registered when afferent information is matched with efferent readiness (Festinger, Burnham, Ono, & Bamber, 1967). The Redding interpretation proposed that afference from the guided system conflicts with efferent information from the guiding modality. There is no conflict, however, from afferent-efferent comparisons in the guiding system. Thus, the subordinate or guided system adapts to the attended modality. Redding and Wallace (1985a) proposed that a central control planner directs these linkages between peripheral sensorimotor systems and determines dominant and subordinate modalities.

It is important to emphasize that sensory conflict alone is not a sufficient condition for adaptation, unless the observer is aware, or believes, that the discrepant information is emanating from one object through different sensory modalities (Welch, 1978). According to Uhlarik (1973), response to altered visual input varies depending on whether or not the subject is aware of the distortion condition. Finally, it has been demonstrated that sensory discrepancy leads to greater adaptation when subjects are allowed to correct their errors with new visual motor responses (Howard, Anstis, & Lucia, 1974; Templeton, Howard, & Wilkinson, 1974; Welch & Rhoades, 1969).

Current Status of Adaptation Research

Until the late 1960s, attempts to understand perceptual events in adaptation were concerned with the nature of sensory systems and particularly the development and plasticity of the visual system. Investigations in the 1970s and 1980s have been more concerned with intermodality organization in adaptation; that is, the information flow between systems and evidence for central processing.

The consensus seems to be that in response to visual displacements, modifications occur in both the visual and position senses at peripheral and at higher processing levels (Gyr, 1979; Kelso, *et al.*, 1975; Kornheiser, 1976; Mather & Fisk, 1985; Welch, 1978). It seems also that the effects of visual and proprioceptive shifts are additive, each contributing in varying amounts to the total adaptive response (Redding & Wallace, 1987). Some sources of information are more salient than others, and in prism adaptation intersensory discrepancy is a powerful cue. Kornheiser (1976) stated that adaptation involves minimizing discordant information between sensory modalities, and that the modality perceived as non-veridical will adapt. The implication is that the individual has some awareness of input from this modality, but has chosen to disregard it.

In general, it is clear that information processing has an important role in adaptation and that a number of variables must be considered in determining the locus of adaptation. One implication is the involvement of attention in complex situations where sensory discrepancies must be resolved. Attention may interact with visual and proprioceptive spatial systems in producing total or partial adaptation to spatial rearrangement.

These ideas about attention, awareness and error-corrective feedback in adaptation are particularly relevant for visual impairment research, which is concerned with identifying strategies that will optimize adjustment to non-experimental visual loss. The difference between a visual rearrangement experiment and a visual impairment study is that the individual in the latter predicament has lost visual capacity, often gradually, and may not be aware of the extent of the visual distortion or may actually avoid confronting the problem, which adds to the confusion generated by competing information from visual, proprioceptive or motor pathways.

Attentional theorists suggest that intersensory discrepancy is an important cue that accelerates adaptation. When vision loss occurs, a conscious effort to focus attention on visual changes and sensory discrepancies may be an important strategy in dealing with the visual disturbance. Clarifying different informational sources should also facilitate the process of eventually minimizing discrepancies. Consistent with these ideas are results from active-passive experiments showing that active involvement of the individual augments visual and non-optical information. The use of perceptual practice and feedback by visually impaired individuals may serve this same purpose. Active-passive theory also implies that certain important perceptual skills may become more automatic through practice and feedback, thus allowing the individual to carry out additional or more complex visual or visual-motor tasks. In summary, a research paradigm concerned with improving visual efficiency in visually impaired individuals that incorporates such ideas from attentional theory and active-passive theory seems to provide a cogent rationale for the use of perceptual training in the adjustment to visual impairment.

LOW VISION AND PERCEPTUAL TRAINING

Basic vision research has concentrated on the non-deliberate or unconscious learning process that occurs when simulated visual distortions are experimentally introduced to normally sighted subjects. These issues of research are clearly theoretical and very rarely have conclusions from these studies been linked to the situation where sensory sight loss or distortion has taken place. Kohler's (1962) observations were an exception. He did suggest the importance of adaptation for cases of detached retina, retinal folds and strabismus, although there was no elaboration on how the understanding of unconscious visual learning might be used in real visual rearrangement situations.

The current project has attempted to bridge this gap by applying some adaptation principles to visual impairment. On a clinical level, the findings in this body of research have implications for a number of visual conditions, especially those related to the aging process, such as degeneration of the macula, which produces its own peculiar visual changes. In macular degeneration, there are a number of possible disruptions that can occur in the visual system, including loss of central vision, blurring, waviness, scotomas or blind spots and visual disorientation due to general disruption of visual functioning. Other disorders, such as diabetic retinopathy, produce comparable visual disruptions.

Although distorted vision resulting from a disease process is not entirely analogous to an adaptation paradigm as described in the perceptual literature above, there are basic similarities. Visual processing is disturbed and the individual does not see in a normal manner. It is not unreasonable to suggest in both of these situations that some form of adaptation takes place involving visual changes, proprioceptive changes or intermodal modifications that together contribute to a total adaptive response. Low vision research may well benefit by utilizing some adaptation principles to help explain adjustment to visual impairment. Further, adaptation theory is compatible with the idea of perceptual training to improve visual and visual-motor skills and the development of such rehabilitative techniques may enhance the use of residual vision.

Early attempts to improve perceptual judgments as a result of controlled practice were first carried out successfully with normally sighted adult subjects (Gibson, 1953). Researchers later questioned whether reading skills in children could be improved as a function of perceptual training (Bieger, 1974; Frostig, 1972; Rosen, 1966, 1968). Although reading did not improve as a result of perceptual training, other perceptual improvements were found in these experiments, including figure-ground discrimination and acuity. Goodrich, Mehr, Quillman, Shaw and Wiley (1977) found that training and practice did improve reading skills with low vision aids in visually impaired adult subjects. In a related area, distance acuity scores improved after 30-40 minutes of perceptual training for visually impaired subjects (Overbury & Bross, 1978).

Conrod, Bross, and White (1986) applied the notion that perceptual processes may be adaptable in a group of patients with age-related maculopathy. They found that perceptual training in the use of peripheral fixation techniques significantly improved performance on certain perceptual tasks, notably figure-ground organization. There were two major conclusions from this study. First, it was concluded that improvement was task specific, and that future investigations should address the issue of training generality. Second, it was emphasized that an important variable may have been instructor encouragement and feedback, which could have contributed to the observed improvement.

A Gestalt Conceptualization

Theoretical considerations governing the current project have suggested that there are a number of factors which will determine whether or not an individual will be successful in adapting to visual rearrangement. When the rearrangement consists of central visual losses due to a disease process, the situation is further complicated. Not only are there visual distortions similar to those described in the adaptation literature, but there may also be disruptions that lead to a perception of instability in the visual world. Patients describe the fading of objects, missing links or properties in familiar objects, and an inability to sort out essential from non-essential details. They often fail to recognize familiar faces, scenes, words and objects; the result may be a confused and disorganized attempt to cope with the visual changes.

Gestalt psychology offers a framework for conceptualizing some of the problems faced by individuals who are visually impaired. The term Gestalt, or "organized structure", suggests a "whole" that is orderly and rule-governed (Kanizsa, 1979). The most basic law of Gestalt psychology is that of "Praegnanz" or good form, which segregates the perceptual field into units that are characterized by stability and simplicity (Forgus & Melamed, 1976). A form with "Praegnanz" is, therefore, the least stressful structure. Achieving this stable and simple psychological organization is accomplished through utilization of such Gestalt principles as similarity, continuity, proximity, inclusiveness, and closure (Koffka, 1935).

Figure-ground discrimination, a basic Gestalt concept, traditionally has been investigated in clinical assessments of children to evaluate perceptual strengths and weaknesses. Low vision researchers in recent years have also used the Frostig Figure Ground Test of Visual Perception (FFG) (Frostig, 1976) or the Bender Gestalt Test of Visual Perception (Bender, 1938) to identify cases of inadequate perceptual functioning (Conrod & Overbury, 1983; Overbury & Conrod, 1982; Quillman, Mehr, & Goodrich, 1981).

Quillman and his co-workers (1981) found that the FFG provided additional information in low vision assessment because it was not perceived as a visual test by most individuals and so performance was less contaminated by self-fulfilling expectations about what a visually impaired person can and cannot do. In Overbury and Conrod's (1982) study, which involved seven measures of visual capacity, the investigators found that the FFG identified visually impaired individuals who were unable to master certain visual-motor tasks, but whose scores on acuity, reading and field tests did not reveal any deficiencies. Interestingly, a self-report questionnaire suggested that these patients were also feeling dissatisfied with their visual abilities. It was concluded that these individuals were not efficient in using perceptual strategies such as closure and figure-ground discrimination. They were unable to generalize previously integrated perceptual experiences to other similar sets of stimuli. They may also have been lacking in motivation, persistence or confidence, which inhibited their performance.

The FFG thus appears to provide two valuable sources of information in low vision research. It offers assessment information about organizational-perceptual strengths and at the same time may help to identify individuals who are not functioning optimally, given a visual impairment.

Two Visual Systems

Another body of research that has important implications for low vision training is one that has investigated the existence of two visual systems, working in tandem, in human vision (Schneider, 1969; Weiskrantz, 1980). The primary cortical system is responsible for foveal or central vision, and is associated with object recognition and feature discrimination. The second, subcortical visual system is responsible for orienting and locating objects in the peripheral field. When central scotomas develop as a result of degeneration of the macula, the individual often has difficulty recognizing and identifying familiar objects and the complementary nature of the two systems is upset. However, the peripheral locating system may be able to compensate to some degree for the loss of this foveal ability to define and identify stimuli by providing some information about the presence of objects obscured by central scotomas.

Presumably, training to develop this ability would facilitate or hasten adaptation to visual impairment, as the individual can learn to use the peripheral system to greater advantage. With practice, the person will perceive more discerningly objects and events which have been picked up in the peripheral visual field. Also, a natural tendency to fixate centrally in the newly blind area when searching for an object will be overcome, as a visual search relocates the object peripherally. Eccentric viewing training seems to have been successful in cases of central visual loss (Goodrich & Quillman, 1977; Holcomb & Goodrich, 1976). An important question that remains is whether this training generalizes to visual situations other than the training setting, which would be important to the overall adjustment process.

Rationale for Perceptual Measures

Previous research considerations supported the idea of enhancing sensory discrepancy in visually impaired subjects and applying feedback strategies to facilitate adaptation in the current study. Further, should subjects learn peripheral viewing and scanning strategies using specific stimuli and practice exercises in a training situation, then they might also apply these strategies in various other real life visual situations where recognition is important, such as recognizing street numbers, signs, labels and the printed word.

A perceptual training programme was designed for the present study, based on sensory discrepancy and feedback theory, as well as Gestalt principles of organization, to instruct subjects in the effective use of residual vision. Tasks were designed that required subjects to utilize principles such as simplicity and closure to successfully identify elementary forms within a complex structure. By not following the line of a particular form to completion, for example, the Praegnanz would be lost, particularly as the exercises increased in complexity and figures became more difficult to recognize. Dependent measures to test improvement were selected to represent both task-specific improvement and more generalized improvement.

Given the strength of the FFG as an assessment device, the current study utilized it as a dependent measure to evaluate improvement in task-specific or organizational-perceptual functioning. The Bender provided another measure of perceptual ability. Although not as widely used as the FFG, the Bender reflects important Gestalt principles of organization, including similarity, grouping, closure and completion. It is also a task that is applicable to a visually impaired population. The norms for the Bender, as well as the FFG, could not be used in this study because the subjects were visually disadvantaged. However, a pretest-posttest paradigm for all dependent measures provided a baseline score on ability for each test.

Modifications of two standard recognition acuity tests were used to measure training generalizability or functional-perceptual improvement. The first measure, Reading Recognition, is equivalent to a traditional binocular near acuity test. A second functional-perceptual measure, Adaptive Acuity, consisted of a conventional wall-mounted distance acuity chart. The distinction between the two tests is that the former allowed the subject to manipulate test stimuli by turning or moving the material closer or further from the eyes, whereas with the latter test was placed at a fixed distance, not moveable by the subject. A third measure, Best Eye Acuity, consisted of the highest of the two monocular subscores on Adaptive Acuity, in other words, the "best eye".

EDUCATIONAL AND PSYCHOSOCIAL COUNSELLING

The number of older visually impaired individuals has increased dramatically in the last decade. Between the years of 1977 and 1984 in the United States, there was a 74% increase in elderly individuals identified as severely visually impaired (Nelson, 1987). It was also estimated that more than 20% of individuals over the age of 65 are either blind in one eye, both eyes, or have chronic visual impairments (Havlik, 1986; Morse, Silverman & Trief, 1987). In

Canada, the consensus is that over 700,000 individuals are visually impaired. It is also known, however, that 80% of the visually impaired population has some remaining, usable vision (Kahn & Morehead, 1973). Medical information and statistics about blindness and visual loss are not lacking. Unfortunately, a comprehensive understanding about the psychological issues associated with visual loss and programmes to address these difficulties has not kept stride with medical advances. The loss of vision at any age can be devastating, but somehow when the loss occurs in the later years of life, as it most often does, it seems even more incapacitating.

Visual impairment interferes with the ability to function optimally in today's visually oriented society. In the elderly, active participation in many areas of life decreases and the role of the older person often becomes more of an observer. Although a modern view of the ageing process implies that elderly individuals can and should be active and involved, it is a fact that many elderly people are physically limited in what they can do. However, these people often enjoy watching others carry out their daily activities. As suggested by Vickers (1987), it is one of life's ironies that as this natural process of handing over the reins of active participation to a more youthful generation takes place, the visual system begins to fail. Dependency upon the visual system coupled with its threatened loss can create fear in the elderly that may be incapacitating. Further, fear itself can lead to a tendency to deny failing vision, to resist medical attention, or give up hope that there is a solution to the problem.

People are living longer today and as the elderly population grows, society's burden to care for this portion of the population increases. One promising and cost-effective solution to this problem is to develop methods of helping the elderly become more independent and more active in terms of caring for their own needs. Activities such as reading, walking and socializing contribute to health and well being and consequently foster independent living. In contrast, visual impairment compromises the ability to take part in these activities, as well as the ability to enjoy observing the activities that others perform.

Some individuals with low vision adapt very well; they adjust readily and continue to lead active and productive lives. Many others who have equivalent acuity losses do not adjust well to their visual deficits. They express dissatisfaction with their visual abilities, the visual aids which are prescribed, and in many cases, life in general. The psychological aspects of adjustment need to be addressed to evaluate what contributes to good and poor adjustment and who is at risk to adjust poorly to visual loss.

As stated by Needham and Ehmer (1980), there are such broad differences in the ways that people cope with sensory loss that no single theory can adequately explain adjustment. Needham and De l'Aune (1976), for example, compared blinded veterans and normally sighted individuals and found that the range of feelings expressed regarding life satisfaction was very similar for the two groups. However, in their clinical experiences with visually impaired clients, the authors noted that individual differences in adjustment are often both dramatic and unexplainable.

Visual loss generally precipitates a sense of fear and reduced personal competence. Anxiety and a sense of hopelessness, in turn, interfere with an individual's ability and willingness to use his or her eyes to optimize remaining visual capacity. For example, the usefulness of perceptual training may be compromised by a negative psychological outlook. Alternatively, improved psychological functioning could have a positive effect on the ability to use residual visual abilities.

A reduced sense of personal competence may also lead to destructive isolation and social withdrawal. Persons with a visual impairment do not appear to be handicapped, and thus are caught in a dilemma; either they make excuses for awkward or incompetent behaviour or they attempt to conceal the fact. The result in either case is often further isolation, inactivity and withdrawal.

One direction that research should take, according to Needham and Ehmer (1980), is toward a cognitive view of adjustment, addressing how faulty thinking patterns influence the way people feel and behave in response to visual loss. Erroneous or irrational thoughts or beliefs may well result in maladaptive adjustment, including depression, anger and anxiety. These authors remark further that society in general holds many erroneous beliefs about blindness. Unless one is faced with the prospect of sight loss, however, these thoughts have little personal impact. The onset of visual loss brings these negative misconceptions to the foreground and their influence may be profound in terms of the emotional state and behaviour of the individual. Needham and Ehmer emphasize the importance of being able to assess the individual's belief system about blindness so that therapeutic interventions can be applied. Replacing a maladaptive belief system with more realistic cognitions and offering instruction in coping skills should result in a more active, productive and satisfying lifestyle.

A related problem in adjustment may be educational, including lack of knowledge about anatomy of the eye and misconceptions about common eye diseases. Elderly people do not know what is happening to their eyesight and crucial information about their visual condition is often not readily available to them. They frequently draw their own conclusions about diagnosis and prognosis and usually the conclusions are extreme. Negative stereotypes about being old, disabled and helpless add to the problem and, for many individuals, contribute to poor adjustment. As suggested by Vickers (1987), visually impaired individuals need to be given an honest and clear picture about sight loss in general and their own unique visual problems in particular. Facing an identified problem is often less distressing and anxiety provoking than the fear of facing the unknown and this may be as true for visual loss as it is for most other problems.

Other psychosocial issues, such as changing dependency needs, are a major source of conflict that often have a negative impact on formerly close relationships with family and friends. Barraga (1976) contends that motivation on the part of the individual to continue living independently is crucial to being successful in adjusting to low vision. On the other hand, Jose (1983) states that individuals who are visually impaired need social support from friends, family and professionals to help reframe attitudes and coping responses into positive and realistic actions. Glass (1973) found that a major component to low vision adjustment was a change in the nature of the impaired individual's expectations. He pointed out further that in the absence of adequate counselling these expectational changes are often random, unpredictable and unproductive.

While many practitioners have recognized the importance of the nonvisual aspects of adjustment to visual impairment, few have investigated psychological factors in terms of intervention and treatment. Past studies were primarily concerned with the low vision patient's adjustment to the use of corrective visual devices. Kelleher, Mehr, and Hirsh (1971), for example, stressed the importance of positive self-attitude with respect to the utilization of low vision aids. Another group of researchers examined the relationship between demographic and psychological variables in the successful use of low vision aids (Grieg, West, & Overbury, 1985; Overbury, Grieg, & West, 1982).

They found that emotional support was positively correlated with successful visual aid use while perceived changes in future lifestyle correlated negatively with the use of low vision aids. Other factors, surprisingly, were not highly correlated with success. These included mood and anxiety level, as well as variables such as amount of vision loss, type of onset (sudden or gradual), and duration of the problem. This study underscored the need for more research regarding relevant psychological variables.

A different approach to assessing adjustment was conducted with ophthalmological patients who were evaluated before and after cataract surgery on visual-motor learning and activity level (Donderi & Murphy, 1983; Murphy & Donderi, 1983). The authors found that activity level, such as walking and shopping prior to surgical intervention and the ability to learn new visual-motor tasks were related to successful post-operative adjustment.

One study addressed the issue of adjustment to sight loss in terms of how well the person had accepted the loss (Jacobs, VanZandt,& Stinnet, 1983). These investigators determined from their survey that the variables most related to good adjustment were life satisfaction, how much life had changed for the individual and whether or not the person perceived that he/she had undergone more losses than others.

If psychological factors play a role in the adjustment to visual loss, then surely psychological interventions have a role to play in the rehabilitative process. The course and direction of low vision research to date have led to the introduction of educational psychosocial counselling as an independent variable in the present study. Although there have not been any controlled intervention studies to investigate such factors, there have been many references in low vision literature to the idea that psychological interventions may be effective in helping people adjust to vision loss, Bishop (1972) identified a positive attitude and adequate opportunity for self-expression as crucial to the adjustment process. According to Allen (1972), adjustment requires that the impaired individual have a keen sense of awareness concerning his or her relationship with non-impaired individuals. Both Bishop and Allen stress the need for accurate and frequent feedback from the environment. More recently, Faye (1984) stressed the importance of contact between the low vision patient and other individuals also affected by low vision in the acceptance of visual loss. Tuttle (1984) emphasized the necessity of timely professional intervention for persons who have been newly impaired to help reduce the intensity and duration of the psychological trauma.

As suggested by Kirtley (1975), the loss of sight is neither a disaster nor a simple inconvenience and yet these are the two most common responses to vision loss. A useful intervention in both situations might be to counsel new, adaptive responses to vision loss. Also, counselling the individual to understand the sighted person's reactions would facilitate social interactions with sighted family, friends and society in general. Provision of information about visual processes and an exploration of coping strategies may improve understanding about visual loss and encourage the development of constructive and realistic cognitions. Furthermore, improved psychological functioning may increase motivation to work toward maximizing visual and perceptual abilities.

Counselling and the Elderly

An important question in the current project in terms of developing useful psychological interventions was the type of therapeutic environment that would be most effective for elderly individuals. Over the years, therapists and practitioners have used a variety of treatments with the elderly in an attempt to answer this question. As concluded by Birren and Schaie (1985), however, in their review of the literature on therapy with the aged, it seems that the elderly respond as does any other age group to different therapy forms and in this sense they do not require special considerations. Therefore, for the reasons outlined below, the two most common of therapy formats were used: individual and group counselling.

Individual counselling, in its many forms, always involves a special interpersonal relationship between counsellor and patient or client. Many of the psychological issues related to vision loss can be addressed in this kind of environment. However, individual therapy is often time consuming and expensive, especially when numerous sessions are required. Further, there is no conclusive evidence to demonstrate that individual therapy is superior to group therapy. An excellent review of 32 empirical studies, covering a broad range of clinical problems, showed that individual and group treatment were equally effective in 75% of the studies. Group therapy was more effective in the remaining 25%, which included problems such as habit disorders, neurotic disorders and career planning (Toseland and Siporin, 1986)

Group counselling offers several potential benefits. It is cost effective, providing an environment that encourages independence and self help and it offers an important social milieu where members can interact, share, learn and gain hope. These factors also seem to be the important elements in successful therapy outcome (Bloch, Crouch, & Ribstein, 1981). Among low vision patients, Emerson (1981) found that group discussions were a useful rehabilitative tool. Jacobs and his co-workers (1983) stated in their survey of adjustment that subjects who had been acquainted with other visually impaired individuals scored higher on adjustment. To date, a comparison of individual and group interventions has not been carried out in the field of low vision. It would be beneficial to know whether these forms of treatment are equally effective.

