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Visual field defects and aphasia testing : a proposed adaptation of the Boston diagnostic aphasia examination.

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Visual Field Defects and Aphasia Testing:

A Proposed Adaptation of the Boston Diagnostic Aphasia Examination

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TABLE OF CONTENTS

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LIST OF FIGURES

CHAPTER ONE

LITERATURE REVIEW

Introduction

Assessment of speech and language functions in the brain-injured adult is a complex and multifaceted process. Careful attention must be paid to both the stimulus and response characteristics of each assessment task. Although many aspects of aphasia testing have been researched extensively, the effect of visual field impairment on aphasia test performance has received little attention in the professional literature. Most authors of widely used aphasia examinations (Porch, 1971; Eisenson, 1954; Schuell, 1965) acknowledge that visual field defects may interfere with optimum test performance; however, these authors provide only vague, general suggestions for adapting test presentation to compensate for visual loss. Several test authors fail to address the issue at all (Keenan and Brassell, 1975; Goodglass and Kaplan, 1976). Nevertheless, nearly 60% of all aphasics demonstrate some form of visual field defect, most commonly homonymous hemianopsia (Minear, 1969). Clearly, the concern at hand is the differentiation of cortical speech and language disorders from peripheral visual loss. Such differentiation is essential to the design of an appropriate treatment program. The following paper addresses the nature of visual field defects and their relationship to aphasia test construction. Presented also is a study evaluating the effectiveness of the author's proposed adaptation of the _Boston Diagnostic Aphasia Examination_ for patients with visual field defects.

Visual Field Defects: Etiology, Assessment, Treatment

A visual field defect can be defined as an area of blindness in the visual space normally subtended by eyes (Brookshire, 1978). Visual field defects result from an interruption in the cortical optic tract. High correlation between CAT scan results and the type of visual impairment has revealed that visual field defect configuration differs markedly depending on the site of the cortical lesion (McAuley & Russell, 1979). Figure 1 represents the effect of lesions interrupting the visual pathways at various points. At point A, a lesion produces complete blindness in the right eye, since all optic fibers from that eye are interrupted. Point B represents a lesion in the optic chiasm. Because fibers carrying information from the temporal visual field of each eye decussate at the optic chiasm, a lesion there causes a loss in the left half of the left visual field and the right half of the right visual field (bitemporal hemianopsia or "tunnel vision"). The lesion at Point C, posterior to the optic chiasm, produces visual impairment in the contralateral visual field of each eye (homonymous hemianopsia). Thus, as depicted in the diagram, the lesion at C in the right hemisphere would produce blindness in the left visual field of both eyes. A complete lesion in the optic radiation (point D) would also produce homonymous hemianopsia. Partial lesions in the optic radiation, however, may result in loss of only one visual field quadrant in both eyes (quandrantopsia). A partial lesion at point E in the temporal lobe may cause blindness only in the upper homonymous quadrants, while a partial lesion at point F in the parietal lobe may result in a visual defect only in

