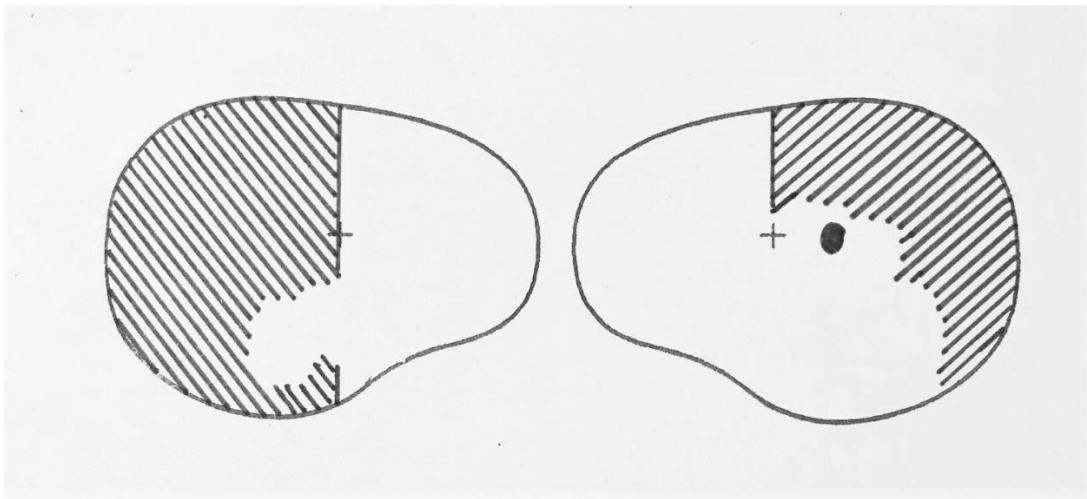


Confrontation Visual Fields

A Concise Guide for Ophthalmologists in Training

Stephen C. Pollock, MD



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Introduction

In the human brain, more neurons and synapses are devoted to vision than to any other sensory or motor function (Walsh & Hoyt's Clinical Neuro-Ophthalmology, 6th ed, 2005, p.3). Consequently, diseases affecting the brain, including brain tumors and strokes, frequently result in visual field defects, and the patterns of field loss nearly always have localizing value. Clinical testing of the visual fields is also critically important for detecting optic neuropathies, for differentiating neuropathic from retinopathic disease, and for evaluating patients with unexplained visual loss.

In spite of the above, many residency training programs offer little or no formal instruction in the proper techniques for performing a confrontation visual field. This may reflect a mistaken belief that ophthalmology residents instinctively know how to perform the test, or it may relate to the ubiquitous availability of automated perimetry. The reality is that performing automated perimetry on every patient is impractical and, in some cases, impossible (i.e., at the bedside). In addition, residents who acquire skill and experience in testing fields by confrontation will be better able to intuit what their patients are experiencing and will be better equipped to interpret the results of formal perimetry.

Type of Testing

This guide will describe the techniques for performing visual fields by confrontation, a.k.a. "confrontation visual fields." This type of test doesn't require complicated equipment and can be performed anywhere.

Duration

The screening portion of a confrontation field takes about 2 minutes to perform. If one or more defects are identified during the screening phase, defining the extent of those defects and their relationship to key landmarks necessarily requires additional time, but rarely more than 5 or 10 minutes.

Equipment

The equipment needed for visual field testing by confrontation is limited to the following:

- The examiner's hands
- A small red test object
- An ocular occluder and/or a supply of adhesive eye patches

A convenient red test object is the cap of a bottle of dilating eyedrops. The examiner holds the bottle with a thumb and forefinger and presents the cap as a target.



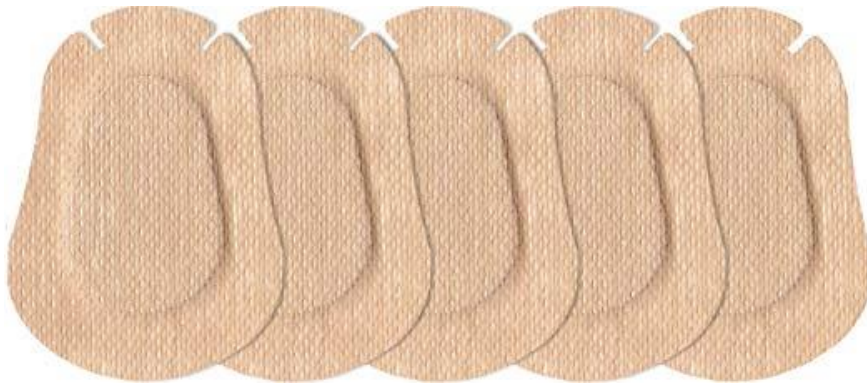
A more elegant target is a circular red disc mounted on the end of a short slender stick. The back of the disc can be white, so that the examiner can alternately present the red target and hide the red target simply by twirling the stick 180°.



The following is an example of a hand-held occluder used for covering one eye while the opposite eye is being evaluated:



An adhesive eye patch can serve as an alternative occlusive device. Use of a patch obviates the need for the patient to hold an occluder in place, thus eliminating an additional task and allowing the patient to focus all of their attention on the eye being tested.



Testing One Eye at a Time

Visual field testing should be carried out in each eye separately. During binocular viewing, the fields of the two eyes substantially overlap. Consequently, a visual field defect in one eye will still register as having normal vision when both eyes are open. The same holds true for binocular defects that occupy different positions in space. Such defects will go undetected by the examiner unless the fields are evaluated one eye at a time.

To establish a familiar routine, begin with the patient's right eye. Note, however, that an exception can be made if the vision in the right eye is significantly worse than that in the left eye. In that situation, it makes sense to reverse the usual order and begin with the better-seeing left eye. This will enable the patient to learn what's expected of them and to become comfortable with the testing procedure before moving on to the more challenging eye.

Occlusion of the Fellow Eye

As noted above, the eye *not* being tested should be covered, either by placing a patch over it or by having the patient hold an occluder over it. If a patch is used, position it diagonally and apply it so that it bows slightly outward, which keeps the underside of the patch from rubbing on the patient's eyelashes.

Young, healthy adults typically have no difficulty closing one eye or positioning an occluder over one eye while undergoing evaluation of the visual field of the opposite eye. By contrast, asking patients who are elderly or who have some degree of cognitive impairment to simultaneously: *a)* hold an occluder over one eye, *b)* maintain fixation with the other eye, *c)* process the examiner's instructions and questions, *d)* observe targets in their peripheral field, and *e)* describe what they see or don't see is akin to having them ride a unicycle on a high wire while juggling bowling pins and singing show tunes. Use of a patch is preferable in such patients.

Fixation

The examiner should instruct the patient to look directly at the examiner's eye during the test. The target eye should be the one directly across from the patient's eye. When the patient's *right* eye is being tested, the patient should be instructed to look directly at the examiner's *left* eye. Conversely, when the patient's *left* eye is being tested, the patient should be instructed to look directly at the examiner's *right* eye. Fixation on the "mirror-image eye" of the examiner results in perfect correspondence between the patient's visual field and the visual field of the examiner. For example, when testing the patient's *right* eye, the patient's temporal field is superimposed on the temporal field of the examiner's *left* eye, and the patient's nasal field is superimposed on the nasal field of the examiner's *left* eye. Thus, the examiner's visual field naturally serves as a normal control.