Rationale for Educational and Psychosocial Measures

Based on the implications of previous research in low vision reviewed earlier, the adjustment measures in this study targeted four coping areas related to visual loss: activity level, cognitive strategies and beliefs used to explain visual loss, personal assessment of residual vision and expectations about the ability to cope in the future. Given that there may be differences in the ways that individuals cope with visual loss, it was important to determine at the outset of the study that such individual differences in adjustment were equivalent across the four experimental conditions. These adjustment issues were addressed in four psychosocial questionnaires that served as pre-intervention and post-intervention dependent measures: Activities, Beliefs, Expectations and Self-Report. These questionnaires are introduced below:

Activities Questionnaire

The work of Donderi and Murphy (1983) with cataract patients provided a starting point for developing this measure. The present self-rating scale is concerned with an individual's day-to-day activity level, including social, leisure, and chore-related activities. It focuses on involvement in such areas as shopping, socializing with friends, and travelling. The specific intent in developing the questionnaire was to determine how much a visual impairment interferes with a person's daily functioning.

Beliefs Questionnaire

This measure was based on a questionnaire developed by Ehmer and Needham (1979), which evaluated myths and misperceptions about blindness in both sighted and blind individuals. For this study, some items were modified and new ones added so as to cover a broader range of issues related to sight loss. More items were included to reflect the functional effects of sight loss, as opposed to questions about stereotyped blindness attitudes. For example, questions about lighting, eyestrain, and the effects of watching television were included.

Expectations Questionnaire

Given that negative expectations have been shown to be an important variable in the adjustment to low vision (Glass, 1973; Overbury et al., 1982), "expectations" were addressed in the current study. This rating scale was designed to determine whether an individual's expectations about the future play a meaningful role in the adjustment process. It addressed factors such as optimism or pessimism by assessing how willing an individual is to undertake or continue daily activities and commitments following the onset of visual impairment.

Self Report Questionnaire

Several references have been made, in low vision literature, to the importance of satisfaction in terms of adjustment to visual loss (Donderi & Murphy, 1983; Jacobs et al., 1983; Needham & De l'Aune, 1976). The rating scale developed for the current study consisted of a personal assessment of the functional effects of visual loss. The items assessed satisfaction with the ability to use residual vision in the performance of global visual activities such as reading, travel, home maintenance and work related tasks.

PRESENT STUDY

The goal of this study was to develop interventions that have a beneficial effect on the adjustment of elderly individuals who have undergone visual loss. Three experimental conditions were investigated: individual perceptual training (PTRAIN), individual educational psychosocial counselling (IEPC) and group educational psychosocial counselling (GEPC). Several theoretical sources reviewed earlier support the hypothesis that visually impaired individuals can adapt to their visually changed environment. First, principles of adaptation have indicated that visual efficiency can be improved through perceptual training. Attentional theory further suggests that increasing awareness of sensory discrepancies will facilitate adaptation. The active-passive perceptual model implies that the optimal way to increase information is through self-initiated active movement. Finally, Gestalt theory provides a framework for a perceptual training approach in a low vision study. Similarly, clinical observations and research suggest that counselling, oriented to educational and psychosocial issues, may facilitate adjustment. It was also reasoned that an interactive process may occur, whereby improved psychosocial strategies positively influence visual functioning or, alternatively, improved perceptual skills have a positive effect on psychosocial functioning.

Pilot Work

The preliminary work had three objectives. First, perceptual training manuals and educational psychosocial protocols that were to be used in the various intervention conditions were designed and piloted. Second, assessment measures to evaluate the effects of perceptual and psychosocial interventions were constructed for use in the pre-intervention and post-intervention phases of the study. Finally, a normally sighted comparison group was assessed on certain of the perceptual and psychosocial measures to provide validational data.

Objectives of the Study

The objectives of the intervention study were the following:

(1) To investigate whether the utilization of perceptual training and feedback to increase awareness of sensory discrepancy in visually impaired individuals would have a positive effect on the performance of five visual-perceptual tasks by PTRAIN participants.

(2) To investigate whether the utilization of educational psychosocial counselling to increase understanding of visual processes and psychological issues related to visual loss would improve performance in four areas of psychosocial functioning for IEPC and GEPC participants.

(3) To determine whether individual and group counselling approaches are equally effective in improving psychosocial functioning.

(4) To determine if there is an interaction between type of intervention and area of functioning, that is, whether the PTRAIN group would improve on psychosocial measures and whether the IEPC and GEPC groups would improve on perceptual measures.

METHOD

Participants

Forty-nine visually impaired adults with a mean age of 70.2 (*SD* = 13.8) years and 50 normally sighted adults with a mean age of 70.1 (*SD* = 7.2) years participated in the project. All of the participants were volunteers for the study from local communities in the Montreal area.

Visually impaired participants were recruited either from the Low Vision Clinic at the Royal Victoria Hospital, the Retinitis Pigmentosa - Eye Research Foundation, the West Island Low Vision Association, or from Community Services referrals in the towns of Mount Royal and St. Lambert. Recruitment of visually impaired subjects was ongoing and continued throughout the intervention portion of the project, which extended over a two year period. Screening criteria for participation in the study included the following: (1) Visual impairment: Sight loss was defined as a visual impairment that interfered with ability to function normally in daily activities. Quantitatively, this was equivalent to a score of 34 or less on the Best Eye Acuity measure. (2) Lower age limit of 30 years: Although sight loss most frequently occurs in the elderly, younger adults with visual impairment were admissible. (3) Adequate physical health: participants had to be sufficiently mobile to attend the sessions at the university. (4) Adequate psychological functioning: This was evaluated in the initial session by two interviewers and was based on interview information and clinical judgements of the interviewers. Criteria included expressed level of comfort and ease about participation and travel to the university, ability to discuss visual problems comfortably and lack of clinical depression or anxiety.

Six individuals were excluded because they did not meet the selection criteria. Six participants dropped out during the course of the project. The reasons were related in three cases to poor health and in the other three cases to difficulty or anxiety about travelling to the university. The final group of 49 visually impaired participants consisted of 36 females and 13 males. Thirty-eight of the participants in this group had a diagnosis of age-related maculopathy. Table 1 presents the primary diagnoses for all of the participants in the study. Most participants were retired, living independently and in relatively good health.

Visually impaired participants who were accepted for the study were randomly assigned to one of four groups: Individual Educational Psychosocial Counselling (IEPC), Group Educational Psychosocial Counselling (GEPC), Individual Perceptual Training (PTRAIN) or no training (Control). There were 16, 11, 12, and 10 participants in these groups respectively.

Normally sighted participants were recruited through local advertising over a two-month period. Selection criteria for these subjects were: (1) the ability to read .4m print with correction, which is the equivalent of 6/6 (20/20) vision and (2) adequate physical health. All individuals who volunteered for the normally sighted group met the selection criteria and completed the study: These 38 females and 12 males provided comparison data for the intervention study.

The groups were equivalent in age, sex ratio and socioeconomic background. Subjects were all middle class and recruited from urban centers. All were physically mobile and there were no other serious medical or psychological problems. These factors helped to ensure that normally sighted and visually impaired participants differed only in terms of visual functioning. The two groups were compared on three variables introduced earlier: Reading Recognition, Adaptive Acuity and Best Eye Acuity, as well as severity of

Table 1

Diagnostic Categories of Visually Impaired Participants

Diagnosis	Frequency
Age-related macular degeneration	38 (78%)
Diabetic retinopathy	4 (8%)
Glaucoma	3 (6%)
Retinopathy of prematurity	1 (2%)
Congenital nystagmus	1 (2%)
Corneal dystrophy	1 (2%)
Retinitis pigmentosa	1 (1%)

Note. N = 49.

impairment and age. As expected, *t*-tests showed significant differences on the four visual measures with the impaired group scoring more poorly. (Means, standard deviations and *t*-test summary tables for the two groups on the four variables are presented in Appendix A.)

Materials

Interview

The initial interview addressed aspects of functioning including diagnosis, history of eye disease, medical status, work history and living situation. (The evaluation form is presented in Appendix B)

Test Materials

Perceptual Measures

These five measures consisted of Reading Recognition, Adaptive Acuity, Best Eye Acuity, Frostig Figure Ground Test of Visual Perception (FFG), and the Bender Gestalt Test of Visual Perception (Bender). They were administered before and after the intervention period to all visually impaired participants.

The administration and scoring of perceptual tests was adapted for use with the visually impaired subjects and the same scheme was used for normally sighted subjects, who were assessed on three of the measures: Reading Recognition, Adaptive Acuity, and Best Eye Acuity. (The measures are presented in Appendix C.)

Reading Recognition. This test was used to measure an individual's ability to recognize and read characters at a "nonfixed" or variable visual distance. The test involved reading a list of 64 progressively smaller numbers using a hand held Canadian National Institute for the Blind (CNIB) Low Vision Reading Test Card. The subject, tested binocularly using preferred reading device, was permitted to vary the distance of the material by moving or turning the card for optimal reading perspective. The same reading correction was used for both pretest and posttest assessments.

Using criteria devised for this project, an individual with normal sight would be expected to read approximately 60 or more characters, equivalent to .4 -.5 *m* print (*ie.* the print size of want ads in the newspaper). An individual with mild to moderate vision loss would be able to read approximately 40 - 50 characters, equivalent to 1 *m* (regular size newsprint). An individual with severe near vision loss would be able to read large headlines at best, or 2.5 *m* print, which would be less than 20 characters on the reading card.

Adaptive Acuity and Best Eye Acuity. The purpose of this test was to provide a measure of recognition acuity using a "fixed" or nonvariable perspective. In this situation, the subject has no control over the material, much as an individual has no control over objects that are encountered beyond arm's length in the visual environment. A wall-mounted Sloan eye chart was used to determine the level of Adaptive Acuity. The chart consists of rows of 46 letters in progressively diminishing size, ranging from the largest letters representing a visual acuity of 6/120 (20/400) to the smallest letters at an acuity level of 6/145 (20/15).

The measurement was taken at a distance of 6 meters. If the chart could not be seen at that distance, the participant moved closer until it could be seen. The furthest distance at which the subject could see the chart on the pretest was the distance used at both pre- and posttest administrations.

The usual method of acuity testing requires the individual to occlude one eye while reading the letters on the chart. The vision in each eye is measured both without and with correction. The refraction expressing acuity is a combination of the distance at which the individual reads the chart (numerator) and the distance at which a normal person reads the same line (denominator), with 6/6 (20/20) indicating normal vision. For this study, each eye was tested separately, using preferred correction and the letters identified by each eye were summed to provide a total Adaptive Acuity score. A perfect score was represented by the correct identification of all 92 letters, regardless of the distance at which the subject was tested.

Participants were also scored on Best Eye Acuity. This measure consisted of the number of letters seen on the same Sloan eye chart using only the strongest eye. Although Adaptive Acuity and Best Eye Acuity are very closely related, it was determined that for some subjects improvements might not be detected in visual functioning unless Best Eye was assessed separately. Some subjects were blind in one eye and no improvement could be expected in that eye. Only a measure of improvement in the Best Eye as a separate measure would result in a true measure of gain.

The Frostig Figure Ground Test of Visual Perception. The FFG (Frostig, 1976), originally a measure of visual motor skills in children, has been used in recent years for assessment purposes with visually impaired individuals (Conrod, *et al.*, 1986; Quillman, *et al.*, 1981). It has been shown in these studies to be a useful assessment device in evaluating sensory-perceptual capacities in low vision clients. The test requires the individual to identify and outline with a pen a series of overlapping geometric forms embedded in 8 designs of varying complexity. The scoring system penalizes distortions in outlining, lack of closure and missing lines (Frostig, 1976).

In the present study, a perfect score for visually impaired participants was represented by the precise identification of all 28 forms. Two judges independently rated the completed drawings.

The Bender Gestalt Test of Visual Perception. The Bender (Bender, 1938) has been used primarily to screen for CNS dysfunction. It consists of nine designs which the subject copies. The present study drew on aspects of Gestalt theory, particularly the emphasis on figure-ground relationships as a fundamental perceptual process and the Bender, therefore, provided a useful measure of improvement on visual perception and eye-hand coordination for visually impaired individuals.

The scoring system, modified for this study, awarded a maximum 10 points, one point for each of the nine figures and an additional point for overall organization. Each configuration was rated on a number of factors, including non-distortion of shape, drawing to scale, correct rotation, integration, closure, completion, perseveration, and corrections. If more than half of the relevant factors for a given drawing were present, the configuration received one point. An extra point was awarded for global organization, which required that two of the three following criteria be met: separation of figures or planning, order of figures and expansiveness. The drawings were rated independently by two judges.

Psychosocial Measures

Four questionnaires were designed and developed for this study: Activities, Beliefs, Expectations and Self Report. Their purpose was to provide more detailed information about an individual's visual condition in terms of these four aspects of adjustment.

As many of the subjects had difficulty reading, the questionnaires were orally administered. Three of the tests, Activities, Beliefs and Expectations, were also administered to normally sighted participants in written form. The Self Report measure could not be used with normally sighted subjects because it specifically evaluated residual visual abilities.

Two of the questionnaires, Activities and Expectations, both related to vision loss and therefore were modified so that questions focused on retirement for normally sighted subjects, rather than sight loss. This also helped to ensure that lifestyle and attitudinal changes reflected in these measures would not be due to age or retirement factors. The Beliefs questionnaire evaluated attitudes about sight loss in general and thus was administered without modification to the normally sighted groups. (See Appendix D.)

General Description of the Psychosocial Measures. Activities Questionnaire: Subjects rated items on the activity scale in terms of whether an activity occurred "more often", "as often" or "less often" than before the visual loss occurred. Three, two and one point(s), respectively, were given for each of 30 items, summing to a possible total of 90 points, indicating the highest level of activity. The final score was expressed in terms of the percentage of this total obtained by the individual.

Beliefs Questionnaire: This measure consisted of 25 true/false items related to knowledge and beliefs about sight loss. It was scored in terms of the total of correctly answered items.

Expectations Questionnaire: Participants were required to rate whether they expected a particular activity such as travelling or keeping fit to be "no problem", "a bit of a problem", "a difficult problem", or "almost impossible" given a visual problem. Three, two, one and zero points were awarded respectively for each of these responses for a possible 42 points in the 14-item scale. The final Expectations score was expressed in a percentage score.

Self Report Questionnaire: This 30-item, 10-point scale provided a self-evaluation of visual abilities in the performance of routine tasks, such as reading mail or writing letters. It represented ratings from "vision not adequate at all" to "vision perfectly adequate". A perfect score was represented by 300 points. The final Self Report score expressed an individual's satisfaction with their visual efficiency as a percentage.

Psychometric Properties of the Psychosocial Measures. Before analysing the results of the intervention study, the questionnaires themselves were evaluated in terms of their psychometric properties. The following steps were carried out: (1) All items on each of the four measures were examined to determine which items adequately represented the relevant psychosocial dimensions. As there were no standard selection rules which could be applied uniformly to all of these questionnaires, item selections were based on the statistics (*e.g.*, frequency distributions, percentages of items passed and failed) obtained from each questionnaire. (2) With regard to internal reliability, Cronbach's alpha (Cronbach, 1951) was used to compute internal reliability coefficients for the four visually impaired intervention groups on the pretest measures. (3) Test-retest reliability was computed for each measure using the correlation coefficient between the pretest and posttest scores of the control group. (4) Pretest data of visually impaired and non-impaired groups were compared and those items that did not discriminate significantly between the two groups were deleted.

Activities: In selecting items for the questionnaire, if a *t*-test did not highly discriminate ($p < .001$) between impaired and normally sighted subjects, then the item was considered for deletion. Older individuals may involve themselves less often in a given activity because of their age, but may attribute this change to vision loss. Deleting items that did not discriminate between impaired and nonimpaired subjects, that is, that both groups engage in less often helped to eliminate this confound. Examples of these activities were cooking and housework.

The final Activities Questionnaire consisted of 14 items. Cronbach's reliability coefficient for this scale was alpha = .78. The test-retest reliability correlation coefficient for Activities was $r(89) = .79$, $p < .001$, suggesting good retest reliability. A *t*-test comparing the Activities score of the visually impaired subjects ($M = .54$, $SD = .12$) and normally sighted subjects ($M = .75$, $SD = .09$) was found to be significant, $t(89) = 10.21$, $p < .001$, indicating that the impaired group was less active.

Beliefs: In determining which items should be maintained in the questionnaire, if 75% or more of subjects from the visually impaired groups correctly answered an item, then it was considered for deletion, so as to control for ceiling effects. Eleven items met this criterion. If visually impaired and normally sighted subjects differed significantly on an item, then that item was included in the questionnaire. Significant differences were found on seven items. For example, more visually impaired subjects than normally sighted subjects believed that watching television can be damaging to the eyes.

The final Beliefs questionnaire consisted of 14 items. The Cronbach alpha reliability coefficient for the Beliefs Questionnaire for the impaired group was alpha = .70. Test-retest reliability measured by the correlation between pre- and posttest scores for control subjects was $r(8) = .91$, $p < .001$. A *t*-test comparing the Beliefs scores of the impaired group ($M = 7.08$, $SD = 3.04$) and the normally sighted group ($M = 8.76$, $SD = 2.23$) was found to be significant, $t(88) = 3.12$, $p < .001$, with the impaired group scoring more inaccurately than the nonimpaired group.

Expectations: Four items were deleted from the original questionnaire. Three items were deleted because subjects stated that the item was not a problem. One item was deleted because it did not discriminate between visually impaired and normally sighted subjects.

Ten items were retained on the final Expectations measure. The Cronbach alpha reliability coefficient for this test was alpha = .83. Test-retest reliability using the control group scores was $r(8) = .76$, $p < .05$. A *t*-test comparing the total Expectation scores from the visually impaired subjects ($M = .64$, $SD = .20$) and normally sighted subjects ($M = .93$, $SD = .07$) was found to be significant, $t(88) = 9.63$, $p < .001$, showing that impaired subjects had lower expectations for themselves.

Self Report: This scale could not be adapted for normally sighted individuals as the items evaluated residual vision. Four items were deleted from the original questionnaire because they concerned visual situations which did not pose a problem for visually impaired subjects. For these items, 25% - 40% of subjects rated their visual ability as "perfectly adequate" for the situation and fewer than 10% of subjects rated their vision in the "not adequate at all" range. Twenty six items were retained in the final questionnaire. The Cronbach reliability coefficient for this measure was alpha = .94. The test - retest reliability coefficient measured by comparing pretest and posttest scores for the control group was $r(8) = .85$, $p < .001$.

Levels of Measures

To clarify the distinctions between the nine dependent measures, they were divided into two major categories, perceptual measures and psychosocial measures, each dealing with two levels of processing: (1) Instructed tasks and (2) Non-instructed skills. These two levels of processing were distinguished in terms of specific and non-specific learning. Subjects were tested directly on skills or knowledge learned in the sessions, as well as non-specific tasks, involving the application of skills or cognitions to novel situations. Table 2 illustrates these levels.

Table 2

Levels of Measures

Perceptual Measures

Level 1: Organizational-perceptual measures (Instructed)

- Frostig Figure Ground
- Bender Gestalt

Level 2: Functional-perceptual measures (Non-instructed)

- Reading Recognition
- Adaptive Acuity
- Best Eye Acuity

Psychosocial Measures

Level 1: Educational-psychosocial measures (Instructed)

- Activities Questionnaire
- Beliefs Questionnaire

Level 2: Attitudinal-psychosocial measures (Non-instructed)

- Self Report Questionnaire
- Expectations Questionnaire

Training Materials

Perceptual Training Manual

The Perceptual Training Manual was designed to provide step-by-step instructions using sets of progressively complex perceptual tasks to help improve the use of residual vision. Explanation, practice and repetition of perceptual strategies, including scanning, peripheral viewing and eye-hand coordination tasks were used to maximize visual efficiency. (Sample exercises from the Perceptual Training Manual are presented in Appendix E.)

Psychosocial Training Manual

These protocols, developed for use with IEPC and GEPC participants, were divided into five topic areas: (1) Introduction, basic anatomy and discussion of visual disorders (2) Social adjustment, dependency issues, pre-planning strategies, contracting with family and friends (3) Effective use of vision, medical and non-medical factors, lighting, contrast, myths and facts regarding vision, importance of medical monitoring; (4) Perceptual strategies, optimizing contrast and lighting, use of scanning techniques, basics of magnification (5) Community resources, rehabilitation agencies, library services, travel assistance, tax benefits, available professionals and their respective areas of expertise, how and where to seek help regarding a visual problem. (The Psychosocial Manual is presented in Appendix E.)

Procedure

Instructors

There were five instructors, all of whom underwent training in the administration of the IEPC, GEPC and PTRAIN interventions. Training involved six group sessions during which the protocols for all intervention groups were introduced, explained, read and practiced to ensure that each instructor followed the material systematically and uniformly. Instructors were randomly assigned to subjects.

Visually Impaired Participants

The subjects were first contacted on the telephone during which a brief explanation was given about the interview to follow and the study in general. Subjects were told that the investigators were looking for new methods to improve visual functioning in individuals with low vision. An appointment for the first interview was given at this time.

During the first meeting, a semi-structured interview was conducted. Individuals who agreed to participate and who met the research criteria signed consent forms at this time. (See Appendix F for ethics considerations.) The next two sessions with all participants consisted of completing the pre-intervention assessment battery: Reading Recognition, Adaptive Acuity, Best Eye Acuity, FFG, Bender, and Activities, Beliefs, Expectations and Self-Report Questionnaires.

After these two assessment sessions, members of the three intervention groups attended five weekly one-hour training sessions. The different interventions were as follows: (1) IEPC Group: Participants explored and discussed with an instructor in five one-on-one sessions issues outlined in the IEPC training protocols. (2) GEPC Group: Participants followed the same schedule and received the same information as IEPC participants, except that meetings took place in a group setting where they were encouraged to share information and ideas with each other. (3) PTRAIN Group: Under supervised one-on-one instruction, participants followed the format described and illustrated in the Perceptual Training Manual.

The eighth and ninth sessions consisted of post-intervention testing for the three experimental groups, including the re-administration of all perceptual and psychosocial measures. Control subjects were informed initially that their role in the study was to help in the development of assessment tools for visually impaired individuals. These participants were also informed, once posttesting was completed, that if they were interested, training sessions were also available to them. Table 3 illustrates the phases of the study for each group.

Normally Sighted Participants

These 50 subjects were first interviewed on the telephone, at which time an appointment was made for a single testing session. At the beginning of that session an explanation of the study was given, after which data pertaining to demographic information and dependent measures (Reading Recognition, Adaptive Acuity, Best Eye Acuity, Activities, Beliefs and Expectations) were obtained and analysed. To ensure representativeness, the normally sighted sample was split into two samples and the 50 subjects were randomly assigned to one of the two groups. Then t-tests were computed to compare the two new samples on the psychosocial questionnaires, as well as on the perceptual measures and age. No differences were found: Activities, $t(48) = 1.54$; Beliefs, $t(48) = 0.25$; Expectations, $t(48) = 0.36$; Reading Recognition, $t(48) = 1.14$; Adaptive Acuity, $t(48) = 0.27$; Best Eye Acuity, $t(48) = 0.93$; Age, $t(48) = 0.84$. As the two groups were found to be equivalent, the results from the original 50-subject sample were used as comparison data for the visually impaired study.