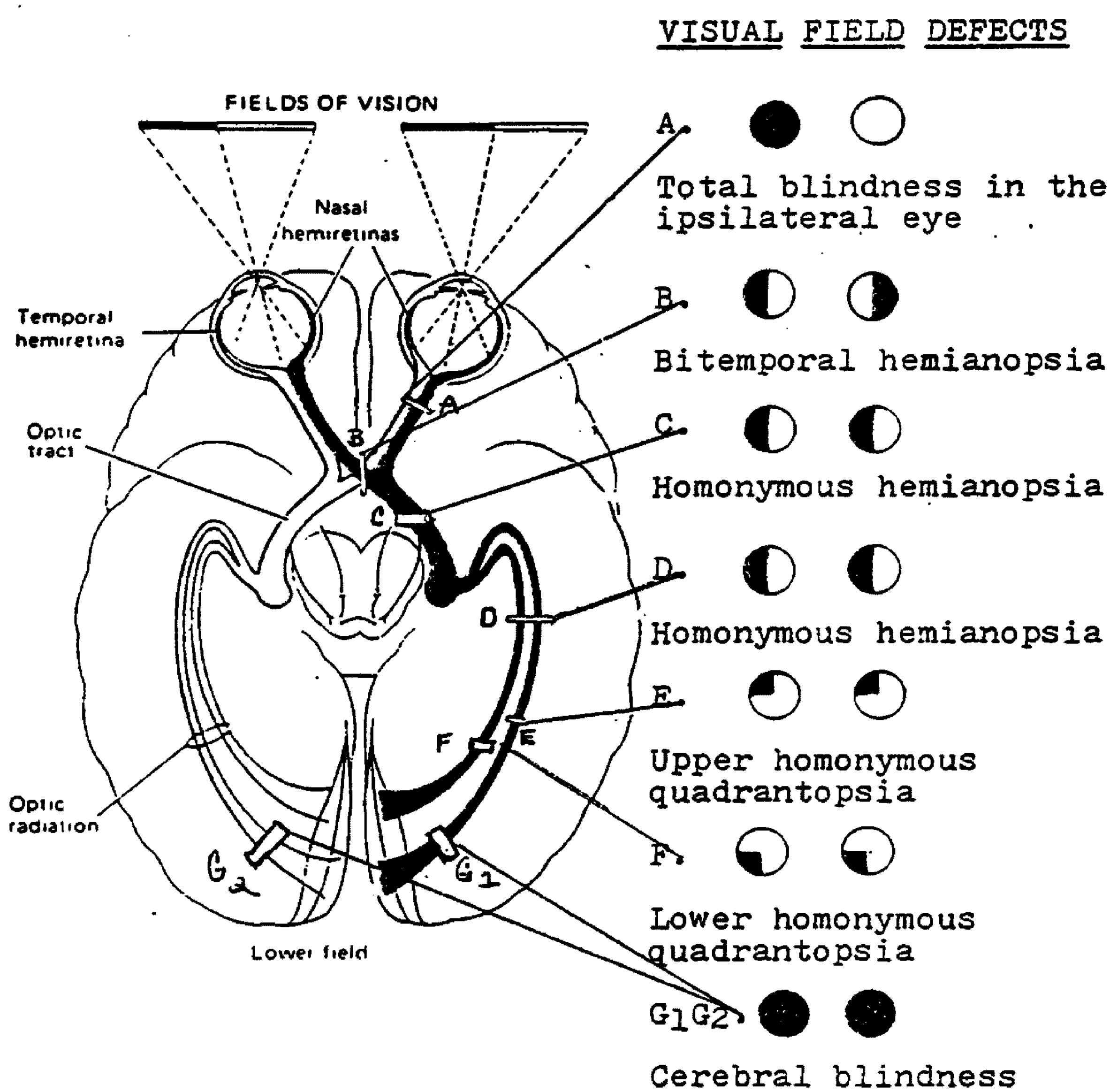

Figure 1 Visual pathway and defects resulting from various lesions. (Adapted from Walsh, 1978)

the lower quadrants. Bilateral lesions of the occipital lobe (G1 and G2) produce bilateral homonymous hemianopsia, often called cerebral blindness since vision is lost in all quadrants (Walsh, 1975). However, in occipital lobe lesions in which the most posterior portion of the lobe (occipital pole) is preserved, an area of central vision remains intact. This phenomenon is known as "macular sparing" (McAuley & Russell, 1979).

Site of lesion is also reflected in the congruity of visual field defects. Lesions in the occipital lobe produce hemianopsias which are congruous, identically shaped in both eyes. Lesions anterior in the optic radiation produce incongruous hemianopsias, which differ slightly in shape (Tate & Lynn, 1977).

Visual field defects less regular than those described above can be caused by small focal lesions of the visual cortex or optic radiation. These irregular visual field defects, called scotoma, are small "blind spots" surrounded by normal vision. Scotoma are often seen in patients with penetrating missile wounds, but are rarely seen in patients following major cerebrovascular accidents (Tate & Lynn, 1971).

Over half of all visual field defects (homonymous hemianopsia and quadrantopsia) are caused by cerebral infarction related to vascular disease. Among patients with involvement of the middle cerebral artery or vertebrobasilar arterial system, over 60% manifest ocular signs and symptoms (Wolintz, 1976). These symptoms differ widely according to the cortical area damaged by arterial occlusion. Occlusion of the middle cerebral artery or its branches often results in a complete incongruous contralateral homonymous hemianopsia, generally accompanied by contralateral hemiplegia and hemisensory defect (Toole & Patel, 1974). In the dominant hemisphere, occlusion of the middle cerebral artery (sometimes called the "artery of aphasia") also commonly leads to aphasia, agraphia, alexia, and acalculia. In the nondominant hemisphere, middle cerebral artery occlusion may cause unilateral spatial neglect, constructive apraxia, dressing apraxia, and anosognosia (Glaser, 1978). Occlusion of the posterior cerebral artery often leads to generally blurred vision accompanying isolated, dense, congruous, homonymous hemianopsia with macular sparing. The hemianopsia may exist independent of any other neurological impairment, but may also be accompanied by visual agnosia or alexia without agraphia (Walsh, 1978).

Onset of visual field defects is usually sudden following cerebrovascular accident. A general blurring of vision may occur at onset, later clearing to leave the defined visual field defect (Wolintz, 1976). Some patients first notice hemianopsia as a shadow or curtain obstructing vision. Others complain of poor vision in the eye to the side of the field defect (Toole & Patel, 1974). Tate & Lynn (1977) report that patients may experience visual hallucinations in the area of the defect, usually flashes of light. Surprisingly, many patients do not report any visual impairment at all. Bender (1984) suggests that this commonly occurring imperception of hemianopsia is caused by the visuoperceptive phenomenon of "completion" in which the subject subconsciously fills in information missing in the visual stimulus. Bender's study of hemianopsia patients indicated that imperception of visual field defects occurs more often with posterior lesions than with lesions anterior in the optic radiation. Denes et al (1982) concluded that denial of perceptual deficits, including hemianopsia, is far more common with right hemisphere lesions.

Because patients with hemianopsia are often unaware, or unable to report, the nature of this visual loss, neuro-ophthamologic examination is essential for all brain-injured patients. Visual field assessment is generally considered to be a routine part of neurological evaluation (Russell, 1976). Two formal ophthamological procedures are standardly used to chart the configuration of visual field defects. The first, tangent screen examination, is used to assess vision within 30° of the central fixation point. The second, retinal perimetry, provides a record of the peripheral visual field, that portion beyond 30° from the fixation point (Wolintz, 1976). Both testing methods require special equipment, and demand that the patient be alert, attentive, and able to follow complex instructions. Unfortunately, most stroke patients demonstrate cognitive/communicative deficits which prevent this type of testing (Tate & Lynn, 1977).

Although tangent screen and retinal perimetry are necessary to define very small or irregular defects or to delineate subtle changes in the visual field, less formal procedures are usually adequate to detect hemianopsia or quadrantopsia. The most common method of visual field examination used with stroke patients is confrontation testing. With this method the examiner attempts to compare the patient's visual field with his own. Confrontation testing can generally be used successfully with patients who are bedridden, aphasic, or highly distractible. Various confrontation tasks are used to assess perception of movement, form and color in each quadrant of the visual field (Tate & Lynn, 1976). The patient, facing the examiner, is instructed to fixate his gaze on the bridge of the examiner's nose. To assess movement perception, the examiner moves a visual target rapidly inward from the perimeter, asking the patient to signal when he first detects the target. Each eye is tested separately. Wolintz (1976) recemmends that targets be placed in diagonally opposite quadrants (for example, the upper nasal and lower temporal quadrants) in order to detect quadrantopsia and avoid the physiologic blind spot in the temporal field.

