# ADVANCED VISUAL FIELDS

2023 June
CSO 201 advanced

# Kinetic Colour Fields

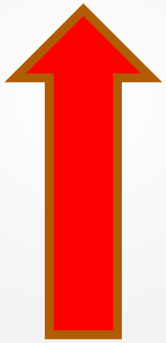
- How much of it is Evidence based or just historical?
- What are we testing when we do the kinetic functional fields?
- What story do they tell when we analyse them?

- How did they come up with the Colours & Meanings in Colour field testing?
- What evidence can we use to justify the explanations?

## Simon's Hypothesis!

# Visual information

- There are 3 channels for visual information processing.
  - Motion
  - Form
  - Colour



**Order of deterioration**

# Visual processes

- **Transmission:** The physics of light and optics of eye.
- **Transduction:** The retinal activity & organization
- **Perception:** The visual pathways & Visual cortex
- **Projection:** The external reality we create.

# Part 1

PERGAMON

Vision Research 41 (2001) 1459–1474

Vision Research

www.elsevier.com/locate/visres

To elucidate the neuroanatomical basis of their residual visual functions, we used fMRI in two hemianopic patients, FS and GY. In the first experiment, a rotating spiral stimulus was used to assess the responsiveness of dorsal stream areas. **Although no response was detectable within denervated or destroyed early visual cortex, motion-sensitive areas (hMT+ /V5) ipsilateral to the lesion showed a strong sustained hemodynamic response. In Px GY, this activation was at least as strong as that of his contralesional hMT+ /V5 to the stimulus in the normal hemifield.**
In the second experiment, coloured images of natural objects were used to assess the responsiveness of ventral stream areas. Again, no activity was detectable in ipsilesional early visual areas, **but extrastriate areas in the lateral occipital cortex (hMT+ /V5 and LO) and within the posterior fusiform gyrus (V4/V8) showed a robust sustained hemodynamic response**.

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# Motion

- Things noted from the study:
  - Retinal function intact.
  - Sensory signals still active.
  - Consciously not aware of stimulus.
  - Noticed Motion detection **(hMT+ /V5)**.

- In Colour field testing
  - Retina healthy,
  - Visual pathway healthy
  - Field of awareness sensitivity reduced.

# Part 2

# Acquired Colour Vision

- How many of you do Colour vision testing?
- What instruments do you use?

- What do you know about acquired CV?

# CV deficiency

- **Red-Green** colour blindness passed down on the X chromosome,
- Issue more common in men less in women.

- **Blue-yellow** colour blindness and complete colour blindness are passed down on other chromosomes,
- Affects males and females equally.

# Defects of colour vision: A review of congenital and acquired colour vision deficiencies

- Nabeela Hasrod, Alan Rubin
- https://avehjournal.org/index.php/aveh/article/view/365/648

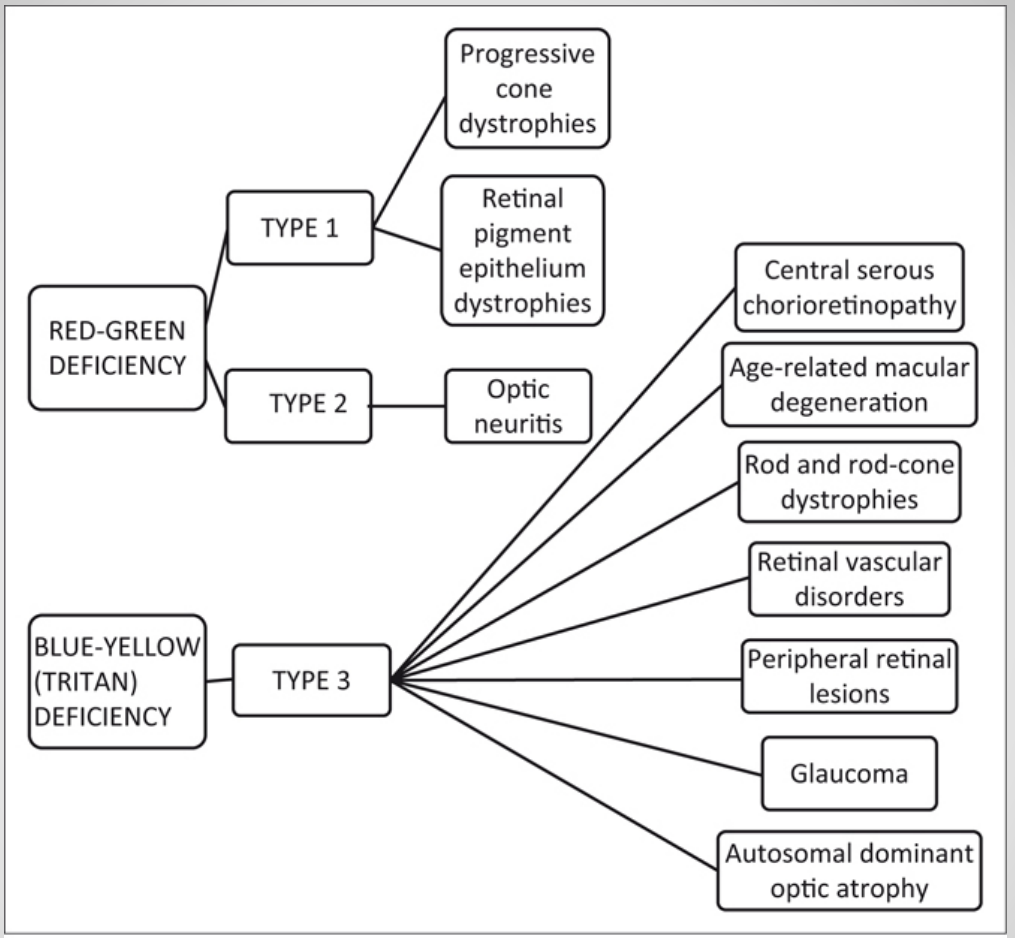



**FIGURE 2:** Flow diagram illustrating the classification of acquired colour vision deficiencies and associated ocular pathologies.

# Acquired CV deficiency

# Acquired CV deficiency

classified as

- Type 1 or Type 2 red-green deficiencies and Type 3 blue-yellow colour deficiency.

**Can this help explain Colour Fields analysis?**

- **Type 1** exhibits protan deficiency characteristics with an altered **protan** spectral luminosity function.
- **Type 2** acquired red-green colour defects are similar to a **deutan** deficiency.
- **Type 3** is a tritan-like defect, sometimes also referred to as **blue-yellow** defect as well as variable deviations in visual acuity.

# What diseases or injuries cause acquired colour blindness

- Colour blindness can also happen if your eyes or the part of your brain that helps you see colour gets damaged.

This can be caused by:

- Eye diseases, like glaucoma or macular degeneration
- Brain and nervous system diseases, like Alzheimer's or multiple sclerosis
- Some medicines, like Plaquenil (a rheumatoid arthritis medicine)
- Eye or brain injuries
- Your colour vision may also get worse as you get older, especially if you get a cataract.

- Kollner's rule.
- Which may be applied to acquired colour defects, states that **acquired blue-yellow colour defects** are the result of changes in the ocular media, choroid and diseases occurring in the outer retinal layers. **[VASCULAR conditions-Systemic]**
- whilst acquired red-green defects are the result of changes in the optic nerve and more inner parts of the visual pathway.
  **[Neuronal conditions – Inflammation-Focal]**
- This rule is useful for the early stages of a condition; however, because of the nature and progression of acquired colour defects, it may not apply when the disease has progressed to an advanced stage.

# Glaucoma

- At the early stages will show Blue Yellow deficiency. (systemic)
- Late stage Red Green deficiency. (Localised disease)

- **Evaluation of Acquired Color Vision Deficiency in Glaucoma Using the Rabin Cone Contrast Test**
- Yuichi Niwa; Sanae Muraki; Fumiyuki Naito; Takayuki Minamikawa; Masahito Ohji
- Investigative Ophthalmology & Visual Science October 2014, Vol.55, 6686-6690. doi:https://doi.org/10.1167/iovs.14-14079

# Acquired Colour vision defects

- Red Green ?
- Nerve damage /Optic neuritis
- Focal condition

- Blue Yellow?
- Vascular condition /diabetes/ glaucoma
- Systemic conditions

# Myopia

- Colour vision and dark adaptation in high myopia without central retinal degeneration Maija Mantyjarvi, Kaija Tuppurainen
- https://bjo.bmj.com/content/bjophthalmol/79/2/105.full.pdf
- All the colour vision tests and dark adaptation examination gave normal results. However, the error scores of the **myopes in (blue)** box Ill of the FM 100 test were significantly higher than those of the controls matched for age.

- It has been reported by Giuffre et al that the performance of **FM 100-hue test improved for 10 out of 15 participants at the time of ovulation**, as opposed to during menstruation or at the beginning of the cycle. [19] Eisner et al [20] have showed evidence suggesting that estrogenic response affects the colour naming of **short-wavelength test stimuli presented on 580-nm backgrounds.**
- ICV was noted even among diabetic subjects without retinopathy. **Significant risk factors for ICV were female gender** and increased intraocular pressure.

PLoS One. 2015; 10(6): e0129391.
Published online 2015 Jun 8. doi: 10.1371/journal.pone.0129391
PMCID: PMC4460124 PMID: 26053017
Impairment of Colour Vision in Diabetes with No Retinopathy: Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study (SNDREAMS- II, Report 3)
Laxmi Gella, [1]

# Diabetics

- The SW VEP latencies (time to respond to **blue-yellow stimulus)** of those with diabetes are delayed when compared with those without diabetes.

- Detecting ocular-visual function changes in diabetes

C A Westall

carol.westallsickkids.ca http://dx.doi.org/10.1136/bjo.2005.073395

- induced diabetic rats, neurons and glial cells in the inner plexiform and nuclear layers of the retina undergo apoptosis early in the course of diabetes[30] and actually precede the development of microvascular lesions.[31]

- Results show a loss of chromatic sensitivity in both the **red-green and yellow-blue** channels, more pronounced under mesopic viewing condition. It was observed that **chromatic loss was not localised to the site of retinopathy but affected peripheral retina also.**

- **Acquired colour vision deficiency in subjects with ARMD and Diabetes**
- September 2008
- Acta Ophthalmologica 86(s243):0-0
- DOI: 10.1111/j.1755-3768.2008.4434.x M O'NEILL-BIBA

# ARM

# Stages of Deterioration

- Stages of Deterioration follow the path of most sensitive function compromised first to the reflexive survival function last.

1. Central Vision acuity > green best focus
2. Then Red due to macular area has most cones
3. Finally blue mid peripheral localisation function and low contrast.
4. Last is motion

# Part 3

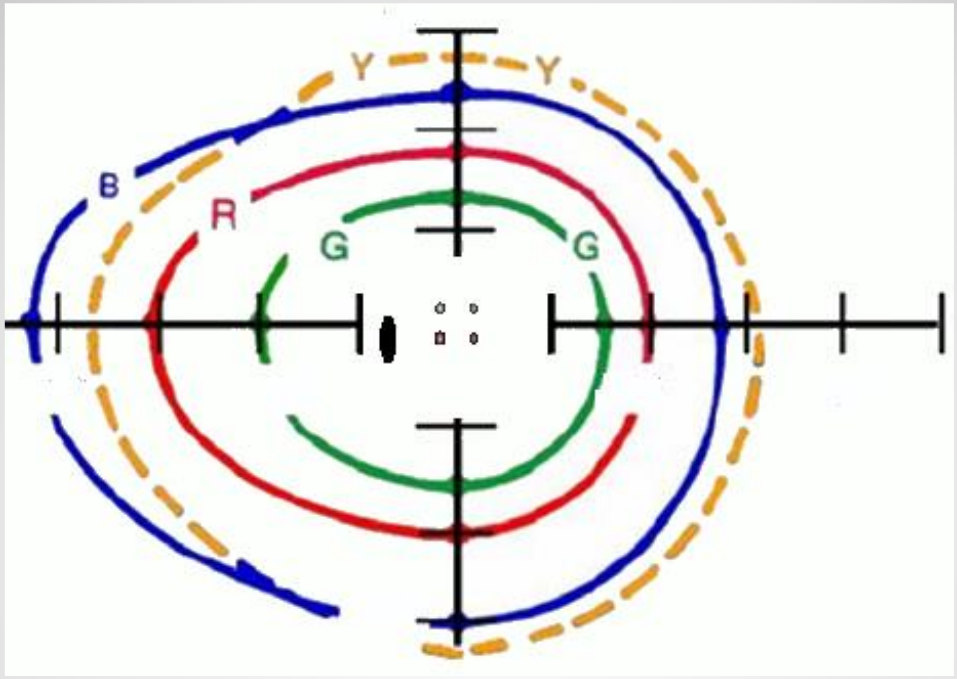
# Colour Field Testing

- Physically we are measuring the saturation point or chromaticity level.
- Integrity of visual pathway and cortex
- All based on the Patients ability in **attention and intension.**

- Measure disturbed function due to
  - Integrity of Photoreceptor, Visual pathway & cortex
  - Stress,
  - Trauma , and
  - Toxicity.

# Colour Field analysis

- Gives information on the severity of the condition.
- How Far the condition has progressed – i.e. stage of deterioration.
- Level of emotional involvement.



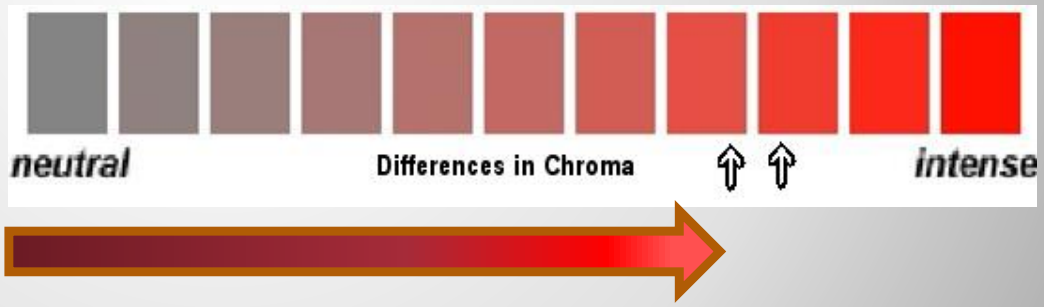

# Colour field for Left Eye

**Normal sequence of colour field & sizes.**

- Largest BLUE
- Smallest GREEN
- Mid size RED
- YELLOW larger Nasal narrower temp

# Kinetic Colour field Tests

- The target moving in tests **our awareness** of the chromaticity (Hue saturation) of the colour coming in from different directions.
- Relates to interference to integrity of visual system.
- Level of Conscious awareness – Attention.




**Chromaticity** is an objective specification of the quality of a color regardless of its luminance. Chromaticity consists of two independent parameters, often specified as hue (h) and colorfulness (s), where the latter is alternatively called saturation, chroma, intensity,[1] or excitation purity. (Wikipeadia)

# John Searfoss

- When there is an interference in the neural flow of input>process>output, a reduced response is given.
- The individual's **sensitivity, awareness, understanding and response are reduced**.
- The result is a constricted white or colour field.

*Searfoss, J. Visual Performance Fields J Optom Photo. Apr 1994, pp 20-22*

# Importance of Kinetic colour fields

- Done pre & post therapy & Syntonics (esp Strabismus).
- Importance of instructional set.
- Importance of standardised repeatable systematic testing procedure.
- Noting down the reliability of patients responses.
- Comparing fields with optometric findings.

# WHEN WE DO VISUAL FIELDS WHAT ARE WE REALY LOOK AT?

# What information do we get when checking a visual Field?

**Ancillary level**

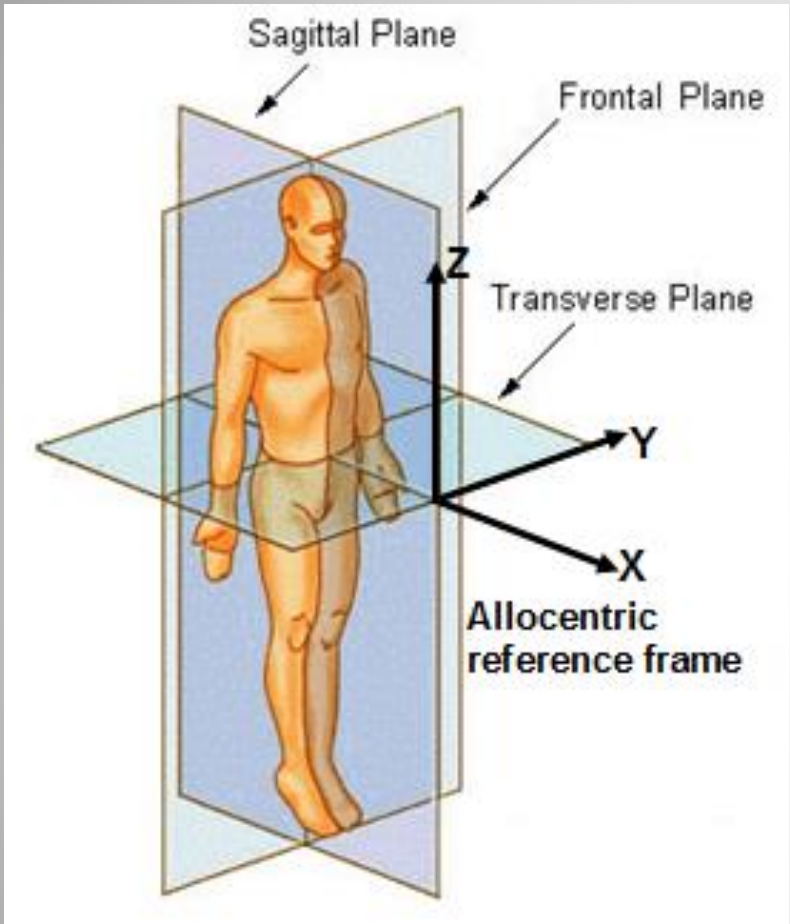
- Dural torque (cranial plate displacement)
- Specific brain area (parietal (where), temporal (what))
- Hemispheric activity (Right vs Left hemisphere)
- Systemic vs Local inflammation
- Toxicity (exogenous/endogenous)
- Fusional skill
- Emotional status
- The amount of effort we put into seeing with each eye.
- If top down (in their head) or bottom up (in their body) issues.