Follow-up

A telephone interview was carried out three to six months after testing was completed with 29 of the 39 experimental subjects who were available. The interview included 14 questions judging whether participants had given up meaningful activities (*e.g.*, physical exercise, visiting with friends) as a result of visual impairment, maintained post-intervention level of functioning, resumed an activity, or initiated a new activity since their last session. An overall rating of adjustment to visual impairment was given to each participant by two independent judges based on emotional, physical and social functioning.

Table 3

Phases of the Study

Group	Pretest (Weeks 1 - 2)	Intervention (Weeks 3 - 7)	Posttest (Weeks 8 - 9)
IEPC	2 sessions	5 sessions	2 sessions
GEPC	2 sessions	5 sessions	2 sessions
PTRAIN	2 sessions	5 sessions	2 sessions
Control	2 sessions	No treatment	2 sessions

RESULTS

The IEPC, GEPC, PTRAIN and control groups were compared in two repeated measures multivariate analyses of variance (MANOVAs) on the perceptual and psychosocial measures. They were first evaluated, however, for equivalence at baseline.

Preliminary Analysis: Group Equivalence

Demographic and Medical Data

The four groups were compared on demographic and medical data to ensure that random assignment had been adequate and that the four groups were indeed equal.

Chi square analyses were used to compare the groups on the following categorical variables: Diagnosis, sex ratio, SES, work status, mother tongue, and living situation. Results confirmed that there were no differences between groups on any of these variables. This was especially important in terms of diagnosis, because the majority of participants (78%) had age-related maculopathy. The analysis confirmed that the different diagnoses were distributed in the same proportion across groups. (A summary of chi-square analyses is found in Appendix G.) The following variables were analysed using a one-way analysis of variance (ANOVA): age, education, health, years of impairment, visual stability and severity of impairment. No group differences were found on any of these variables. (See Appendix G for ANOVA tables.) In summary, the results indicated that the subject groups were similar with regard to social, cultural and visual diagnostic factors.

Dependent Measures

Finally, the four experimental groups were compared at baseline on all nine dependent measures to ensure that they were equivalent before treatment began on the five measures of visual functioning and on the four measures reflecting psychosocial adjustment to visual impairment. ANOVA results showed that there were no baseline differences between groups on any of the perceptual or psychosocial measures. (See Appendix H for ANOVA summary tables.)

In summary, the four groups were found to be equivalent initially on the nine dependent variables. This indicated that the method of random assignment was adequate.

Effectiveness of Interventions

A repeated measures multivariate analysis of variance (MANOVA) was conducted on each of the two sets of dependent variables.

Tests of Assumptions

The major assumptions underlying MANOVA are multivariate normality and homogeneity of the variance - covariance matrix. Tests of assumptions were conducted for each of the two reported MANOVAs. Multivariate normality is difficult to assess and is usually evaluated by means of univariate statistics (Stevens, 1986). The z-scores within each group for all variables included in the MANOVA were evaluated to determine the presence of univariate outliers which would have affected the distribution of scores. If outliers were detected, subjects' scores were moved to within one unit of the next most extreme score on the distribution (Tabachnick & Fidell, 1989). The skewness coefficient for each variable within each group was then evaluated. There were no significant departures from normality for any of the distributions. The Mahalanobis distance measure was used to detect multivariate outliers. There were no multivariate outliers for either MANOVA. Homogeneity of the variance - covariance matrix was evaluated by the Box M statistic. This statistic was nonsignificant for both the psychosocial [F (108, 3652) = 1.40] and the perceptual [F (63, 3843) = 1.60] MANOVAs.

When sample sizes are unequal, as in this case, the computation of sums of squares can be misleading, because the design is nonorthogonal. The statistical problems associated with a nonorthogonal design were avoided by using BMDP 4V to compute MANOVAs (Tabachnick & Fidell, 1989). BMDP uses an unweighted-means approach such that each cell of the design is given equal weight regardless of its sample size. Finally, the computation of MANOVA requires that there are more subjects than dependent variables within each cell. This rule was not violated as there were ten subjects in the smallest cell and no more than four variables per MANOVA.

MANOVA Results

Psychosocial Measures

Redundancy among variables was assessed by examining the intercorrelations between the psychosocial measures. As there were no correlations higher than .70 (Tabachnick & Fidell, 1989), all four variables, Activities, Beliefs, Expectations, and Self Report were included in the MANOVA. The correlation matrix is presented in Table 4.

A 2 x 4 (Time x Intervention Group) MANOVA was then computed. The Wilks Lambda criterion was significant for the multivariate F test of the Time x Group interaction, $F(2,111) = 2.12$, $p < .05$. Inspection of the univariate F tests revealed that only the Beliefs questionnaire significantly contributed to this effect, $F(3,45) = 3.70$, $p < .05$. (The multivariate summary table for all of the psychosocial measures is presented in Appendix I.)

Repeated measures t-tests computed within each group were used to determine the nature of the Time x Group interaction on the Beliefs Questionnaire. Because multiple t-tests were required, the Bonferroni correction was applied so as to protect against Type I errors. This set

Table 4

Intercorrelations between Psychosocial Measures for Visually Impaired Subjects

	Activities	Beliefs	Expectations	Self Report
Activities	-			
Beliefs	.47(.001)	-		
Expectations	.51(.001)	.29(.05)	-	
Self Report	.30(.05)	.18(.22)	.46(.001)	-

Note. n = 49. Probability levels in parentheses.

the alpha level at .01 for significance. Results showed that the performance of the IEPC and GEPC groups improved significantly over time, whereas that of the perceptual training and control group did not improve. The means, standard deviations and *t*-test results for the Beliefs Questionnaires for the four groups are presented in Appendix J. The differences are illustrated in Figure 1.

Perceptual Measures

Intercorrelations were also computed for the perceptual measures. Table 5 presents the results of this analysis. High correlations were found between the FFG and Bender, $r(49) = .79$, $p < .001$ and between Best Eye Acuity and Adaptive Acuity, $r(49) = .89$, $p < .001$, indicating redundancy among the measures. As the FFG has been used more frequently in low vision work and has shown itself to be an effective instrument in assessment work with the visually impaired, it was selected for the MANOVA, and the Bender was eliminated from this analysis. Best Eye Acuity was chosen over Adaptive Acuity for the MANOVA because it seemed to be a more accurate measure of visual efficiency, that is, it does not discriminate against individuals who are completely blind in one eye. Therefore, a MANOVA was computed on three perceptual measures: FFG, Reading Recognition and Best Eye Acuity.

The Wilks Lambda criterion for the Time x Group interaction was found to be significant, $F(9,105) = 3.45$, $p < .001$. Inspection of the univariate F tests indicated that all three perceptual measures contributed to this effect: FFG, $F(3,45) = 5.94$, $p < .01$; Adaptive Acuity, $F(3,45) = 4.47$, $p < .01$; and Reading Recognition, $F(3,45) = 2.81$, $p < .05$. Hotelling T^2 *post hoc* tests were computed within each group to assess change from pre- to post-intervention on the three measures. The *post hoc* test showed significant multivariate effects of time for the IEPC group, $F(3,13) = 5.05$, $p < .05$ and the PTRAIN group, $F(3,9) = 6.92$, $p < .01$. (See Appendix K for multivariate and *post hoc* perceptual summary tables.)

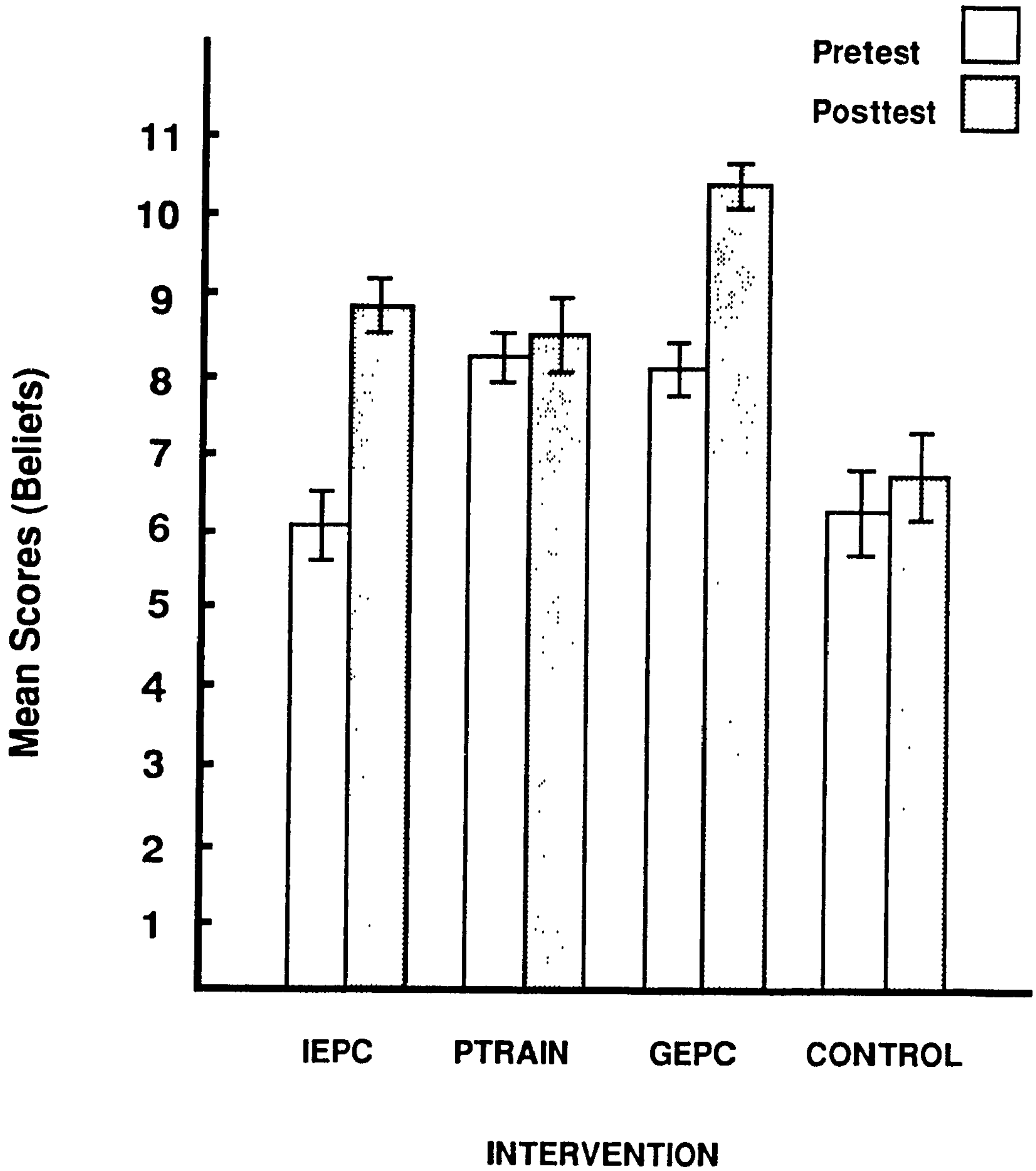

Figure 1. Means (and standard errors) for four groups on Beliefs Questionnaire.

Table 5

Intercorrelations between Perceptual Measures (Reading Recognition, Adaptive Acuity, Best Eye Acuity, Frostig Figure Ground, Bender Gestalt) for Visually Impaired Subjects

	RR	AA	Best Eye	FFG	Bender
RR	-				
AA	.66(.001)	-			
Best Eye	.47(.001)	.89(.001)	-		
FFG	.62(.001)	.29(.04)	.32(.05)	-	
Bender	.43(.002)	.33(.02)	.31(.05)	.79(.001)	-

Note. n = 49. Probability levels in parentheses.

(The means and standard deviations for the three perceptual measures for all four groups are presented in Appendix L.) Figures 2a, 2b and 2c illustrate the results for perceptual measures. In summary, the IEPC and PTRAIN programmes were found to contribute significantly to improvement on perceptual measures, whereas the GEPC programme was no more effective than the control condition.

<u>Follow-up</u>

An ANOVA was used to compare the intervention groups on a follow-up total "lifestyle" score, which reflects three aspects of coping with low vision: (1) Maintains level of activity achieved at post-intervention (2) Resumes a meaningful activity (3) Initiates new activity. The ANOVA results indicated a difference between groups, $F(2,28) = 5.06$, $p < .05$ on this composite score. A *post hoc* Tukey analysis showed a significant difference ($p < .05$) between IEPC ($M = 3.08$, $SD = 2.0$) and GEPC ($M = 5.33$, $SD = 1.32$) groups, but not between GEPC and PTRAIN ($M = 3.86$, $SD = 1.07$) groups.

Chi-square analyses were then used to further compare the groups on the three aspects of coping. The first finding was that all but one of the participants from the three intervention groups maintained post-intervention level of functioning at follow-up. Second, all groups resumed a meaningful activity that had been given up because of the onset of visual impairment: This was the case for 100% of GEPC subjects, 61.5% of IEPC and 57.1% of PTRAIN subjects. These differences were marginally significant, x^2 (2) = 5.01, $p = .08$. In terms of initiating an activity, there was also a trend toward significance, x^2 (2) = 4.81, $p = .09$., with 77.8% of GEPC subjects, 30.8% of IEPC and 57.1% of PTRAIN subjects initiating a new activity.

Overall, the results indicate that the intervention programmes were successful in improving performance on selected visual and educational

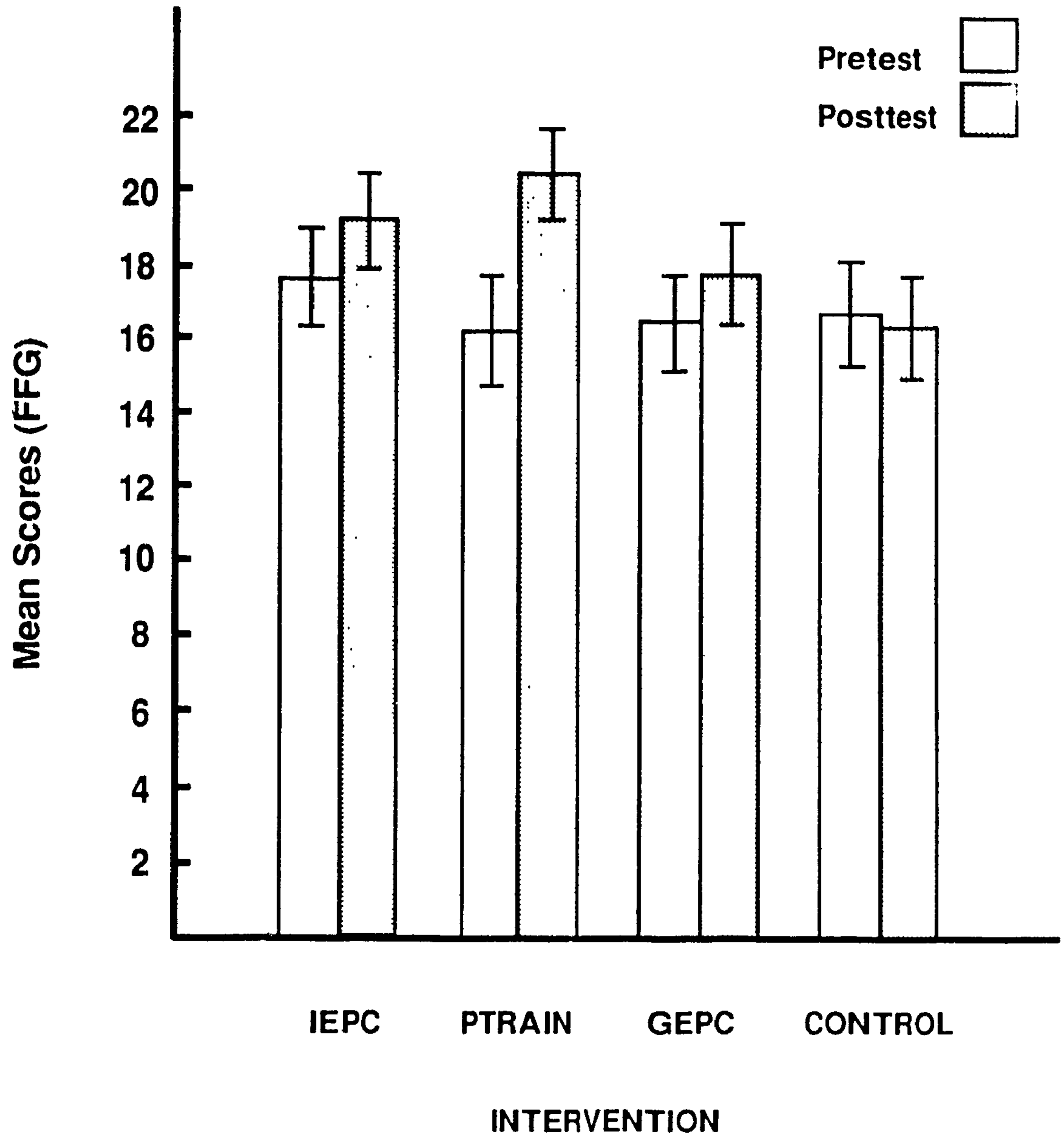

Figure 2a. Mean Frostig Figure Ground scores (and standard errors) for four groups.

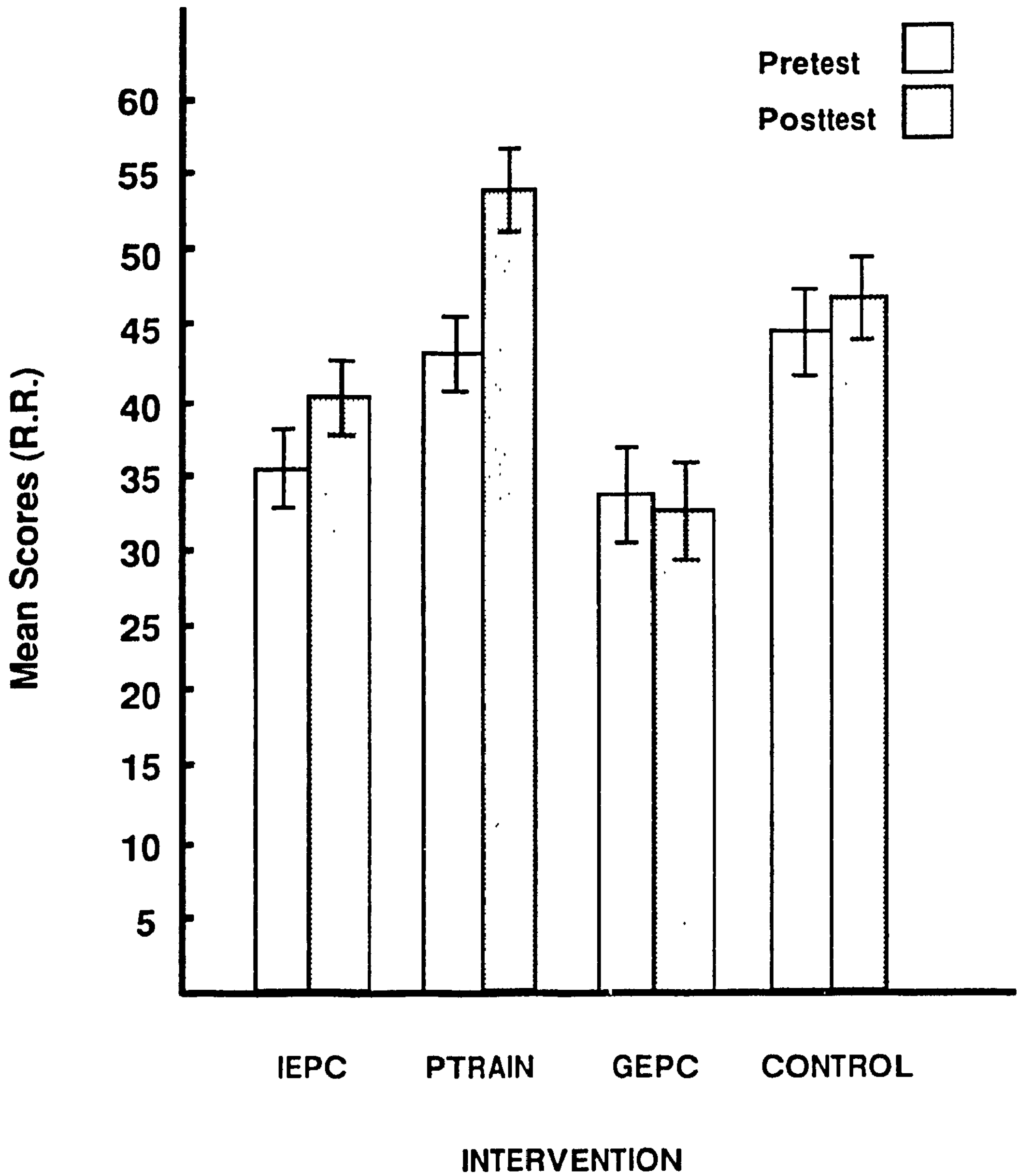

Figure 2b. Mean Reading Recognition scores (and standard errors) for four groups.