Color perception is easily assessed by using brightly colored targets in the procedure described above. The patient is requested to identify the color of the visual stimulus. To assess perception of form, the patient may be asked to count fingers in the various quadrants of the visual field (Wolintz, 1976).

If the examination described above does not reveal any appreciable field defects, then the technique of double simultaneous stimulation can be used. Both eyes are unoccluded and identical colored or moving targets are presented to the patient's lateral fields of vision. Sometimes only one object is presented, and on other trials boths objects are used. Patients with hemianopsia will fail to perceive the object presented to the defective field when both fields are stimulated simultaneously. Often double simultaneous stimulation will reveal decreased perceptual ability in some portion of the visual field that was not detected by the basic tests for movement, color and form perception (Brockshire, 1978).

A disorder closely related to, and often confused with homonymous hemianopsia is unilateral spatial neglect, or hemi-inattention. This deficit does not necessarily involve blindness in some portion of visual field, but is rather a disorder of arousal and attention. Walsh (1978) describes the syndrome as a tendency to neglect one half of extrapersonal space. The patient with hemi-inattention is generally less responsive to stimulation (visual, auditory, or tactile) on the affected side. Unilateral spatial neglect is nearly always accompanied by homonymous hemianopsia, but may exist independently of visual field defects (Anderson, 1971). Denes, et al (1982), in his study of 50 hemiplegic patients, found that although homonymous hemianopsia occurred with equal frequency in right or left hemisphere lesions, hemi-inattention was far more frequent and severe with right hemisphere damage (particularly right parietal lesions). The symptoms of unilateral spatial neglect are often very similar to those of visual field defects, especially regarding visuospatial tasks. Where the patient with homonymous hemianopsia does not perceive visual information from the side of the defect, the patient with unilateral spatial neglect does not attend to the affected side.

Homonymous hemianopsia adversely affects a patient's ability to perform many functional activities. Ambulation is difficult since the patient may bump into objects on the side of the defect, or be hit by objects from outside his field of vision. Driving an automobile is often impossible because of the patient's inability to perceive moving traffic on one side. Many patients neglect to eat the food on one side of their plates, unless the plate is rotated, bringing the food into the intact visual field.

Hemianopsia and quadianopsia also affect performance on many academic and vocational activities. Any task which requires visual scanning is likely to be affected. Reading, in particular, is often significantly impaired. Granutsos et al (1983) describe the reading impairment in left hemianopsia as one of "anchoring" and the reading deficit in right hemianopsia as one of "scanning." Patients with left homonymous hemianopsia fail to "anchor" at the left margin when reading. Such patients often begin reading near the midline of the page and have difficulty selecting the correct line of print when returning to the left side. The "scanning" deficit displayed by patients with right homonymous hemianopsia is slightly different. The patient with right hemianiopsia is generally able to select the correct line of print, but often omits words to the right side of midline. Contextual cues may aid this patient in scanning effectively to the right, so reading errors in right hemianopsia are often inconsistent. Quadrantopsias generally cause patients to make inconsistent errors in either anchoring or scanning of the corresponding quadrant of the printed page. With both hemianopsia and quadrantopsia reading becomes more impaired as the size of print decreases. Reading comprehension is often poor in patients with visual field defects, both because the omitted words interrupt the flow of meaning and because increased attention to visuoperceptual processes distracts the patient from retaining information (Weinberg et al, 1979).

Performance on writing and calculation tasks is also commonly impaired as a result of homonymous hemianopsia. Patients with left hemianopsia often begin writing in the middle of the page, while patients with right hemianopsia often leave the right side of the page blank. Calculation tasks are difficult because patients tend to ignore columns of figures to the side of the defect. Copying of figures is also impaired, with the patient omitting portions of the shape on the affected side. (Granutsos et al, 1983).

Due to the various deficits in ambulation, self-care, and graphic communication which can result from hemianopsia or quadrantopsia, visual field defects are a negative prognostic indicator for stroke recovery (Haerer, 1973; Anderson, 1971. Considerable attention in the rehabilitation literature has been devoted to ameliorating the effects of hemianopsia on functional living skills. In general, the prognosis for spontaneous recovery of vision is poor (Walsh, 1976; Wolintz, 1978). Zihl and Von Cramon (1979) state that patients with homonymous hemianopsia secondary to vascular disease present a poor prognosis for spontaneous recovery, although some improvement may be noted within two weeks post onset. However, they state that perimetric blind areas may fluctuate in sensitivity. In their study, Zihl and Von Cramon were successful in increasing the sensitivity and visual field size of several hemianopsia patients by using concentrated stimulation with flashes of light.

In view of the relatively poor prognosis for complete recovery of vision in the affected field, most treatment approaches have focused on compensation training. The patient is, by various methods, taught to turn his head from side to side to appreciate the full visual field. Although important visual stimuli should be placed within the intact visual field during acute illness, later in rehabilitation such stimuli may be moved past midline to encourage compensatory head turning (Russell, 1976). Other successful treatment techniques documented in the literature are scanning to a series of brightly colored lights (Weinberg et al, 1979), pointing to a moving light on a blackboard (Taylor et al, 1971), and visual/verbal cueing to the side of the defect on word search tasks (Granutsos, et al 1983).

Progress in compensation training appears relatively slow for most patients. Anderson (1971) reports that 50% of the patients with homonymous hemianopsia she studied remained dependent in ambulation, communication, or self care after six weeks of rehabilitation as compared to 24% of the patients without visual defects. Weinberg et al (1979) noted improvement in visual compensation only after four weeks of daily treatment. It appears, therefore, that most patients with hemianopsia who are seen by a speech pathologist early in the course of rehabilitation will not have learned to compensate effectively for their visual defect. Because hemianopsia interferes significantly with visual scanning, reading, writing, and calculation, performance on many standardized aphasia tests will be impaired. The speech pathologist is then left with the puzzling problem of determining which test errors are due to the visual field defect, and which are due to cortical language impairment. The following section addresses the problems of test construction for patients with visual field defects and evaluates the usefulness of several commonly used aphasia tests with the hemianopsia population.