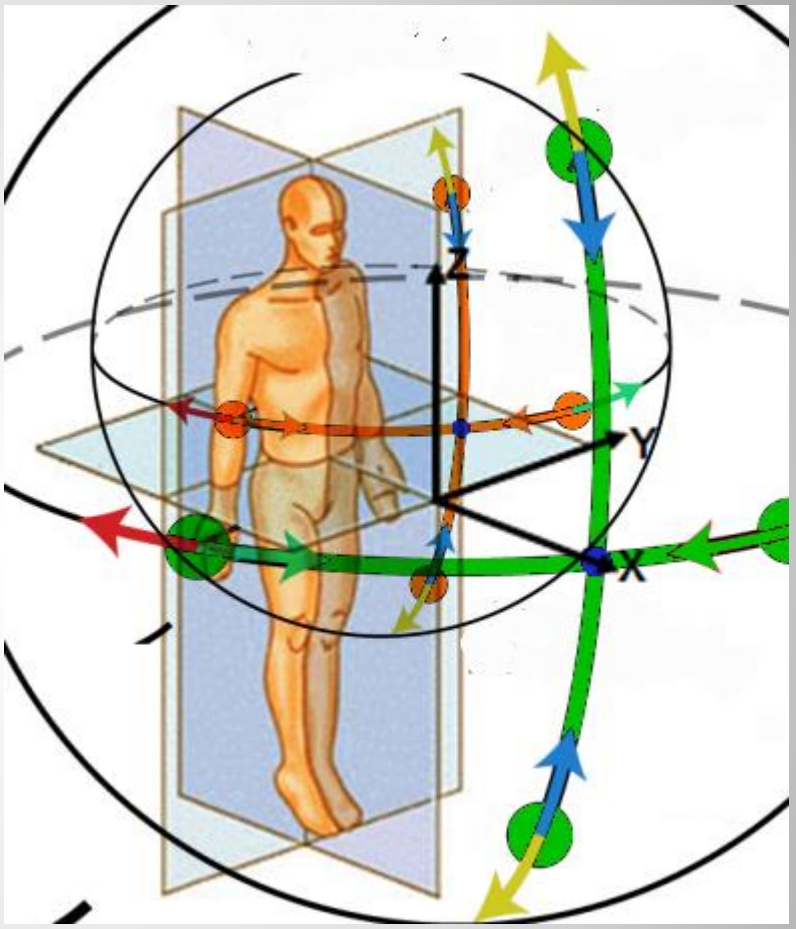
# Visual fields and impact on Behaviour

How our field of vision governs our behaviour, emotions and relationship with the world around us!

*Every man takes the limits of his own field of vision for the limits of the world.*

- **Schopenhauer**




# Visual field is not just in one plane or horopter But can differ with distance

# Visual field  reduction

# Three areas of influence of peripheral vision

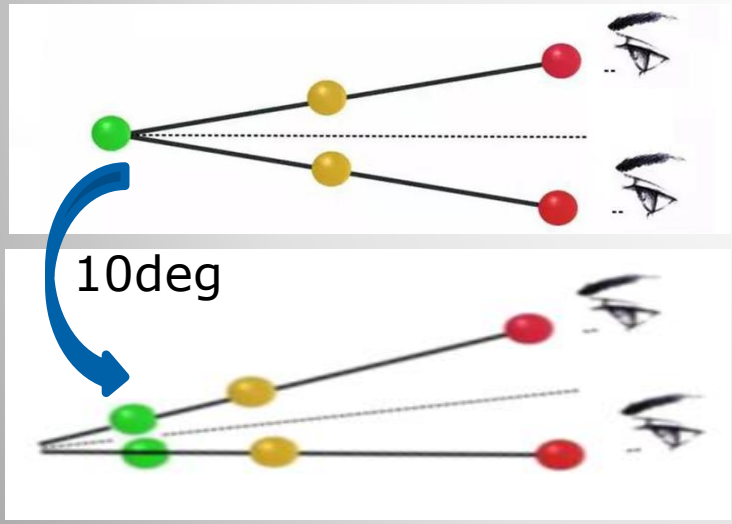
1. Personal space is a **3D field of comfort** –the space around us we feel safe.
2. Field of attention (Z axis space of attention & Fluency of ease of shifting).
3. Style of processing information Field dependant to non field dependant. (focal or ambient processors)

Size of these fields will diminish with stress.

- If stressed then how close we allow things can come to us diminishes – comfort area is further away from us
- As we need to concentrate more to attend, field becomes flat & reduces in size leaving focal attention – working distance reduces also.
- As the Field of processing reduces- comprehension is reduced (the amount & our ability to process information)

# Brock String

- Is a 3D projection of our field of vision.
- Testing in different distances gives the changes in field of comfort.


**Distance from nose to where it splits is our comfort zone**

**ALSO**

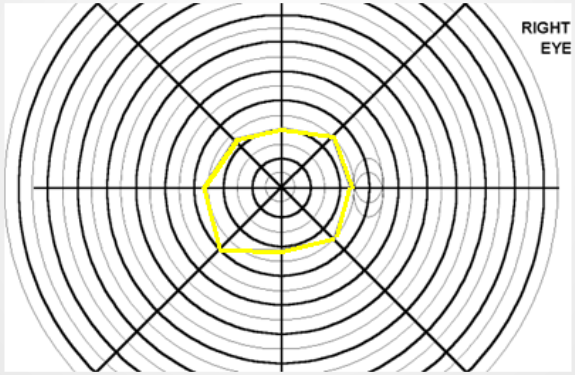
**Brock String test is also an indicator of the field size from the straight direction of gaze**

# Three Zones in our field of Vision

# THE POWER OF PERIPHERAL VISION

- If your peripheral vision is diminished, you would be stuck focusing on each individual part with no context.
  - Klein compares this to being hyper-rational –

"the attempt to apply deductive and statistical reasoning and analysis to situations where they do not apply.

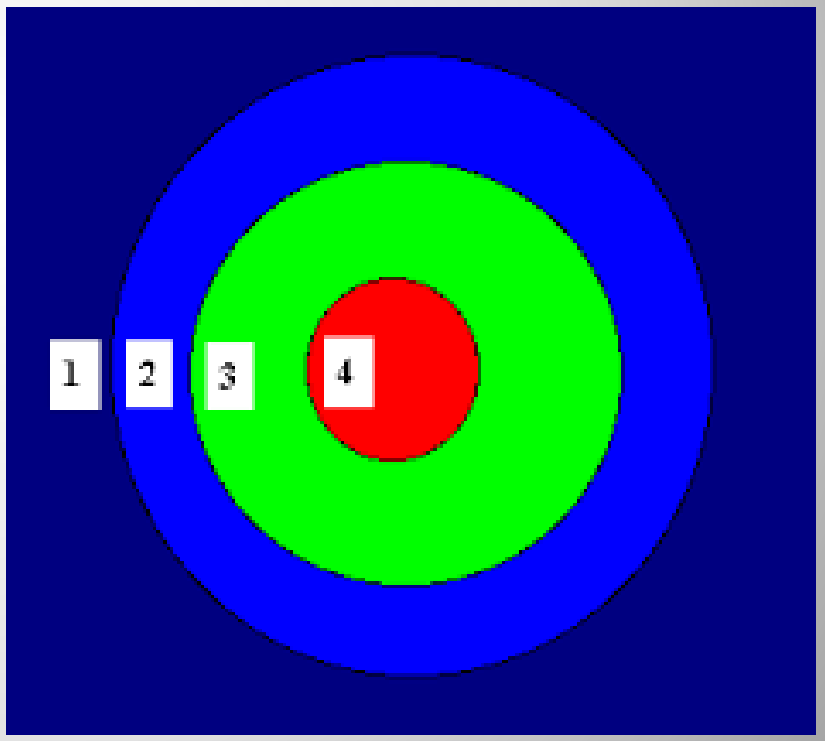



- The context (the surrounding emotions [VF]) have a major impact on the analysis of our central focus and inner resources (comprehension & understanding), all of which are constantly changing in terms of their emotional impact on us.

# 4 Zones of Visual Field

## These indicate how the person relates to the world

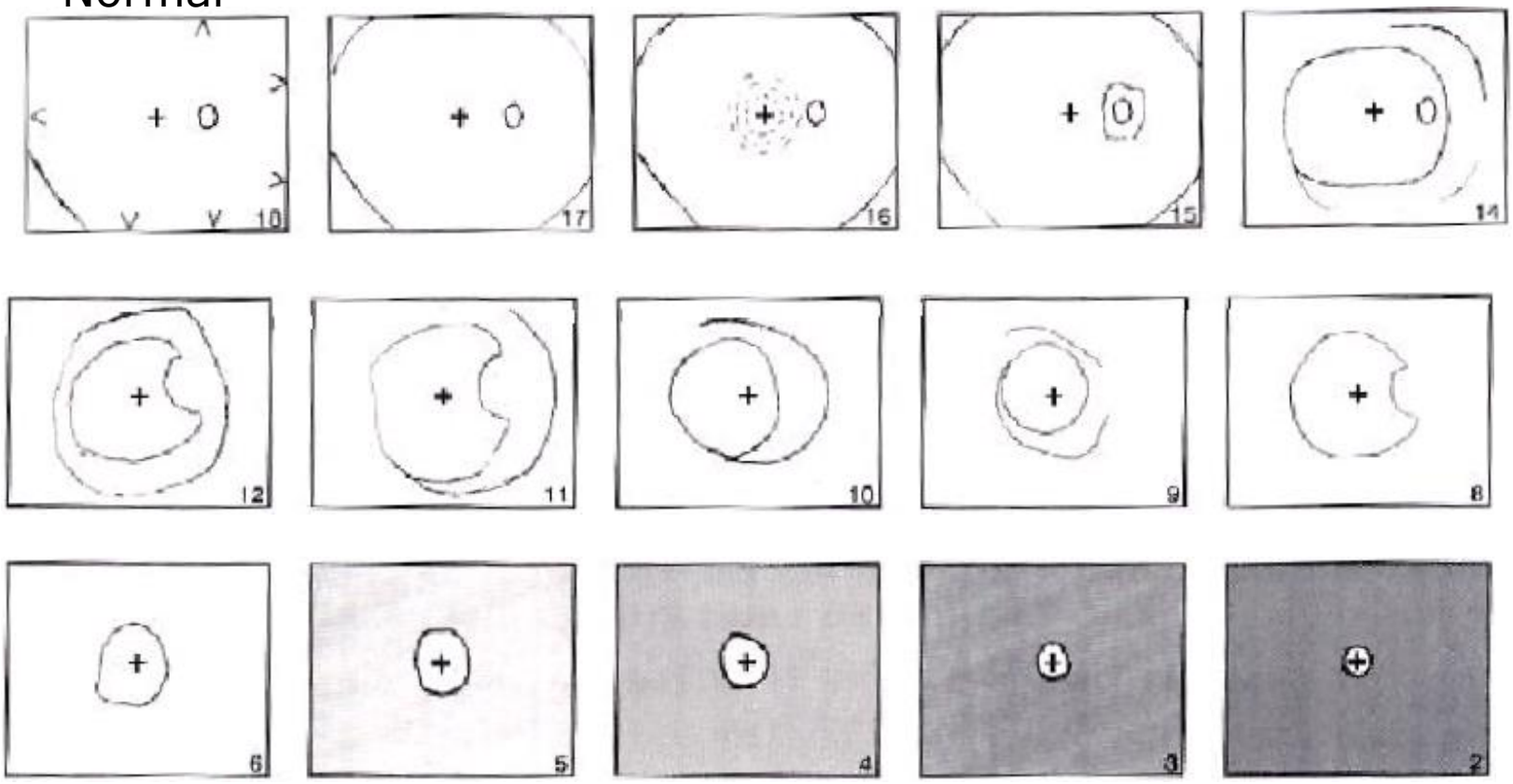
- 1] Projected world (assumption world exists a particular way/past)
- 2] Peripheral (motion detection, reflex responses)
- 3] Intermediate (ease of shifting- flexibility)
- 4] focal (foveal identification – scrutinising, understanding)




**Deterioration =1 towards 4 last**

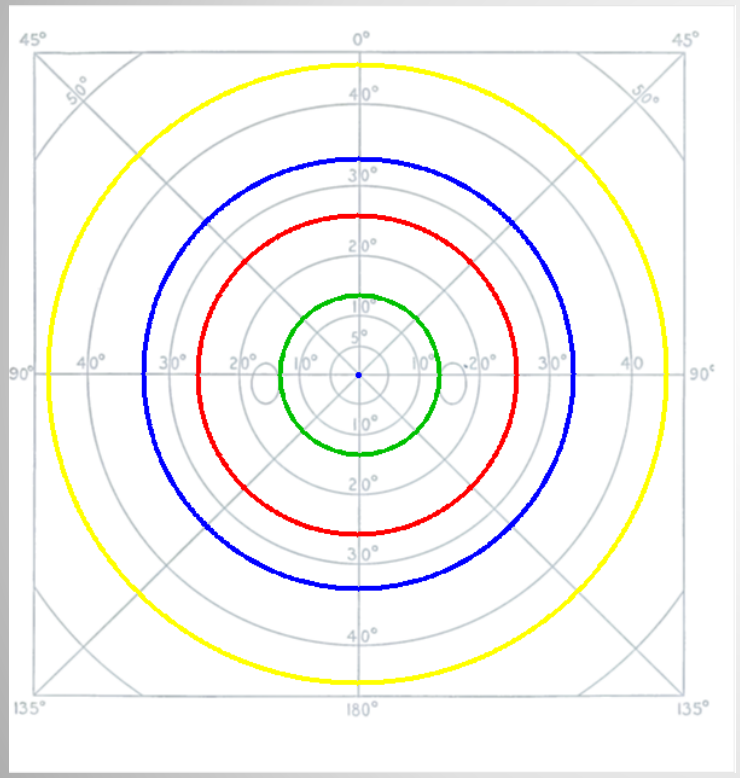
# Stages of Kinetic Visual Field Reduction