Note, too, that when the patient fixates on the examiner's eye, the visual axes of the patient and the examiner are colinear, which makes it easy for the examiner to assess the adequacy of fixation and to detect any losses of fixation.

CAVEAT: *Having a patient use the examiner's nose as the fixation target is strongly discouraged. Doing so would disrupt the correspondence between the patient's field and the examiner's field. Furthermore, it would make it difficult for the examiner to determine the adequacy of fixation or the position of the major perimetric landmarks (e.g. vertical meridian, horizontal meridian, physiologic blind spot).*

The Plane of Testing

In order to obtain an accurate assessment of the patient's visual field, all test objects must be presented such that their distance from the patient is identical to their distance from the examiner. The examiner should imagine a vertical plane that bisects the space between herself and the patient. Objects presented within this "plane of testing," whether stationary or in motion, will always be equidistant from both individuals.

The importance of operating within the plane of testing cannot be overstated. Doing so ensures that the position of the test object in the patient's visual field is identical to the position of the object in the examiner's field. This topographic correspondence means that the examiner always knows exactly where the object is located in the patient's visual field, based on the examiner's own perception of the object's location.

CAVEAT: *The adverse impact of testing outside of the test plane can best be demonstrated by example. Imagine that the examiner presents a target in the patient's upper temporal field, but the positioning of the target is such that it's closer to the examiner than it is to the patient. The patient will perceive the target to be smaller and closer to fixation than the examiner perceives it to be. Conversely, the examiner will perceive the target to be larger and farther away from fixation than the patient perceives it to be. The patient's field and the examiner's field no longer correspond to one another.*

Basic Screening Protocol

Screening for the presence of defects is the initial objective when performing a confrontation visual field test. While recommendations may differ regarding the basic components of a screening exam, the following maneuvers are commonly carried out:

PERIPHERAL: ■ Test the patient's ability to count fingers in all four quadrants

CENTRAL: Use a red test object to:
■ compare sensitivity across the vertical meridian
■ locate and define the physiologic blind spot

First, explain to the patient that you're going to be evaluating their vision, one eye at a time. Then occlude one of the patient's eyes, either with a patch or by having the patient hold an occluder. (During the test, you should of course close your own eye — the one directly across from the patient's occluded eye). Instruct the patient to "Look straight at my eye" while pointing an index finger at your open eye. You may want to add "Keep looking directly at my eye, even if I show you things off to the side."

Test Ability to Count Fingers. Position both hands, fists closed, below the horizontal meridian, with one hand in the patient's right lower quadrant and the other hand in the patient's left lower quadrant. In just one quadrant, display 1, 2 or 5 fingers, and

simultaneously ask “*How many fingers do you see?*” After the patient responds, close that hand, then display 1, 2 or 5 fingers in the other lower quadrant, asking “*How many now?*” Repeat this sequence in the two upper quadrants.

TECHNICAL TIPS:

Each hand should be situated no more than 30° to 35° from fixation. Presenting fingers more peripherally than this makes it difficult for anyone, including normals, to provide reliable responses.

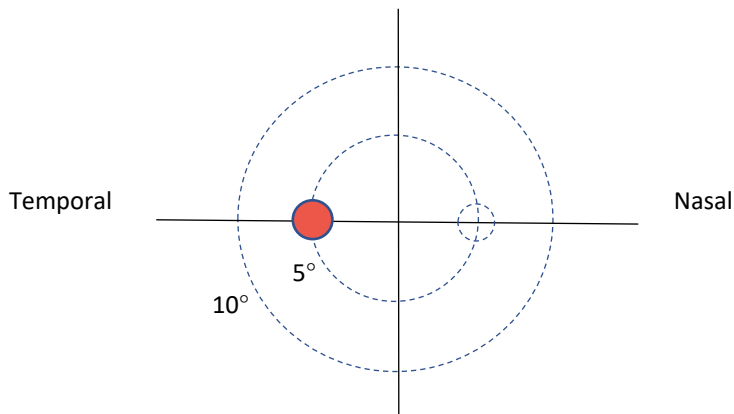
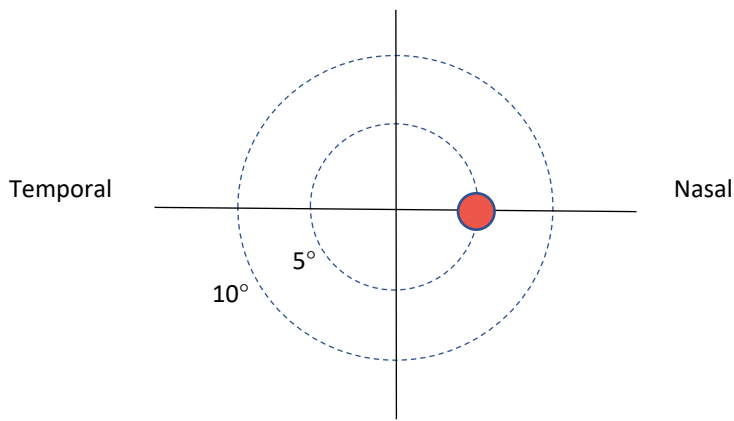
Avoid displaying three fingers or four fingers. Attempting to show three fingers can challenge the dexterity of the examiner. In addition, many patients with normal vision experience difficulty distinguishing three fingers from four in their peripheral fields.

Make sure that your palm is *facing the patient’s eye*. In this way, you ensure that your finger display will always be perpendicular to the patient’s peripheral line of sight, i.e., perpendicular to the line extending from the patient’s eye to your hand. Any other hand position is problematical. If your fingers were to point toward the patient’s eye, or if your hand positioning was such that the patient could see your fingers only from the side (with the result that the closest finger would block one or more of the others), you would inadvertently be creating conditions that favor a delayed or inaccurate response, regardless of whether or not the patient’s vision is normal.

If a patient provides an incorrect response in one quadrant, simply make a mental note of it and continue testing until all four quadrants have been assessed. Do not say “*Are you sure?*”, and do not immediately re-test the questionable quadrant. Doing so would interrupt the screening sequence, alert the patient that something may be wrong, heighten their anxiety level, and create an incentive for them to guess or to glance away from the fixation target. Once all four quadrants have been screened, it’s OK to re-test the suspicious quadrant to determine if a deficit truly exists. As will be discussed later in the guide, detection of a field defect during screening obligates the examiner to further evaluate the defect — its size, its shape and its relationship to key perimetric landmarks.

Compare Sensitivity Across the Vertical Meridian. Having screened the periphery, attention can now be turned to the central portion of the field, a circular area extending roughly 15° from fixation in each direction. A red test object is useful for screening within this area for two reasons: 1) its small size facilitates detection of smaller defects, and 2) impaired perception of the color red is a sensitive indicator of localized abnormalities within the central field.

The simplest maneuver is to have the patient compare their perception of red on either side of fixation. Remind the patient to *“keep looking straight at my eye.”* Begin by presenting the red target about 5° nasal to fixation, and ask the patient what color they see. After they respond, move the target to a position about 5° temporal to fixation, and again ask what color they see. Normal responses, of course, are *“red”* and *“red.”* If this is what the patient reports, ask if the red appears equally vivid and bright on both sides. In a normal patient, one expects an affirmative response.