Visual Field Defects and Aphasia Testing

The significance of visual field defects for standardized test performance has been addressed only briefly in the neuropsychology literature. Doehring (1961) determined that a group of brain-damaged patients with homonymous hemianopsia received lower I.Q. scores than a matched group of patients with normal vision. Lesak (1976) notes that patients with visual field defects and/or hemi-inattention perform poorly on the following tasks commonly used in neuropsychological testing: written word recognition, color matching, picture recognition, "draw a man" tasks, visually presented calculation, copying designs, cancellation tasks, and visual retention for block designs. Lesak suggests caution in inferring cognitive deficits from impaired performance on such tasks in a hemianopsia patient.

Standardized aphasia examinations also include many tasks which are biased by visual field defects. Webb & Love (1983) compared scores on the Porch Index of Communicative Ability (Porch, 1971) for patients with visual field defects with scores for patients with normal vision. They found that patients with field defects earned significantly lower scores on verbal subtests. Although the visually impaired patients performed more poorly on many gestural and graphic subtests as well, the differences were not statistically significant.

Minear (1969) found that visual field defects significantly decreased performance on the visually presented tasks included in the Minnesota Test for Differential Diagnosis of Aphasia (Schuell, 1965). Performance on tasks presented in two sensory modalities (e.g., auditory and visual) was not significantly decreased. Minear expresses concern that inexperienced examiners may erroneously interpret lower scores on visual subtests as evidence of aphasia.

Visual field defects then, may complicate the already difficult process of aphasia diagnosis. Most instruments for the assessment of aphasia are based on a three-stage model of language (Figure 2). This model divides language processes into three parts: an input (reception) stage, a central (processing) stage, and an output (expression) stage (Brookshire, 1978). Since the central processing stage cannot be directly observed, the examiner makes inferences about the functioning of the processing component by observing relationships between input and output behaviors. Any disturbance in the sensory input mechanisms (vision, audition, tactile sensation) can make such inferences invalid. For example, a patient with a severe hearing loss, who fails an auditory comprehension task, is certainly displaying a communication deficit; however, that deficit may not be aphasia. Similarly, a patient with homonymous hemianopsia, who is unable to comprehend a reading passage, may be displaying a symptom of visual loss rather than a language processing impairment. When sensory input mechanisms provide a garbled or incomplete representation of the stimulus, the examiner cannot confidently assert that the

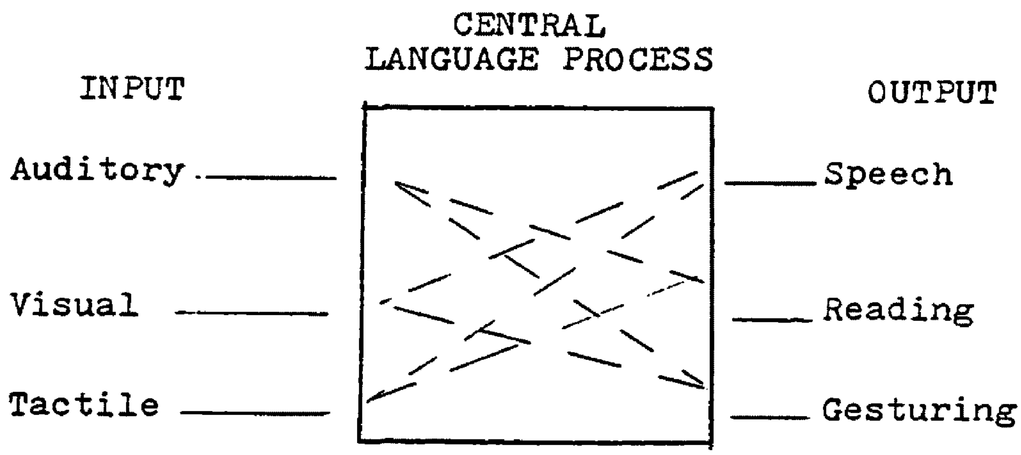

Figure 2: Model for language processing (Adapted from Brookshire, 1978).

central processing component is responsible for impaired performance.

The aphasic patient with homonymous hemianopsia, then, presents a special diagnostic problem. The patient's functional communication deficits arise from two sources: a cortical language processing disorder and a peripheral visual loss. The challenge of differential diagnosis is to define the existing language deficits and determine their interaction with the visual loss. Such diagnosis is essential to devise an effective appropriate treatment program. With this goal in mind, the following principles are proposed for asessing the patient with visual field defect

1. The patient's functional level of communication should be assessed first. How well does the patient interpret visual language stimuli, such as signs or newspaper headlines, which normally occur in his environment?

2. The patient's vision should be fully assessed. The visual field defect should be defined as carefully as possibly using confrontation testing or tangent screen/retinal perimetry. Visual acuity should also be evaluated.

3. The patient's language processing abilities should be fully assessed using an aphasia examination which is not biased by visual impairment. The examination should include only stimulus items which can be easily and accurately perceived by a patient with a visual field defect. Such an examination would allow the clinician to make more valid inferences regarding language processing.