Normal



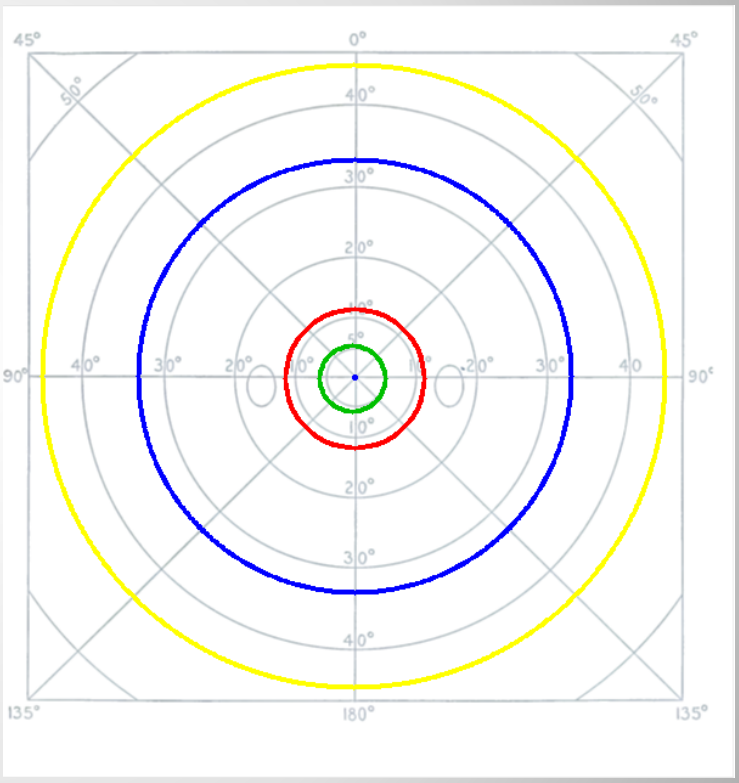

Loss in vision

# Field changes#1




Stage 1

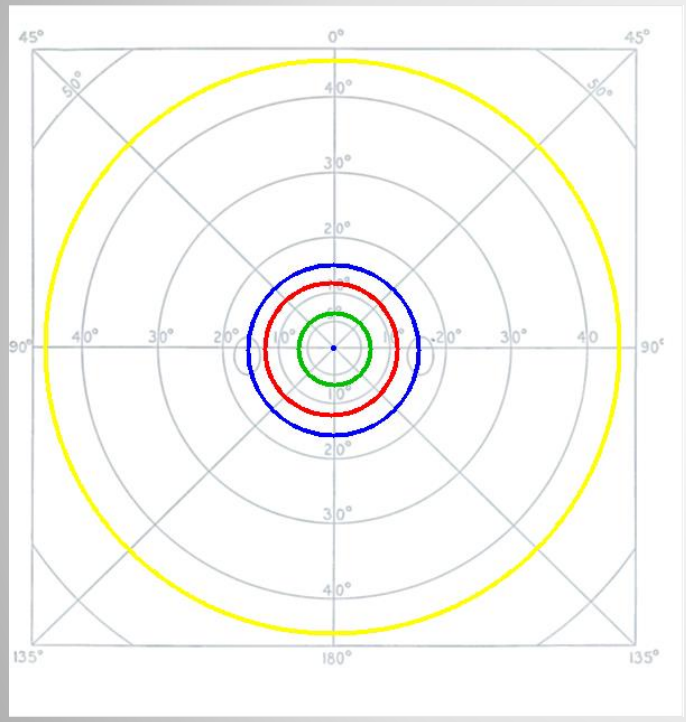
Green field reduced
Focal




Stage 2

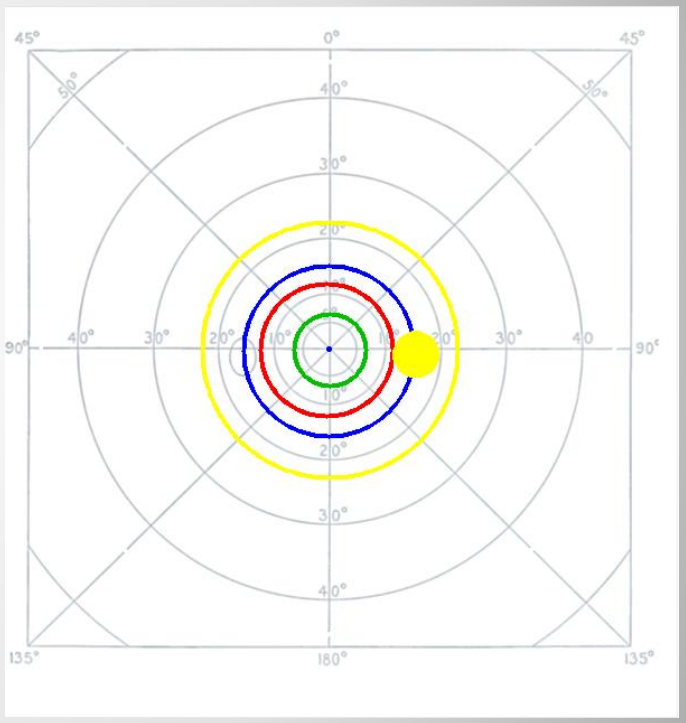
Now Red Field reduced also
Systemic involvement

# Field changes #2




Stage 3

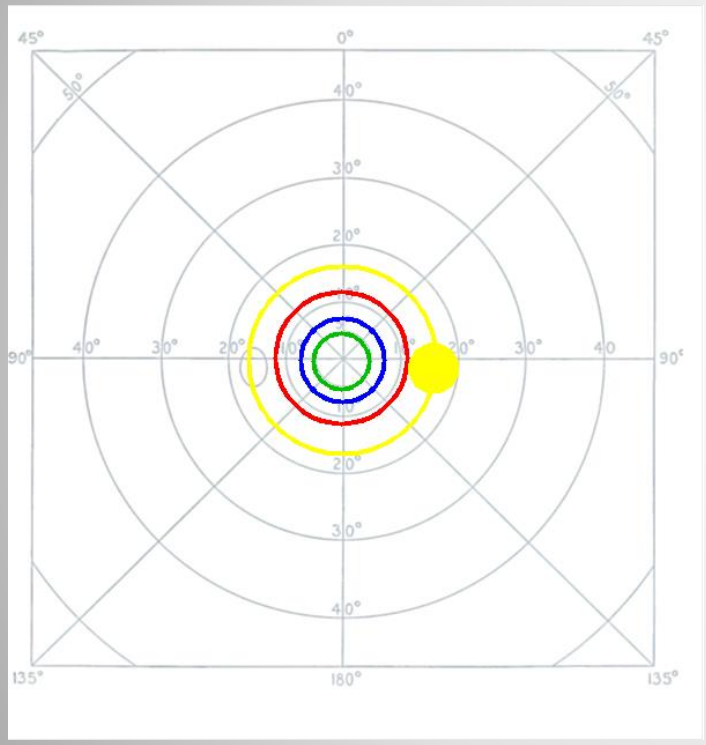
All 3 colours reduced only




Stage 4

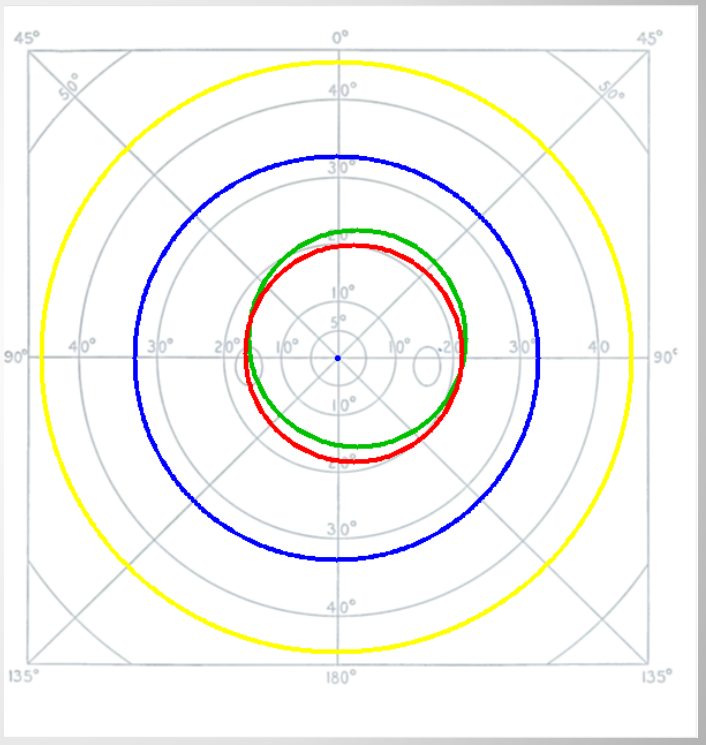
White field now reduced as well
Blind spot enlarged

# Field changes #3




Stage 5

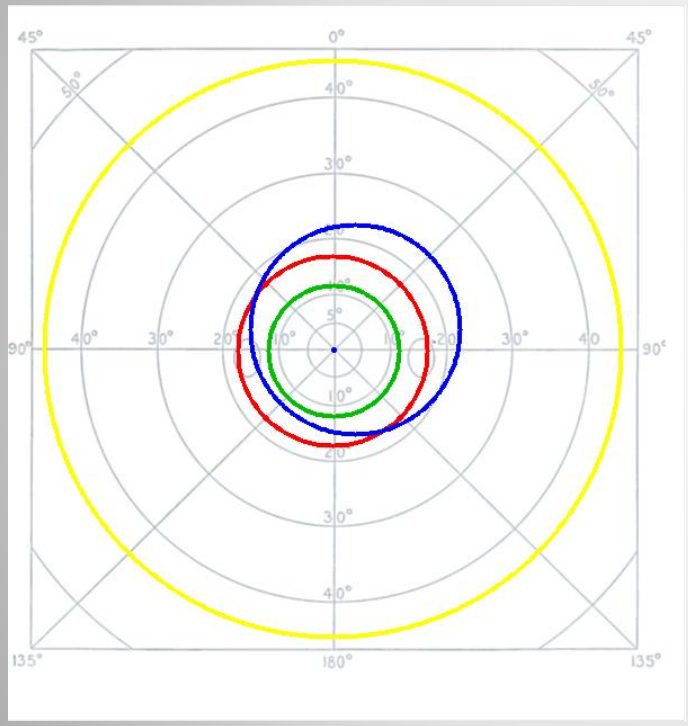
Very small fields within BS




Exog Stage 1

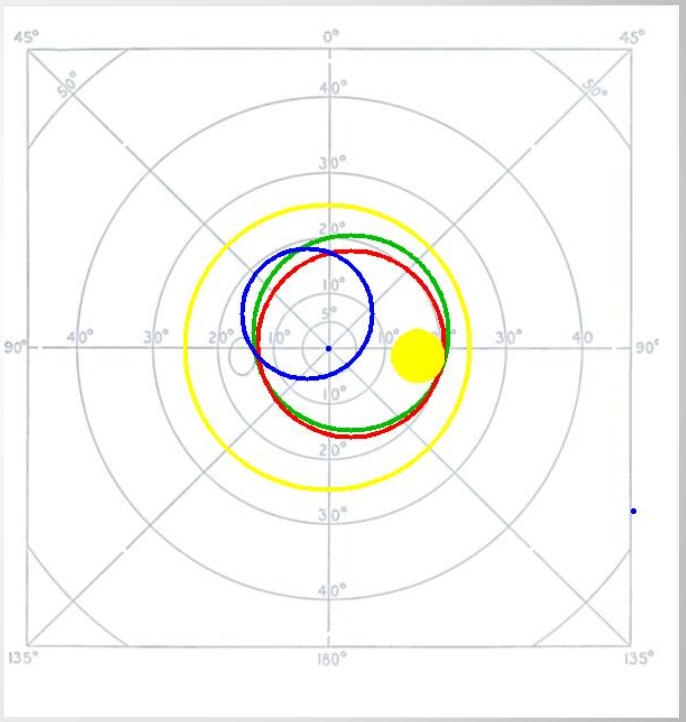
Green reduced & interlace with red

# Field changes #4




Exo/Endo Stage 2

Greens smallest Red & Blue interlace
Mental issues

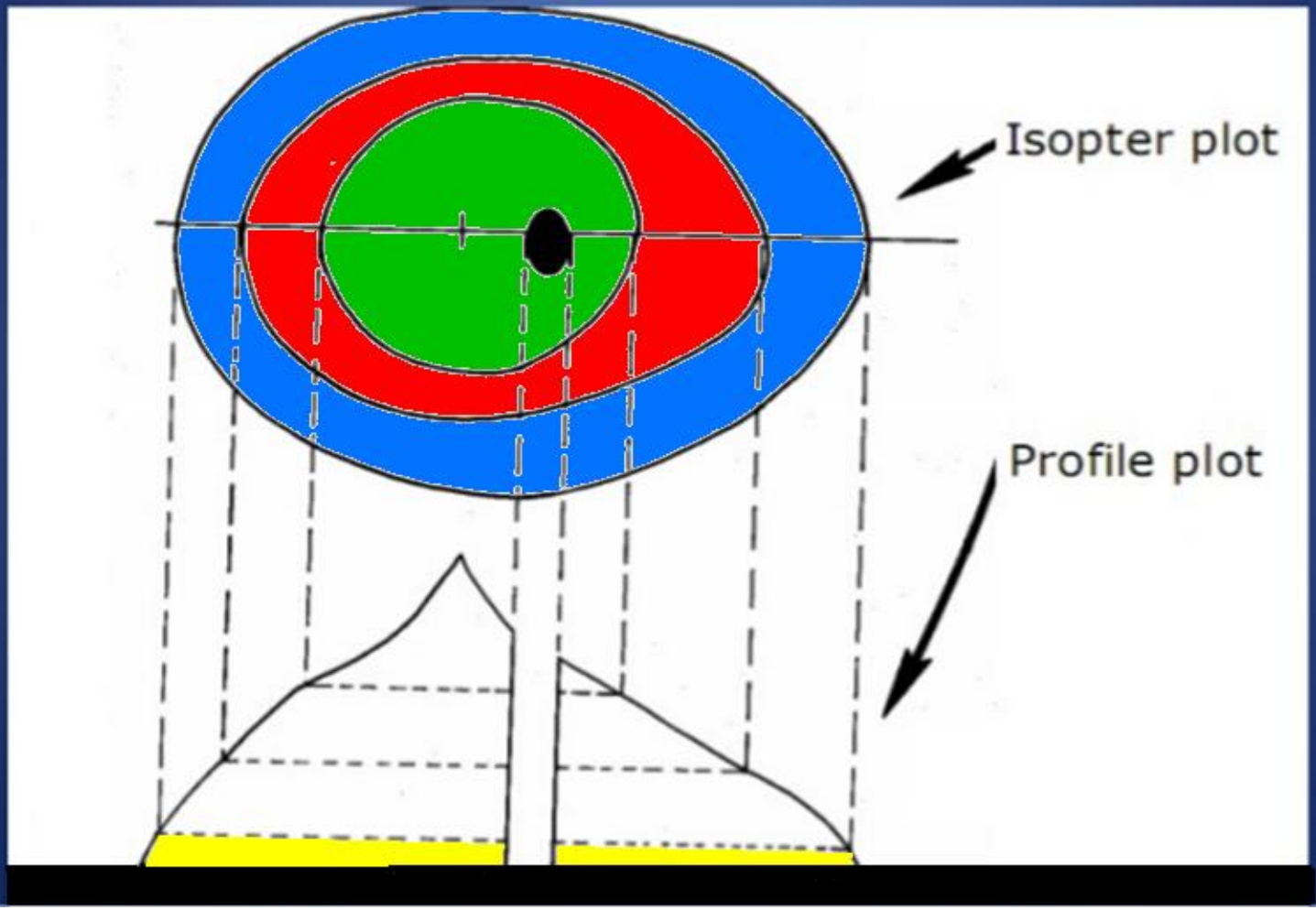



Exo/Endo Stage 3

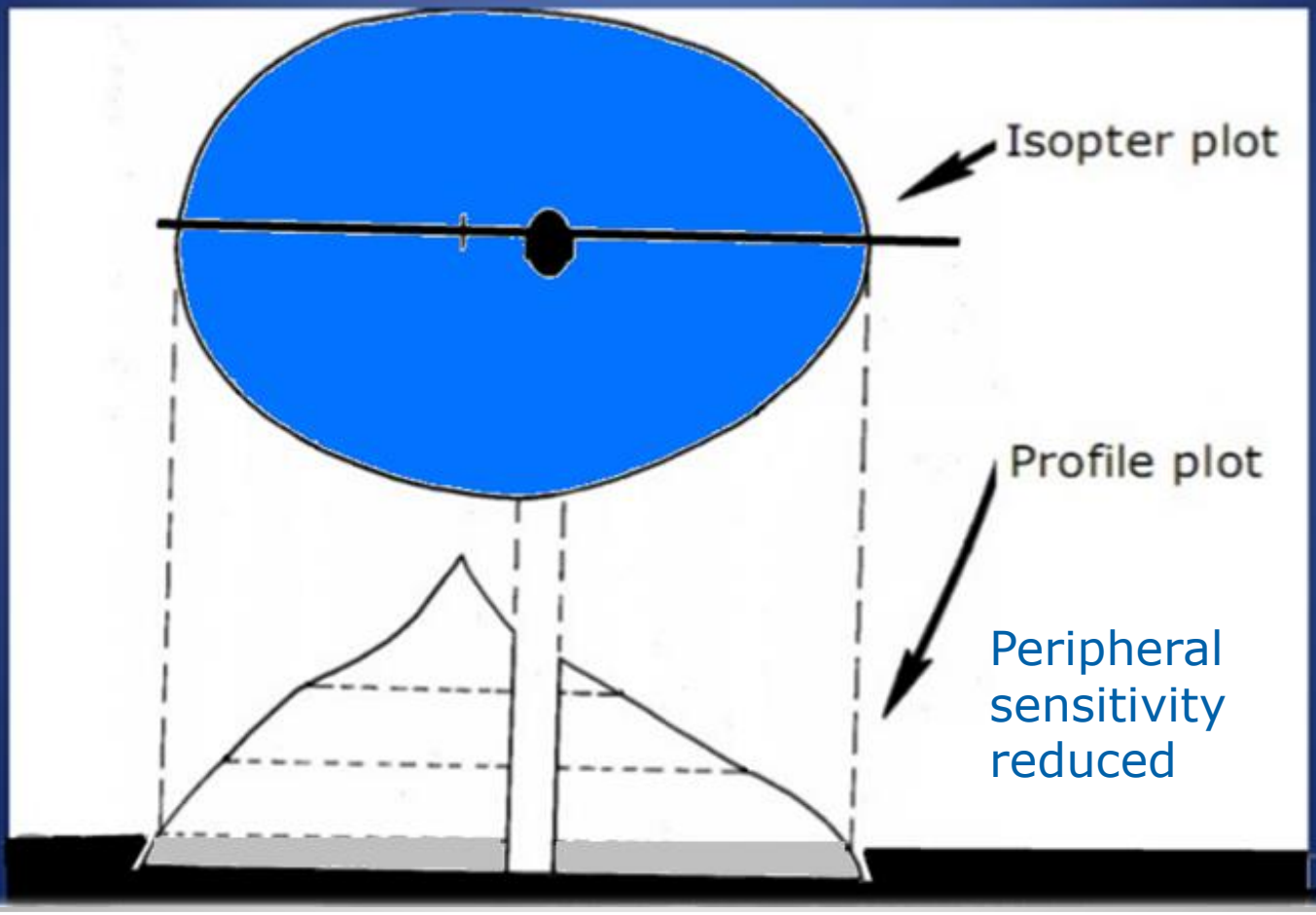
All interlacing blue smallest
Mental & emotional issues