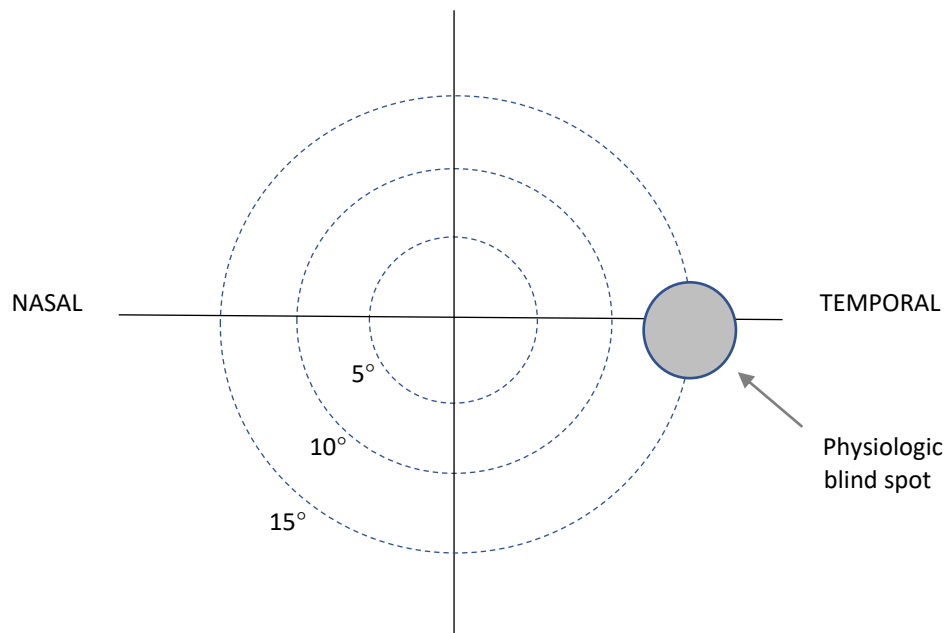
When defects are present, the patient may respond that the target looks “pink” or “gray” or “dark” on either the nasal or temporal side. They may even report that they can’t see it at all on one side. As was mentioned earlier, detection of a field defect during screening obligates the examiner to further evaluate the defect with respect to its size, its shape and its relationship to key perimetric landmarks. The techniques for further defining defects in the central field will be covered later in the guide.

TECHNICAL TIPS:

Moving a target within the central visual field in full view of the patient is an almost irresistible invitation for the patient to begin following the target instead of maintaining steady fixation. So as to prevent this from happening, be sure to keep the target hidden from the patient’s view during movement — whether you’re moving the target into its initial position or moving it to a different location in the field. If you’re using an eyedrop bottle, obscuring the red cap can be accomplished by rotating the bottle 90° toward yourself (i.e., away from the patient) so that the cap is blocked by the bottom of the bottle and/or by your fingers. If you’re using a red disc mounted on a short stick, the disc can be obscured as described above, or alternatively, it can be hidden by twirling the stick so that the red side of the disc faces away from the patient and toward you.

In addition to hiding the red target when moving from a nasal location to a temporal location and vice-versa, you also should avoid moving the target in a straight line along the horizontal meridian. Moving your hand in this way would temporarily block the patient’s view of your eye, interrupt fixation, and may prompt the patient to follow your hand. Instead, when moving the target from one side to the other, execute a U-shaped excursion or “swoosh” just below fixation.

Locate and Define the Physiologic Blind Spot. The final screening step is to locate and map the patient’s physiologic blind spot. The blind spot corresponds to the position of the optic nerve head (optic disc) at the back of the eye. In normal individuals, it subtends an angle of about 6° and is centered approximately 15° temporal to fixation and slightly below the horizontal meridian:



Evaluating the physiologic blind spot has numerous advantages:

- It permits detection of pathologic enlargement, which occurs in the setting of papilledema and other forms of optic disc swelling.
- It serves as a check on the plane of testing, i.e., it serves to confirm that the targets you're presenting are equidistant from you and the patient.
- It enables you to visualize a polar coordinate system superimposed on the central field, which makes the mapping of central defects more precise.

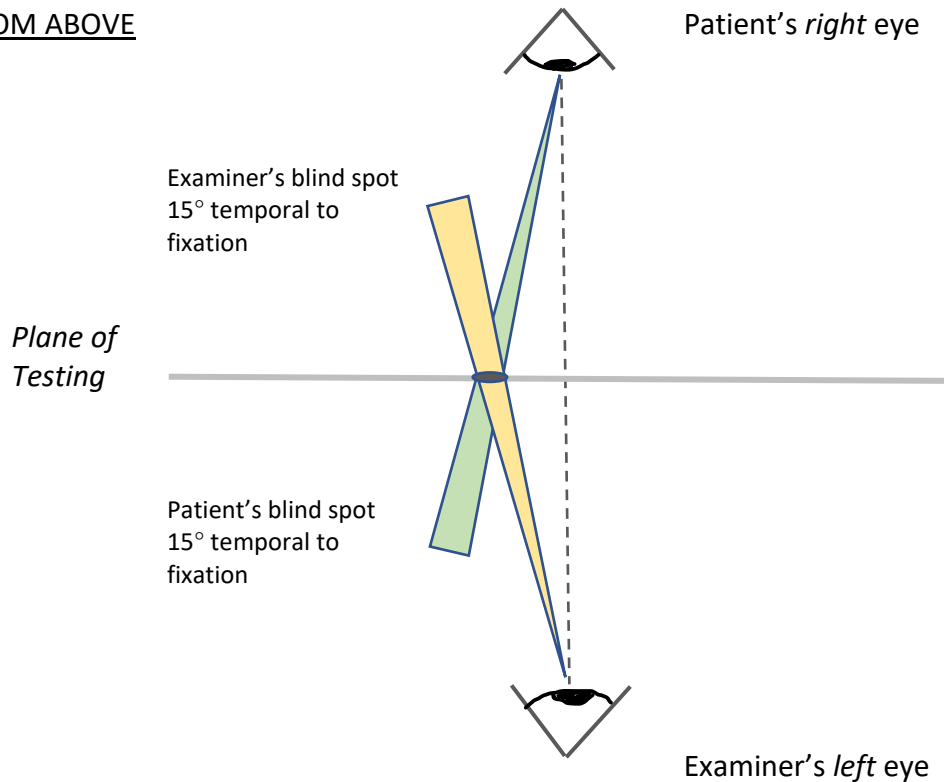
Start by presenting the red target midway between fixation and the blind spot. Remind the patient to keep looking straight at your eye. Slowly move the target in the temporal direction. As you do, instruct the patient: *"Tell me when the red target disappears"* (or *"Tell me if the red target seems to go away"*). Once the patient notifies you that they can no longer see it, stop moving the target and say *"Tell me when it comes back"* (or *"Tell me when you can see it again"*), then resume slowly moving the target temporally. As soon as the patient reports that they can see it again, move the target back into the blind spot, and verify by asking *"Gone again?"* You can then map the upper and lower limits of the blind spot in the same manner — first moving the target upward until it's seen, then returning it to the blind spot, then moving it downward until it's seen.