The first two principles discussed above are fairly easily implemented. Both visual assessment and functional communication evaluation are routine diagnostic procedures in many rehabilitation facilities. Implementing the third principle, however, poses a considerable problem. None of the currently available standardized aphasia examinations are ideal for patients with visual field defects. As discussed previously, many patients with homonymous hemianopsia initially experience a general blurring of vision, along with blindness in the affected field. These patients demonstrate impairment in both scanning and discriminating visual test stimuli. Certainly an ideal test for visually impaired patients would eliminate the use of visual stimuli; however, the very nature of a comprehensive aphasia examination demands the inclusion of visual tasks such as reading. Presented here, then, are several criteria for the design and administration of visual stimulus items used in aphasia testing with patients who have visual field defects. The criteria are then applied to evaluate stimulus items in the following commonly used aphasia tests: the Boston Diagnostic Aphasia Examination (BDAE, Goodglass and Kaplan, 1976); the Aphasia, Language Performance Scales (ALPS, Keenan and Brassel, 1975); Examining for Aphasia (EFA, Eisenson, 1954); the Porch Index of Communicative Ability (PICA, Porch, 1971); the Minnesota Test for Differential Diagnosis of Aphasia (MTDDA, Schuell, 1965); and the Western Aphasia Battery (WAB, Kertesz, 1982).

A. Objects, rather than pictures, should be used as stimulus items whenever possible.

The use of objects rather than pictures is suggested to simplify the visual discrimination task for the hemianopsia patient. Since objects are three dimensional, they provide the extra visual cues of natural shading and perspective (Lesak, 1976). Depending on the manner of test presentation, objects can also provide tactile sensation. Some aphasiologists have suggested that objects are easier for normally sighted aphasics to name. However, Nation and Corlew (1974) found that objects and pictures produce very similar naming performance in aphasics with normal vision. Thus, it appears that using objects rather than pictures simplifies the visual, but not the linguistic, task.

Due primarily to concerns of portability and ease of administration, several major aphasia tests rely on picture stimuli for most tasks. The BDAE relies totally on picture stimuli. The MTDDA also relies heavily on pictures only using objects for one sequential command task. The PICA, WAB, and EFA use a combination of both pictures and objects for visual tasks. Only the ALPS includes objects exclusively as stimulus items.

B. If pictures are used, they should be large, simple, and distinctive.

Once again, this suggestion is intended to simplify the visual discrimination task. For a hemianopsia patient, indeed any aphasia patient, large simple line drawings are more easily perceived than small complex pictures. Unfortunately, several prominent aphasias tests display less than ideal artwork. The pictures included in the PICA are quite small (approximately 5 cm) and poorly shaded. Some of the drawings included in the MTDDA are also small (5 cm) and contain unnecessary and distracting details. The picture stimuli on the BDAE are somewhat larger (5-8 cm), but are poorly arranged and very detailed. The drawings intended to convey movement (Card 3) are particularly ambiguous. The drawings included in the EFA, although now somewhat dated, are considerably larger (10 cm). Some of the best stimulus pictures in a currently published aphasia examination can be found in the WAB. The pictures are large (9 cm), bold, and simple.

C. All reading material should be presented in large, bold-faced type.

Reading is one task necessarily presented visually on aphasia tests. As noted previously, reading performance in hemianopsia patients becomes progressively more impaired as the size of print decreases (Weinberg et al, 1979). To aid the patient with hemianopsia in both scanning and discriminating reading material, the print should be large and distinct. A variety of print size is found among the aphasia examinations reviewed here. Size ranges from the very small type (0.20 cm) found in the MTDDA to the large print (1.5 cm) found in the ALPS. The EFA, PICA, WAB, and BDAE display print in the size range 0.5 to 1 cm. Although print size cannot be enlarged excessively lest the size of passages become unmanageable, some increase from the above quoted measurements seems advisable.

D. The need for scanning of visual displays should be reduced as much as possible.

Horizontal scanning is one of the primary skills affected by hemianopsia or quadiantopsia. Patients with visual field defects are likely to perform poorly on language tasks which require the patient to visually search for the correct work or picture. Both the BDAE and MTDDA include tasks requiring horizontal scanning for word identification. The BDAE and MTDDA also present several reading sentences on one stimulus card, thus increasing scanning difficulty. The BDAE, in particular, presents many graphic and pictured items at close proximity on stimulus cards. The ALPS and PICA, on the positive side, present only one item per stimulus card. The WAB solves many horizontal scanning problems by presenting word lists vertically.

E. All test materials should be presented to the patient's best field of vision.

When the size and configuration of a visual field defect is known, an examiner can aid the patient in both scanning and discriminating test stimuli simply by placing test items in the best field of vision. This display adaptation is usually the only concession made by test authors for adapting testing to meet the needs of hemianopsia patients. The ALPS and WAB allow considerable flexibility in shifting object displays either horizontally or vertically. The PICA requires standard positioning of objects and test cards; however, Porch states that materials may be placed "slightly toward the best field of vision.) (1971, p.3). The SEFA AND MTDDA manuals suggest presentation to the best visual field when testing hemianopsia patients. The BDAE manual, however, makes no mention of adapting stimulus presentation to compensate for visual field defects.

F. Test presentation should allow for verbal and/or visual cueing to to the affected side.

Verbal/visual cueing to the side of the visual field defect has long been considered an effective treatment procedure for hemianopsia patients. The use of this technique to aid in aphasia testing seems a logical extension of a proven approach. Porch (1971) suggests examiners caution hemianopsia patients to scan the entire test surface during PICA administration. Such an instruction, though appropriate, seems inadequate for patients with comprehension, attention or memory deficits. Instead, what is needed is a consistent system of cueing which calls the patient's attention to the affected side before each visual test item. Such cueing is not allowed during administration of most standardized aphasia tests, including the PICA, MTDDA, BDAE, and WAB. Tests such as the ALPS and EFA which are more flexible in presentation could conceivably allow cueing to the affected side.

Clearly, the criteria established above are not met by any of the aphasia tests reviewed, or for that matter, any current test. The clinician is then left with the task of adapting an existing aphasia test to suit the needs of hemianopsia patients.