# Fields of awareness changes

# Hill of Vision

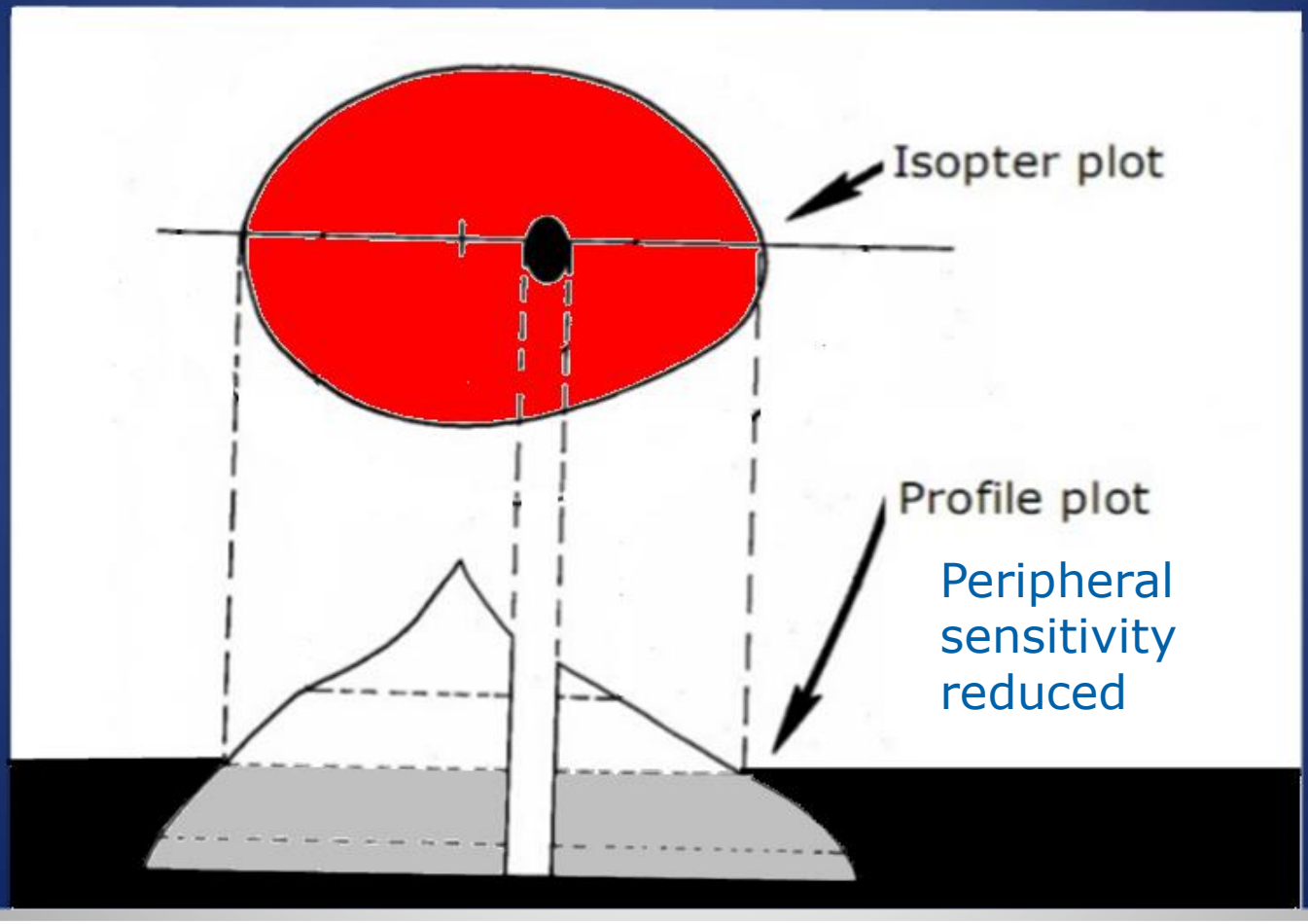


# Hill of Vision



# Hill of Vision

**Pervcentage of Field reduced**
**Percentage of Blind sot increased**



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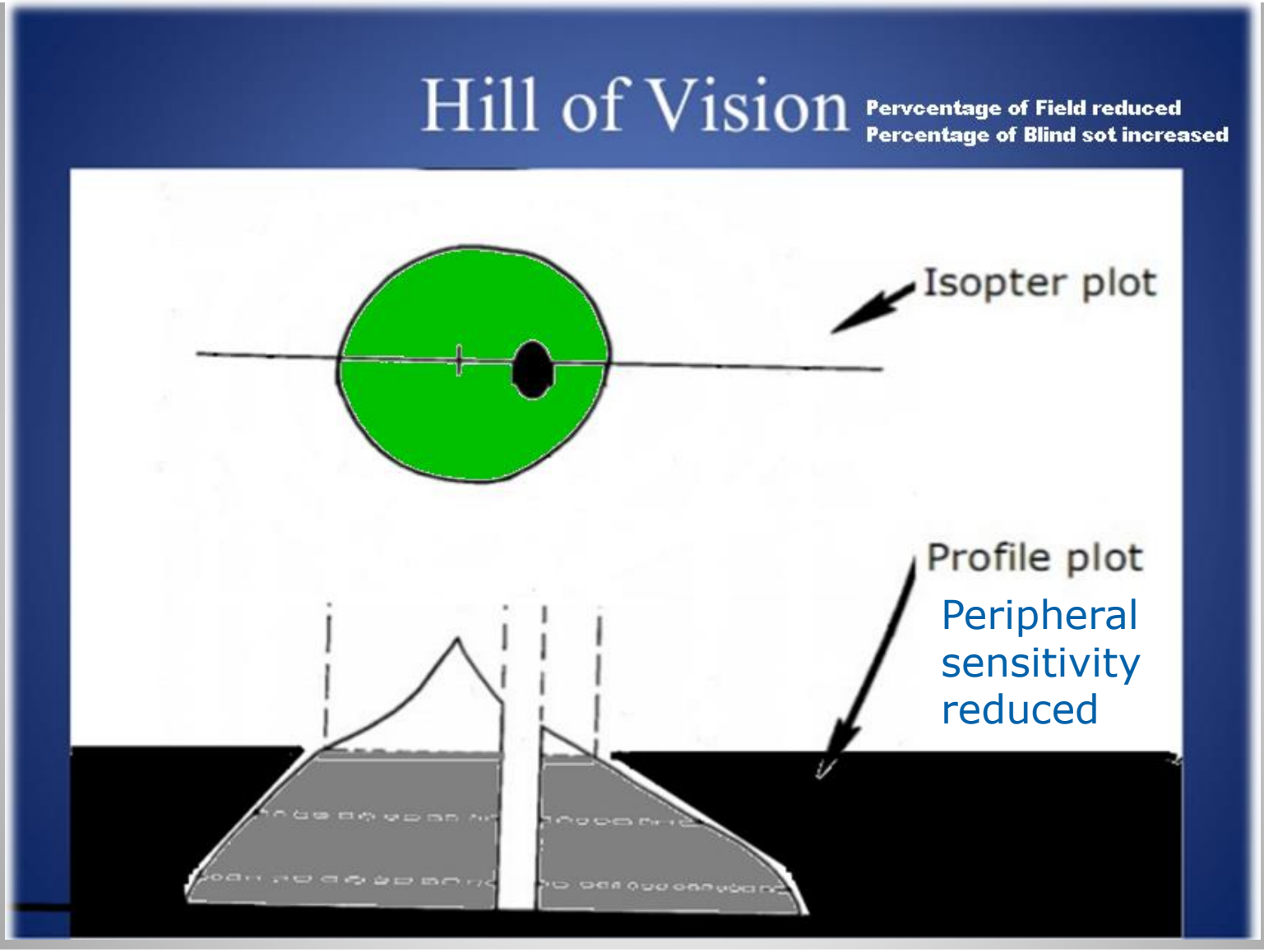
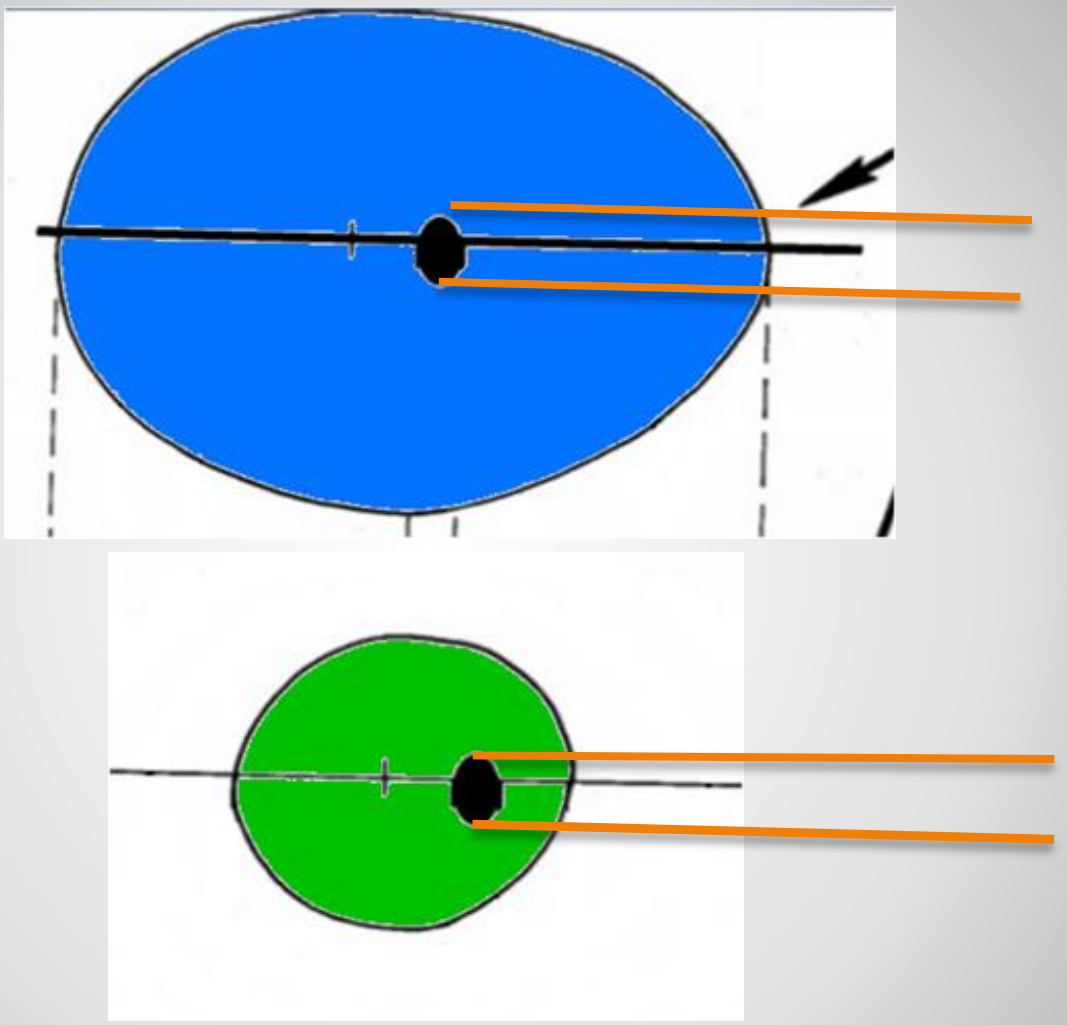
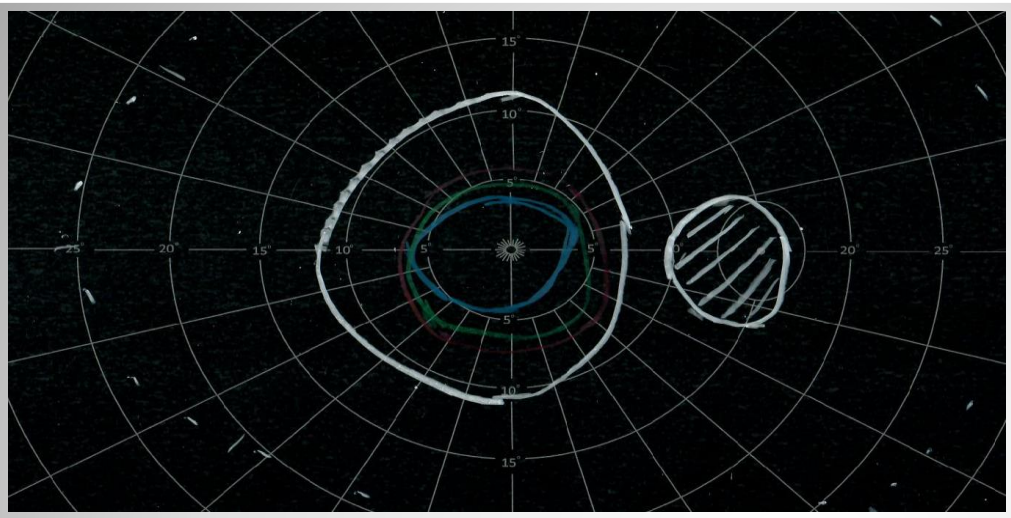
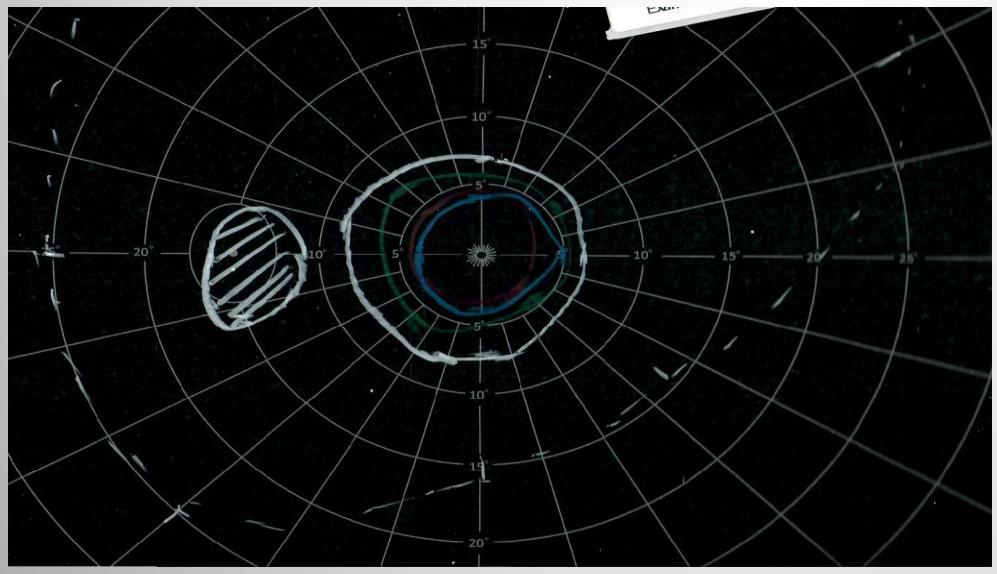