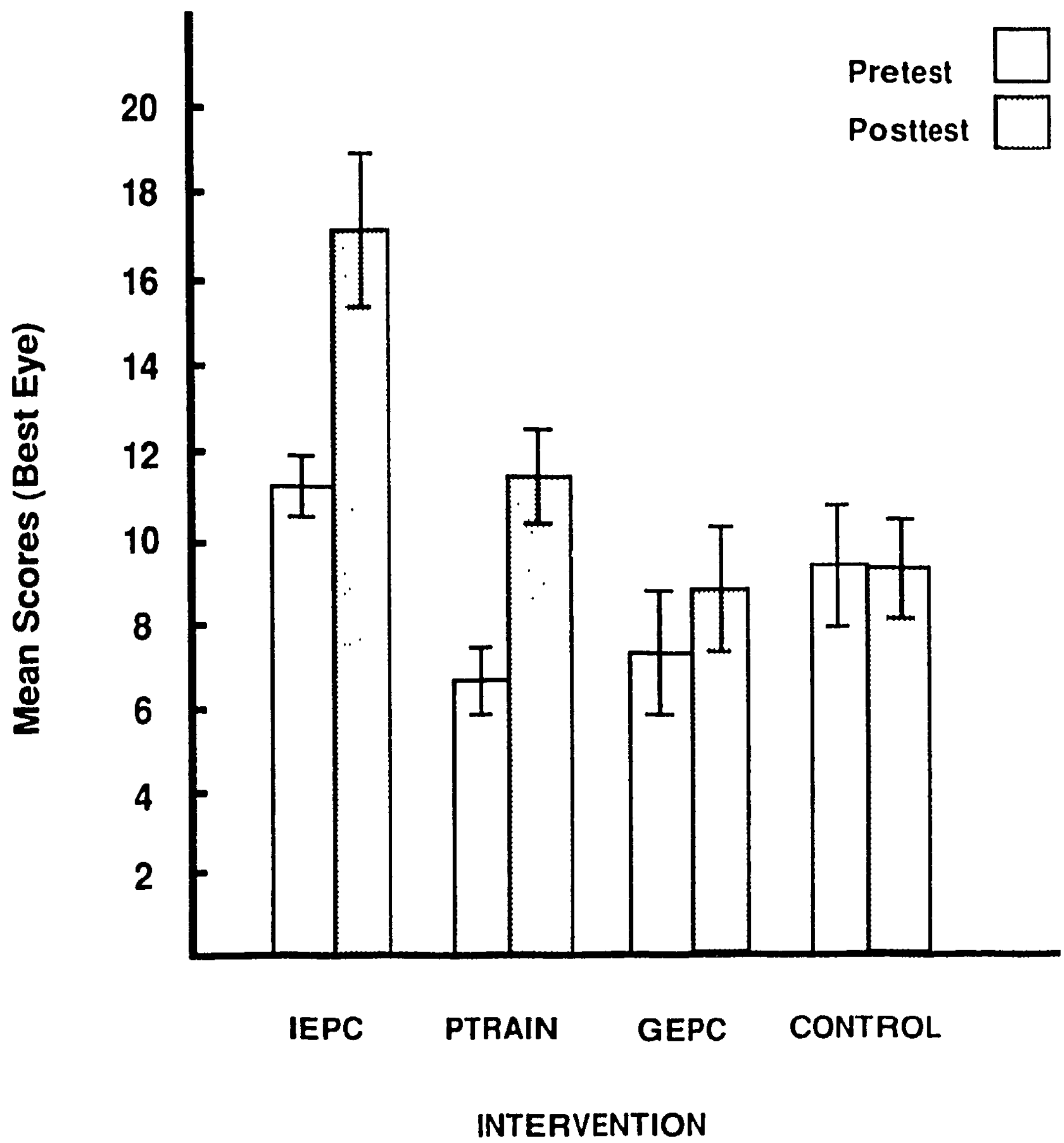

Figure 2c. Mean Best Eye Acuity scores (and standard errors) for four groups.

psychosocial tasks. More specifically, perceptual training (PTRAIN) subjects improved significantly on the FFG (Level 1), as well as on Adaptive Acuity and Reading Recognition (Level 2). PTRAIN subjects did not improve on psychosocial measures. IEPC and GEPC subjects improved on one of the psychosocial measures, Beliefs (Level 1), but not on other psychosocial measures. Finally, the IEPC group, but not the GEPC group, showed significant improvement on all perceptual measures. These results are summarized in Table 6.

Table 6

Levels at which Improvements occurred for each Group on Perceptual and Psychosocial Measures.

	Perceptual		Psychosocial	
	Level 1	Level 2	Level 1	Level 2
PTRAIN	yes	yes	no	no
IEPC	yes	yes	yes	no
GEPC	no	no	yes	no
Control	no	no	no	no

DISCUSSION

The primary objective of this study was to develop effective clinical interventions for individuals who have undergone visual loss. A second goal was to contribute to the theoretical understanding of the perceptual processes and psychosocial factors that are involved in the adaptation to visual changes.

Generally, the results indicate that the interventions were successful. Perceptual training participants improved on all perceptual tasks. Both individual and group psychosocial counselling participants improved in the accuracy of beliefs and knowledge about about sight loss. Finally, IEPC subjects improved, as well, on the perceptual tasks. The details of these results are discussed below.

Perceptual Training

Previous low vision research has shown that specific perceptual skills can be improved with instruction and practice. However, perceptual improvement in these studies was limited to the skill being learned (Conrod, *et al.* 1986; Overbury & Bross, 1978; Overbury & Quillman, 1991; Trudeau, Overbury, & Conrod, 1990). Figure-ground discrimination ability, for example, improved as a result of training, but this training did not seem to help subjects with other visual-perceptual problems. These studies questioned whether more generalized improvements could be expected from perceptual training. For example, could training in scanning or eccentric viewing have a positive effect on important everyday visual problems such as the ability to recognize familiar faces, street signs, numbers and landmarks?

The use of two levels of perceptual measurement helped to answer this question. Level 1 tasks focused on Gestalt principles of organization, such as figure-ground discrimination skills that were practiced in the sessions, whereas Level 2 measures were not practiced skills. These skills involved recognition tasks and required that the subject apply strategies learned in the sessions to new visual problems. Post-intervention test results showed that the PTRAIN subjects improved on both levels of visual functioning, which included the FFG (Level 1) as well as Reading Recognition and Adaptive Acuity (Level 2), thus giving support to the idea of training generalization.

A general attentional model in which the goal is to minimize sensory discrepancy (Kelso, *et al.*, 1975; Lackner & Levine, 1978; Levine & Lackner, 1979; Redding, *et al.*, 1985; Redding & Wallace, 1985a, b; 1987) provides a possible theoretical framework for explaining the adaptation to visual impairment observed in the present study. In visual impairment, two perceptual systems are often in conflict. Vision has changed but proprioceptive and motor pathways are providing information as before. It is likely, for the most part, that the individual will attend to visual information, first, because of a natural tendency (visual capture) to do so and, second, because this once dependable system is now providing disturbing or conflicting information that cannot be ignored, such as blurriness, blind spots, waviness or other distortions.

According to Redding's interpretation of the adaptation process, in this situation the visual system becomes the guiding system. Efferent information from this system conflicts with afferent information from the adapting or nonattended modality, but there is no conflict between afferent-efferent information in the guiding (visual) modality, and so the guided (perceptual-motor) system adapts. In a typical rearrangement experiment using displacement devices, the subject is required to focus attention on visual cues, while disregarding proprioceptive information from the arm or hand, which attempts to make correct pencil markings on intersecting lines. After a number of trials during which the subject, wearing the displacement prisms, views himself making incorrect placements, the sensorimotor system adapts to the situation resulting in a reduction of behavioural errors.

In the perceptual training sessions of the current study, attention was also focused on visual information. Subjects were required to make accurate pencil markings by copying or outlining various figures. Placements became more accurate with training and performance improved. It is reasonable to suggest that here, as above, the disregarded proprioceptive system adapted and the result was shown in a "reduction effect". This interpretation is further supported by self-reported ratings of residual visual ability, which did not improve. Subjects did not perceive any difference in their visual functioning, possibly because it was a perceptual-motor adjustment that accounted for improvement in this situation.

The Self Report ratings may have been quite accurate in detecting "no change" in visual abilities, because the changes occurred in another modality. As suggested earlier, perceptual-motor changes do not necessarily imply visual adaptation. Stratton (1896) was able to perform perceptual-motor activities, but rarely saw his body as being in an upright position while wearing inverting goggles. Kohler (1962, 1964), in the Innsbruck experiments, also demonstrated the ability to perform various complicated motor tasks, but did not report that vision was improved. There may be similarities for visual impairment, that is, an improvement in functional abilities without the perception of any improvement or change in visual ability.

These interpretations help to clarify the role of central processing in adaptation to visual impairment, particularly with regard to the important notion of practice. If one were to accept the view of Festinger and Canon (1965), for example, that a central state of readiness based on prior experience activates efferent programmes in current situations, then it would be important to maximize an information store based on many experiences. Thus, for the visually impaired observer, a cumulative record of learned efferent references obtained from numerous exposures in similar situations will help the individual respond in a more accurate, focused, and meaningful way to visual distortions.

The more information the individual has, the more likely it is that adaptation will occur, but this conflicting information could be confusing or overwhelming, particularly when visual impairment is involved. Attention theory explains how confusion is avoided (Neisser, 1976). Theoretically, the amount of information that can be attended to at any given time is unlimited, although attention is not usually divided among sources. When the skills involved are highly practiced and automatic, however, the individual can cope with more than one source of information. An important implication in this regard for visual impairment is that practice may improve performance on perceptual skills and allow the individual to cope with more information from competing sensory pathways.

Maximizing information sources is important, but input alone is not sufficient. There may also have to be an awareness of sensory discrepancy for adaptation to occur (Welch 1969; 1978). For the visually impaired individual, being aware of sensory conflict likely permits the individual to discriminate between faulty visual input due to a disease process from an actual, but unfamiliar, object or scene.

Harris (1965) would not explain adaptation in terms of attentional factors and the disregarded or guided modality. However, his views are not entirely in conflict with those of attentional theorists. He postulated that the visual sense is not as flexible as supposed and that in cases of visual rearrangement, the position sense, rather than vision, adapts. His theory also implies, however, that attention, information and awareness are important factors in adaptation. He claimed that in most rearrangement experiments, not enough information from the position sense was provided and thus adaptation of the felt position of the body did not occur. When the information is increased from the muscle spindles, so is sensory discordance and the discrepancy is registered. In his experiments, using more proprioceptive feedback, adaptation occurred in the position sense.

An analogy may be provided by the present investigation, where feedback occurred for the PTRAIN subjects with each set of perceptual exercises. The subject was encouraged to be aware of the effects of moving the to-be-deciphered material closer or further from the eyes and positioning the head or arm to maximize accuracy and minimize errors. The results are consistent with demonstrating the importance of awareness level and attention, and consistent with Harris's findings that proprioceptive feedback, including error-corrective feedback and practice, is needed for adaptation to occur.

If perceptual training methods explain improvement in the PTRAIN group, how can significant improvement on all three perceptual measures by the IEPC group, but not by the GEPC group, be explained, particularly when both groups received the same informational content in their sessions? Probably most important, unlike the GEPC format, the PTRAIN and IEPC interventions were individually administered. Here, visual and perceptual strategies and skills were addressed to the specific visual needs of the individual, rather than to the general needs of a group. The sessions were, therefore, more personally relevant to PTRAIN and IEPC participants than they were to GEPC participants. Perceptual improvement was expected for PTRAIN subjects because of the practice and feedback, but even without actual training, improvement may have also occurred for IEPC participants because of the emphasis on understanding visual and perceptual processes. IEPC subjects may have applied their new learning outside of the sessions and later, successfully, in the post-intervention assessment phase. As Festinger and Canon (1965) suggested, active movement may not be necessary as long as there is a record of efferent impulses available to the observer. Practice between sessions may have provided enough feedback that, in addition to the informational nature of the sessions, was sufficient to improve perceptual functioning at posttesting.

In theoretical terms, the PTRAIN and IEPC sessions may be compared to active and passive conditions. It has been the consensus that active movement produces greater adaptation by increasing reafferent memory traces to compare with current visual feedback, resulting in more precise and accurate movements (Held, 1964, 1965; Kohler, 1962, 1964; von Holst, 1954). IEPC subjects were not given the opportunity to practice visual-motor skills in the sessions and in this sense they were passive. However, they were not passive in that they may have been motivated to increase their attention to and awareness of visual problems. In other experimental situations, where adaptation was found in passive conditions, these same non-specific motivational and attentional factors may have contributed to improvement. This interpretation is in agreement with the position of attention theory proponents who suggest that awareness facilitates adaptation, particularly when the individual focuses on one source of information (Kornheiser, 1976; Lackner, 1977; Redding,*et al.* 1985).

The improvement of both IEPC and PTRAIN groups on perceptual measures is not inconsistent with other current low vision findings. A study by Overbury and Quillman (1991) found that there were no differences between in-clinic perceptual training and homework (no feedback) conditions for their visually impaired subjects. The authors suggested that the perceptual approach of individuals in a visual training programme may not be modified by a teaching paradigm. Instead, the process "is arrived at by each person" and is facilitated by the utilization of various training materials and strategies. These findings may apply to the present study as well. The PTRAIN condition utilized instruction and training in eccentric viewing, for example, while the IEPC condition offered information and explanation. Improved IEPC functioning may be attributed to new understanding, with the subjects working out the process on their own.

The educational part of the intervention, addressing pertinent issues about visual diseases and prognoses, may also have helped IEPC subjects. Many individuals undergoing sight loss consciously try to ignore visual changes. They may not be aware of sensory discrepancies and, further, they may deny that what they are seeing, or not seeing, is actually occurring. Often, they believe that this is an unexplainable illness that will ultimately result in blindness. However, education about visual processes seemed to have helped them understand more clearly the medical source of their visual problems and the rationale for adopting new strategies to counteract these real visual changes. Instead of minimizing the presence of visual distortions, the sessions maximized awareness of sensory discrepancies. Ultimately, IEPC subjects achieved approximately the same level of visual functioning as the PTRAIN group, but in a manner explained by an alternative theoretical framework. This important focus was apparently less salient in the GEPC condition.

Overbury and Quillman (1991) have suggested that the results of any visual training programme may not be immediate. Active rehabilitation after visual loss has occurred may take months and probably follows a hierarchical path, similar to a child developing a repertoire of perceptual skills. The GEPC intervention process seemed to have prioritized social functioning. Perceptual issues may have been placed lower on the priority scale, but these kinds of improvements might have occurred at a later date. A more extensive follow-up phase, including re-administration of all measures, might have detected such changes, which here can be only speculative.

Finally, although both PTRAIN and IEPC groups showed significant improvements on perceptual measures, in terms of percentages, PTRAIN changes were more impressive than those of the IEPC group: 83% vs 50% on the FFG, 92% vs 75% on Reading Recognition and 75% as compared to 62.5% on Best Eye Acuity. Earlier studies that found improvements on perceptual tasks (Conrod, *et al.*, 1986; Trudeau, *et al.*, 1990) were difficult to interpret because of the possible effects of instructor bias and feedback. In the current study, a systematic attempt was made to provide a structured series of instructions and exercises that could be administered in a standard manner to all participants. These methodological considerations helped to ensure that instructor effect was minimized and that perceptual training effects were maximized. Together with the high percentages of improvement for the PTRAIN subjects, the results suggest that perceptual training is an appropriate and applicable intervention technique for visually impaired individuals.

Psychosocial Counselling

There were significant differences between visually impaired and normally sighted groups at baseline on the Activities, Beliefs and Expectations Questionnaires. The psychosocial findings are important because they show objectively, for the first time in low vision research, that there are identifiable psychological consequences to visual loss.

Also important, on the Beliefs measure at post-intervention assessment, both the IEPC and GEPC groups had achieved the same level as the normally sighted group in terms of knowledge and beliefs about sight loss. These results suggest that negative cognitive-affective changes associated with the onset of visual loss are modifiable early in the adjustment process. Tuttle (1984), as well as many other low vision professionals, has emphasized the need for early intervention when visual loss occurs. The form and content of such help have not been explored or researched as yet, but a reasonable assumption would be that the process of adjustment should begin with education about low vision.

The Beliefs measure was the most likely psychosocial measure to change as a result of the interventions in the present study, because the Beliefs items reflected subject matter addressed directly in the sessions. However, some psychosocial issues associated with visual loss simply may be more resistant to change than others. The other measures may have been accurate in reflecting such resistance after only five weeks of intervention. If the process of adjustment is hierarchical, as suggested, then other more difficult changes may have occurred later.

The follow-up interview, carried out three to six months after the completion of the study, found evidence of certain changes. The results from this interview have to be interpreted cautiously because of biases that may have affected the responses of the participants, especially the desire to please the interviewer. However, the reports of the participants seem to imply that the longer-term effects of the interventions were positive, particularly for the GEPC intervention.

Improvements in many participants included increased confidence, more independent travelling and the return to previous activities such as golf and physical exercise. Among GEPC "graduates", one enlisted at a local agency for the blind as a volunteer reader for clients more impaired than herself. Another sponsored and organized a benefit show to raise money for a low vision group. Yet another graduate re-established a previous writing career and has since published several journal articles and a chapter in a book, in addition to starting a low vision telephone network group. A fourth individual has become politically active and continues to hold a position on the executive of a group representing disabled individuals. PTRAIN changes did not appear to be so striking, except for one participant who campaigned on behalf of a local Rotary club and donated a substantial sum of money to visual impairment research. One PTRAIN participant stated simply that learning how to use eccentric viewing techniques had been the most helpful.

Although improvements were noted in other groups, it seems that the most consistent and perhaps most dramatic changes occurred in the GEPC group, because more of these participants initiated new activities or returned to a previous level of functioning. The kinds of changes that occurred would not be unexpected given the focus of the GEPC intervention. Initially, the social nature of the GEPC intervention appeared to have been over-emphasized, but follow-up results indicate that later gains were made by this group. These findings are of interest because they help to strengthen the rationale for the educational portion of the counselling interventions.

The lack of improvement on other psychosocial indicators may be because the measures are not sufficiently sensitive to detect subtle changes. On the Activities measure, more open-ended questions might further clarify how and why time is divided among various activities. Shifts in activities may well be realistic and appropriate despite improved visual skills, such as an individual who has rediscovered the radio and now prefers this mode of communication to television or the newspaper.

The Self Report Questionnaire also showed no improvement after the intervention period. The scale rates the usefulness of a person's eyesight in performing various tasks, but it does not evaluate alternative sensory-perceptual skills. Many participants described strategies or substitutes for failing central vision, such as peripheral vision to identify a familiar face, auditory cues or improved hand-eye coordination. In this situation, although vision was not perceived as more useful, strategies were useful, but this was not reflected as being "satisfied" in Self Report scores.

Problems in Low Vision Research and Clinical Implications

One obstacle in this project was the limited availability of subjects. Because the visually impaired population is a small and diverse population, differences in diagnosis, symptoms, and course of disease render it almost impossible to group a sufficient number of homogeneous categories. Comparisons between individuals who do have a similar medical status are also problematic because the experience of visual loss is so unique. It follows that one major requirement of any intervention programme dealing with sight loss would be that it encompass a broad range of vision-related problems, so as to be applicable to the majority of individuals in this heterogeneous population.

Instructional protocols were developed for two broad topic areas relevant to a number of disease categories involving visual losses. The IEPC and GEPC protocols attempted to present educational and psychological issues common to the majority of individuals who have lost some sight and to provide a framework that would encourage the adjustment process to begin or to continue its work. Issues include anatomy of the eye and visual diseases, as well as the psychological implications of being visually impaired, family concerns and community resources. Results, including follow-ups, indicate that the educational and psychosocial aspects of the protocols are appropriate in content, level of sophistication, and interest for the majority of visually impaired individuals in this age group.

Similarly, the perceptual training protocol covers a range of perceptual skills, such as optimizing fixation, scanning, and efferent monitoring strategies to facilitate organization of the visual field and best utilization of remaining visual capacity. Perceptual improvements on three different tasks by the PTRAIN group indicate that the varied content was beneficial.

The material was also selected, organized and presented in large print so that the workbook could be self-administered under other circumstances. This was considered to be a very important feature of the perceptual training approach. It is known that low vision professionals often do not have the time and resources to conduct one-on-one sessions with low vision clients and their clients usually cannot afford such a service, even if available. Nor do governments or agencies financially support, as yet, this type of therapy. Compounding these difficulties is the reluctance of many visually impaired elderly individuals to leave their homes, because of their disability. Thus, some sort of contact and counselling is needed to engage the individual outside of the doctor's office or low vision clinic.

If such a programme were available to low vision professionals, it might provide a useful, economic way of helping to rehabilitate newly diagnosed visually impaired individuals. The PTRAIN sessions, conducted with a minimum of instructor contact and suitably prepared manuals, seem to lend themselves well to take-home training format. Providers of services for the visually impaired may begin to utilize similar approaches to guide rehabilitative efforts with their clients.

In addition to difficulties in defining intervention content is the more difficult issue of defining the nature of instructor - participant interpersonal contact. Psychological factors that intervened unexpectedly in earlier studies (Conrod, *et al.*, 1986; Trudeau *et al.*, 1990) were anticipated in the current study. For example, most participants had limited knowledge or interest in the methods of research. For many of them, just the effort of attending the sessions was considerable and there were occasions when participants were feeling anxious and fearful about their visual problems. It was difficult under these circumstances to present seemingly unrelated topics such as perceptual strategies.

These difficulties required some attention at the outset of the project. An initial individual interview session was held for all participants, where the role of the participant was clearly explained. A structured approach was used throughout all sessions in terms of the material presented to the subjects, the format of the presentation, and the environment in which it was presented. The instructors also attended six preparatory sessions to discuss strategies for maintaining the organization and structure of the sessions. It is likely, therefore, that the contact was relatively standard from session to session and subject to subject. This control ultimately helped to strengthen the results of the study because experimenter effects were minimized.

Conclusions

This study, addressing both clinical and theoretical issues related to visual loss, represented some initial steps in developing and refining interventions and assessment instruments for visually impaired individuals.

The psychosocial measures assessed certain aspects of psychological functioning that were perceived to be related to successful adjustment, including changes in normal activity level, beliefs and misconceptions about sight loss and expectations for future functioning. Differences that were found between visually impaired and normally sighted groups on three of these measures reflected important psychological factors that need to be addressed in low vision research and clinical settings.

There are advantages to using self-administered rating scales and questionnaires in assessment. They are economical, easily administered and valuable for monitoring progress. Results are objectively obtained through a standard scoring system and reliability and validity can be assured through proper test development. There is a place for such assessment devices in the field of visual impairment. Continued development of the present questionnaires should help to identify the specific aspects of psychological functioning that relate to adaptive coping. The results have demonstrated, for example, that visually impaired individuals hold more negative beliefs about blindness than do normally sighted individuals and that these cognitive factors are modifiable through education.

Comparisons between perceptual training and psychosocial interventions indicated that both approaches are beneficial. Results indicate that an individualized approach addressing both perceptual and psychosocial issues may provide the optimal overall intervention. Several findings supported this conclusion. The IEPC group improved on perceptual and psychosocial measures, whereas GEPC and PTRAIN groups did not show this transfer of effect, although both of these groups improved in their particular domains of training. This suggests that a combination of factors from each of these latter two interventions provided IEPC participants with optimal improvement. What was shared with the GEPC condition was the educational, psychosocial content. What was shared with the PTRAIN condition was the individual format of the sessions and quite probably the focus on visual and perceptual processes. This focus was less salient in the socially-oriented GEPC format.

The most important clinical implication from the results relates to the benefits of a multidimensional intervention. A careful assessment of the needs of the visually impaired client through a low vision examination and clinical interview should determine who will benefit from individual counselling, perceptual training or group support. However, given the limitations in resources of most clinical settings today, an optimal solution might be brief, educational counselling followed by perceptual training either at home or in a group setting.

Follow-up interviews indicated that the effects of low vision interventions were positive beyond the experimental setting. Reported effects after three to six months were related to physical, emotional and social levels of functioning. A more comprehensive follow-up test battery, including perceptual measures, could have further strengthened the main results.