If the evaluation of the blind spot is being performed properly, and in particular, if the red target is consistently presented within the plane of testing, then the experience of the examiner will mirror that of the patient. When the patient reports that the target has disappeared, you will simultaneously note the disappearance. And when the patient reports that the target has come back into view, you will see it re-emerge at the same time. If this is NOT the case, the most likely explanation is that the red target is NOT being presented in the plane of testing, i.e., the target is not equidistant from you and the patient. There are two possibilities:

- 1) The target is closer to the patient than to you. In this situation, the patient will report that the target has vanished while you still perceive it.
- 2) The target is closer to you than to the patient. In this situation, you will lose the target in your blind spot while the patient still sees it.

In either case, you'll need to adjust target distance so that your blind spot and the patient's blind spot perfectly overlap. This condition is met only within the plane of testing:

VIEW FROM ABOVE



The third advantage of evaluating the patient's physiologic blind spot is that it enables you to visualize a set of coordinates covering the central portion of the visual field. This polar coordinate system includes meridional lines — principally the horizontal and vertical meridians, which intersect at the point of fixation — as well as a scale of degrees along each meridian. Armed with this mental image superimposed on actual space, you will be able to map the location and extent of central defects to an accuracy of $\pm 3^\circ$, which approaches the accuracy afforded by automated (computerized) perimetry.

With the red target situated within the patient's blind spot (and yours), note the distance between the target and fixation. That distance corresponds to 15° of *temporal* field along the horizontal meridian. Now mentally subdivide that 15° segment into three equal parts, the first part extending 5° from fixation, the second extending 10° from fixation, and the third extending 15° from fixation. You now have a quantitative scale. It then becomes a simple matter to picture an equivalent horizontal scale on the *nasal* side of fixation: 5° , 10° and 15° . Finally, imagine taking an imprint of the horizontal meridian and rotating it 90° so as to create an equivalent vertical scale, one that extends 15° above fixation and 15° below fixation. Any visual field defects identified within the central visual field can now be mapped with respect to a quantitative and remarkably accurate system of spatial coordinates.

Methods of Further Defining Defects

If no visual field defects have been identified during the screening process, then the examination is complete, and the medical record can reflect "Confrontation fields full," or "Visual fields full to confrontation."

However, if one or more abnormalities have been detected during screening, it's incumbent on the examiner to fully characterize each abnormality. The questions you need to address include the following:

- How extensive is the defect, i.e., how much area does it cover?
- What are its relationships to the key perimetric landmarks — vertical meridian, horizontal meridian, fixation, and the physiologic blind spot?
- Is it absolute or relative?

Extent of the Defect. For defects that are enclosed on all sides by normal field and thus qualify as scotomas, you can explore the size of the defect by positioning an appropriately sized target within the non-seeing area, then slowly moving it outward until the patient reports

visualization of the target. Repeat this in several directions (right, left, up and down, at a minimum) to obtain a clear sense of the size and shape of the scotoma.

On the other hand, if the defect is *not* enclosed and instead is continuous with non-visual space outside the limits of the normal field, you can position a hand or finger in this peripheral nether region and slowly move toward fixation until the patient reports visualization. This can be repeated along several radial meridians.

CAVEAT: *Avoid using a small red test object to define defects in the periphery of the visual field. Color perception is primarily a central (macular) function, and regardless of color, small targets are difficult for anyone to perceive in the far periphery.*

Relationship to Key Perimetric Landmarks. Localizing the pathologic lesion responsible for a visual field defect depends in large part on the relationship between the defect and the major landmarks: the vertical meridian, the horizontal meridian, the point of fixation, and the physiologic blind spot. It's particularly important to determine whether or not a newly discovered defect ends abruptly at the vertical meridian, i.e., "respects the vertical," since such defects nearly always reflect the presence of intracranial disease.

For example, if a patient is unable to count fingers or perceive your hand in the upper temporal quadrant of their right eye, explore respect for the vertical by positioning your left hand in that quadrant with your index finger pointing upward toward the ceiling. Slowly move your vertical finger nasally, toward the vertical meridian, while instructing the patient to tell you as soon as they see your finger. If they report seeing the finger just as the edge of it reaches the vertical, it's highly likely that the defect is hemianopic in character, either bitemporal or homonymous.

Assume for the moment that the upper temporal field defect in the patient described above does indeed respect the vertical meridian. You'll then want to determine whether or not the defect breaks at the horizontal meridian as well. Explore this by again placing your left hand in the patient's upper temporal quadrant, this time with your index finger positioned horizontally. Slowly move your finger downward while instructing the patient to notify you as soon as they see your finger. If they report seeing the finger just as the edge of it reaches the horizontal meridian, then the defect conforms to a quadrantanopia. On the other hand, if the finger isn't seen until it's well below the horizontal, then the defect represents an incomplete hemianopia, denser above. Of course, determining whether the defect is bitemporal or homonymous will depend on the findings in the fellow eye.

Be aware that bitemporal hemianopias may involve the central visual field exclusively. These so-called “central bitemporal defects” can be associated with essentially normal peripheral fields. They are identified by their strict respect for the vertical meridian. If you identify a temporal defect during screening of the central visual field, be sure to use the red target to assess the relationship of the defect to the vertical meridian.

Some homonymous defects also reside exclusively in the central portion of the visual field. Such defects, termed “homonymous hemianopic scotomas,” tend to be dense, paracentral, and highly congruous. Though not all of these defects extend to the vertical meridian, most do, and some also respect the horizontal meridian. Use the red test object to map defects of this type.

Finally, it’s important to recognize that visual field defects resulting from optic nerve disease often connect to the physiologic blind spot. Some, such as cecocentral scotomas, extend from the blind spot to involve fixation. Others, referred to as arcuate defects, appear to originate from the upper or lower pole of the blind spot and fan out nasally in the shape of a scimitar. To accurately map these types of central defects, use a small red test object. For optic nerve related defects that are large and involve the periphery (e.g. altitudinal field loss), it’s preferable to use your hand and/or your index finger to explore the extent of the defect.

TECHNICAL TIP:

It can be challenging to map central scotomas or cecocentral scotomas. Patients with these defects may exhibit unstable fixation, especially if their visual acuity is 20/200 or less. An eye that won’t stay still — and by implication a scotoma that won’t stay still — can frustrate your attempts to map the defect margins with a small red target.

In these situations, instruct the patient to *“Look straight at my eye,”* and then ask them *“When you’re looking right at my eye, can you see the eye or does it become blurred or disappear?”* If the patient responds that the eye becomes blurred or that it disappears altogether, you have successfully documented the presence of a central scotoma.

(You might wonder how the patient can look straight at your eye if they can’t see it. The answer is that most patients can intuit the location of your eye from the portions of your face that remain visible — ear, nose, forehead, cheek, plus the other eye).

Relative vs. Absolute Defects. In addition to size and shape, visual field defects possess the property of *depth*. The depth of a defect is the degree to which sensitivity to visual stimuli is reduced within the boundaries of the defect. The reduction in sensitivity ranges from very mild to complete loss of ability to perceive even the strongest stimulus.

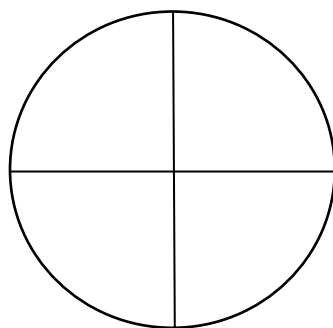
If sensitivity is depressed within a defined area but the patient still has residual vision in that area (e.g. blurred outlines of objects), the defect is said to be *relative*. By contrast, if vision is completely absent in the involved area, the defect is described as *absolute*.