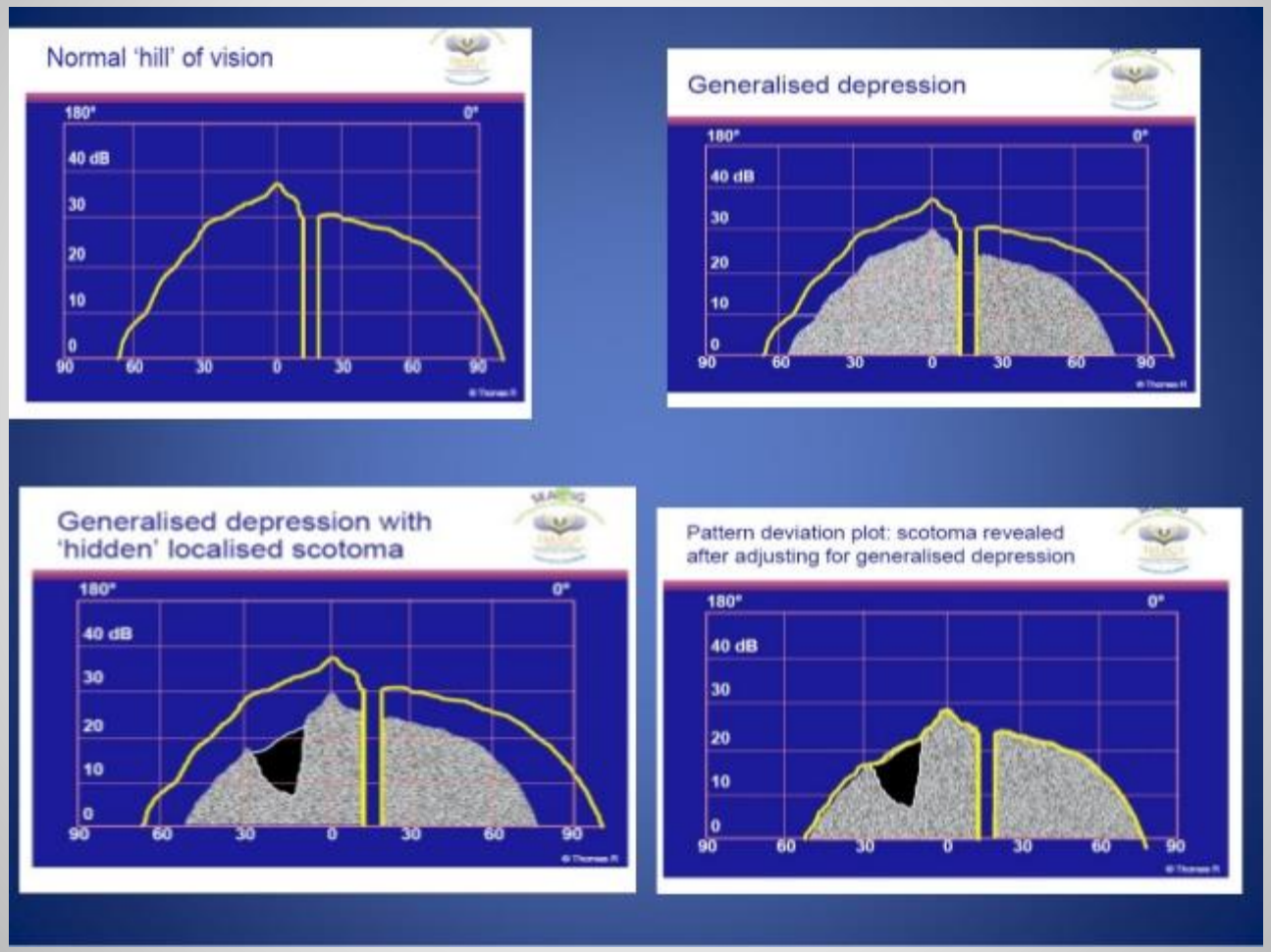




## Compare

- RE, LE, vs OU
- Motion
- Blind Spot (even if White inside BS)
- Colours size
- Colours shape
- Colour sequence
- Colours interlacing

- **Pathological changes in VF**




**Loss of receptors or cortical function**

- **MENTAL & EMOTIONAL**

# MENTAL & EMOTIONAL

# Vision in depressive disorder (Dopamine)


- Emanuel Bubl,**Ludger Tebartz Van Elst**,Matthias Gondan,Dieter Ebert &Mark W. Greenlee


- Pages 377-384 | Received 06 Dec 2006, Published online: 08 Dec 2009
- https://doi.org/10.1080/15622970701513756
- https://www.tandfonline.com/doi/abs/10.1080/15622970701513756?journalCode=iwbp20



- **Abstract**
- ***Background.*** **Reduced dopaminergic transmission has been implicated in the pathophysiology of major depression. Furthermore, dopaminergic neurotransmission plays an important role in the physiology of visual contrast sensitivity** (CS). To test the hypothesis that altered dopaminergic neurotransmission plays a role in major depression we measured contrast sensitivity in patients with major depression and in healthy control subjects. ***Methods.*** Twenty-eight patients diagnosed with major depressive disorder were compared to 21 age-matched control subjects on their ability to detect a Gabor target with slightly elevated luminance contrast embedded in seven equi-contrast distracters. ***Results.*** Contrast discrimination thresholds were significantly elevated in unmedicated and medicated patients with major depression compared to control subjects, at all pedestal contrast levels tested. ***Conclusions.*** **Contrast discrimination performance is reduced in depressive patients and might reflect a state of altered dopaminergic neurotransmission.**

# Vision in depressive disorder (Dopamine)

- Reduced dopaminergic transmission has been implicated in the pathophysiology of major depression. Furthermore, dopaminergic neurotransmission plays an important role in the physiology of visual contrast sensitivity (CS).
- Contrast discrimination performance is reduced in depressive patients and might reflect a state of altered dopaminergic neurotransmission.
- Reduce blue yellow colour vision sensitivity
    - **Reduced contrast may present as reduced field sensitivity**

# COLOUR FIELDS

**MEASURE DISTURBED FUNCTION DUE TO STRESS, TRAUMA , AND TOXICITY.**

**Can be viewed at the Physical level,**

***Biochemical**
***Functional level or**
***Pathology**

**OR interpreted as the level of coping emotionally.**

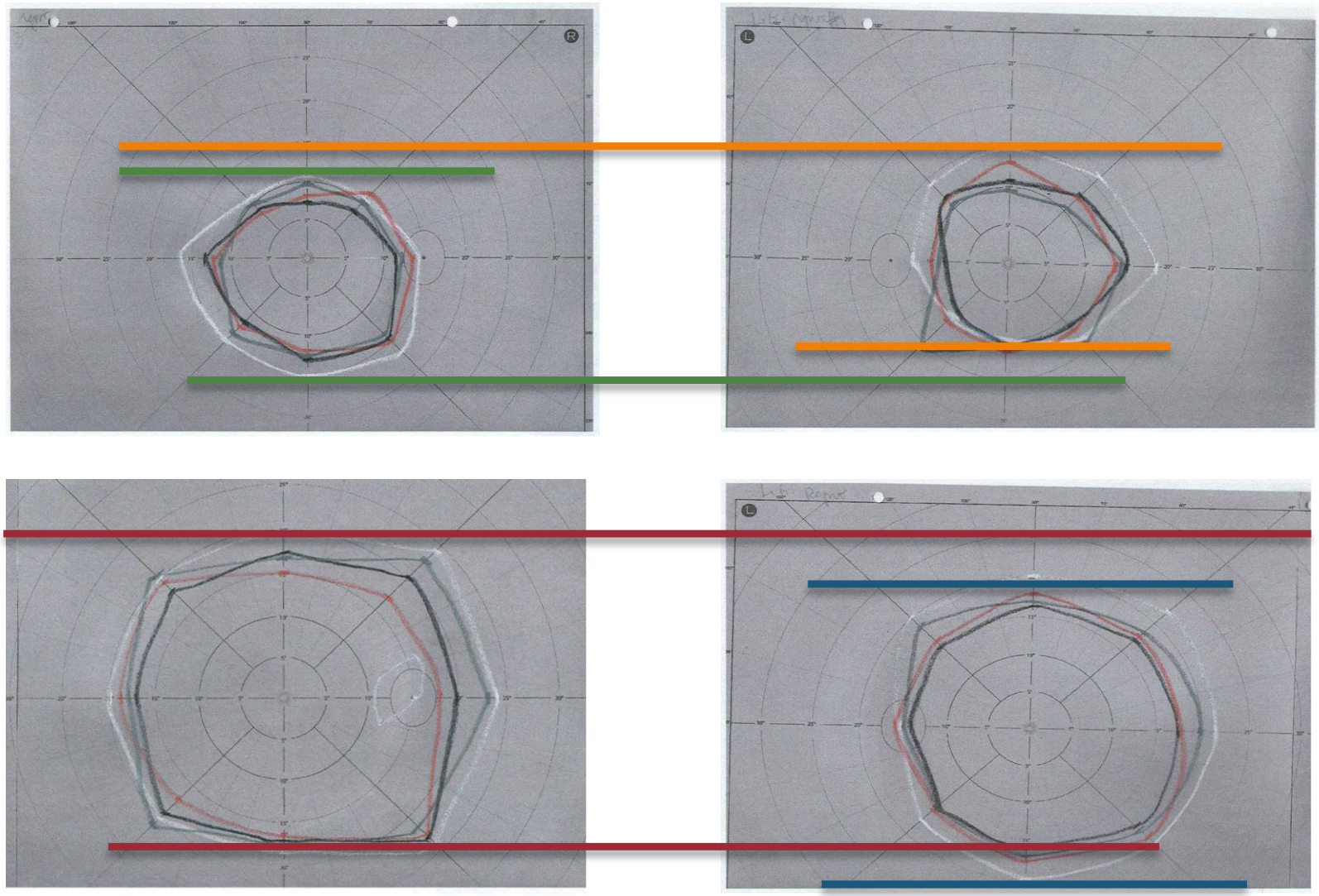
# Functional Kinetic Visual Field Measurement

- Reduced Visual Performance in the absence of organic cause
- What you see:
  - Generalized constriction of form and color
  - Enlarged blind spot (If there is a field reduction but if normal blind spot review pathology.)

# EXAMPLES OF PATIENTS WITH HEAD TRAUMA & VERTICAL DIPLOPIA

Right

Left



# Interpretation of Colour fields

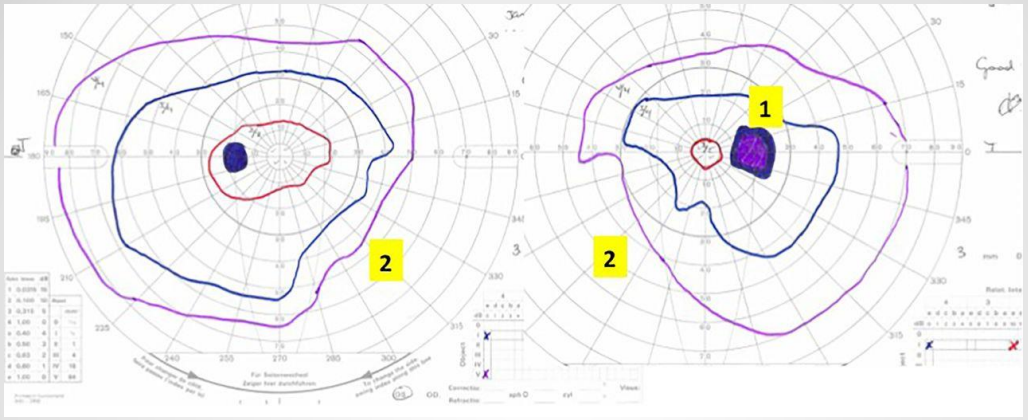
# Special states that affect visual field results

# Blind Spot

**Enlarged blind spots,**

- Having reading problem cases, exhibit slower speeds of both picture and word recognition.
- Implying slower processing  skills.
- Miss projection of space leading to reduced cognitive function.
- Less visual information getting through to process.

Enlarged blind spot – questionable swelling of ON?




- Goldmann visual field from papilloedema. This patient has papilloedema from idiopathic intracranial hypertension. Goldmann fields show (1) an enlarged blind spot and (2) inferonasal field restriction.

# Infra nasal involvement ??

# With every level of reduction in size of field means:

- Increased symptomology –
  - (headaches, asthenopia, etc)
- Decline in our coping mechanisms. -
  - The amount of life's stressors harder to manage.
- Decline in our mental states –
  - reduced memory, concentration
- Increase in more psychological issues –
  - depression, anxiety.
- The longer the Chronic condition the more emotional issues govern symptoms.
- Toxicity present from either or both exogenous endogenous sources

- Any differences in sizes between the fields of the two eyes is an indication of a trauma:
- **1] Physical trauma** – TBI
- **2] Emotional trauma** – death of a love one
- **3] Visual trauma** –Strabismus Amblyopia.

# Right Eye VS Left Eye Fields

# General Rule

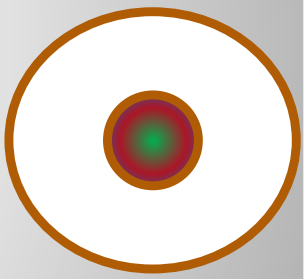
- Dominant eye has the smaller field
  - -central processing
- Larger field non dominant weaker eye
  - – peripheral processing for localising

# Relationship of white verses Colour fields

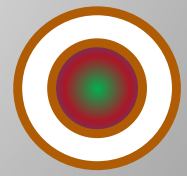
White is coping mechanism, awareness and alertness.

Colour is the resources available.

- Large white field, smaller colour field –
- coping- but has to work hard giving.



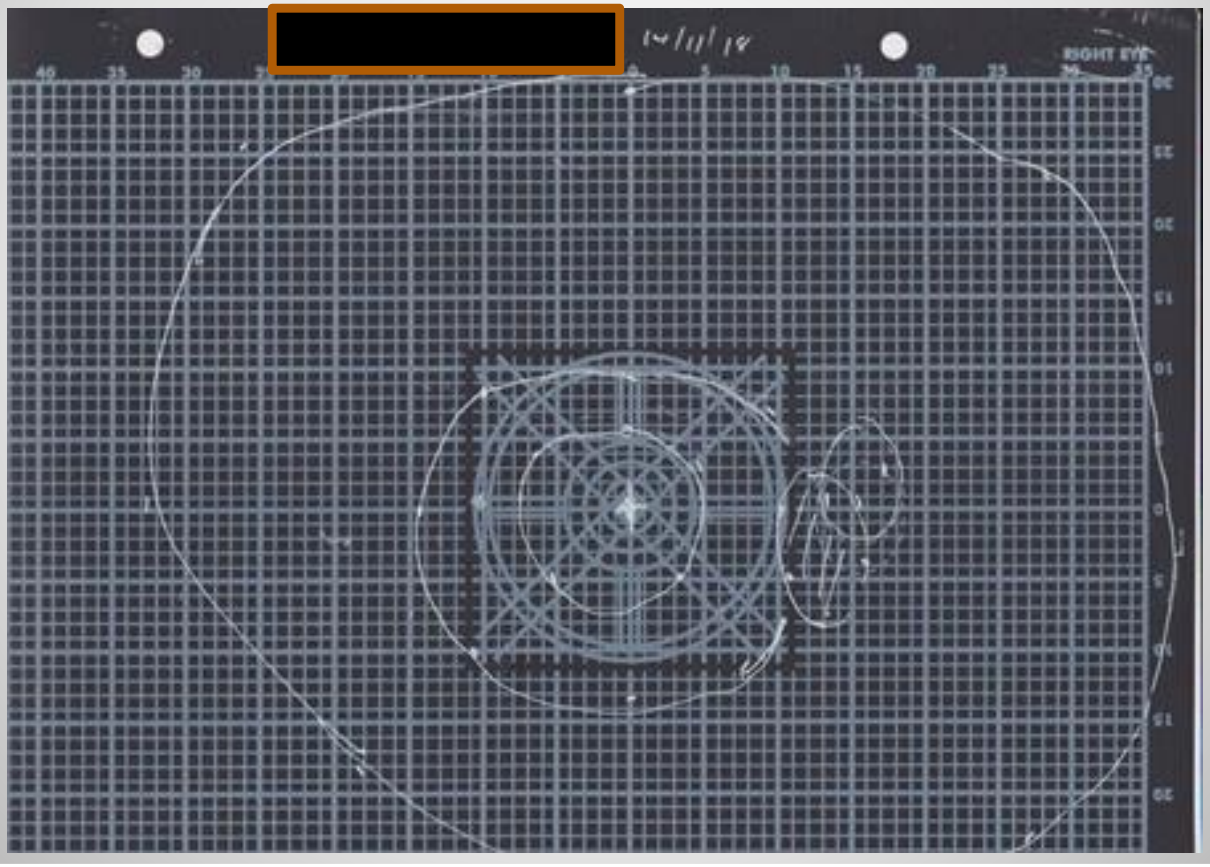
- Both reduced –system shutdown
- closed in, Self protection, Self critic



# Dural torque

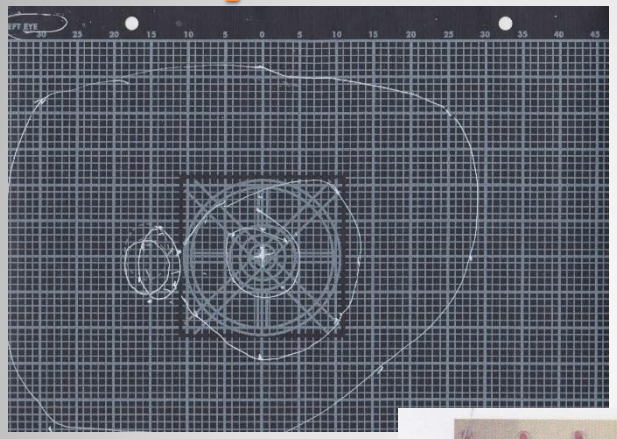
- Under circumstances of trauma, there is often a mis-alignment of the cranial bones which is often associated with a mal-position of the spine.  An appropriate referral may be in order to a Chiropractor or Osteopath who has received advanced post-graduate work in the field of Craniopathy.
- 
- The correct anatomical position of the blind spot will indicate when the appropriate adjustments and proper cranial functions are again in balance.