The aphasia test most biased by visual impairment is probably the BDAE. Small print, crowded stimulus cards, and ambiguous drawings make the visual tasks formidable. Goodglass and Kaplan (1976) make no mention of adapting the test for visually impaired patients. Beele, Davies, and Muller (1984) suggest a different layout of the pictures on stimulus cards 2 and 3 to aid patients with visual problems. Helm-Estabrooks (1984) suggests cutting out BDAE line drawings and separating them on a dark background. She cites a case study of a 63-year-old man whose test score improved by 30 points with this adaptation.

Adapting a test like the BDAE has both clinical advantages and disadvantages. Non-standardized presentation of a standardized test may invalidate the use of normative data. The examiner must be cautious in the interpretation of test scores. Nevertheless, an adapted form of a test may be more useful in obtaining relevant clinical information. In the case of hemianopsia patients, the examiner may be able to obtain a clearer view of the patient's language processing abilities by eliminating the effect of visual loss.

The following study describes a proposed adaptation of the BDAE for patients with homonymous hemianopsia. The adapted test was designed to meet, as nearly as possible, the previously stated criteria for appropriate visual test stimuli. The purpose of this study was to determine whether the adapted test could effectively eliminate the bias of visual impairment, thus yielding a higher BDAE score which reflected language processing more closely. Five stroke patients with homonymous hemianopsia were administered visual portions of both the standard BDAE and the adapted test. Significant differences were noted in test performance. This report examines those differences and discusses their implication for testing aphasic patients with hemianopsia.

CHAPTER II

METHOD

Subjects

Five patients, two female and three male, participated in the study. All of the patients were admitted to Tulsa Rehabilitation Center following cerebrovascular accident (CVA). Two of the patients demonstrated right hemisphere lesions accompanied by left homonymous hemianopsia. One patient exhibited a large left hemisphere lesion with a corresponding right homonymous hemianopsia. Another subject with a left hemisphere lesion presented with congenital blindness in the right eye, accompanied by a nasal hemianopsia in the left eye. The fifth subject was diagnosed with bilateral cortical lesions and dense left homonymous hemianopsia. The presence of hemianopsia in each subject was determined by confrontation testing, and confirmed by the attending physician and the occuptaional therapist. Formal ophthalmological examination was not performed on any of the patients prior to this study due to the patients' existing medical, linguistic, and cognitive deficits. All of the patients wore prescription lenses to correct for visual acuity defects. The subjects with right hemisphere lesions also demonstrated some degree of unilateral spatial neglect. Subjects were at least 21 days post onset of CVA (x = 46.4 days, range = 21-120 days). All of the patients had completed a high school education. Presence of functional communication impairment was confirmed for all patients by administration of the Aphasia Language Performance Scales according to the standard instructions. All of the patients exhibited at least a moderate communication deficit. The subjects were each enrolled in a comprehensive rehabilitation program consisting of speech therapy, occupational therapy, physical therapy, and recreational therapy. Compensation for the visual field defect was common goal of the rehabilitation team, addressed by each therapist throughout the treatment program.

Procedures

Following the initial screening battery (ALPS and visual confrontation testing), each patient was given two forms of the BDAE. Only the nine BDAE subtests which require visual stimuli were included in testing (subtests IIA, IIIF, IIIH, IIIK IVA, IVB1, IVC, IVD, VC2). All testing was conducted in a quiet therapy room with adequate lighting. The examiner was seated across a small table from the patient. The same examiner administered both forms to each subject.

Each patient was first given Test A, the form of the BDAE adapted for use with hemianopsia patients. The specific nature of the adaptations will be described in the following section. Testing was completed during the patients' regular speech therapy sessions (generally two sessions per day), with all subtests administered within three days.

After approximately one week (x = 6.8 days, range = 5-8 days), the patients were given Test B, the standard form of the BDAE. During the intertest period, all the patients participated in their routine therapy program, which included activities to teach compensation for the visual field defect. The standard form of the BDAE was administered and scored according to the instructions provided by Goodglass and Kaplan (1976). The stimulus cards were those provided in the test packet. Again, testing was conducted during 30-minute therapy sessions and was completed within three days.

Test Adaptation

The BDAE visual subtest stimuli were adapted in form and presentation. The actual content of the test items remained unchanged. The BDAE was adapted according to the following previously stated criteria for testing hemianopsia patients.

A. Objects rather than pictures should be used as stimulus items whenever possible.

In order to maintain the original content of the BDAE, objects were not substituted for the picture stimuli. Some of the naming items used in the BDAE, such as "hammock" and "falling," are very difficult to represent with objects in a consistent manner. Thus, although object stimuli would have been preferable, objects were not used in the present study

B. If pictures are used, they should be large, simple, and distinctive.

Once again, to maintain the original content of the BDAE, the standard line drawings were not altered in form. The drawings were, however, enlarged 160% to provide for easier visual discrimination. The finished size ranged from 6-13 cm as compared with 5-8 cm on the original test. The pictures were also re-inked to ensure bold distinctive lines.

C. All reading material should be presented in large bold-faced type.

All reading material on the BDAE was also enlarged 160%. Print on the adapted test cards ranged from (0.9 to 1.9 cm) as compared to 0.5 to 1.0 cm for the original BDAE. Enlarged print was re-inked to provide boldness and clarity. The style of type used in the original BDAE was maintained in the adapted test.

D. The need for scanning of visual displays should be reduced as much as possible.

To decrease scanning difficulty, each item on the reading subtests (IIIF, IIIK, IVA, IVB1, IVC, IVD, VC2) was presented on a separate stimulus card. Stimulus cards 1 and 2, which contain the picture stimuli used for auditory word recognition and visual confrontation naming, were also adapted to simplify visual scanning. The enlarged stimulus items were separated more widely on a larger text card. The card measured 11 x 14 inches, as compared to 7 x 10 for the original BDAE. The arrangement of items was identical to that used in the standard test cards. The various categories of pictured stimuli (e.g., objects shapes, letters on the adapted test) were separated by a wide (0.5 cm) dark line. Two thin lines were used to separate categories on the original BDAE.