Note that some visual field defects incorporate both relative and absolute components. For example, a large central scotoma resulting from optic neuritis or from a compressive lesion of the optic nerve may be absolute at its center but may be relative further away from fixation. Such defects are said to have sloping margins.

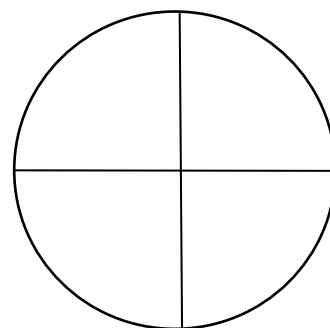
Recording Test Results

When recording the results of your visual field examination in the medical record, it is essential to represent the field *from the patient's point of view*. There are no exceptions to this rule. The field positioned on the right represents the field of the patient's right eye, while the field positioned on the left represents the field of the patient's left eye.

Two types of templates exist for recording the results of confrontation visual fields. The simplest (but least satisfactory) template consists of a pair of circles divided into quadrants:



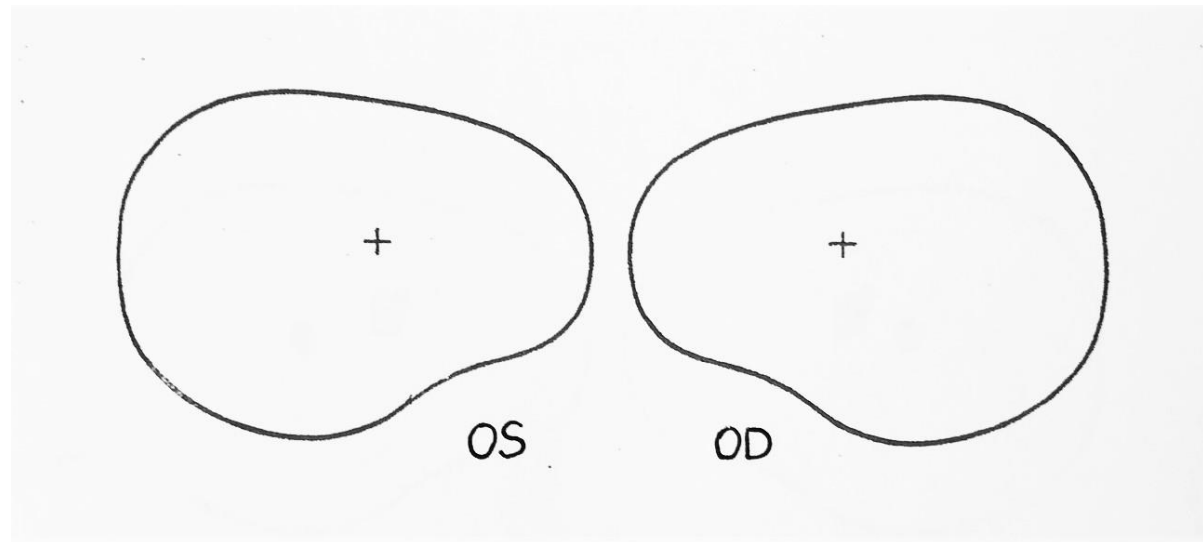
Patient's Left Eye (OS)



Patient's Right Eye (OD)

The obvious problem with the template shown above is that the monocular visual field of human beings is not circular. In normal individuals, the superior field extends 55° to 60° from fixation, the nasal field extends 60° to 65° from fixation, the inferior field extends 70° to 75° from fixation, and the temporal field extends 90° to 95° from fixation.

A template that's more representative of reality is shown below:



This is the template that will be used for the Mini Atlas of visual field defects that appears at the end of the guide.

Screening Variations

The basic screening protocol outlined on pages 6 through 12 represents a sensible, efficient and commonly used approach. That said, some clinicians prefer to employ alternative techniques when performing a confrontation visual field. Some of these alternatives are listed briefly below:

Alternative Peripheral Techniques

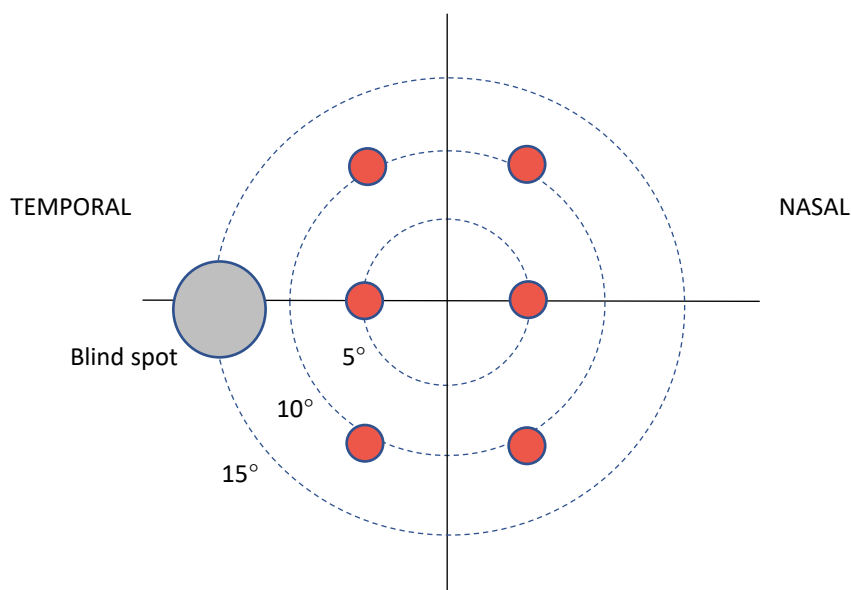
- Hold up both hands, one in a temporal quadrant and one in the corresponding nasal quadrant, and simultaneously display 1 or 2 fingers with each hand. Ask the patient *"How many total fingers am I holding up?"* This technique has the advantage of screening for the phenomenon of extinction as well as for the presence of peripheral field defects. If the patient provides an incorrect response, each quadrant will need to be assessed individually in order to distinguish between field loss and extinction. (Anderson AJ et al. *Clin Exp Optom* 2009; 92:1:45-48).
- Wiggling fingers. Position one hand in a quadrant and instruct the patient to tell you when they see your finger start to wiggle. After a pause, wiggle your index finger.

A variant of this technique is to hold up both hands, one in a temporal quadrant and one in the corresponding nasal quadrant, then wiggle the index finger of just one hand and ask the patient to identify which finger is wiggling.

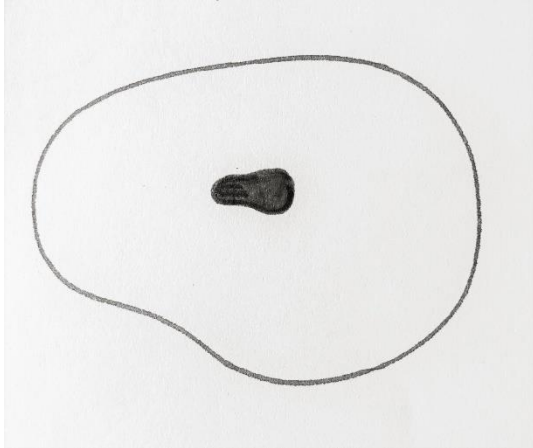
- Kinetic testing of the outer boundaries of the field. This technique involves positioning a hand or finger outside the limits of the normal visual field (i.e., within non-visual space), then moving it inward toward fixation until the patient reports seeing the target. This maneuver is repeated along multiple meridians for 360°. The process is time-consuming, technically cumbersome (the examiner has to reach beyond 90° to map the outer margin of the temporal field!), and yields no information about defects that are fully enclosed by normal field.