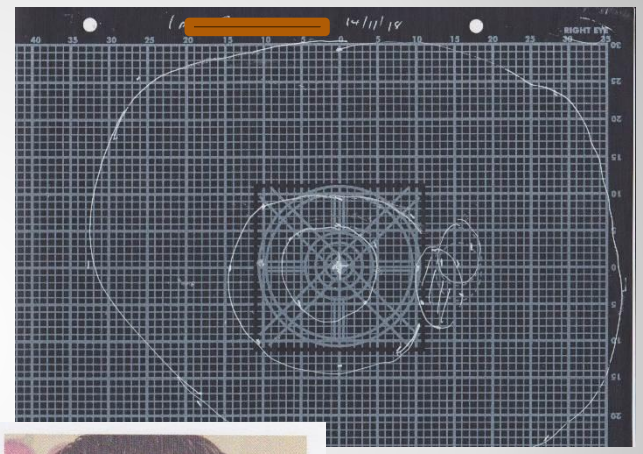
# Field plot showing dural torque the blind spot is displaced inferiorly and nasally

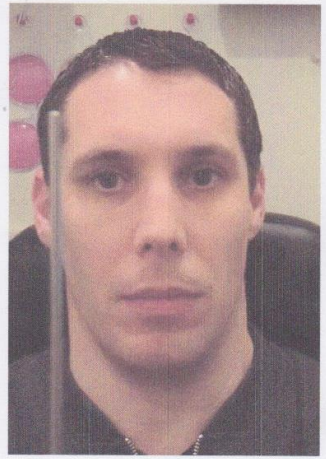


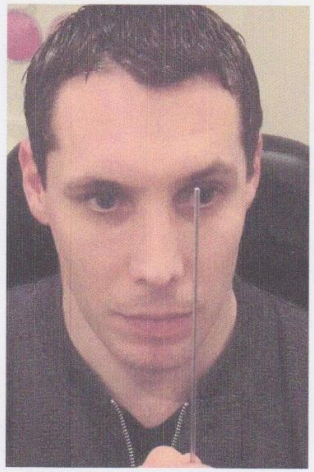
# Field plot showing dural torque

## the blind spot is displaced inferiorly and nasally









The result of this is that has anomalous perception of his visual space, resulting him in leaning to the side, tilting his head to the side, and getting a mismatch between his visual, tactile and proprioceptive inputs to the brain which will combine to exaggerate his PPPD.

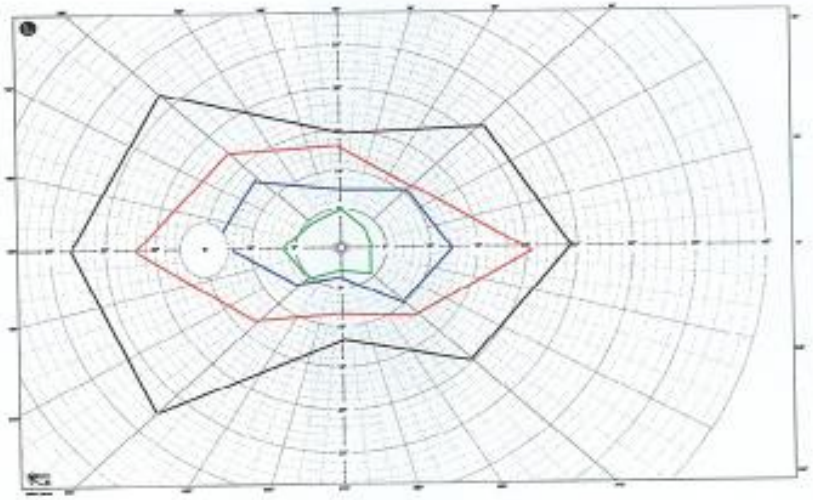
# Some common signs of dural torque or misalignment of the skull, axis, and atlas include:

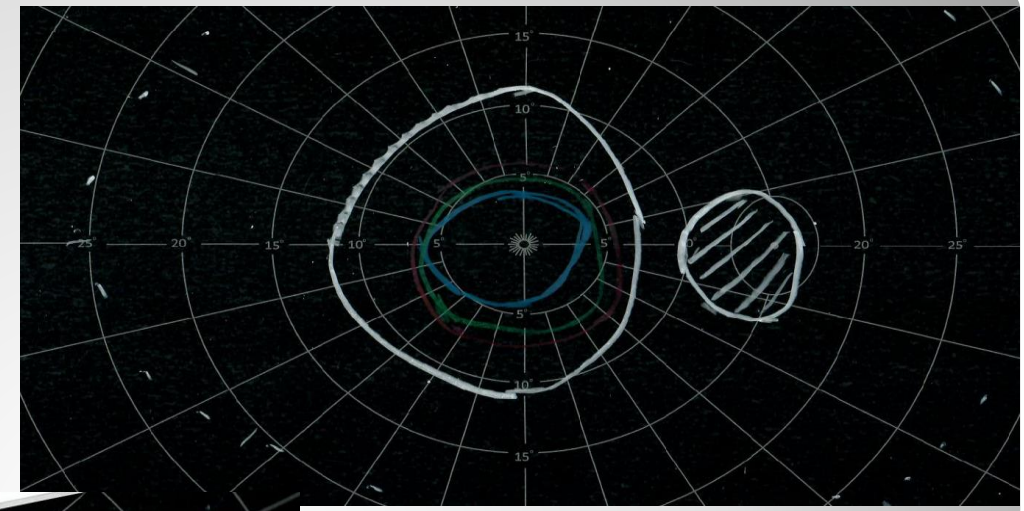
- 1) Unequal pupil size
- 2) Unequal palpebral size
- 3) One eye looks higher than the other
- 4) Unequal shoulder height
- 5) Unequal hip height
- 6) Leg length unequal
- 7) High breathing centre

# Irregular Field

*Irregular field :*

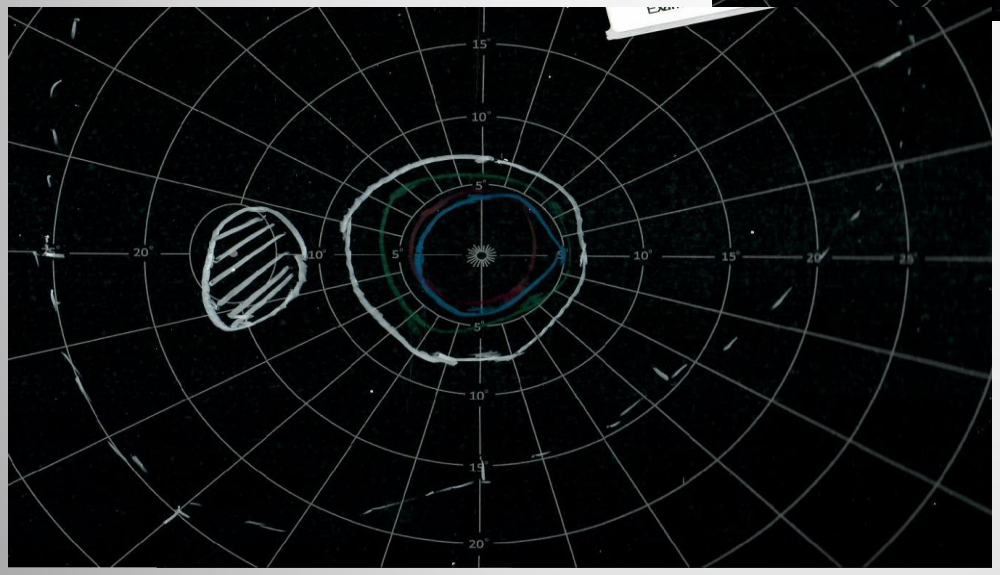
The shape is not circular.