What would be required, ideally, in a future study is a replication including both perceptual training for individual and group conditions, psychosocial counselling for individual and group conditions and a combination (perceptual training and psychosocial counselling) condition, all of which would serve to clarify the factors that contribute to successful adjustment. Further development of the psychosocial instruments to substantiate reliability and validity would also be important. Reliability should be established on larger samples and also over longer periods of time. Identification of the internal structure through factor analysis might also be helpful. There was some indication, for example, that the Activities Questionnaire included three components: social, chore-related and leisure activities. These factors might be differentially important depending on the sample being tested.

A major goal in this study was to contribute to the theoretical understanding of visual and perceptual adaptation. Until the late 1960s, attempts to understand perceptual events in adaptation were concerned with the nature of sensory systems and particularly development and plasticity of the visual system. Later, more emphasis was placed on intermodality organization, including information flow between systems and evidence for central processing. As research efforts have clearly implicated multiple components, another shift is indicated, emphasizing the contribution of attentional factors.

This study has demonstrated the importance of attention in adaptation. It is not known, however, how attention becomes involved or how stimulus cues elicit attentional resources. If the resolution of complex sensory discrepancies involves more than automatic processing, at what stage of processing does attention become involved? Is it necessary to be "aware" of a discrepancy for it to be resolved? The current results would indicate that this is so. The subjects in this study were clearly different from traditional adaptation subjects in terms of awareness. However, awareness in IEPC subjects increased and focusing on sensory discrepant information was sufficient in itself to begin the adaptation process, without feedback or practice. Attention may thus be seen as an early selection process that predictably determines sensory dominance, but may also be seen as a limited capacity central resource that is differentially allocated to sensory modalities depending on situational demands, such as instructions and information availability. In complex or novel situations such as the current study, the allocation of attention may override the early selection process. Attentional factors possibly have played a similar central role in traditional adaptation experiments.

Important to the field of low vision, on the other hand, is the further development of a strong theoretical basis in support of intervention methods to help in the adjustment to vision loss. The introduction of cognitive or attentional theory, as well as perceptual research findings, helped to provide a framework for the current project. What may be required in this field, in the future, is a more comprehensive perceptual theory specifically formulated to deal with visual impairment problems, one that includes an evaluation of relevant psychosocial adjustment factors.

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Appendix A

Means and Standard Deviations Showing Differences between Visually Impaired and Normally Sighted Groups on Visual Measures and Equivalency on Age

Variable	Visually Impaired n=49		Normally Sighted n=50		*df*	*t*
Reading Recognition	39.06	(19.08)	63.64	(1.24)	97	8.77***
Adaptive Acuity	12.16	(12.02)	63.42	(18.98)	97	16.01***
Best Eye	8.96	(8.14)	35.68	(8.21)	97	16.17***
Severity of Impairment	2.02	(0.81)	3.00	(0.00)	97	8.36***
Age	70.24	(13.79)	70.14	(7.18)	97	0.05

***p<.001

Appendix B

Intake Questionnaire

Date: ____________________ Group Condition: ________________

Time Available: ____
Travel Needs: ____

- -

Name: ____________________________ Sex: ____________________
Address: ____
Telephone: ____
Age: _____________________________ Marital Status: __________
Pref Language: _____________________ Ethnic heritage: __________

- -

Visual Problems:

____

____

____

Duration:____
Acuities: Better: ____________________ Worse: ________________
Ophthalmologist: _____________________ Eye Record Requested:______
General Health: ____

- -

Education: ____
Employment: Working: _______ Occupation: ______________________
Retired: ________ Homemaker: _____________________
Work History: Work change due to visual loss: Yes: _______ No: __________
Comments: ____
Early retirement due to visual loss: Yes: _______ No: ________
Comments: ____
Living Arrangements: Alone: ______ Partner: _______ Friend(s): __________
Partner and Children: _______Children or extended family: __________
Living Facilities: Apt: __________ House: __________ Group: ___________

Appendix C Perceptual Measures

C.1 Reading Recognition - CNIB Low Vision Reading Test Card

C.2 Adaptive Acuity and Best Eye Acuity

C.3 Frostig Figure Ground Test of Visual Perception

C.4 Bender Gestalt Test of Visual Perception

CNIB LOW VISION READING TEST CARD

JAEGER PRINT SIZE OR EQUIVALENT		METER PRINT SIZE	DISTANT VISION (IN FEET)		POINT PRINT SIZE	COMMON PRINT EQUIVALENT
J30	LEAF	6M	20/300	8425	36	Large headlines
J20	BRAIN	4M	20/200	37691	24	Small headlines Pre-school books
J16	CLEAN	3.2M	20/160	25187	21	Large print books Pre-school books
J12	GREAT	2.5M	20/125	96430	18	Large print books Primary books
J10	WIFE	2M	20/100	82536	14	Book age 7 — 9
J8	DOWN	1.6M	20/80	47109	12	Book age 9 — 12 Typewriter
J7	FAST	1.4M	20/70	32652	10	Adult books
J6	MEAL	1.2M	20/60	94037	9	Magazines
J5	SORT	1M	20/50	65214	8	Newspapers
J4	HERO	.8M	20/40	78630	7	Newspaper print Paperback books
J3	ROSE	.6M	20/30	52491	6	Telephone book
J2	PONY	.5M	20/25	16378	5	Stock Market
J1	LOVE	.4M	20/20	42903	4	Want ads Births and Deaths

ADAPTIVE ACUITY

BEST EYE ACUITY

NAME:______________________________

AGE:__________

PRETEST DATE.______________________

VIEWING DISTANCE.___________________

TOTAL NUMBER OF LETTERS. O.D _____________O.S._____________

VISUAL ACUITY

K

D V

Z S

O R N

V O

T H V

H V T

O T V H

V H O T

T V H O

V O T H O V

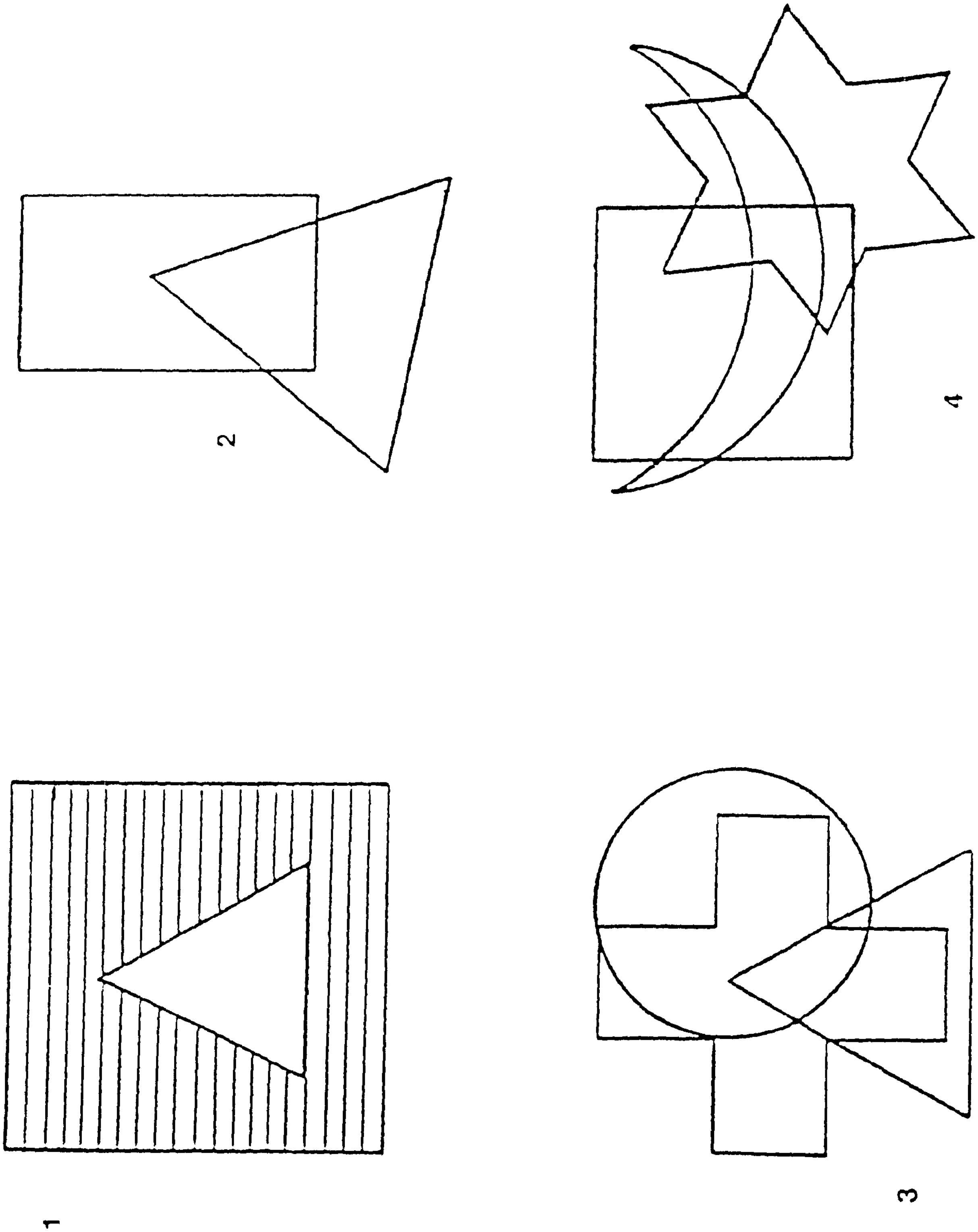
H T O V T H

O H V T H O

POSTTEST DATE:________________________________

VIEWING DISTANCE:______________________________

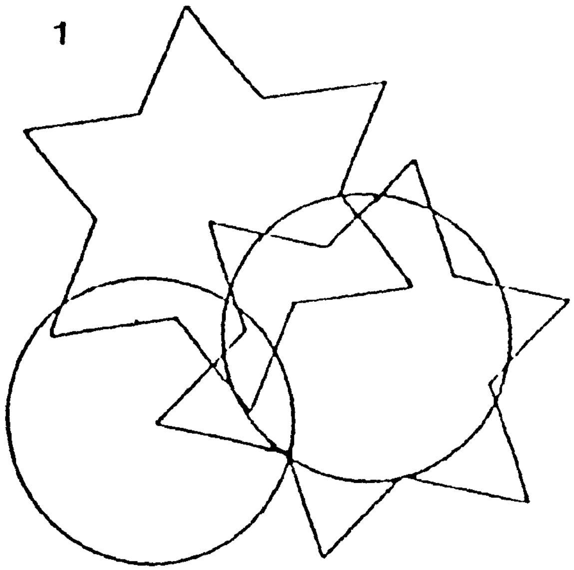
TOTAL NUMBER OF LETTERS. O.D._____________O.S _____________



FIG

FIG

1



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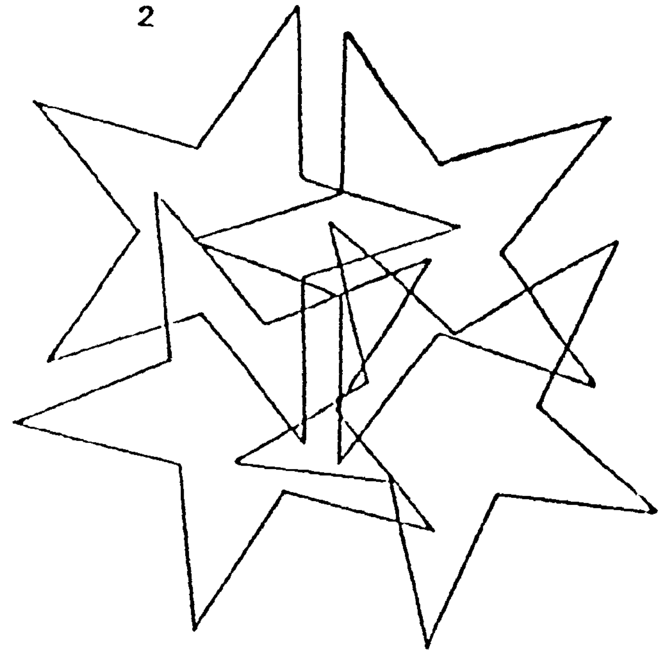

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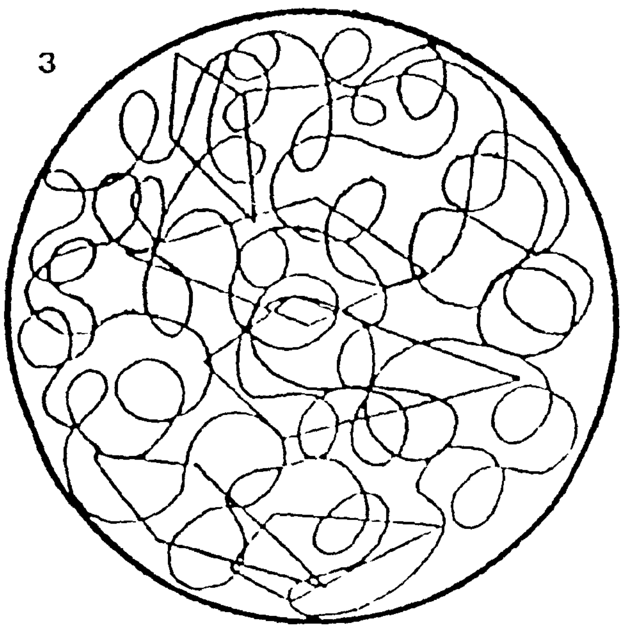

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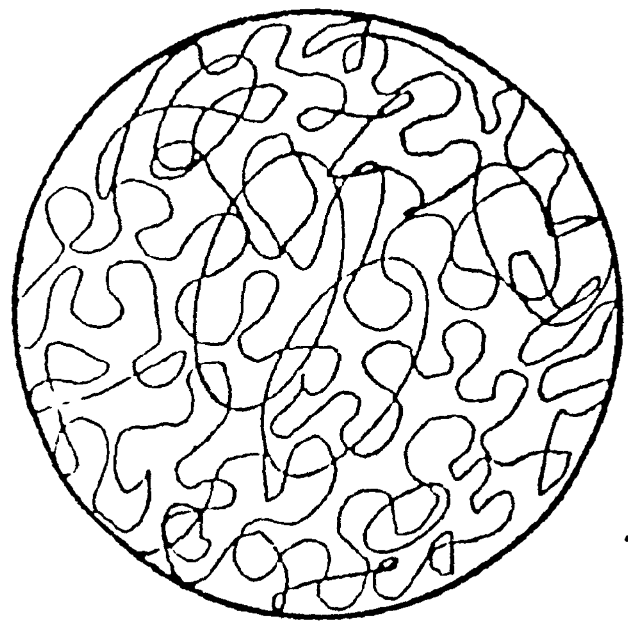
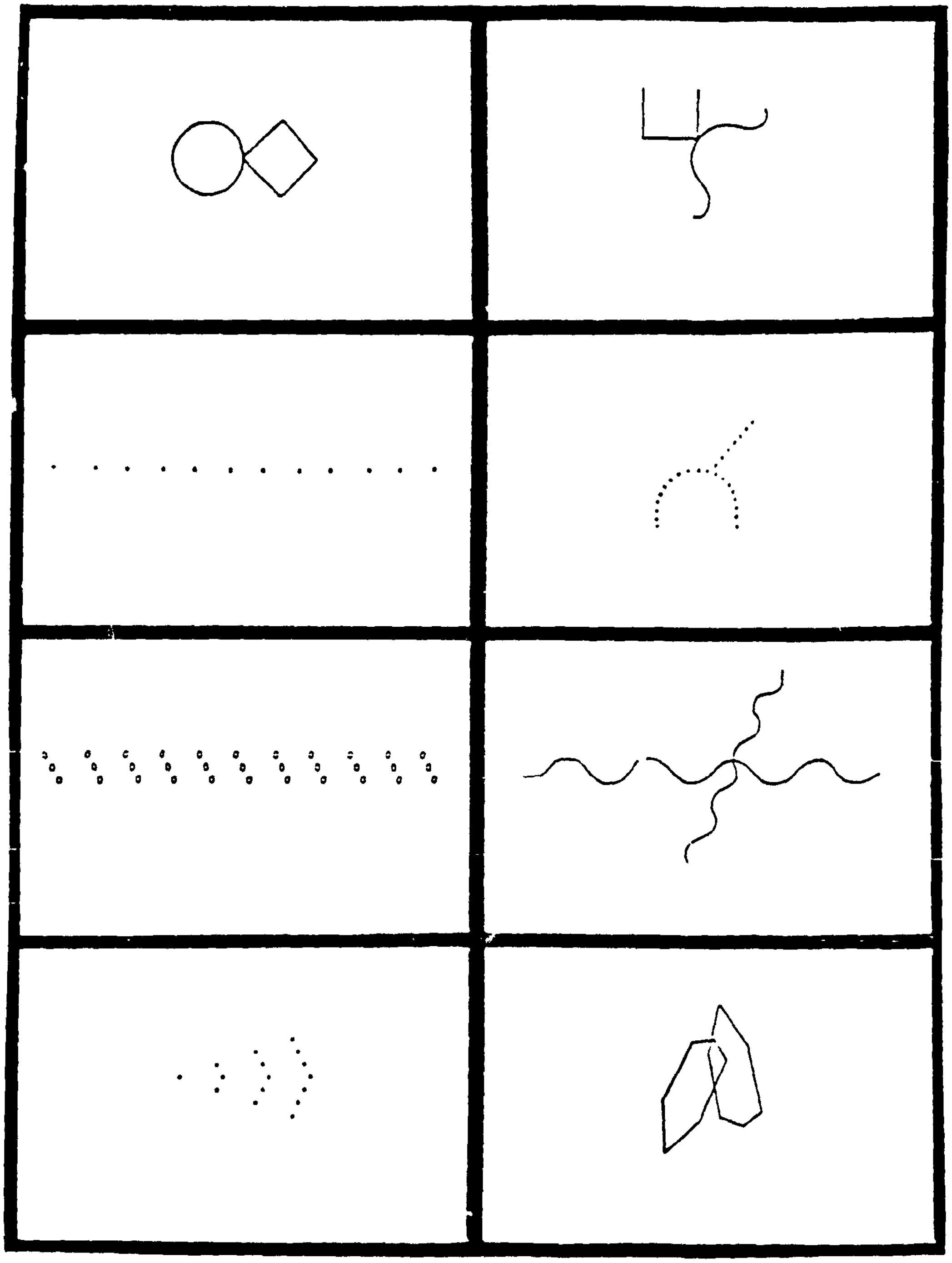


Bender Gestalt



Appendix D Psychosocial Questionnaires

D.1 Activities

D.2 Beliefs

D.3 Expectations

D.4 Self Report

Appendix D.1

Activities Questionnaire

For each of the following activities indicate whether you participate more often than, less often than, or as often as before your visual loss (or retirement). If circumstances other than your visual loss make the activity not applicable to you, indicate in the allotted space.

( ) 1.Getting together with friends
( ) 2. Visiting family members
( )* 3. Having family members visit you
( )* 4. Gardening
( ) 5. Reading
( ) 6. T.V.
( )* 7. Radio
( )* 8. Caring for older/younger family members
( )* 9. Arts/crafts
( ) 10. Walking for pleasure
( ) 11. Walking to perform errands
( )* 12. Club or organization activities
( )* 13. Housework
( )* 14. Hobbies
( ) 15. Personal grooming (eg. shaving, matching)
( ) 16. Household shopping
( ) 17. Pleasure shopping
( )* 18. Card games
( )* 19. Parlor games (eg. Scrabble)
( ) 20. Travelling
( )* 21. Volunteer work
( ) 22. Writing letters
( )* 23. Household bookkeeping
( )* 24. Civic activities
( )* 25. Employment (eg. consulting, occasional work
( )* 26. Recreational physical activity (eg. bowling, curling)
( ) 27. Planning or participating in a new activity
( ) 28. Going to the theatre, cinema
( )* 29. Cooking
( ) 30. Using buses or subway

*These items were deleted from the revised questionnaire

Activities D.2

Beliefs Questionnaire

Indicate whether you: Agree (A) or Disagree (D)

( )* 1. You should always look at the person you are talking to even if you have trouble seeing their face clearly.
( ) 2. If you have poor vision watching a lot of TV can be damaging to your eyesight.
( ) 3. People with poor vision should not cross streets alone.
( ) 4. You have to see someone's face to know whether they are smiling or not.
( ) 5. Once a visual problem occurs, it tends to get progressively worse.
( ) 6. If you can't see well enough to read ordinary books and magazines, you will have to give up reading for enjoyment..
( ) 7. An eye doctor is the only person who is professionally trained to help people with poor vision.
( )* 8. Governments sometimes provide useful vocational devices for people with low vision, but they should try and get along without for them.
( ) 9. If your vision gets poor, you will also feel weak and generally less healthy.
( ) 10. It is not possible to train people to see things better.
( ) 11. There are very few games, puzzles and appliances designed for people with poor vision.
( )* 12. Only people who have no sight at all should carry a white cane.
( ) 13. There is no way for someone with very poor vision to easily use a clock or watch.
( )* 14. It would be embarrassing to claim an extra tax exemption for visual impairment even though it is permitted.
( )* 15. It's better to try and act normally sighted than get involved in training programmes for the visual impaired.
( ) 16. How well you see does not depend on what kind of lightbulb you use as long as it is bright enough.
( ) 17. Most devices specially designed for use by people with poor vision are expensive and awkward.
( )* 18. There is a lot of special research being done to better understand and solve problems of visual impairment.
( )* 19. A landlord may refuse to rent a house or apartment to a visually impaired tenant if he wants to do so.
( )* 20. You can be legally blind and still have some sight.
( ) 21. If you use your vision too much, you run the risk of using it all up.
( ) 22. Visual aids strain your eyes and can be harmful to your
( )* 23. It is a waste of time to work on improving poor vision.
( )* 24. Even if a visual aid helps you function better you should not use it if it makes you look strange.
( )* 25. If you are visually impaired it is embarrassing to be associated with the blind.