Alternative Central Technique

- **Enhanced Testing of Sensitivity Across the Vertical Meridian.** Screening the central visual field by having the patient compare their perception of red on either side of the vertical meridian was described on page 8 of the guide. Recall that the red target is first presented about 5° nasal to fixation and then about 5° temporal to fixation. Both target locations lie on the horizontal meridian, which is adequate for detection of most cecocentral defects and paracentral hemianopic defects. However, using two test sites will not reliably detect arcuate defects or homonymous hemianopic scotomas that don't extend to the horizontal meridian. In order to enhance the sensitivity of the testing protocol, consider increasing the number of test sites from two to six — two on the horizontal meridian, two about 10° above the horizontal meridian, and two about 10° below the horizontal meridian:

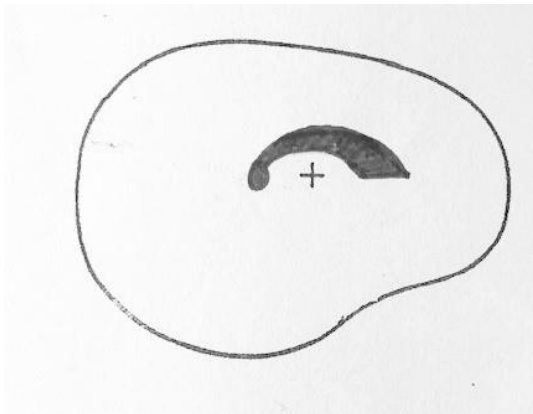


Mini Atlas of Visual Field Defects



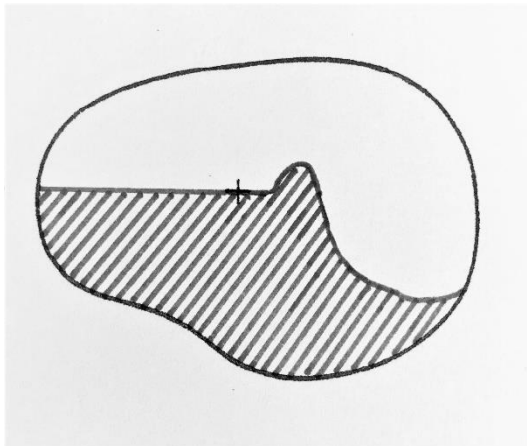
Defect Type: Cecocentral

Localizes to: Optic nerve



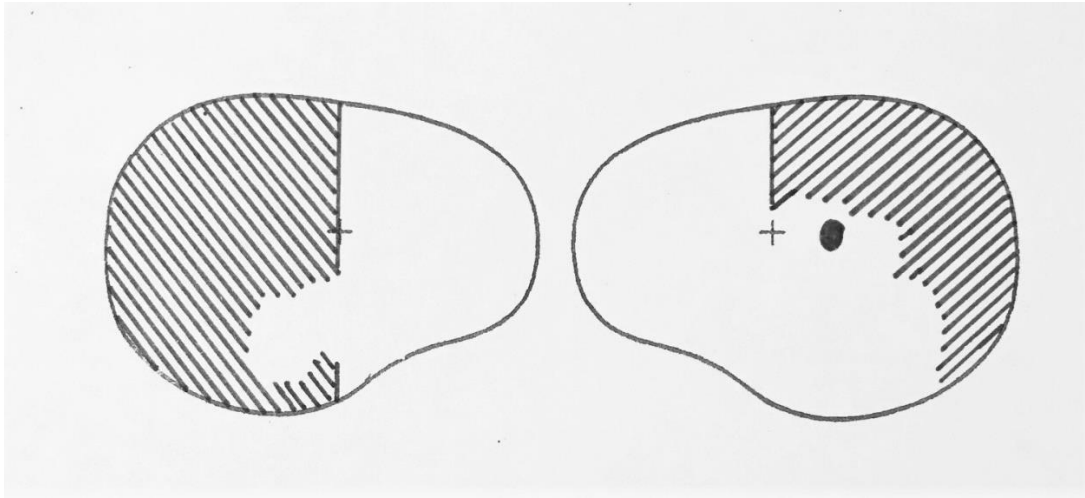
Defect Type: Superior arcuate

Localizes to: Optic nerve



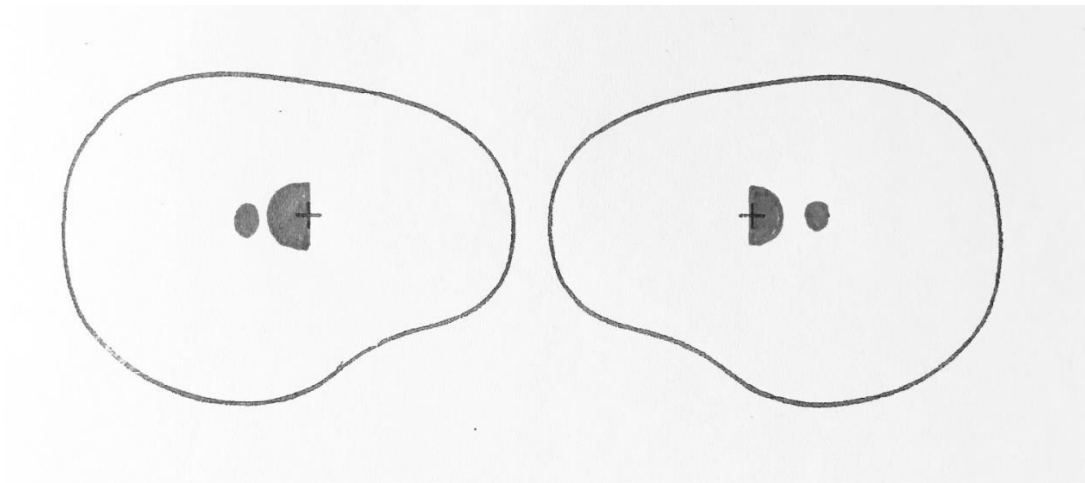
Defect Type: Inferior altitudinal
(incomplete)