The adapted test materials were all presented past midline toward the patient's best field of vision. The degree of lateralization toward the best field of vision was determined through confrontation test results and patient's indication of where he could best perceive the stimulus items.

F. Test presentation should allow for verbal/visual cuing to the affected side.

A consistent method of auditory/visual/verbal cueing was used to direct the patient's attention to the affected side. A large (0.5 cm x 3.4 cm) red cardboard margin marker was placed on the edge of the test card to the side of the visual field defect. Prior to the presentation of each test item, the patient was instructed to "Look to the red line." The clinician simultaneously tapped the margin marker providing an auditory cue.

With the exception of the modifications described above, the adapted form of the BDAE was presented and scored in accordance with the instructions given in the test manual. Although consent for participation in the study was obtained from each patient prior to testing, patients were not advised regarding the purpose of the study until after they had completed both test forms.

CHAPTER III

RESULTS

This study was designed to determine whether the BDAE version adapted for hemianopsia patients would produce significantly higher scores than the original BDAE. A summary of test scores for the adapted test (Test A) and the standard BDAE (Test B) can be found in the Appendix. In general, all of the subjects achieved higher scores on the test form adapted for hemianopsia than on the original BDAE. Of the 40 score pairs where some difference occurred, in 38 pairs the adapted test score was larger than the original test score.

A t-test for related measures was performed to determine whether the differences between scores on Test A and Test B were statistically significant. Please see Figure 3 for a listing of the resulting t values. Significant differences were found for performance on the following subtests: auditory word discrimination ($t = 3.53$, 4 df, $p = .05$), word reading ($t = 3.57$, 4 df, $p = .05$); visual confrontation naming ($t = 3.13$, 4 df, $p = .05$), and oral sentence reading ($t = 2.83$, 4 df, $p = .05$). Although scores on the remaining subtests differed, these differences did not reach statistical significance.

Figure 3

SUBTEST	II A	III F	III H	III K	IV A	IV B1	IV C	IV D	V C2	Total Score
t - value	3.53	3.57	3.13	2.83	2.13	2.00	2.06	1.42	1.00	4.06

Figure 3: Subtests and obtained t-test values ($p = .05$)

Several interesting patterns arose from the test results. Those subtests which yielded significantly different scores were also the subtests with the greatest number of possible points. This follows from the fact that statistical significance is more difficult to achieve with differences between very low values.

Manner of scoring also affected the results. The three subtests with the largest number of possible points (visual confrontation naming, auditory word recognition and word reading) are timed tests in which response time partially determines the score. In many cases, the subjects made correct responses on both Test A and Test B; however, on the standard BDAE the subjects required more time to scan the visual display and thus received a lower score. On the untimed subtests, the visual scanning time was not a determinant of the final score.

The reading subtests also yielded interesting results. While the word reading and sentence reading subtests produced significantly different results, differences between scores on the paragraph reading subtests were small. Many of the subjects found reading paragraphs very difficult, scoring poorly on both Test A and Test B.

The scores on the timed visual confrontation naming subtests were significantly different. The scores on the untimed written confrontation naming subtests were nearly identical for Test A and Test B. These findings may reflect the discrepancy in possible scores (96 for the visual confrontation naming subtest, 10 for written confrontation naming). The results may also have reflected the increased sensitivity of timed tasks.

In an attempt to allow comparison of score differences without the bias caused by variable possible subtest scores, the data were subjected to an additional manipulation. The mean difference of scores for each subtest was divided by the possible number of points in that subtest to yield a percentage of difference. Please see Figure 4 for a listing of the percentage values. The highest percentage of difference was found for word reading (56%), word recognition (33%), oral sentence reading (24%), word-picture matching (24%), and auditory word discrimination (22%). The word recognition and word-picture matching subtests received relatively high percentage scores, even though the previously discussed t- values did not indicate a significant difference. Low percentages of difference were found for visual confrontation naming (11%), symbol and word discrimination (16%), paragraph reading (8%), and written confrontation naming (2%).

<u>Figure 4</u>

SUBTEST	II A	III F	III H	III K	IV A	IV B1	IV C	IV D	V C2
PERCENTAGE	22	56	11	24	16	33	24	8	2

Figure 4: Subtests and obtained percentage of difference

The magnitude of difference between test scores did vary according to site of lesion. Patients with left hemianopsia showed the greatest difference between performance on Test A and Test B. The reader should recall that all of the subjects with left hemianopsia also showed some degree of unilateral spatial neglect.

These patients exhibited very little head turning during testing unless cued. The patient with the most severe visual field deficit, right hemianopsia with congenital right eye blindness, actually showed the least improvement in scores from Test B to Test A. This subject displayed a great deal of compensatory head turning during testing with both forms.

Although compensatory head turning would seem to increase post onset, no clear patterns of test results could be traced to time post onset of CVA. The subject only three weeks post stroke achieved a difference between test scores nearly identical to the patient four months post stroke. In most clinical aphasia studies, however, all of these subjects would be considered recent CVAs.

Test administration considerations were also addressed in the analysis of the study results. The adapted BDAE proved to be somewhat more clumsy to administer, primarily because of the large number of test cards. The adapted BDAE also required an average of 30 minutes longer to administer than the original test. This time can be generally attributed to materials management and responses cueing.

CHAPTER IV

DISCUSSION

The results of this study revealed that all five subjects performed better on the version of the BDAE for visual field defects than they did on the original test. The test adaptations seemed to aid subjects with both visual discrimination and scanning. The auditory/visual/verbal cueing technique used on the adapted test seemed effective in increasing compensatory head turning to the affected side. Improvement in scanning was noted particularly on the oral sentence reading and word recognition subtests. Although the form of the stimulus pictures remained the same for both test versions, the enlarged pictures used on the adapted test appeared to facilitate visual discrimination. The value of the picture adaptations is revealed by improved scores on the auditory word discrimination, visual confrontation naming, and word-picture matching subtests.