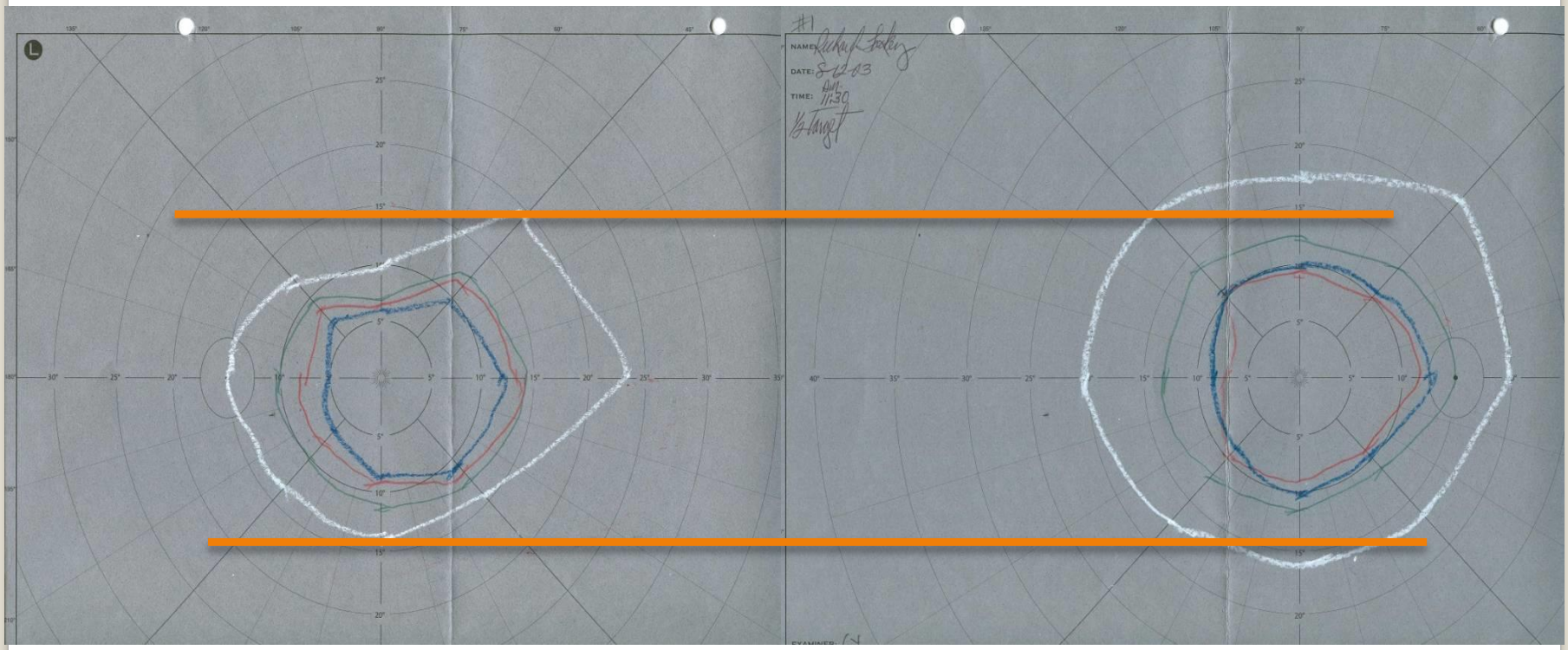



Right Eye

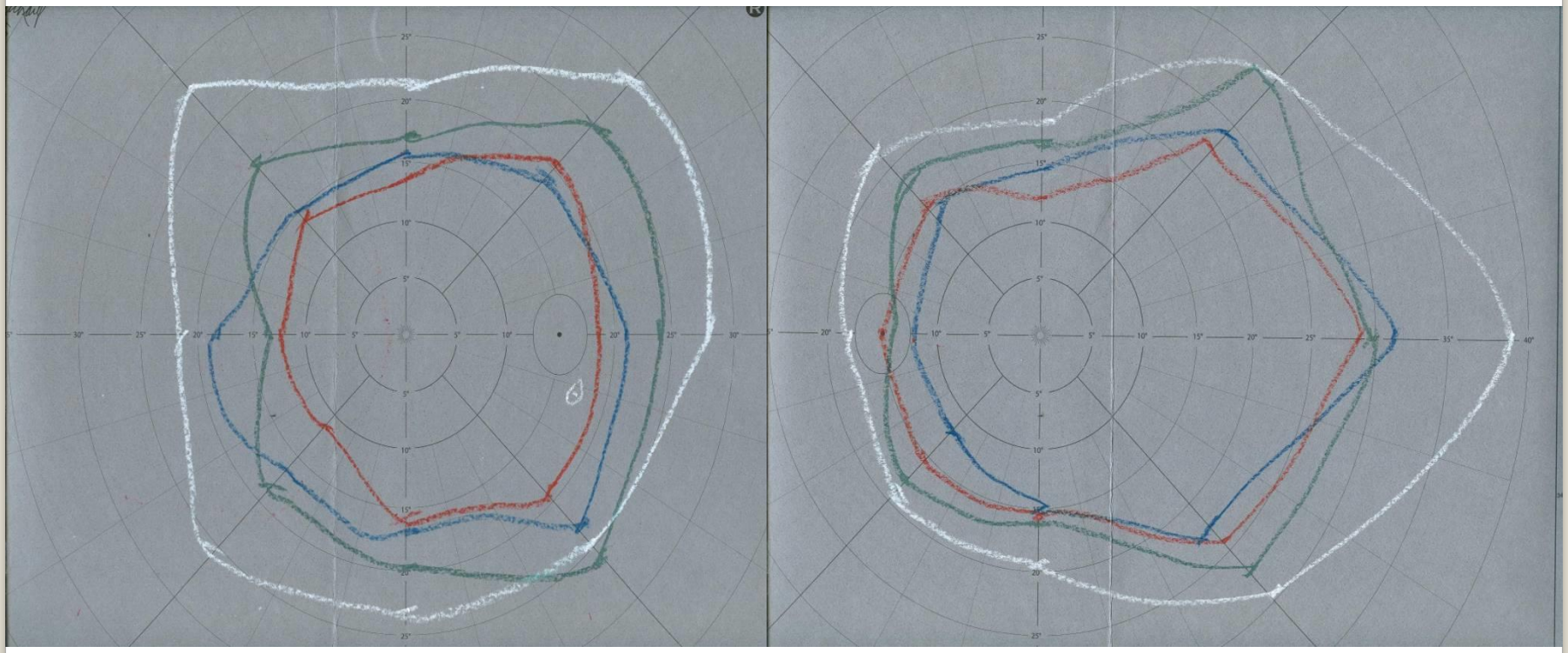
Left Eye



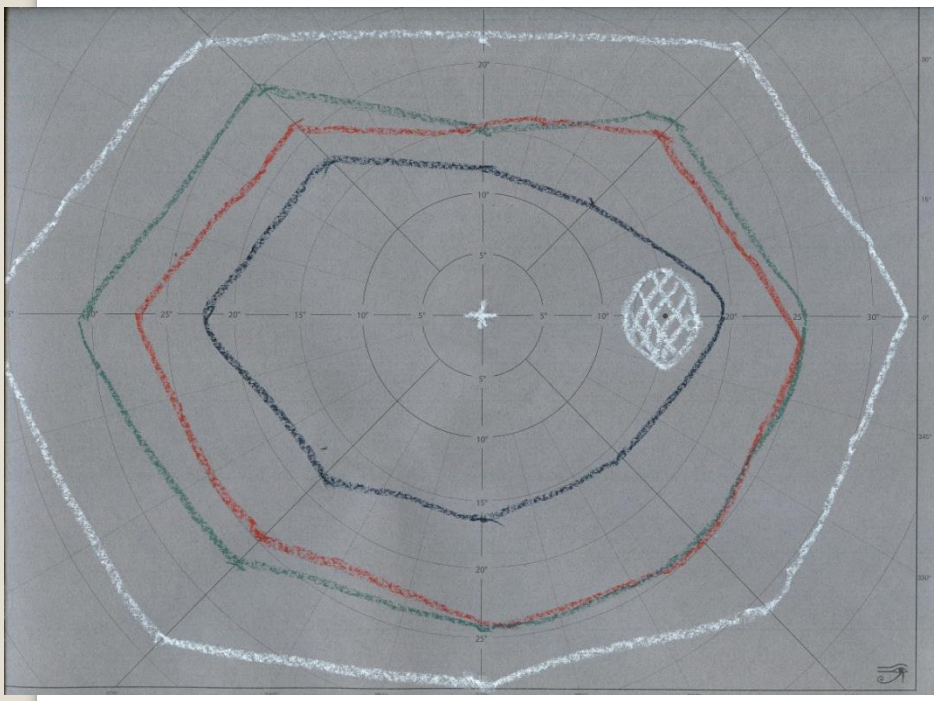

# TEST – what can you tell from these

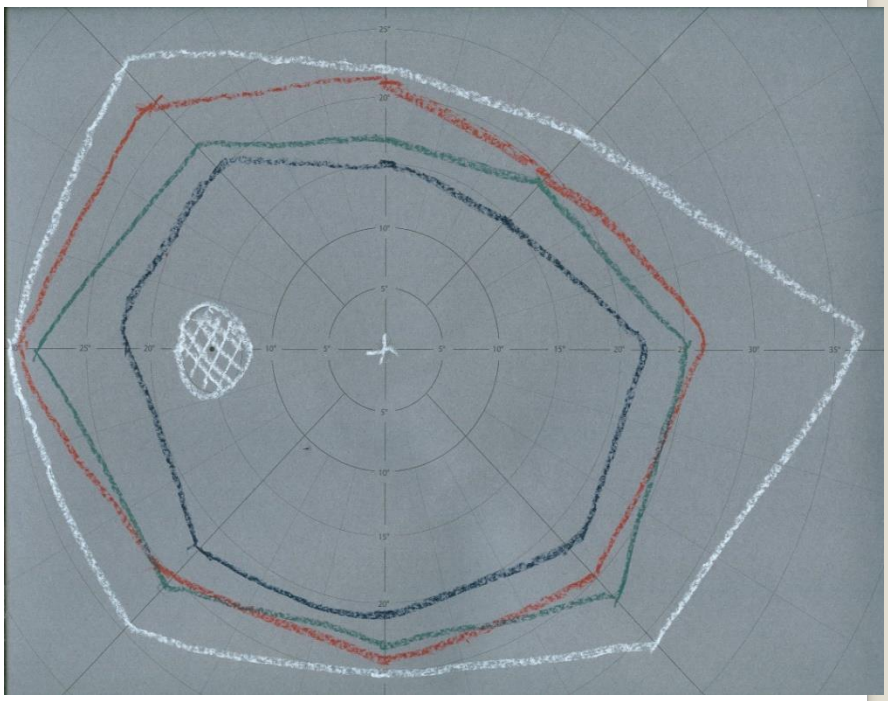



# 43 Year old Male Cerebral Vascular Accident With Vertical Diplopia



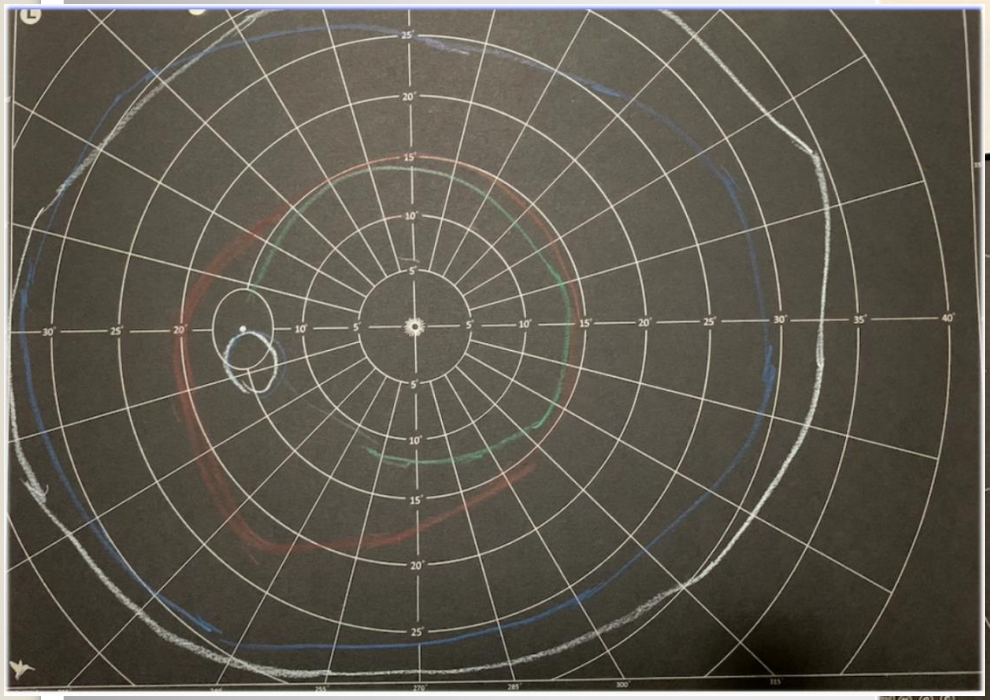
## Exogenous toxicity

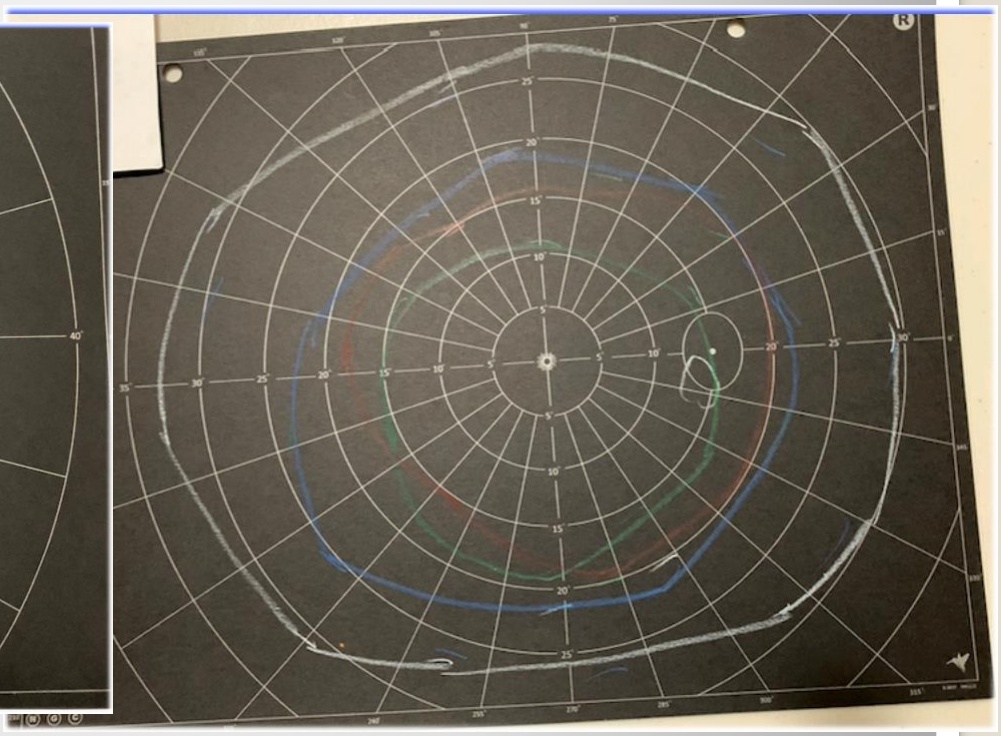




## Emotional / Adrenal issues

# Sample test results of Kinetic colour VF





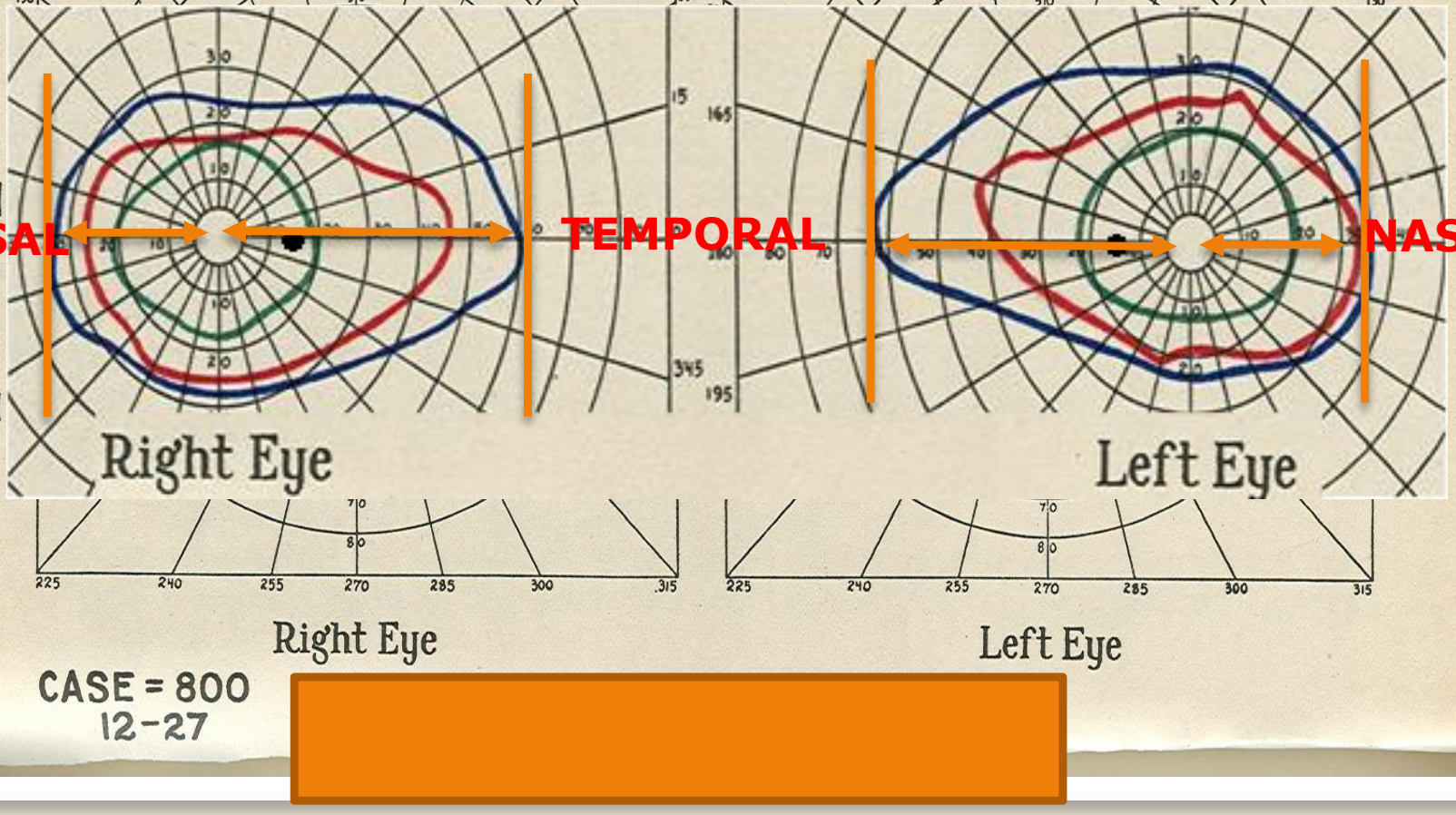
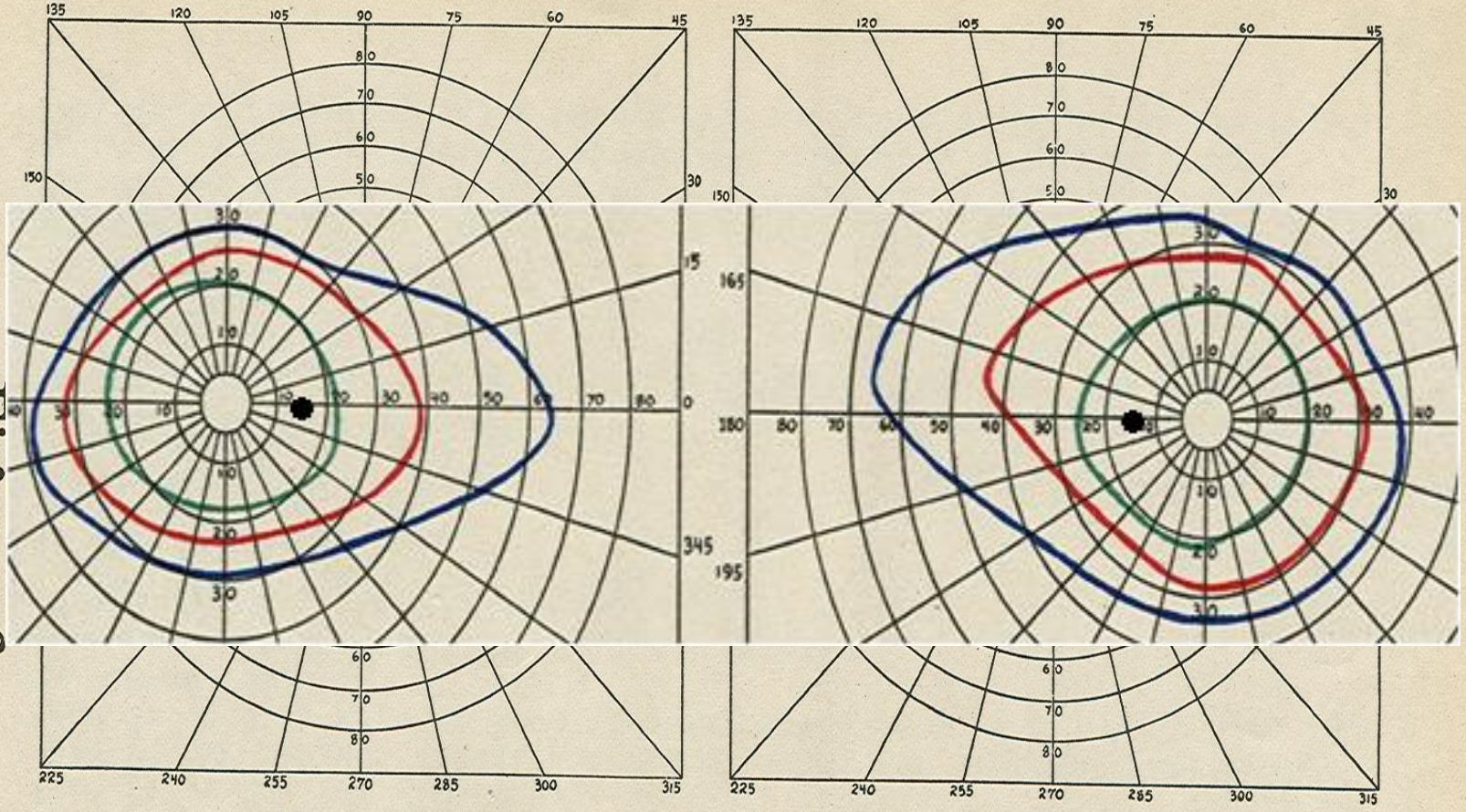

NASAL
TEMPORAL
NASAL
Right Eye
Left Eye
Right Eye
Left Eye
CASE = 800
12-27

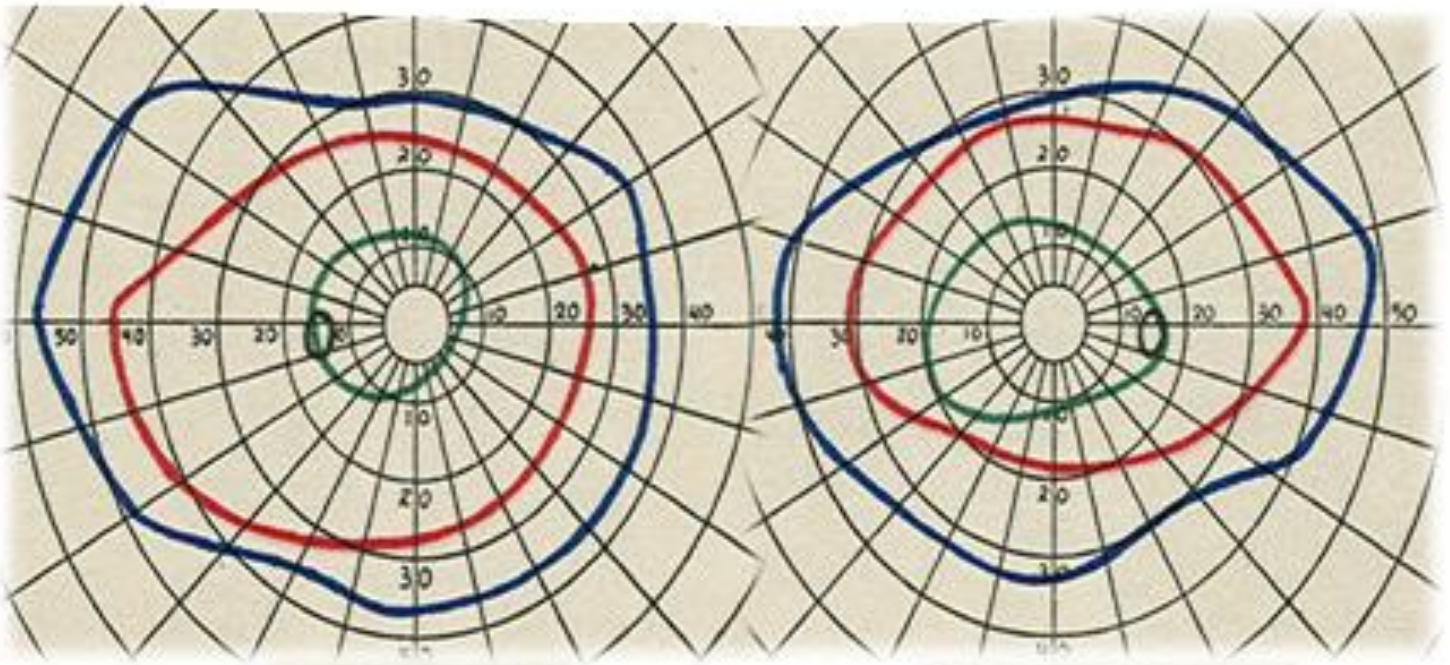
Figure 5.

Figure 6.