*These items were deleted from the revised questionnaire

Appendix D.3

Expectations Questionnaire
(Pretest)

With regard to your visual loss (or retirement), do you expect that:

*1. Staying close to your friends will be
   a. no problem
   b. a bit of a problem
   c. a difficult problem
   d. almost impossible

2. Getting around in the city will be ( )

3. Enjoying your leisure time will be ( )

4. Making new friends ( )

5. Keeping up with personal correspondence will be ( )

6. Taking care of your home will be ( )

7. Travelling around on vacation will be ( )

8. Having company at home will be ( )

*9. Maintaining a good diet will be ( )

10. Looking well groomed will be ( )

11. Keeping fit will be ( )

12. Having hobbies will be ( )

*13. Keeping interested in what is going on around you will be ( )

*14. Having good relationships within your family will be ( )

*These items were deleted from the revised questionnaire

Expectations Questionnaire
(Posttest)

Do you think that your experience with this low vision service has enabled you to think more positively about:

*1. Staying close to your friends
   a. no problem
   b. a bit of a problem
   c. a difficult problem
   d. almost impossible

2. Getting around in the city ( )

3. Enjoying your leisure time ( )

4. Making new friends ( )

5. Keeping up with personal correspondence ( )

6. Taking care of your home ( )

7. Travelling around on vacation ( )

8. Having company at home ( )

*9. Maintaining a good diet ( )

10. Looking well groomed ( )

11. Keeping fit ( )

12. Having hobbies ( )

*13. Keeping interested in what is going on around you ( )

*14. Having good relationships within your family ( )

*These items were deleted from the revised questionnaire

Appendix D.4

Self Report Questionnaire

Rate on a scale of 0 -10 the degree to which you think your vision is useful in each of the following situations. "0" indicates that your vision is not adequate at all and "10" indicates that your vision is perfectly adequate.

( ) 1. Finding a small object that has just fallen to the floor.
( ) 2. Picking up a glass of water from a nearby table.
( ) 3. Using a wrist watch to tell the time.
( ) 4. Reading a personal hand written letter.
( ) 5. Looking up a number in the telephone white pages.
( ) 6. Recognizing objects (eg. living room chair) in a picture in a magazine.
( ) 7. Grooming in front of a mirror.
( ) 8. Finding a desired medicine bottle on a bathroom shelf.
( ) 9. Recognizing a familiar face when you meet someone on the street.
( ) 10. Locating stains or smudges on an item of clothing.
( ) 11. Identifying the value of paper money or coins.
( ) 12. Reading a novel.
( ) 13. Locating the first step of a staircase indoors.
( ) 14. Seeing holes, ice or other areas of dangerous footing on a sidewalk.
( ) 15. Dialing a number on a dial or push button telephone.
( ) 16. Recognizing the facial expressions of a person with whom you are talking.
( ) 17. Being able to walk comfortably through bright or shadowy areas.
( ) * 18. Finding the knob on a door.
( ) 19. Detecting an obstruction (eg. bicycle) on the sidewalk where you are walking.
( ) 20. Finding an aisle in a supermarket or a department store.
( ) * 21. Grasping someone's hand to shake hands
( ) 22. Writing a note with a pen or pencil.
( ) 23. Watching T.V.
( ) 24. Identifying the food and serving yourself at a buffet table.
( ) 25. Finding a path to the washroom through a crowd of people
( ) 26. Pouring a cup of tea or coffee from a kettle.
( ) * 27. Finding an empty seat on a bus or train.
( ) * 28. Recognizing a desired entrance or location on a familiar city block.
( ) 29. Entering a dark room (eg. restaurant or movie theatre).
( ) 30. Locating curbs or stairs when walking outside.

*These items were deleted from the revised questionnaire.

Appendix E

E.1 Sample Exercises from the Perceptual Training Manual

E.2 The Psychosocial Manual

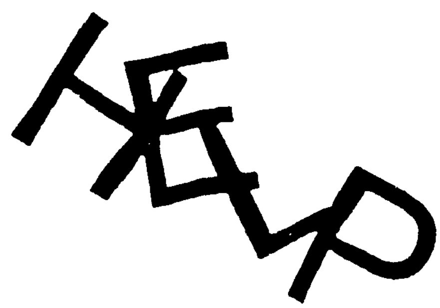
Appendix E.1 Sample exercises from the Perceptual Training Manual

UNSCRAMBLING:

FOR EACH GROUP OF OVERLAPPING LETTERS OR NUMBERS, IDENTIFY THE WORD OR NUMBER SET AND TRACE THEM.

EXAMPLE:

WORD: C A R D



WORD: H E L P

WORD: _ _ _ _

WORD: _ _ _ _ _

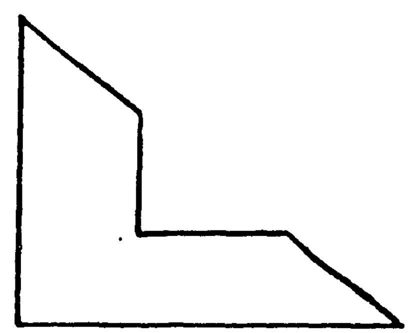
WORD: _ _ _ _

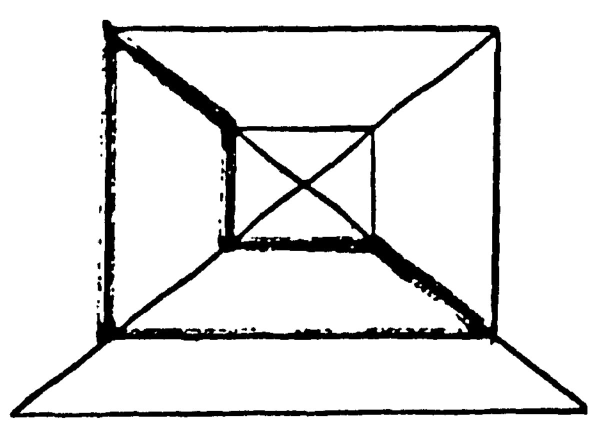
WORD: _ _ _ _

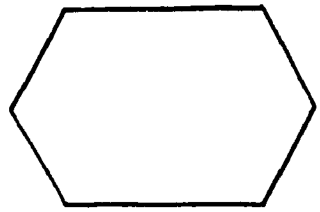
HIDDEN FIGURES:

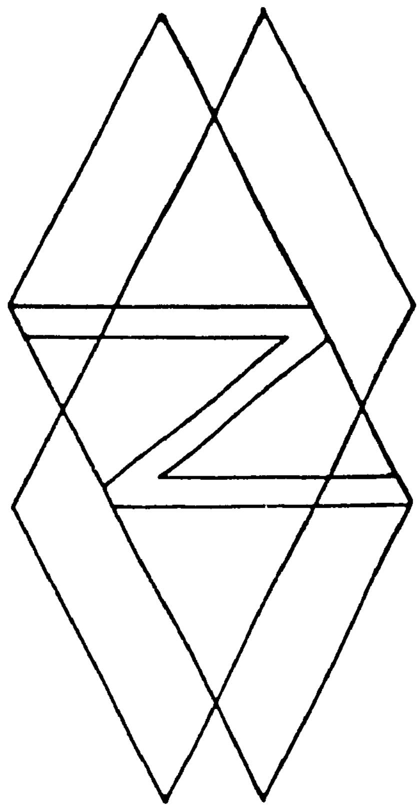
IN EACH FIGURE BELOW, FIND AND TRACE THE SIMPLE FIGURE ABOVE.

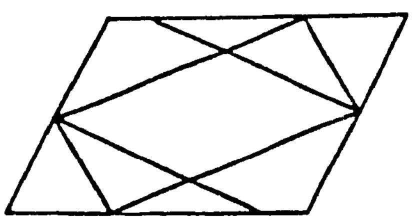
EXAMPLE:

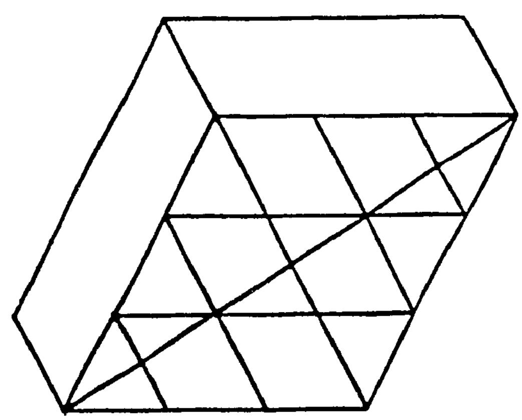












IN THE FOLLOWING PUZZLE, YOU ARE TO FIND THE WORDS INDICATED BELOW IN THE GRID OF LETTERS ABOVE. THE WORDS CAN BE FOUND IN STRAIGHT HORIZONTAL, VERTICAL OR DIAGONAL LINES, EITHER BACKWARDS OR FORWARDS. THERE WILL BE LETTERS LEFT OVER EVEN AFTER YOU HAVE FOUND ALL OF THE WORDS. ENCIRCLE THE WORDS AS YOU FIND THEM AS IN THE EXAMPLE BELOW.

TREES

H	I	Z	I	B	H	S	A
R	P	C	U	C	A	S	F
E	G	J	R	O	P	E	R
P	O	I	A	E	S	E	B
I	B	O	N	N	X	K	S
N	V	Y	E	L	P	A	M
U	C	H	E	R	R	Y	R
J	U	D	M	T	W	X	L

FIND THE WORDS:

JUNIPER
BIRCH
MAPLE
ASPEN
CHERRY
ASH

COMPOSERS

A	C	E	T	R	A	Z	O	M	F
I	H	F	A	J	L	J	U	M	I
F	O	X	S	M	H	A	R	B	G
R	P	O	U	T	I	M	A	Y	R
A	I	L	R	D	E	G	V	B	U
C	N	I	R	O	W	E	Y	C	Z
V	O	E	B	D	B	Y	Z	P	B
I	V	U	R	M	T	H	I	T	A
Y	O	L	E	D	N	A	H	I	C
O	X	T	A	K	M	E	R	L	H

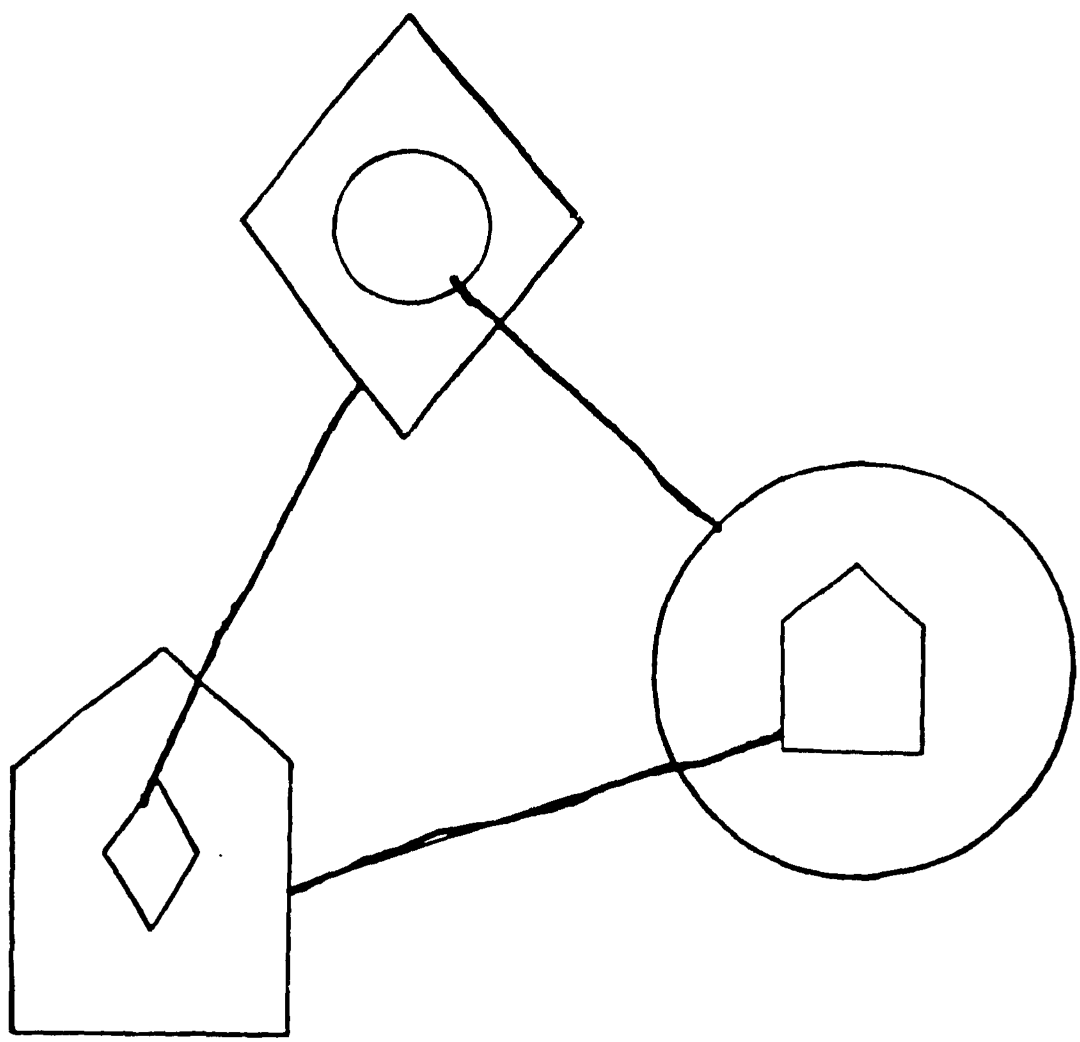
FIND THE WORDS:

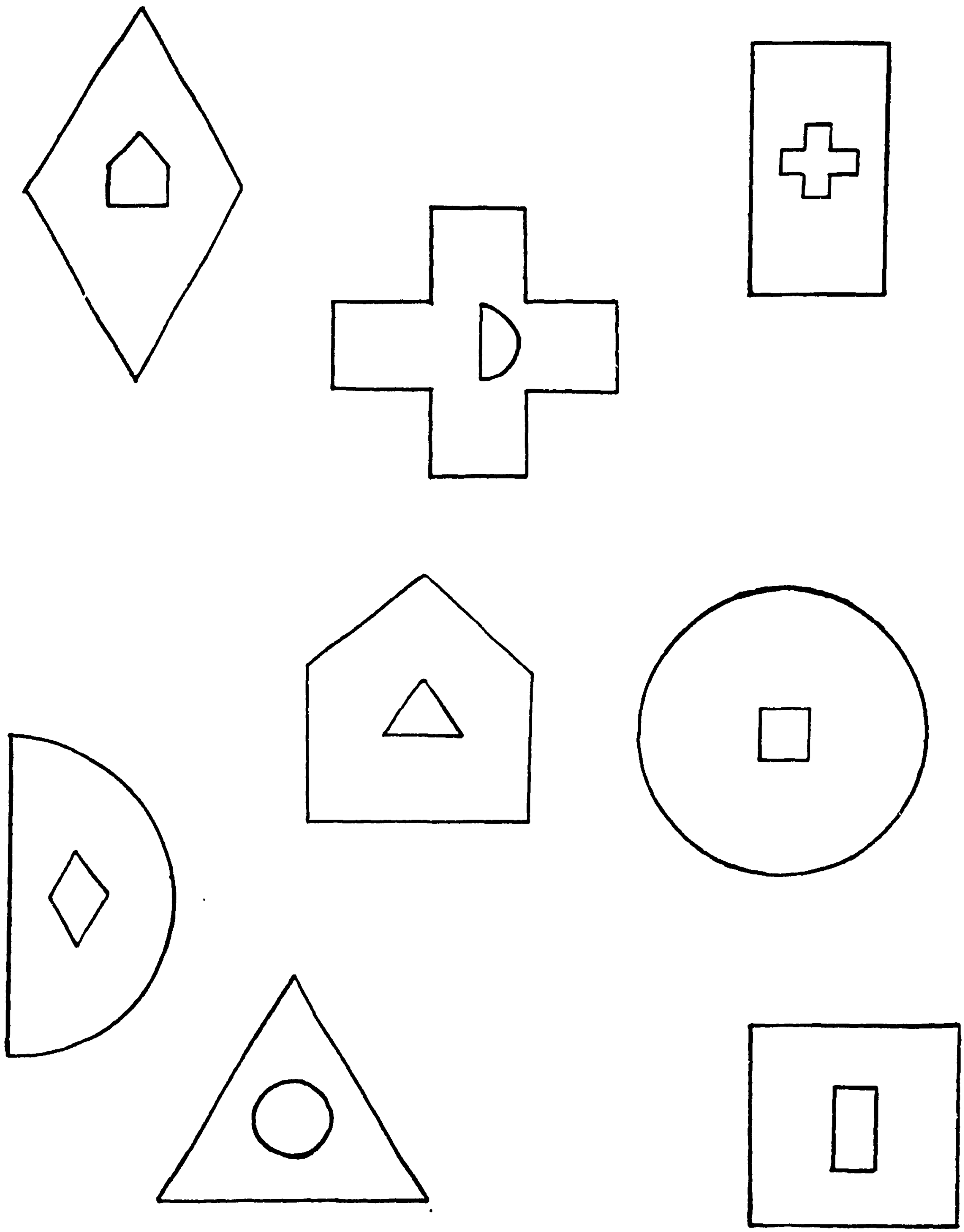
HANDEL
CHOPIN
BRAHMS
VERDI
MOZART
BACH

PROGRESSIVE FIGURES:

SHOW HOW THE FIGURES PROGRESS BY CONNECTING THEM SO THAT THE CENTRAL DESIGN BECOMES THE OUTER DESIGN OF THE NEXT FIGURE.

EXAMPLE:

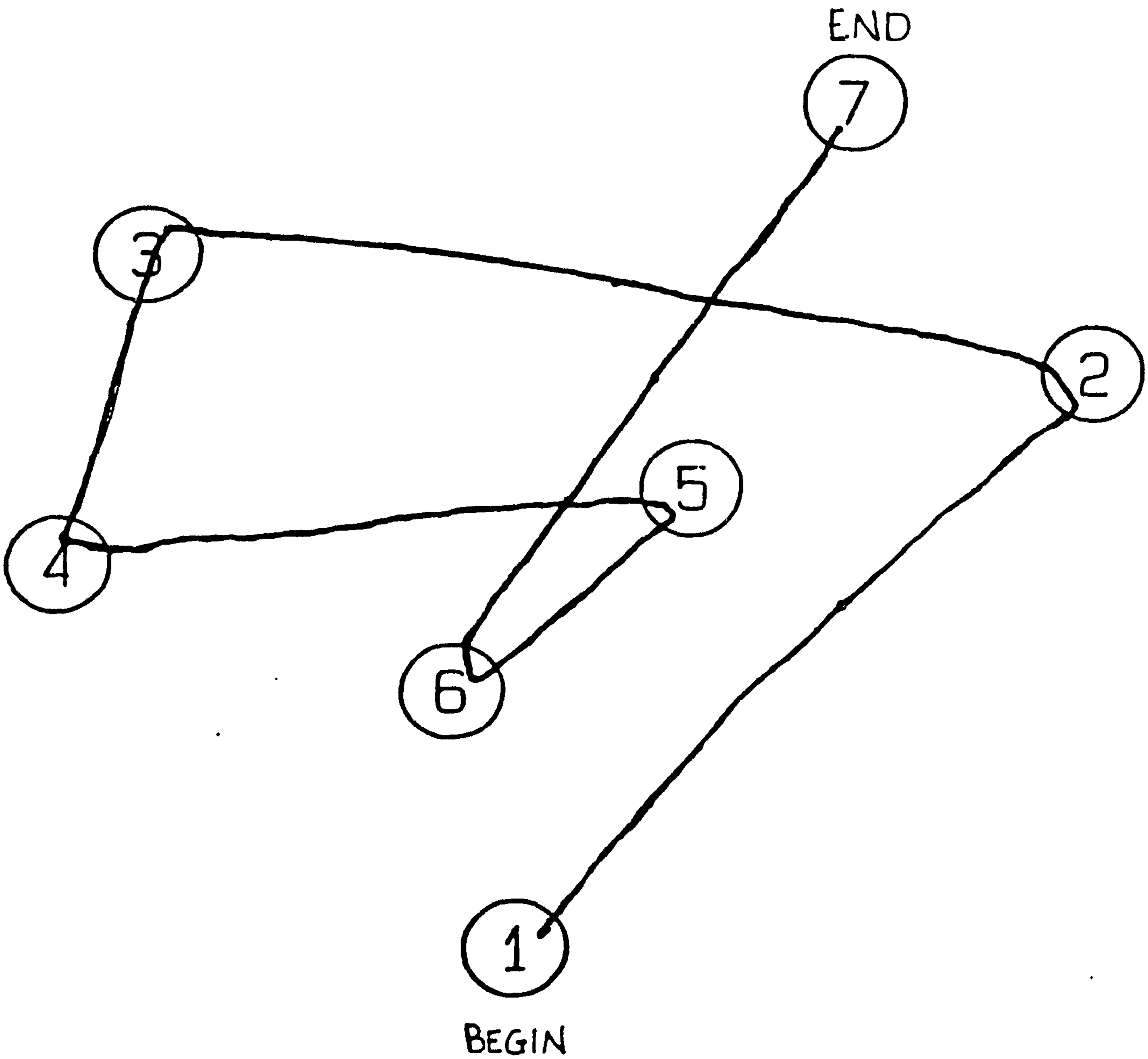


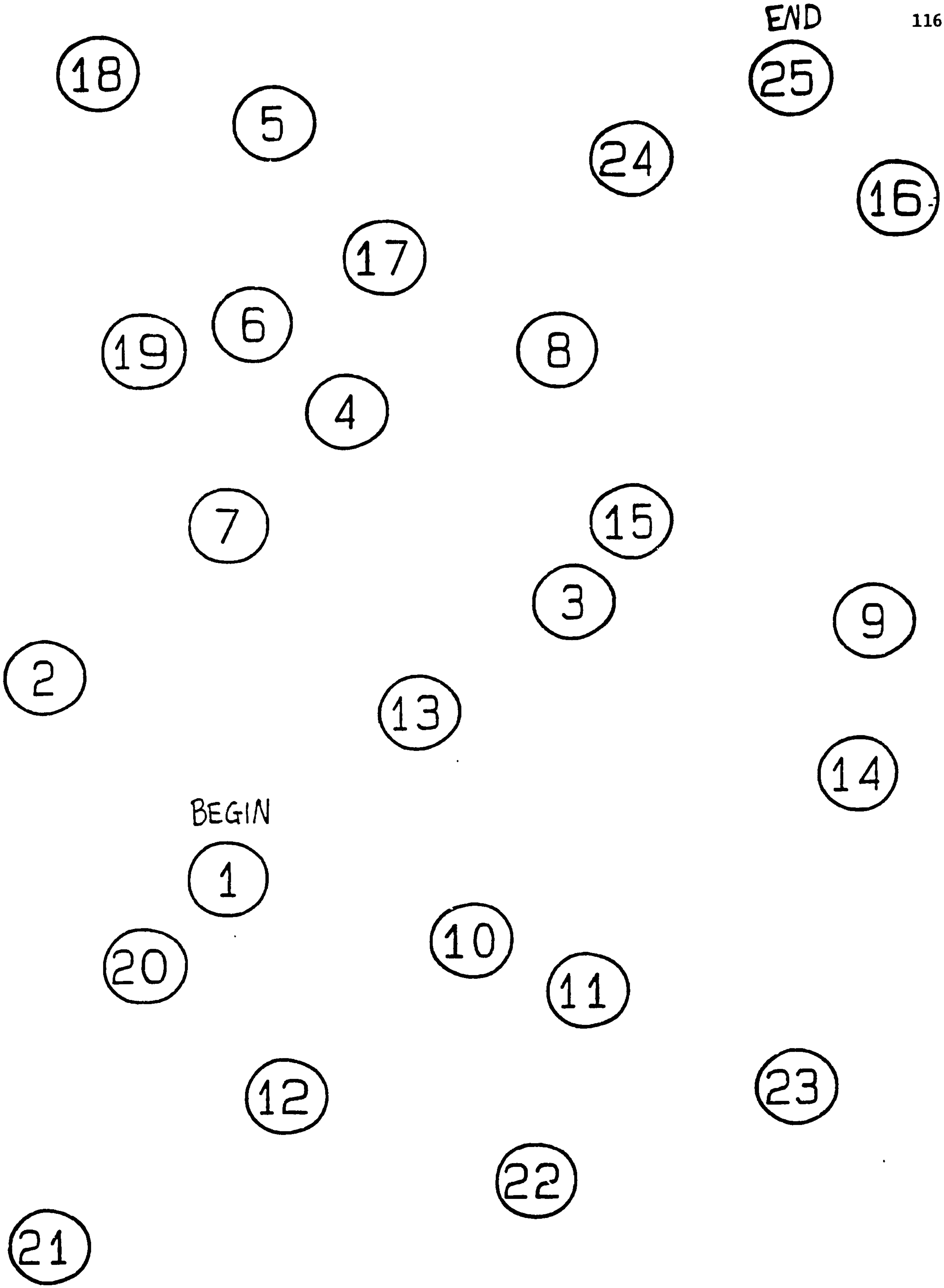


TRAILMAKING:

STARTING WITH THE CIRCLE MARKED WITH THE NUMBER 1, JOIN ALL OF THE CIRCLES IN ORDER UNTIL YOU REACH THE END.