As discussed in the previous chapter, considerable variation was noted in the magnitude of difference between subtest scores. Although several subtests registered large improvements, some subtests showed only small gains. This variability indicates that the test adaptations may have been more effective for some subtests than others. The difficulty of the test task may also be responsible for the small improvements found on some subtests. For instance, subjects generally performed poorly on the paragraph reading subtest during both test administration. Because test scores on both versions were low, little difference in scores could be obtained.

The fact that performance on the adapted test was almost uniformly better than performance on the original BDAE is remarkable considering the order of test administration. Recall that the adapted BDAE (Test A) was administered first. Spontaneous recovery and therapeutic improvement would both contribute to increased scores on the second administration of any aphasia test. Nevertheless, when the unaltered form of the BDAE was administered one week following initial testing, scores were markedly decreased. Since no unusual events occurred during the intertest period, the most obvious factor to account for the score difference is the change in the test. The change as described previously, involved alterations in test form and presentation only; test content was preserved. Thus, the results of this study appear to indicate that the changes made for Test A simplified the visual scanning and discrimination task for hemianopsia patients. The adaptations, then, at least partially eliminate the bias involved in testing patients with visual field defects using the BDAE. Elimination of this bias allows the clinician to make more valid inferences regarding the patient's language processing abilities.

The potential effect of the obtained score improvements on test interpretation must be emphasized. Of course, the standardization data for the original BDAE cannot be directly applied to the adapted test due to changes in task form and presentation. Nevertheless, a glance at the percentile rankings compiled for the original BDAE reveals the possible implications of the score improvements found for the adapted test version. In some cases, the difference in scores could indicate a change in percentile rank of 50-70%. Such a difference would be clinically significant in diagnosis of both type and severity of aphasia. Using the adapted test, a clinician would be more able to make diagnostic decisions based on language processing deficits rather than peripheral visual loss.

The design of this study did not allow for analysis of the relative value of individual test adaptations. However, the complete adaptation package did appear to reduce visual scanning and discrimination difficulty. The results of this study appear to indicate that administration of the adapted BDAE, altered according to the criteria stated here, is preferable to use of the original test version when evaluating the language processing abilities of patients with homonymous hemianopsia.

Additional time and effort spent in evaluation using the adapted test is an investment in more valid and useful test results. Combined with functional communication evaluation, and vision assessment, use of the adapted BDAE is more likely to yield the clinical picture required for effective treatment planning.

The study described here is, however, limited in scope and thus in application. Much additional research is required before the testing principles presented here can confidently be generalized to the larger population of visually impaired aphasics.

Replication of this study with a larger group of subjects would aid in the generalization of results. Since only five subjects were included in this effort, individual variation may have biased the obtained results. When using a larger group of subjects, a factor analysis might be implemented to examine the value of specific adaptations (i.e., cueing, picture enlargement).

Since one clinician administered all the testing in this study, examiner bias may have also affected the test results. Replication of this study should include demonstration of interexaminer reliability.

The testing principles suggested here could theoretically be applied to any aphasia test used with patients having visual field defects. Further research efforts should examine the usefulness of these principles for adapting other commonly used aphasia tests. The use of these adapted test versions should also be considered for patients with deficits related to visual field defects. The use of cueing to the affected side seems appropriate for patients with unilateral spatial neglect, since the symptoms they display on reading tasks are very similar to those noted with homonymous hemianopsia. The use of enlarged print and distinct pictures would be likely to aid patients with many types of visual impairment. Hopefully, further research in this area will allow the design of an aphasia test specifically for visually impaired patients. Such a test would be a valuable resource for any practicing aphasiologist.

Visual field defects afflict a large proportion of the stroke patients seen for speech and language evaluation. No currently available aphasia examination is adequate to determine the language processing skills of a patient with homonymous hemeinopsia or quadrantopsia. The sparsity of research in this area to date leaves many questions unanswered for the practicing clinician who must assess visually impaired patients. This study describes several adaptations made to the BDAE which were successful in reducing visual scanning and discrimination difficulty for visually presented tasks. Although the results are somewhat useful in a narrow clinical sense, the primary value of this study is the direction it lends for further research. Hopefully, in the years to come, much research will address the complex issue of aphasia testing with visually impaired patients.

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APPENDIX

SCORE SUMMARY

SUBJECT	CVA	VISUAL FIELD DEFECT	SUBTEST IIA		IIIF		IIIH		IIIK		IVA		IVB1		IVC		IVD		VC2		TOTAL	
			VERSION A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1	Right	Left	66½	36½	30	24	98	86	9	5	10	8	8	7	10	9	5	6	10	10	241½	192½
2	Left	Right	69	55	27	22	89	67	0	0	6	7	7	7	10	8	0	0	8	7	216	173
3	Left	Blind Rt. Eye Right	70	67	29	29	96	95	9	8	9	9	8	8	10	10	6	5	10	10	247	241
4	Bilat	Left	59½	38	30	21	84	78	9	3	10	7	8	1	8	0	2	1	8	8	220½	157
5	Right	Left	65	53	29	21	96	84	6	5	10	6	8	4	10	9	6	3	9	9	235	194

SUBTESTS

Number	Title
IIA	Auditory Word Discrimination
IIIF	Word Reading
IIIH	Visual Confrontation Naming
IIIK	Oral Sentence Reading
IVA	Symbol and Word Discrimination
IVB1	Word Recognition
IVC	Word-Picture Matching
IVD	Reading Sentences and Paragraphs
IVC2	Written Confrontation Naming