CASE = 800
12-27

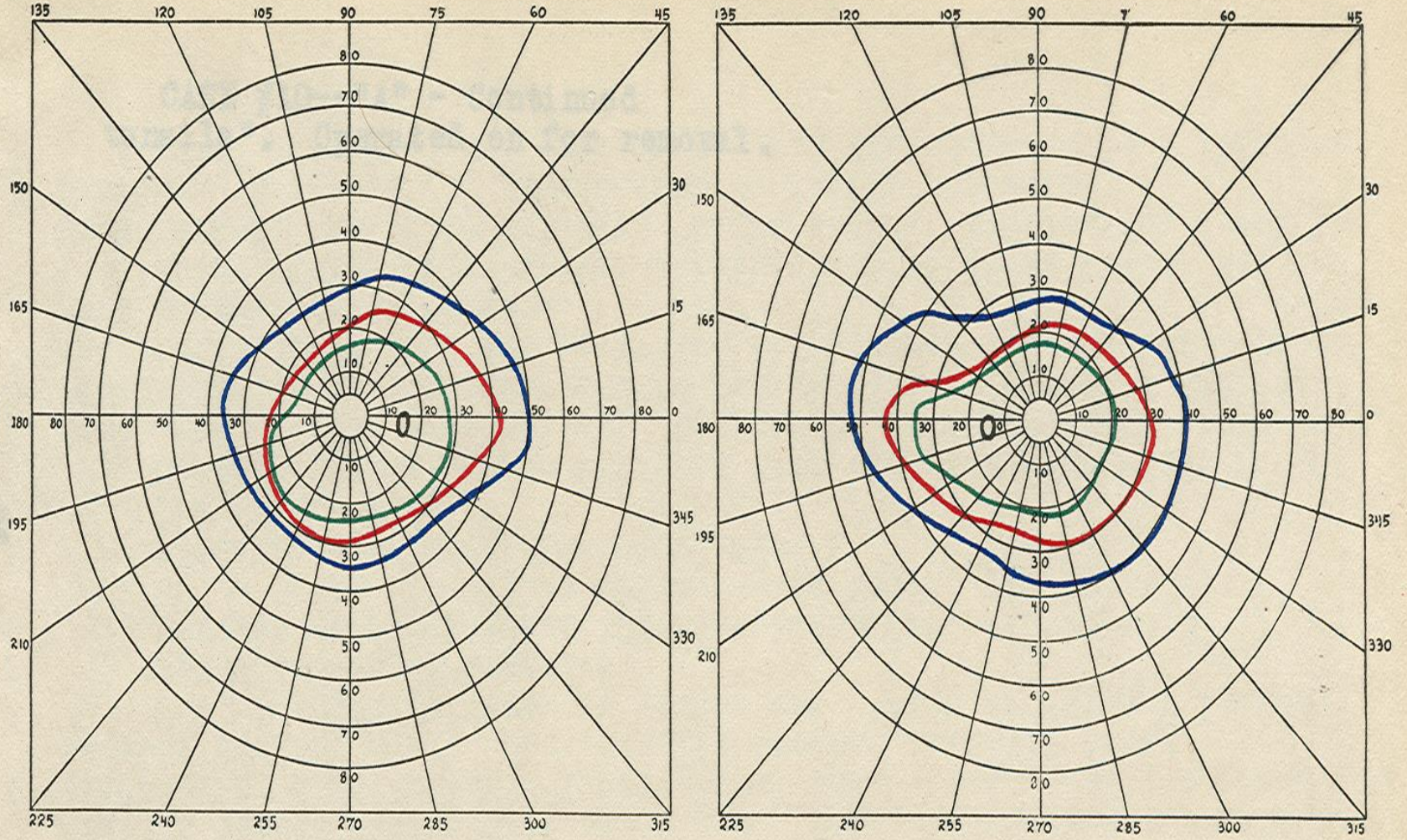
After Corrective Training



Left Eye

Right Eye

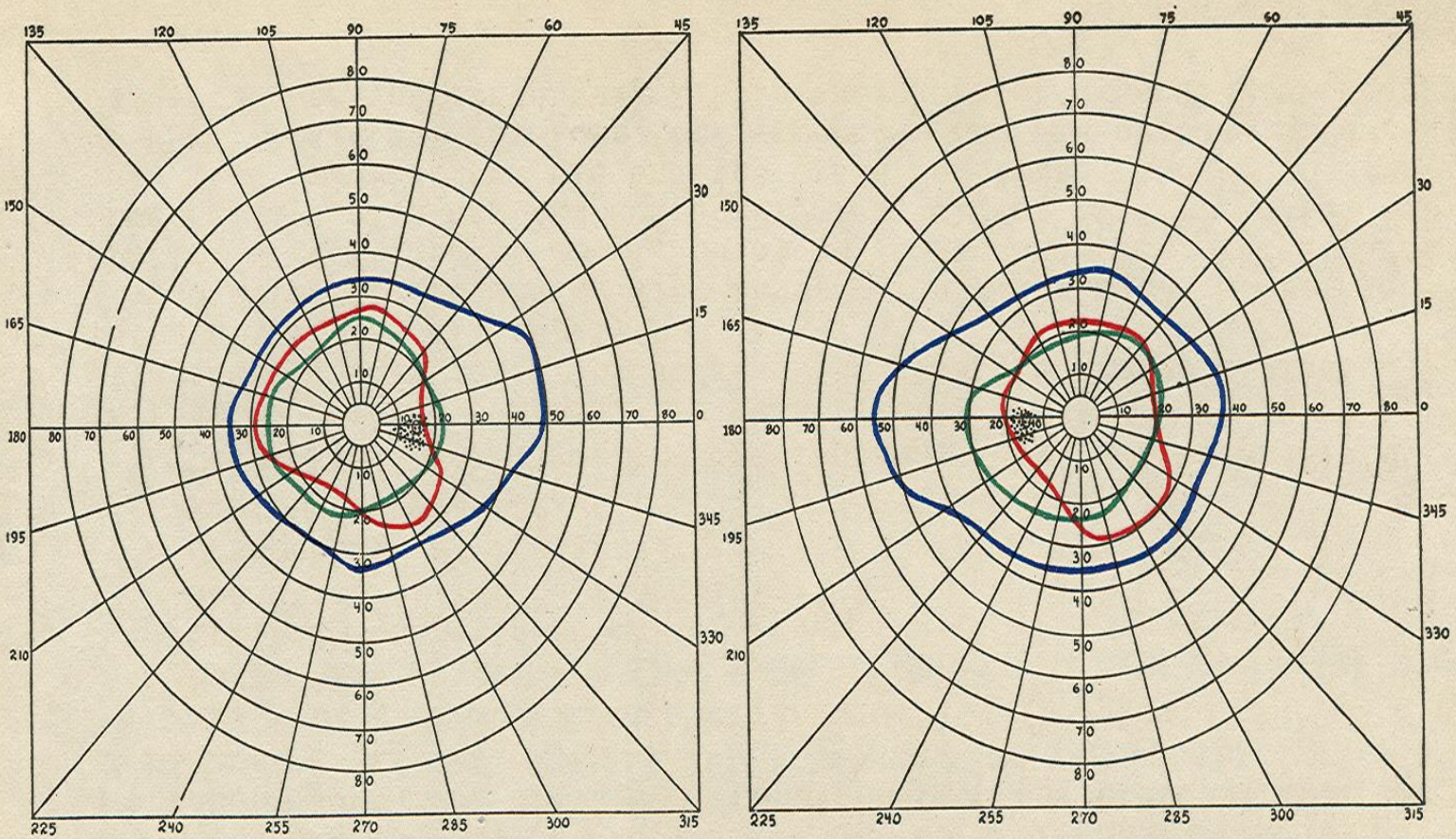
Figure 8.




CASE = 10C
5-26

After Removal
of Tonsils

Figure 9.




CASE=1721
6-26

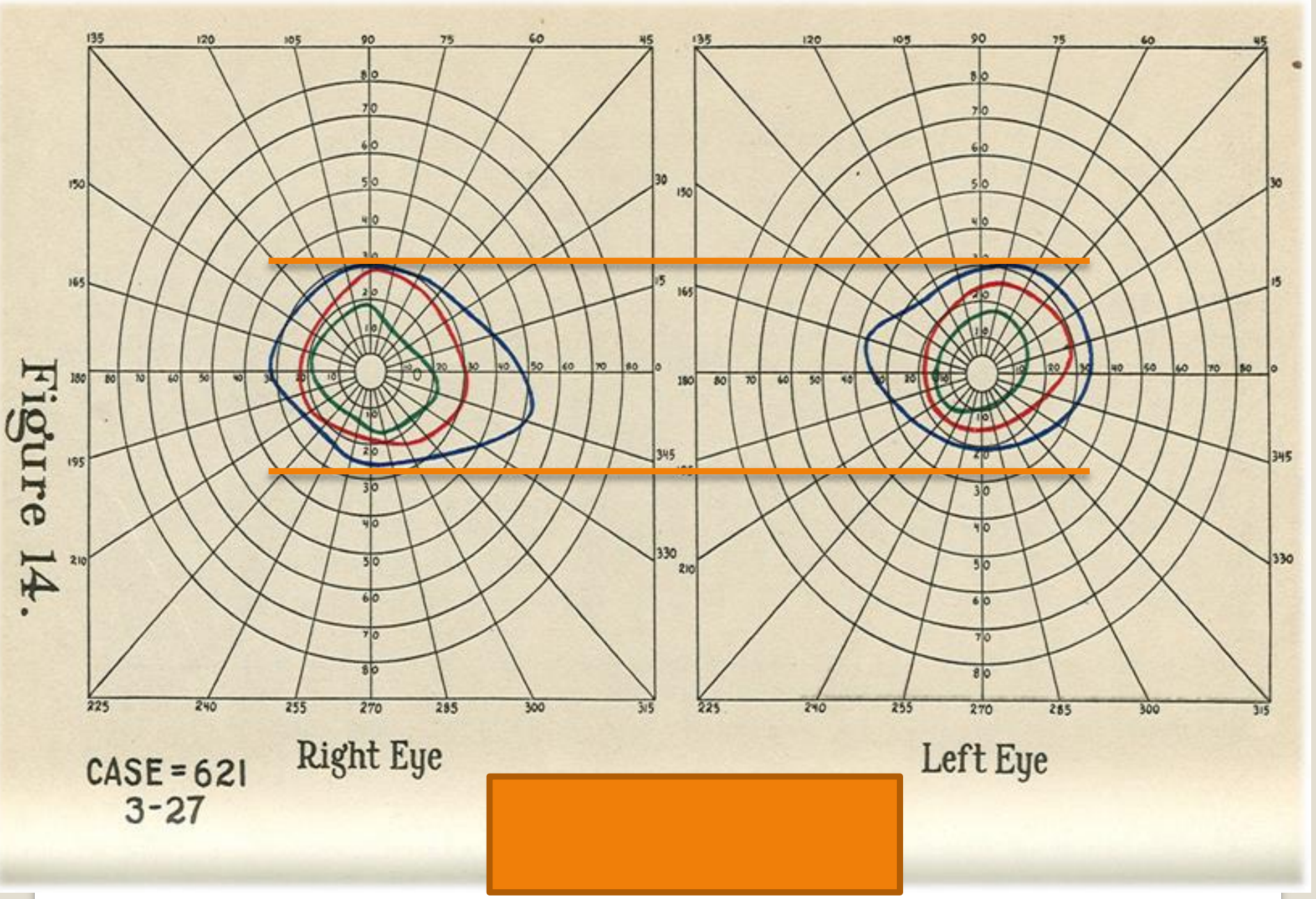


Figure 14.
CASE = 621
3-27
Right Eye
Left Eye

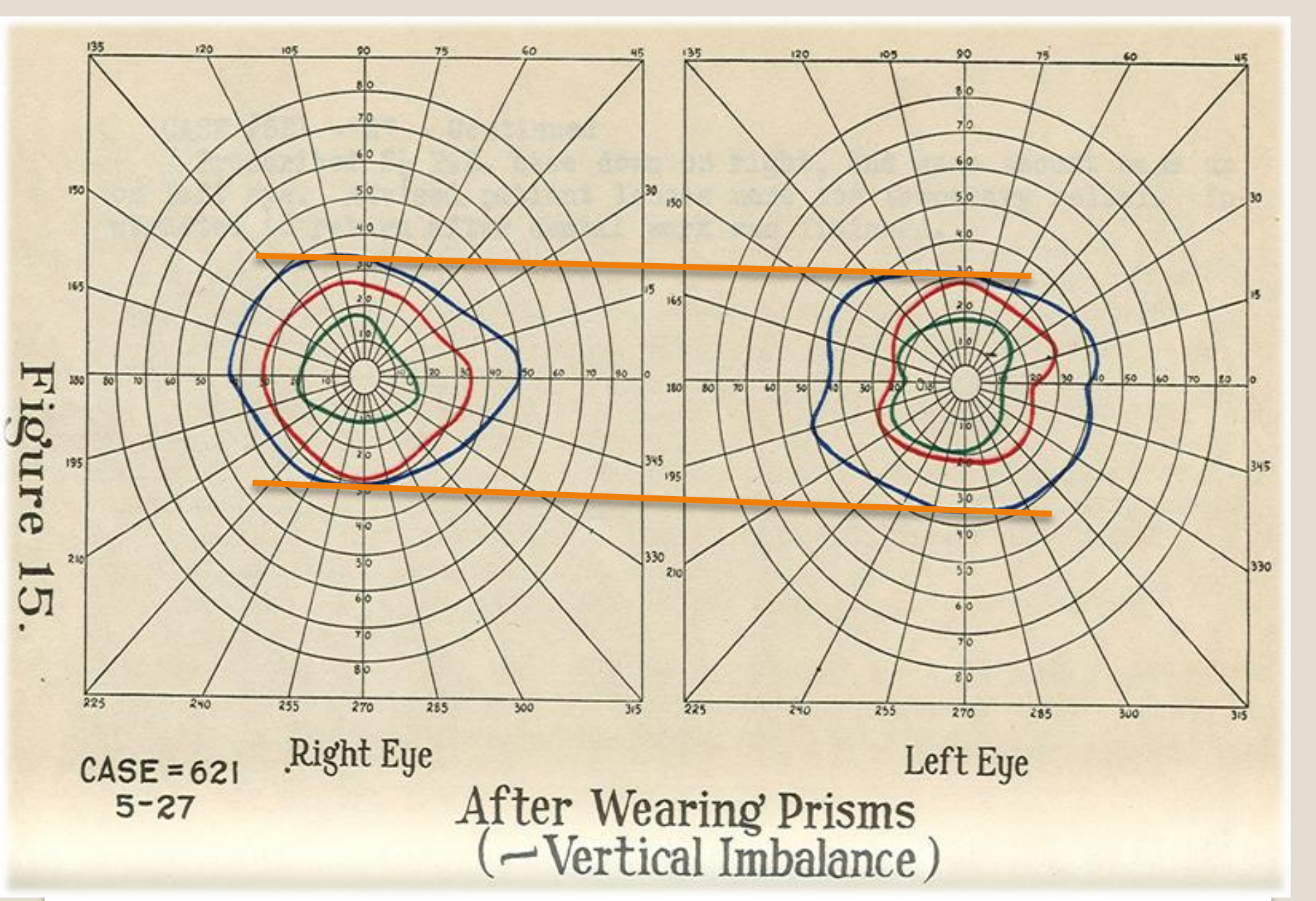


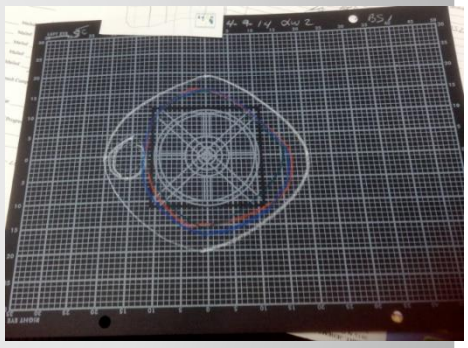
Figure 15.
CASE = 621
5-27
Right Eye
Left Eye
After Wearing Prisms
(– Vertical Imbalance)

# Rules of Thumb

- If fields are normal in size but blind spot is enlarged, results will not hold unless the blind spot is back to normal size.

- If twenty sessions have been given and blind spot and/or fields are improved but not entirely normal in size, discharge patient for four to six weeks and then re-measure fields.

- If fields remain unchanged or deteriorate, resume treatments and decide whether to continue with the same gentler frequency if the fields have not deteriorated or use a stronger frequency if deteriorated.



**Enlarged Blind spot & interlacing**

# Other Rules of Thumb

- If fields are 10 degrees or less, prepare the patient before treatments that more than one series of treatments may be needed

- The longer the condition has existed and/or the severity of the condition, the greater the probability for an extended period of treatments

- When the condition is deeply embedded, not only the visual system but the physiological, mental and emotional systems are usually also involved.

# Visual Field Summary

- The visual field represents a comfort zone for how much information a person can deal with and process.
- Peripheral areas represent the past and the future and the macula is the present.
- How we utilize peripheral awareness has major implications for our performance as thinking , functioning individuals.
- The visual field gives us a read out of how bio-electrically active and lit up the brain is." (Ellis Edelman)


THANK YOU