Localizes to: Optic nerve



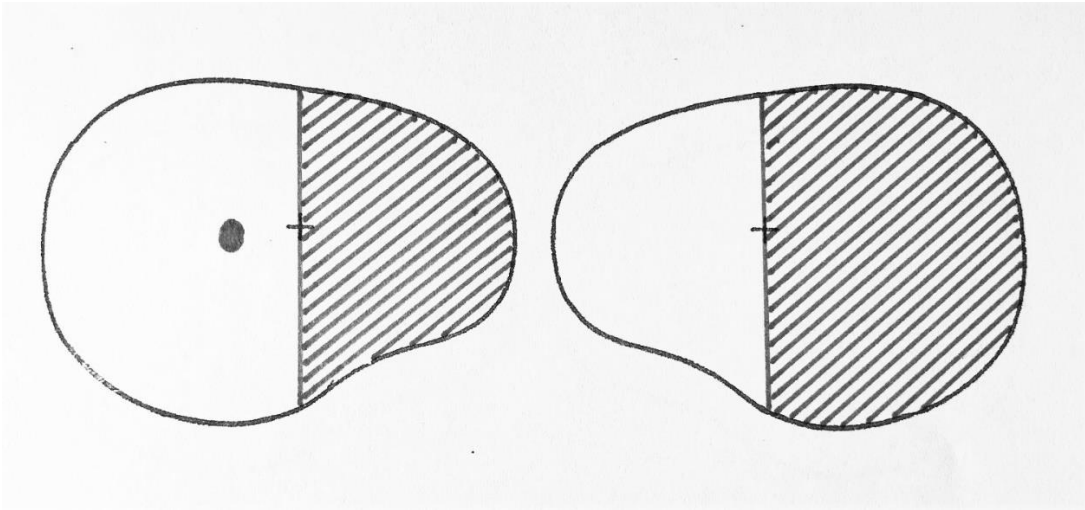
Defect Type: Bitemporal hemianopia (incomplete)

Localizes To: Optic chiasm



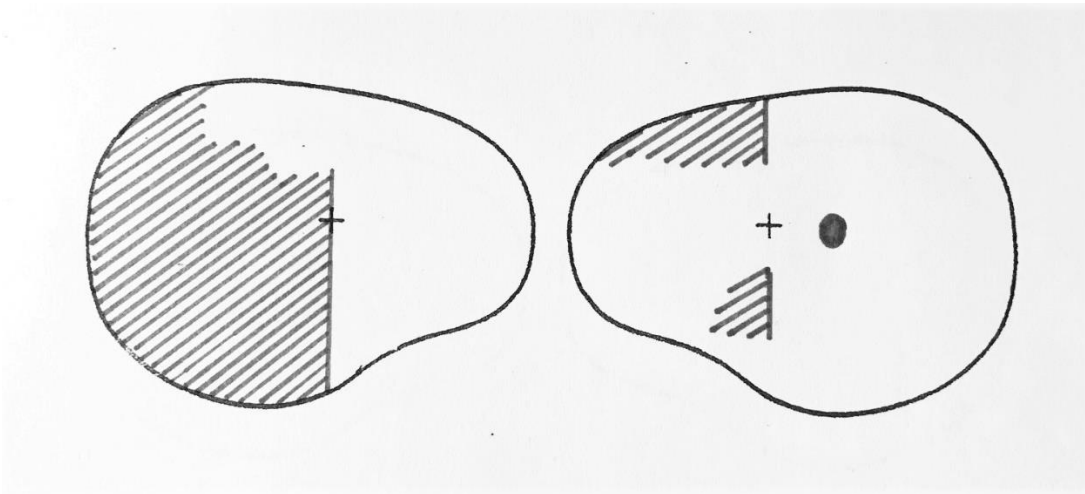
Defect Type: Central bitemporal hemianopia

Localizes To: Optic chiasm



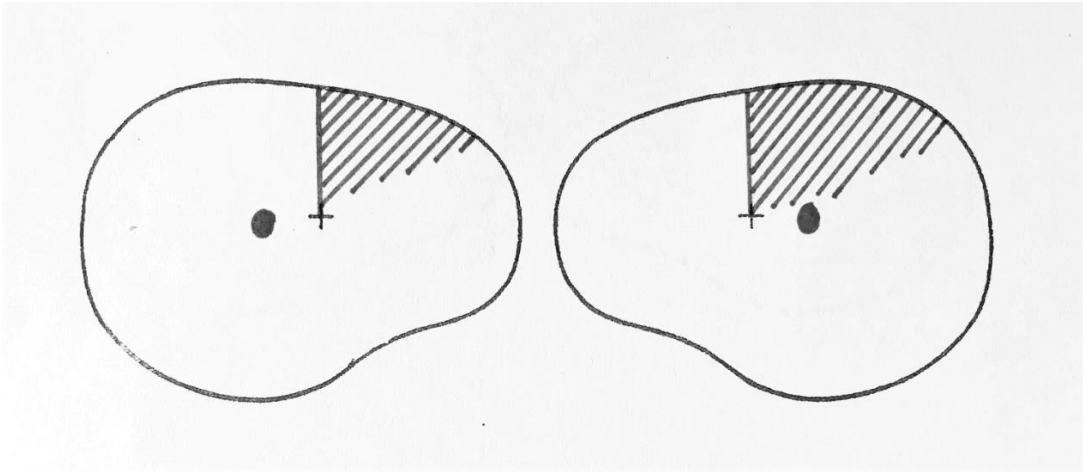
Defect Type: Complete right homonymous hemianopia

Localizes To: Retrochiasmal pathways on the left
(otherwise non-localizing)



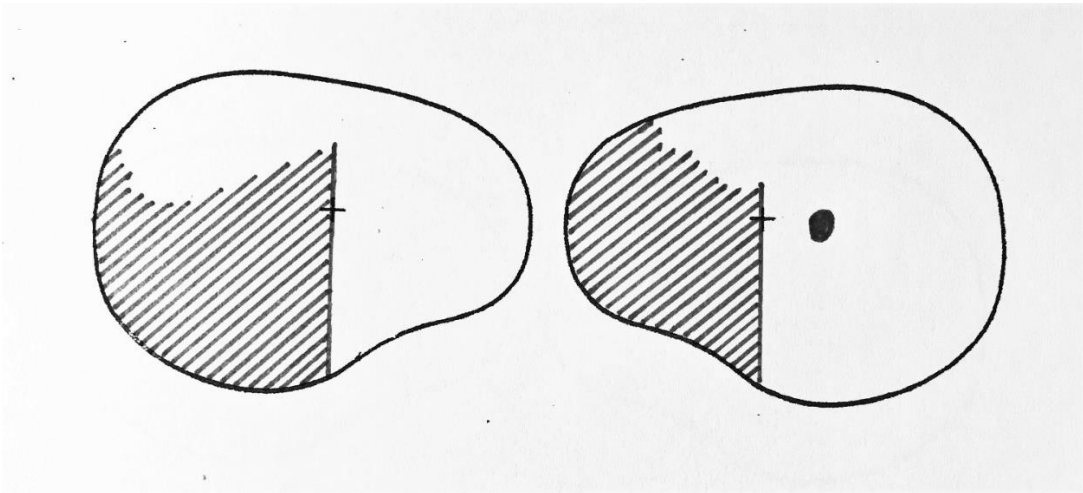
Defect Type: Highly incongruous left homonymous hemianopia