EXAMPLE:




END
18
25
5
24
16
17
6
19
8
4
7
15
3
9
2
13
14
BEGIN
1
10
20
11
12
23
22
21

Appendix E.2 The Psychosocial Manual

INDIVIDUAL EDUCATIONAL PSYCHOSOCIAL COUNSELLING (IEPC)

Session 1: Introduction

This material is a session by session protocol for use with subjects in the IEPC condition of this research. Much of this material is a verbatim guide to interactions between the subject and the researcher. While such interactions need not follow the verbatim guide precisely, the content and flow of all sessions should be precisely governed by it.

The IEPC condition requires each subject to participate in five sessions. Thus, the protocol below is divided into five distinct units, one per session. Each session should be one hour in length. Each subject should be scheduled for a session once weekly, over a five-week span of time. If a subject is ill, or is otherwise obliged to miss one session, his/her sessions may resume normally after the absence. If, however, a subject must be absent for more than one intervening session date, his/her continued participation must be carefully re-evaluated. It is therefore important that no subject be scheduled over a period of time such as vacation, which will include foreseeable absences of more than one session date.

As these IEPC sessions indeed involve subject counselling, it is critically important that subject-researcher interactions be warm, sensitive and professional. Subjects should finish each session feeling comfortable and positive.

Introduction

Introduce yourself. eg. You are a psychologist involved in the study of visual impairment. Inform participant about the nature of the sessions, outlining the fact that Session 1 will be primarily introductory; Session 2 will deal with family and social issues; Session 3 involves use of your eyes and lighting; Session 4 deals with perceptual strategies. Session 5 deals with community resources. Encourage participant to be candid and open and to feel free to raise questions at any time, within the framework of the session.

To the Participant: I would like to ask you a few questions that will help us to better understand how you feel about your sight loss and how we might be better able to help you cope with it. The questions do not have right or wrong answers. They are not intended to test you, but to let us get to know you.

1. Since your sight loss, which do you find more difficult: dealing with people around you, like friends and family, or dealing with things such as books, tools, safety hazards and the like?

____

____

____

2. Regarding your sight loss, what three kinds of problems trouble you most? Rate them on a scale form 0 - 10, with 0 indicating little difficulty and 10 indicating great difficulty.

Problems	Rate
1.______________________________	
2.______________________________	
3.______________________________	

3. How, in general, do you feel about your sight loss now, as compared to when you first learned about it?

____

____

____

____

4. Is there anything else about your sight loss that you would like to tell me?

____

____

____

____

5. How do you feel about the kind and amount of help you have received to help you cope with your sight loss since first finding out about it?

____

____

____

____

6. Do you expect to gain something from your participation here?

____

____

____

____

Vision Quiz

Introduce questionnaire, informing the participant that its purpose is to determine how much understanding he/she has about the implications of sight loss. Explain that the questions will be reviewed at the end of the session, and in the meantime we will talk about some things pertaining to eye disease that might be interesting to the subject.

Vision Quiz 1

1. You run the risk of harming your eyes when you sit very close to the television. (T or F)
2. Wearing glasses that are too strong can damage the eyes. (T or F)
3. People should be taught not to hold their books too close to their eyes when reading as this can cause harm to the eyes. (T or F)
4. Eye doctors are so busy that it is not a good idea to bother them with a lot of questions about your eye condition. (T or F)
5. Cataracts can sometimes grow back after surgery. (T or F)
6. A cataract is actually a film over the eye that can be peeled off with surgery. (T or F)
7. A blue eye should not be used for transplanting into a brown eyed person. (T or F)
8. Rarely, a contact lens can get lost behind the eye and even get into the brain. (T or F)
9. Most visually impaired people eventually become totally blind. (T or F)
10. A white cane indicates that a person is totally blind. (T or F)
11. If you do not rest your eyes regularly you can use up your remaining vision. (T or F)
12. The problem with using low vision aids is that you risk further weakening your eyesight. (T or F)

Patient's Understanding of Eye Condition

Ask when he/she first noticed an eye problem; what has happened to his/her eyesight since then and what has been learned from doctors or others about eye disease. ie. Obtain detailed (written) history of the visual problem from the patient's viewpoint.

Brief Presentation on Anatomy of the Eye

Suggest talking for a few minutes about how the eye functions. Draw freehand, using a thick black marker on white pater, a simple representation of an eyeball, as illustrated in this manual. Working from the cornea inwards, name each structure and include the following information:

Cornea: Transplantability: relatively, but only useful under certain conditions.

Iris and pupil: Exhibits the visible eye colour. Pupil changes size to accommodate bright or dim lighting.

Lens: Bends light to focus on retina. Cataract: Reduced transparency. Deterioration in the ability to pass light to the retina.

Aqueous humor: Anterior chamber fluid in front of the lens. Glaucoma occurs when there is too much aqueous humor which stretches and damages eyeball.

Vitreous humor: Posterior chamber fluid behind the lens.

Retina: Back of the eye where photocells receive light and send signals along optic nerve.

Macula: Located in the center of the retina; area of daytime vision, most sensitive to colour and detail.

Macular Degeneration: Occurs when the photocells in this region fill up with stray pigment form other regions in the eye and the cells no longer function. It is very common in older individuals.; the exact cause is unknown. It just seems to be part of the natural aging process.. There are two forms of macular degeneration: dry and hemorrhagic. In the first case, visual loss is very gradual and steady, but does eventually stabilize. In the second case, loss and /or partial recovery is sudden, abrupt and unpredictable. However, in neither situation does the effect go beyond the area of the macula and the individual will always maintain good and useful peripheral vision.

Note. If patient is already well informed with regard to the anatomy of the eye, or if the material seems otherwise inappropriate, modify the explanation or discuss implications in terms of adjustment, how they obtained their information, how it affected them, etc.

Review of Vision Quiz 1

Begin by suggesting that misconceptions may play a role in making it hard to live with visual loss and suggest to the subject that this would be a good time to review the quiz and look for areas that often cause difficulty. Then go through the questions, one by one, paying particular attention to questions that have been answered incorrectly.

INDIVIDUAL EDUCATIONAL PSYCHOSOCIAL COUNSELLING

Session 2: Psychosocial Issues

Note to the Instructor: Unlike other sessions, you will not be concentrating on the presentation of formatted material. The participant should be encouraged to think of himself/herself as the expert in knowing what it is like to be visually impaired. Your role is to listen and structure the process so that it is beneficial to the participant. ie. Be supportive and reassuring in those situations where good coping is evident and provide some guidance in areas where the participant appears tentative or uncertain.

As mentioned above, the material under the heading "To the Participant" is intended to guide the interaction. Please use care not to use this material in a verbatim fashion; the emphasis can be on those relationships, but conversely where it is known that the participant is more or less alone, this loneliness should not be exacerbated. In this case, the focus should be more on the participant's general interactions with other people.

To the Participant: Chances are very good that all of the help you have received so far in dealing with your eye problem has dealt with the health of your eyes and perhaps the use of glasses and other aids. Most people who lose some eyesight find that there are other important issues relating to visual loss that are more difficult to discus. These could be things like dealing with your family, friends and others or getting along with unexpected changes in your lifestyle.

Dealing with Family and Friends

Note. This process may entail some anxiety on the participant's part and therefore the interaction should be thought-provoking and constructive, but not alarming and disquieting.

Often the crux of the problem of dealing with people is two-fold:

(1) There are new limitations about the kind of things you can do and the efficiency with which you can do them. eg. Not being able to read the small print or the oven dial or the bus stop sign or recognize a face or see the white napkin on the white table cloth. These are very real problems that are frustrating and embarrassing, and they may seem to limit you from doing things or being with people.

Note for diabetic patients: Medication schedules, diet restrictions and considerations, fatigue, other physical aspects of the disease such as insensitivity to touch, cardiac and renal implications.

Question: How have you dealt with people when these problems have arisen?

To the Instructor: Note the emotional content of the response and the ease with which the participant discusses these issues. People tend to have difficulty acknowledging negative feelings regarding their visual loss. The goal here is to reassure the person that feeling such as frustration, embarrassment and anger are to be expected and instead of being suppressed, they should be constructively expressed. ie. The client should be encouraged to utilize these feelings to mobilize more effective communication and the development of more effective coping strategies.

- What do you do when you need help in a social situation such as a restaurant, party or outing?
- What kinds of plans do you make in advance for dealing with an awkward situation such as a picnic, buffet or theatre?
- If presented with the opportunity to attend such an event, how do you decide whether or not to go?
- How do you feel about asking for help in a grocery store?

(2) Not only do you have trouble understanding what you will be able to do and what may be difficult for you as you go from one situation to another and one day to another, but so also do the people you deal with have difficulty. This makes it hard for you to know when and how you might need help. It also makes it difficult for your friends, family and others to know how and when to help you.

Question: How free do you feel to discuss your need with other people and how do you approach the problem?

To the Instructor: The emphasis here should be on pre-planning and developing effective strategies based on good communication. Use examples where appropriate.

- It might be useful to have a discussion right in the beginning with the people closest to you so that you can educate them as to what is happening with your vision. ie. To let them know that you are prepared to deal with the problem realistically and you hope that they will do the same.

- A kind of informal contract with your family and friends may be helpful. ie. You agree to let them know honestly when you need a little help and they agree to help you when you express that need. Furthermore, you agree to spell out as clearly as you can just what kind of help you might appreciate and they agree to give you the kind of help you specify. In this way you may minimize people doting on you when you don't need them to or being in your way when they are trying to help.

- When you feel a little down, let your friends and family help just the way you might help them in other kinds of situations.

- Help others in the family as much as you can. That will make all of you feel good about living together, despite your visual problem. ie. Try and find some activity where you are the helpful one.

Note. For diabetic patients, the reference to planning includes diet and medication, as well as visual limitations.

When the above topics seem to have been covered adequately, summarize the session briefly and introduce the idea that the focus on planning and development of strategies in this session will be given greater specificity in the following sessions. ie. Stress continuity. For example, in Session 3, more efficient visual functioning through the use of lighting and visual aids will be discussed. In Session 5, utilization of community resources will be addressed.

INDIVIDUAL AND EDUCATIONAL PSYCHOSOCIAL COUNSELLING

Session 3: Effective Use of Vision

The purpose of this session is to explore some common questions, fears and misconceptions about using your residual vision. The topics below should be discussed informatively but also casually, as the goal of this session is to have the participant leave feeling more comfortable and positive about his/her remaining vision. Begin with Vision Quiz 2 and then relate topics below to patients responses.

Vision Quiz 2		T	F
1.	Eye strain is a condition of the retina of the eye	( )	( )
2.	Repeated eyestrain causes long term loss of useful vision.	( )	( )
3.	Watching a bright television in a dimly lighted room can be harmful to the eyes if done for long periods of time.	( )	( )
4.	Reading for long periods in dim light may damage your eyes.	( )	( )
5.	Headaches are usually due to eyestrain.	( )	( )
6.	It makes no difference what type of light bulb you use if your vision is poor.	( )	( )

Fluctuating Vision

People with low vision may experience changes in how well they see things. There are two possible reasons for these changes: (1) Medical factors and (2) non-medical factors.

Medical Factors

a. There could be fluctuations in the primary eye problem where, as discussed last week, abrupt changes may occur.

b. There is a certain risk with any elderly person that visual problems may occur. ie. Glaucoma, diabetes, cataracts macular degeneration are not mutually exclusive.

c. Conclusion: After you have learned from your ophthalmologist that you have a visual problem, it is important to continue to see your doctor on a regular basis so that you can keep your eyes as healthy as possible.

Not only is it important for you to see your ophthalmologist regularly, but you will probably find it useful to ask your doctor to provide you with a full explanation of your visual condition and what you may expect from it.. ie. Look upon yourself as a consumer; take an active role. Explain exactly how your visual impairment affects you and your current needs for remediation.

Non-medical Factors

a. Lighting: Not all lighting is the same. Incandescent light, from an ordinary light bulb, emits and thus reflects all colours, whereas light such as fluorescent or neon emits and reflects only limited colours. Thus a person with impaired central vision might see better with incandescent light.

- With impaired vision, moderately bright light is best and direct lighting (light shining right on material being looked at) may reduce troublesome shadows. For this reason, it might be helpful to use a goose-neck lamp to illuminate work or reading material whenever possible.

- Notice the stress on moderate lighting. If lighting is too bright, rather than help vision, especially in elderly people, it may produce a blinding glare.

- When working with very light materials, such as white on a black background, even moderate, direct lighting may produce uncomfortable glare.

- Don't be afraid to experiment with different wattages, until you find the one that is comfortable. Most people find approximately 75 w optimal.

- Glare can be a problem outdoors. You may find that wearing tinted sunglasses, especially in bright, snowy conditions, will help to reduce the effect of this glare and will make adjustment to the darker conditions when you go indoors somewhat easier. Smoked grey tinted glasses are often satisfactory, but you should not be afraid to try others to suit your own needs.

b. Contrast: With diminished vision, sensitivity to light/dark contrasts is generally reduced and, therefore, objects may be harder to pick out against their backgrounds. You may be able to increase the usefulness of your vision by creating work situatic ns in which you maximize light/dark contrasts. Use examples: Sewing, placemats, putting things down on different coloured backgrounds, yellow acetate over print.

c. Fatigue and visual efficiency: Seeing involves not only using the eyes, but using your mental faculties as well. Thus, under conditions when you are less mentally alert, you may not see things quite as well. eg. fatigue, excessive distraction and stress. There may be days when you are seeing less well than on others and you think your eye condition has changed. On those days, it may very well be that your eye condition has not changed at all, but you are experiencing the effect of these other factors. Also, remember that fatigue, distraction or stress may cause any of us to be a little more clumsy when handling or working with things or moving around. If you experience times like this, the fault may not be with your vision at all.

Note. Suggest to the participant the importance of good nutrition, rest and regular exercise.

Myths and Facts about using your Eyes

- Vision is a process not commodity. Although you may feel some strain or tension while using your eyes, your vision cannot "get used up". Diseases can make parts of the system break down, but not "use".

- The eye strain problem: Eyes can be strained, but this has nothing to do with vision. Strain in the eyes is like strain anywhere else. It happens when muscles get tired. Two kinds of muscles in the eye can get tired: muscles that focus vision for close work and muscles that turn the two eyes inward, so that they can coordinate view of a near object.. (Use an object to demonstrate, by having the person hold and view it af 5 ft or so, and then have him/her view it progressively closer and closer.)

- Eye strain can be reduced by paying attention to your viewing distance. Because of your visual impairment, you have a tendency to want to view things close up. This is because the closer you hold things, the larger the image on the retina and therefore the sharper the detail. There is no distance at which you will harm your eyes, but for the sake of your comfort, you may wish to compromise between the larger image and less strained viewing distance.

<u>Role playing Exercise</u>

Often the best help and support a new patient with low vision can get is from another patient. Some of the things I've been exploring with you over the last few days may be different from some things you've thought about concerning your visual impairment and I'd really appreciate having your thoughts and opinions about this. Let's do something different for a few minutes and just for fun pretend that I'm a new patient who has just sat down beside you in the clinic. The receptionist has introduced you to me as someone who has been coming to the clinic for some time and I decide that you may be helpful to talk to. Let's assume that we have 5 or 10 minutes to chat and I, as a newcomer, have many concerns and questions about what is happening to me. Try to give me all of your expertise, including anything you may have learned in the last two weeks, so that you can help me as much as possible.

Opener: Hi, my name is ______________________; this is my first time here.

- My doctor has told me that I have something called macular degeneration and I'm really afraid I may be going blind.

Other examples:

- I was afraid to come here today by myself, because I didn't want to use my eyes if i could avoid it.

- I don't watch TV anymore, because I'm afraid of using up my vision.

- I asked my doctor about an eye transplant. Do you think that's unrealistic?

- I worked for 25 years doing watch repairs. Do you suppose I burned out my eyes that way?

Conclusion: As this exercise completes the session, it is important to be both relaxed and positive in this new form of interaction, to ensure that the participant feels comfortable about role-playing.

INDIVIDUAL EDUCATIONAL PSYCHOSOCIAL COUNSELLING

Session 4: Perceptual Strategies

Vision Quiz 3

1. The function of a magnifying glass is to enlarge the image of an object. (T or F)
2. A good rule is: The brighter the light the better the sight . (T or F)
3. There is little point in wearing prescription glasses if your vision is severely impaired. (T or F)
4. If you are visually impaired, it is not a good idea to wear sun glasses, because they just darken everything and make it less visible. (T or F)
5. Low vision prescr,ptions provide immediate improvement for most visual problems. (T or F)

Optimizing Fixation

Note about Imaging: Using the eyeball drawn in Session 1, draw three objects, a cross, a triangle and a square to the left of, in front of and to the right of the cornea. Then draw a straight line from each object, through the center of the lens, to show where each one is imaged on the retina, reminding the participant that the macula is the location on the retina where acuity is normally best. In the normal eye, the function of the peripheral retina is to locate an object in the visual field, ie. to capture our attention. The macula then identifies and describes the object, ie. examines it in detail. In other words, we have two seeing systems: the "where" system in the periphery (locating where things are) and the "what" system (identifying what things look like). When parts of one system are not working well, parts of the other system may learn to take over its job.

- When the eyes are normal, after the peripheral retina "where" system first spots something, there is a natural tendency to look straight on at an object, so that the image is formed on the macula by the "what" system, which can then study it, as in the case of the triangle above. ie. The "where" system tells the eyes to move and search. The "what "system tells the eyes to stay still, fixate and examine.

- When the macula ("what" system) is not working well, looking at things in the normal way puts the image precisely on the part of the eye that has problems seeing and you will experience blurred vision, or perhaps see nothing. When the periphery (the "where system") is not working, locating objects is dependent on the "what" system to search the way the "where" system normally does.

- eg. Macular Degeneration: What you need to do is look at things in a new way, (above, below, at the side) so that when you look at them, they form an image off the macula, as with the cross and the square.

- Glaucoma: Use constant and deliberate shifting of the gaze so that the central sensitive area optimizes its field of surveillance. When you enter room survey using eyes and head to get a panorama of the environment.

- eg. Diabetes: Assess the scotomatous areas and use examples accordingly

- In other words, to see things best with your eye condition, you may find it useful to view them at an angle instead of straight on. It is not necessary to turn your head, just move your eyes so that you see things from the corner of your eye.

Illustrative Example for Macular Degeneration: First, look straight on at my face as you normally might do and note how clear it appears to you. Then, imagine the numbers on a clock face surrounding my face and try looking straight on at 12:00, 3:00, 6:00, and 9:00 o'clock. Each time, you should still be able to see my face. If you note the condition at which my face is clearest, that may tell you how to get the sharpest image of something you want to see. You may want to experiment with this exercise on your own.

Illustrative Example for Glaucoma: I am going to ask you to close your eyes. While your eyes are closed, I am going to move my hand to different locations. When I tell you to open your eyes, locate the position of my hand as quickly as possible. Now I am going to move my hand quickly. Keep your eyes open and track my hand as I move it.

Scanning

Some current thinking about seeing things in three dimensional depth suggests that moving your eyes over a scene and keeping track of how much they seem to move as the scene changes may help you see depth a little better. Even while your "what" system is examining something, some eye movement may be useful. What this means is that even while you are having trouble seeing something you may actually see it better if, instead of staring at it, you shift your gaze away from it from time to time, making mental note of how much you have shifted your gaze and how the scene has changed its appearance when you did so.

Example: Draw a clock face with a cross at 12:00 and a circle at 10:00. Ask the subject to imagine that he/she is standing in the middle of the clock looking straight on at the cross. Notice that the circle is at 10:00. Now turn to face the circle and stare at it. Notice that the 10 has shifted to the position of 12, and also that the cross, which was originally at 12:00 is now at 2:00, relative to your direction of gaze. ie. Notice that depending on where you look, different things in your environment have different positions relative to you. If you pay attention to this relative shifting around of things in your environment, as you naturally turn your head, body and eyes, the information you gain may help you better pinpoint the location of obstacles in your path.

Example: imagine that you are crossing a street and that there is a car moving toward you. You note the approximate speed at which the car is moving and adjust your walking speed accordingly so that you stay out of the path of the car. ie. You "record" the information; the rest is done implicitly, without any apparent effort or awareness on your part.

You may also find it helpful, when looking at a scene, to do this shifting of your gaze by focussing on an edge or corner and trying to trace the edge as it bends and curves to form a recognizable contour. In other words, if an object is hard to recognize, try to see if the movements of your eyes can actually trace out its outline until it takes on a recognizable shape.

Reading Strategies

- Line marking; eg. white or black card,window
- Target with eccentric viewing
- The need to move your eyes more
- Limit your reading to material that is regularly formatted, so that you can easily pick up beginnings of lines and where the next line is going to be.
- Try and restrict reading to uniform print size.
- Take regular breaks to help cope with the fatigue that comes with your efforts.
- Quality of print: eg. good contrast, dark print on light paper. Don't expect optimal success with phone books, newspapers, mimeographed or xeroxed materials
- Develop your own strategies:

eg. Yellow acetate over poorly contrasted print

eg. Practice or persist in extracting meaning out of text even when all of the words are not visible eg. Work at guessing letters that are difficult to see: Ron (not Ran) came to the door.

Note. Ask about any strategies they individual has discovered and found to be useful.

Magnification and Visual Aids

When your vision is impaired, one of the most helpful things we might do is to help you to see things more clearly by making them look bigger, while still keeping them in focus.

To demonstrate: Draw a letter on a piece of paper, such that the person, using monocular vision, cannot see it at arm's length. Bring the paper closer until the letter is clearly visible and closer again, until the letter becomes blurred, pointing out to the subject how the letter becomes subjectively larger (magnified) with proximity.

This process of enlarging is called magnification, and although it sounds like a complicated topic, I think that talking for a few minutes about how things are magnified may take the mystery out of it for you. Simply, there are four ways to magnify things.

1. Object Enlargement: Involves increasing the actual size of an object. eg. Large print books, telephone dials, sewing needles, TV screens.

2. Convex Lens Magnification: Involves reducing the distance between the object and the eye. eg. The demonstration above (bringing an object closer to the eye until clear). This type of magnification is most often used for reading and requires "plus" lenses called microscopes. Magnification in this case is accomplished just as in the exercise above, solely by bringing the object closer to the eye. The function of the lens (or microscope) is just to clear the image as your action enlarges it.

3. Double Lens Magnifier: Involves using two lenses (positive and negative) that artificially enlarge the image of an object on the retina. ie. You neither change the size of the object nor the distance at which you view it. The first lens projects a large image on the second lens. It then clears the image on the retina as would a magnifier. Lenses that work like this are called telescopes and are often useful for improving travel efficiency. One drawback is that things appear unrealistically close and fast moving.

4. Projection: Involves projecting an enlarged image of an object on a screen using a convex lens. eg. A slide projector, a closed circuit television. The advantage to this is that it permits enlargement to be as much as you need without distortion. The disadvantage is that the equipment is large, cumbersome, expensive and complex to operate.

The Consumerist Point of View

No single visual aid can suit all of your needs. It may be comfortable to read a typewritten letter or a small book while holding a magnifier in your hand, but it will doubtless be difficult to hold a hand magnifier and a white page phone book at the same time. It will be up to you to spell out in detail the kinds of things you want to do or read and therefore the kinds of different visual aids you would like to have. You should also remember that using these devices is somewhat like playing a new game in which you just don't know the right moves. At first, it is a little awkward or clumsy, but you probably will get better with practice. Also, remember that people with impaired vision who use visual aids, like anyone else who wears glasses, may also need more powerful or less powerful or just plain different visual devices as time passes. ie. You need to re-evaluate regularly the visual devices you are presently using.

INDIVIDUAL EDUCATIONAL PSYCHOSOCIAL COUNSELLING

Session 5: Resources

During the 20th century, a wide range of professional and support services have evolved in the U.S. and Canada to assist visually impaired people in leading normal lives. Because it is often preferable for people who lose some vision in their later adult years to avoid getting mixed up in the world of blindness, they often remain unaware of many of the services available to them in that world. Since those services and facilities are designed to help people with varying degrees of visual loss, you may find some of them well worth knowing about. To help familiarize you with some of these services, we thought we would talk about a few of them, such as telephone services, transportation, tax exemptions, reading materials, leisure services and support groups.

Telephone Services

Obviously, many people have difficulty seeing the telephone dial. Show the person a large print dial and demonstrate how it works. (Recall when we talked about reading and lighting, we mentioned that telephone books can be very difficult to read.) It's handy, therefore, to note that by contacting your local telephone company business office (the number is on your phone bill), you can request an application form for free directory assistance. This can be filled out by any professional person (doctor, minister, bank manager, teacher) who knows about your visual impairment.

Transportation Services

There are two kinds of services available to help reduce the high cost of transportation:

- Local transportation on M.U.C.T.C. Metro and buses is available free of charge by obtaining an I.D. card from the Montreal Association for the Blind (M.A.B.) indicating your visual impairment.

- You are entitled to travel half fare or, more precisely, to have a guide accompany you free of charge over long distances on many train and bus routes. To do this you must apply for a "two for one" travel pass from the M.A.B. whenever you are about to make a trip. If you present this pass at the ticket window when you buy your travel tickets, your guide will be ticketed free of charge. Unfortunately, airlines do not provide this service, but they do have specific personnel assigned to work as passenger agents to assist you.

Note. All of the services that we have mentioned that are available through the M.A.B. can be obtained simply by calling them and asking for the Social Services Department. If you indicate to them what your needs are, they will likely send someone to meet you in your home or have you come to visit them to process your request. (Although it is necessary to register with the M.A.B., the client may partake in only those services that are desired.) This information applies to library services as well: See next heading.

Library Services and Reading Materials

- Large Print Reading Materials are available locally on a library loan basis from: Atwater Library

Cote St. Luc Library

Fraser-Hickson Library

Lachine Library

Westmount Library

- Large print books can also be purchased from several specialized publishing houses, most notably:

Clovernook Printing House

7000 Hamilton Ave.,

Cincinnati, Ohio, 45231.

- Subscriptions are available from:

N.Y. Times Large Type Weekly and N.Y. Times Large Type Puzzle

229 West 43rd St.

N.Y., N.Y., 10036. (212) 556-1234

or

Reader's Digest Fund for the Blind, Inc.

Large Type Edition, large Type Reader

Pleasantville, N.Y., 10570.

Audio Reading Materials

Some local libraries have a limited number of books available.

(eg. Cote St. Luc, Lachine, T.M.R., and Westmount)

Recordings for the Blind (mostly educational materials)

20 Roszel Rd.,

Princeton, N.J., 08540.

The M.A.B. provides a full range of library services, including popular and educational books and magazines, recorded on records and/or cassette tapes. The service also will assist you in obtaining record players and tape players with which to read these materials. Finally, the service also allows you to give the M.A.B. any personal material that you may have difficulty reading and have them record it for you. All of these library services are available to you by telephone if you so desire.

Tax Exemptions

Both the federal and Quebec Provincial Governments provide an additional exemption for income tax purposes if the individual filing the return can provide an ophthalmological certification of legal blindness. If your spouse is filing a joint return and you can certify legal blindness, then your spouse can obtain an additional exemption on the basis of your visual impairment. The C.N.I.B. can provide further information and help with your returns.

Social and Leisure Support Services

- The M.A.B. offers a variety of planned, leisure activities on a group basis, such as special sewing classes, french language classes, parties and some limited recreational sports. You may wish to contact them.

- Several large and well-known agencies in the U.S. make a wide variety of specially designed tools, kitchen aids, reading and writing aids, household items (clocks and watches) and games which are available to people with limited vision. eg. Large easily readable dials on electrical devices or enlarged print scrabble players.

These materials are best described and found in a couple of catalogues:

American Foundation for the Blind Catalogue of Aids and Appliances,
15 West 16th St.,
New York, N.Y., 10011.

or

American Printing House for the Blind,
P.O. Box 6085,
Louisville, Ky., 40206-0065.

Specialists that can Help You

Practically every profession that is concerned with helping people at all has developed ideas about how to help people with visual impairment. Therefore, there are ophthalmologists, optometrists, O & M specialists, teachers, social workers and psychologists all working in various ways to assist people with visual impairment. The confusing thing is who to talk to about what:

Perhaps it will help if we briefly discuss some of these professions and then you can ask questions about this or anything at all that we have discussed.

Ophthalmologists: These individuals are medical doctors specifically trained to recognize and treat with medicine or surgery, when possible, biological malfunctions of the eyes. They are also qualified to prescribe glasses that may improve your vision. When the ophthalmologist has completed his/her work with you, he/she may refer you to other professionals who can assist you in optimally using and getting along with any eye problem you might have. Medical questions about your eyes should be directed by you to your ophthalmologist; however, the ophthalmologist's busy schedule and time limitations probably make it preferable that you address questions about visual aids, ongoing advice and counsel about training services and community resources to some of the other professionals.

Low Vision Specialists: These specialists may come from a variety of different training backgrounds, including optometry, psychology, education and social work. Because of this, the particular services available in a given low vision clinic may vary somewhat from one clinic to another. Common to all clinics, however, are the following:

- The provision of special glasses, lenses and non-optical aids (eg. telephone dials, cards, writing aids) to assist in the use of residual vision.

- The provision of information about other services and resources in the community.

- Monitoring of your visual functioning and cor uing advice on the care and use of your eyes (eg. There seems to have been a change in your vision; perhaps you should see your ophthalmologist and then we can consider a change in your prescription or, there does not seem to have been a change in your eye condition, but your needs have changed and perhaps you should consider another type of visual aid.)

Optometrists: The are trained to test your vision and may prescribe lenses to improve it. Generally, they maintain independent offices to which you may go, but as mentioned above, they may be found working as low vision specialists.

Orientation and Mobility Specialists: You may find that getting around on the city streets and using metros is a little more taxing since you have begun to have difficulty with your vision. O & M specialists are teachers trained to help visually impaired people make best use their vision, other senses and to help them them plan and organize their routes of travel so a to lessen this stress and increase travel safety.

Rehabilitation Teachers: Often carrying out relatively ordinary activity such as writing, sewing and cooking, etc., seems to be a real problem when your vision starts to deteriorate.

Even basic day-to-day chores like preparing meals can sometimes leave you feeling less efficient than before. As with travel, there are lots of techniques for using your remaining vision, other senses, working aids and your ability to plan ahead, all derived form the experience of others with similar problems that can be learned. Rehabilitation teachers are trained to give this kind of assistance.

Social Workers: Although we discussed in the last session some ideas about how you might feel more comfortable with your family and friends, sometimes accomplishing this can be somewhat difficult. In those situations, a social worker may be able to engage both you and others with whom you live in dialogue that might prove helpful. ie. A social worker may provide an objective third party who may help to sort out troublesome areas of communication between you and others. They will also help to set up and obtain additional services in such areas a recreation and rehabilitation. If you register for general services at a large agency such as the M.A.B., it will probably be a social worker with whom you will have your initial interview and who will help you to arrange for all of your other services

Psychologists: These professionals are concerned with how individuals think feel and behave in various situations. Psychologists specializing in visual impairment are particularly trained to understand and deal with how people thin, feel and behave when they are attempting to make a personal adjustment to their own visual loss.

Thus, the psychologist can provide overall coordination for may of the services that we have already mentioned as provided by low vision specialists, rehabilitation workers and social workers. Also, those psychologists who ar especially trained as clinical psychologists can help you in a very personal way to come to grips with any troubling fears, questions, inhibitions or frustrations that may be getting in the way of your best adjustment.

Synthesis and Discussion: We have talked about a lot of different professionals playing a lot of different and confusingly overlapping roles in the area of visual impairment. The bright side of all this confusion is that there are many people from many different training backgrounds all contributing their efforts to understanding and helping to make your problem a little less troublesome. These professionals all have a different perspective on visual impairment and what this means for you is that you will see many different approaches concerning your condition. It is not likely that any one of these individuals can or should provide help in all problem areas. If you find that you feel frustrated when dealing with a certain professional, you might want to search though this list in your mind and think about who else might be of help to you.

We have discussed many aspects of visual impairment during the last five weeks and now that we are about to finish, I would be very pleased to answer any questions that you have and just as important, I would very much appreciate your impressions about the last five weeks.

Appendix F

Appendix F.1

Ethics Considerations

As this project was funded both by Concordia and McGill Universities in conjunction with the Royal Victoria Hospital, the research proposal was first approved by the Chairman of the Ophthalmology Department of the Royal Victoria Hospital and the hospital's ethics Committee. A similar ethics approval procedure was carried out at Concordia University.

All participants were asked to sign two consent forms, one providing for release of information by ophthalmologists to the researchers and the other ensuring adequate understanding on the part of the participants. Confidentiality in terms of the information and data provided by participants was ensured. Participants were reimbursed for their travel expenses and for those who could not travel to the university on their own transportation was provided.

Appendix F.2

Consent Form

The study in which you are being asked to participate is designed to investigate the visual abilities, attitudes and feelings of individuals with low vision. The study will be done in 3 stages, spread over 9 weeks. The stages will be:

1. Pretesting: A series of non-medical tests which will allow us to assess your attitudes, visual abilities and feelings about your visual loss (2 meetings).

2. Training: The phase where we are going to work with you individually or in groups (5 meetings). These sessions will essentially consist of perceptual training or discussion on how you adapt to your visual loss.

3. Posttesting: A second series of tests allowing us to evaluate the effect of the training you will have received (2 meetings).

It is hoped that the results of this study will provide us with important information to help us build a basis for better health care in the area of low vision. It is understood that the information which you provide will be kept in strict confidence and that you will have a right to the data, in summary form, following the completion of the study. It is also understood that you may withdraw from the study at any time.

Your signature below indicates that you were informed of the purpose of this study and that you agree to participate.

Signature:______________________________

Name: (Print)___________________________

Date:__________________________________

File Number:____________________________

Appendix F.3

Request for Release of Information

I have volunteered to participate in a low vision study in the psychology department at Concordia University. I understand that information about my current eye condition is vital to this study, and I hereby authorize you to obtain such information from my ophthalmologist. I also understand that any such information shall be confidential to the research staff of the study.

Date:________________________

Signature:_________________________
Participant

Date:________________________

Signature:_________________________
Witness

Appendix G Comparisons on Medical and Demographic Variables

G.1 Chi-square Analysis

G.2 ANOVA Summary Table

Appendix G.1

Chi-square Analysis of Demographic and Medical Data Showing Group Equivalence at Baseline

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Diagnosis: x^2 (3) = 2.57, p = .46

Sex Ratio: x^2 (3) = 3.26, p = .35

SES: x^2 (12) = 9.76, p = .64

Work Status: x^2 (3) = 5.45, p = .14

Mother Tongue: x^2 (3) = 3.46, p = .32

Living Situation: x^2 (3) = 1.10, p = .77

Table G.2

ANOVA Summary Table of Demographic and Medical Data showing Group Equivalence at Baseline

Age

Source	SS	MS	df	F
Group	3.13	1.04	3	1.07
Error	43.64	0.97	45	

Education

Source	SS	MS	df	F
Group	4.60	1.53	3	1.85
Error	35.61	0.83	43	

Health

Source	SS	MS	df	F
Group	0.66	0.22	3	0.63
Error	16.79	0.35	43	

Years Visually Impaired

Source	SS	MS	df	F
Group	2.28	0.76	3	1.12
Error	30.53	0.69	45	

Visual Stability

Source	SS	MS	df	F
Group	0.74	0.24	3	1.07
Error	9.90	0.23	43	

Severity of V.I.

Source	SS	MS	df	F
Group	2.82	0.94	3	1.47
Error	28.15	0.64	44	

Appendix H Comparisons on Dependent Measures

H.1 Perceptual Measures

H.2 Psychosocial Measures

Appendix H.1

ANOVA Summary Tables showing Equivalence on Perceptual Measures at Baseline

EEG

Source	SS	MS	df	F
Between	23.16	7.72	3	0.08
Within	4478.39	99.52	45	
Total	4501.55		48	

Bender

Source	SS	MS	df	F
Between	6.07	2.02	3	0.25
Within	358.33	7.96	45	
Total	364.41		48	

Reading Recognition

Source	SS	MS	df	F
Between	1027.34	342.45	3	0.89
Within	17371.48	386.03	45	
Total	18398.82		48	

Adaptive Acuity

Source	SS	MS	df	F
Between	311.54	103.85	3	0.70
Within	6627.15	147.27	45	
Total	6938.69		48	

Best Eye

Source	SS	MS	df	F
Between	192.31	64.10	3	0.89
Within	2923.61	66.46	45	
Total	3115.92		48	

Appendix H.2

ANOVA Summary Tables showing Equivalence on Psychosocial Measures at Baseline

Activities

Source	SS	MS	df	F
Between	.06	.02	3	1.40
Within	.60	.01	45	
Total	.65		48	

Beliefs

Source	SS	MS	df	F
Between	47.75	15.90	3	1.80
Within	397.93	8.84	45	
Total	445.67		48	

Expectations

Source	SS	MS	df	F
Between	.05	.02	3	0.40
Within	1.82	.04	45	
Total	1.86		48	

Self Report

Source	SS	MS	df	F
Between	.22	.07	3	2.35
Within	1.42	.03	45	
Total	1.65		48	

Appendix I

MANOVA Summary Table for Psychosocial Variables

		SS	MS	df	F
	Wilks				
Group	.6876			12,111	0.17
Activities		0.06	0.02	3,45	0.90
Beliefs		93.12	31.04	3,45	2.13
Expectations		0.13	0.04	3,45	0.62
Self Report		0.27	0.09	3,45	1.48
Error					
Activities		0.97	0.02		
Beliefs		656.15	14.58		
Expectations		3.17	0.07		
Self Report		2.75	0.06		
	Hotellings				
Time	23.91			4,42	5.58***
Activities		0.00	0.00	1,45	0.38
Beliefs		52.51	52.51	1,45	19.80***
Expectations		0.00	0.01	1,45	0.44
Self Report		0.00	0.01	1,45	1.37
	Wilks				
Time x Group	.5809			12,111	2.12*
Activities		.01	0.00	3,45	1.17
Beliefs		29.46	9.82	3,45	3.70*
Expectations		0.04	0.01	3,45	1.33
Self Report		0.03	0.01	3,45	1.67
Error					
Activities		0.12	0.00		
Beliefs		119.36	2.65		
Expectations		0.49	0.01		
Self Report		0.27	0.01		

***p <.001, *p <.05

Appendix J

Means and Standard Deviations for Four Groups on Beliefs Questionnaire

		Intervention			
		Pretest	Posttest	df	t
Group	n				
IEPC	16	6.12 (3.40)	8.87 (2.75)	15	3.64*
GEPC	11	8.09 (2.58)	10.45 (1.81)	10	3.36*
PTRAIN	12	8.16 (2.08)	8.50 (3.26)	11	0.74
Control	10	6.20 (3.49)	6.70 (3.56)	9	1.01

Note. Means indicated first, standard deviations in parentheses.
*$p < .01$ (Significant after Bonferroni correction)

Appendix K Perceptual Summary Tables

K.1 MANOVA Summary Table

K.2 Hotellings T^2 Summary Table

Appendix K.1

MANOVA Summary Table for Perceptual Variables

	Wilks	SS	MS	df	F
Group	.7265			9, 105	1.63
FFG		70.62	23.54	3, 45	0.13
Reading Recognition		3243.90	1081.30	3, 45	1.47
Best Eye		660.33	220.11	3, 45	1.42
Error					
FFG		8303.77	184.53		
Reading Recognition		32998.37	733.30		
Best Eye		6961.93	154.71		
	Hotelling	SS	MS	df	F
Time	31.99			3, 43	10.19***
FFG		75.53	75.53	1, 45	21.27***
Reading Recognition		341.43	341.43	1, 45	10.96***
Best Eye		178.61	178.61	1, 45	10.36**
	Wilks	SS	MS	df	F
Time x Group	.5318			9,105	3.45***
FFG		63.22	21.07	3, 45	5.94***
Reading Recognition		417.70	139.23	3, 45	4.47**
Best Eye		145.30	48.43	3, 45	2.81*
Error					
FFG		159.77	3.55		
Reading Recognition		1401.54	31.14		
Best Eye		775.70	17.24		

***$p < .001$, **$p < .01$, *$p < .05$

Appendix K.2

Hotellings T^2 (Post hocs) Summary Tables of Perceptual Measures for Four Groups

IEPC

	Hotellings		df		F
	17.49		3, 13		5.05**
FFG					
	Source	SS	df	MS	F
	Time	19.53	1	19.53	9.46**
	Error	30.97	15	2.06	
Reading Recognition					
	Source	SS	df	MS	F
	Time	205.03	1	205.03	13.06***
	Error	235.47	15	15.70	
Best Eye					
	Source	SS	df	MS	F
	Time	258.78	1	258.78	6.43*
	Error	603.72	15	40.25	

PTRAIN

	Hotellings		df		F
	25.37		3,9		6.92**
FFG					
	Source	SS	df	MS	F
	Time	112.67	1	112.67	21.25***
	Error	58.33	11	5.30	
Reading Recognition					
	Source	SS	df	MS	F
	Time	610.04	1	610.04	7.53*
	Error	891.46	11	81.04	
Best Eye					
	Source	SS	df	MS	F
	Time	117.04	1	117.04	9.37**
	Error	137.46	11	12.50	

Note. ***$p < .001$, **$p < .01$, *$p < .05$

GEPC

	Hotellings	SS	df	MS	F
	6.85		3, 8		1.83
FFG					
	Source	SS	df	MS	F
	Time	14.73	1	14.73	2.40
	Error	61.27	10	6.13	
Reading Recognition					
	Source	SS	df	MS	F
	Time	7.68	1	7.68	0.31
	Error	246.82	10	24.68	
Best Eye	Source	SS	df	MS	F
	Time	10.23	1	10.23	5.04
	Error	20.27	10	2,03	

Control

	Hotellings	SS	df	MS	F
	4.43		3,7		1.15
FFG					
	Source	SS	df	MS	F
	Time	0.80	1	0.80	0.78
	Error	9.20	9	1.02	
Reading Recognition					
	Source	SS	df	MS	F
	Time	7.20	1	7.20	2.33
	Error	27.80	9	3.09	
Best Eye					
	Source	SS	df	MS	F
	Time	1.25	1	1.25	0.79
	Error	14.25	9	1.58	

Appendix L

Means and Standard Deviations for Four Groups on Perceptual Measures

		Group	
		Pre-intervention	Post-intervention
FFG	IEPC	17.69 (10.31)	19.25 (10.10)**
	PTRAIN	16.08 (10.67)	20.42 (8.75)***
	GEPC	16.18 (9.03)	17.81 (9.14)
	Control	16.60 (9.51)	16.20 (9.30)
R.R.	IEPC	35.75 (21.84)	40.81 (20.12)**
	PTRAIN	43.33 (16.48)	53.42 (18.60)*
	GEPC	33.91 (21.27	32.72 (21.54)
	Control	44.90 (17.32)	46.10 (16.69)
Best Eye	IEPC	11.44 (8.47)	17.12 (13.65)*
	PTRAIN	7.08 (5.25)	11.50 (7.00)*
	GEPC	7.36 (9.46)	8.73 (9.47)
	Control	9.40 (8.75)	8.90 (7.80)

Note. Means indicated first, standard deviations in parentheses.
* $p<.05$
** $p<.01$
*** $p<.001$