Localizes To: Right optic tract



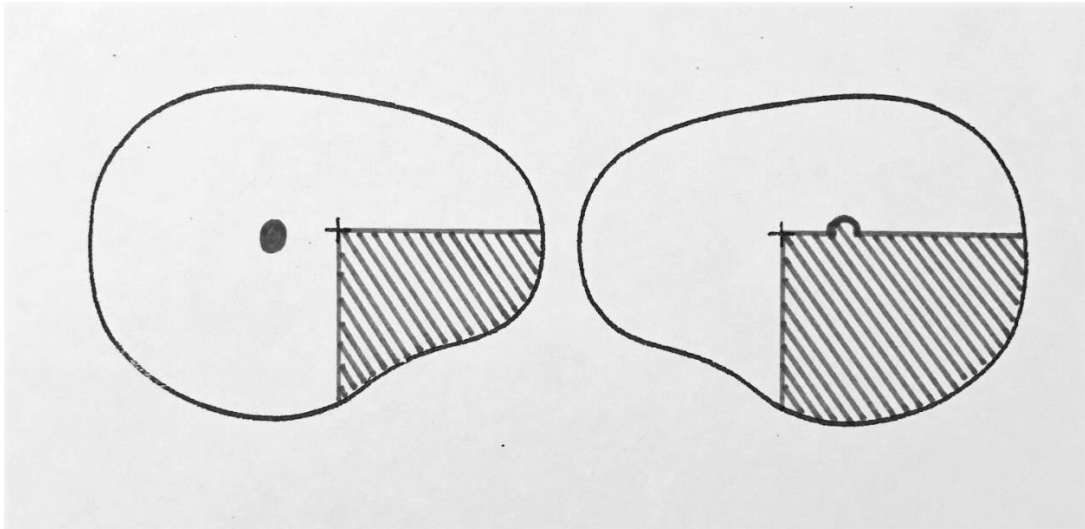
Defect Type: Right homonymous hemianopia, denser above (“pie in the sky”)

Localizes To: Optic radiations, left temporal lobe



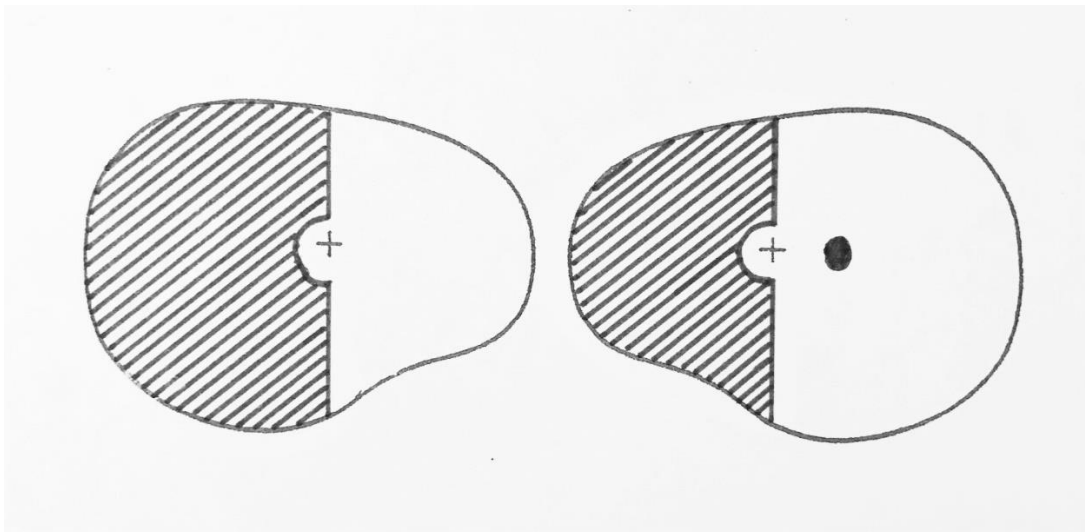
Defect Type: Left homonymous hemianopia, denser below

Localizes To: Optic radiations, right parietal lobe



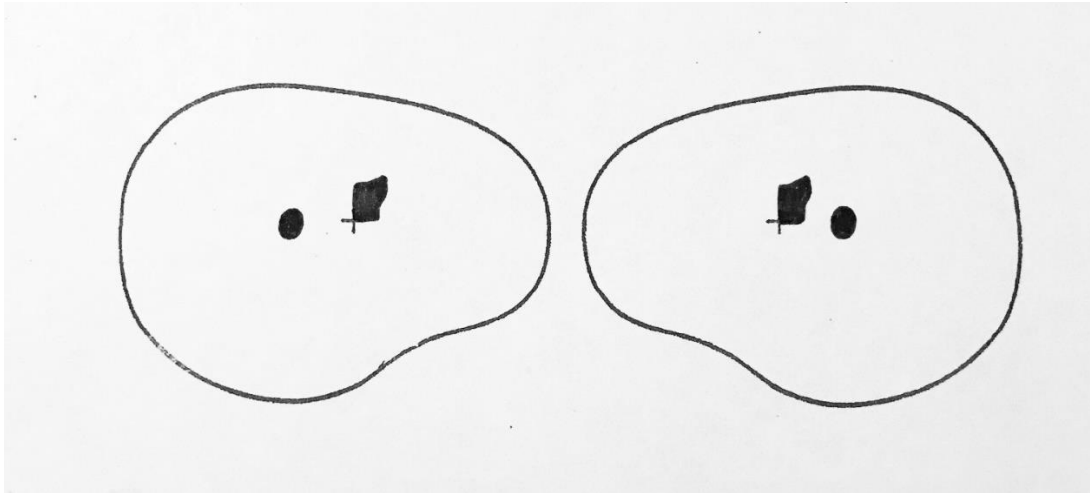
Defect Type: Right inferior quadrantanopia

Localizes To: Occipital lobe, left upper calcarine bank



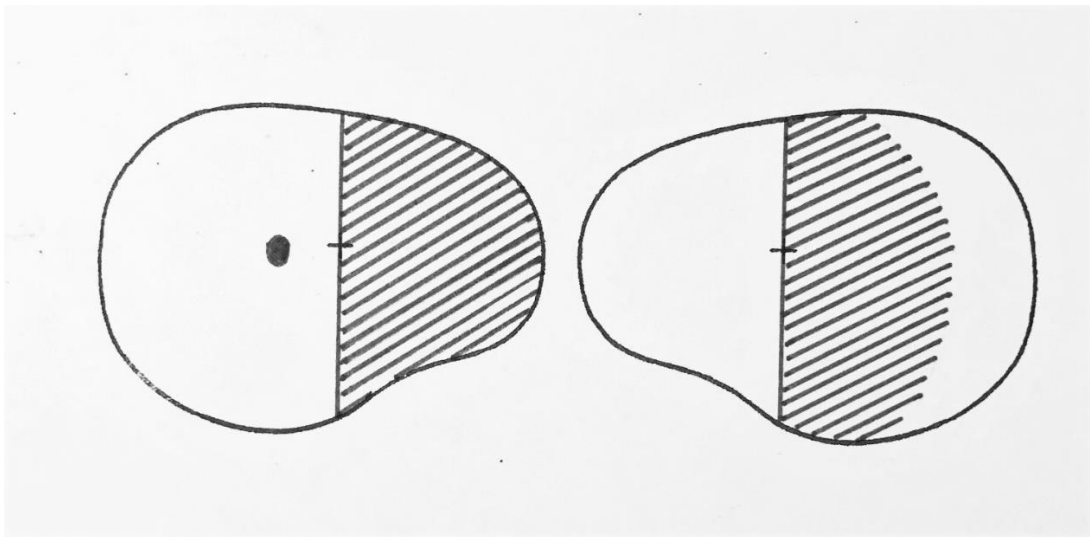
Defect Type: Left homonymous hemianopia with macular sparing

Localizes To: Right occipital lobe, sparing the pole



Defect Type: Homonymous hemianopic scotoma, right upper quadrant

Localizes To: Left occipital pole, lower calcarine bank



Defect Type: Right homonymous hemianopia with sparing of the temporal crescent

Localizes To: Left occipital lobe, with sparing of the anterior calcarine cortex surrounding the parieto-occipital sulcus