Alzheimer’s and vision in the current panic

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Brownstone

Rational Ground

My favorite analogy: the mouse and the computer

If the M- Pathway fails, the P- Pathway fades

Shioiri & Cavanaugh,
Vision Research, 1989

Reppas, Usrey & Reid
Neuron 2002

trox/motion reversal:
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Macknik & Livingstone
Nature Neuroscience 1998

Filling-in References that
have motion reversing

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Research 2001

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Bassi CJ, Solomon K, Young D.
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70(10):809-813;1993

Motion keeps the image awake

"regular" carried by the Magnocellular pathway

Magnocellular pathway is more developed
earlier than Parvocellular

Reduce M- activity by 20% and we lose the picture in 80 msec

The gap is filled in, strongly enough to
create rivalry with the other eye

The loss of the image interferes with fixation

The loss of fixation accuracy eventually increases motion

If motion (or positional error) exceeds the threshold, the
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Thilo, Santoro, Walsh & Blakemore
Nature Neuroscience 2004

Burr, Morrone & Ross
Nature 1994

Hafed
J of Vision 2017

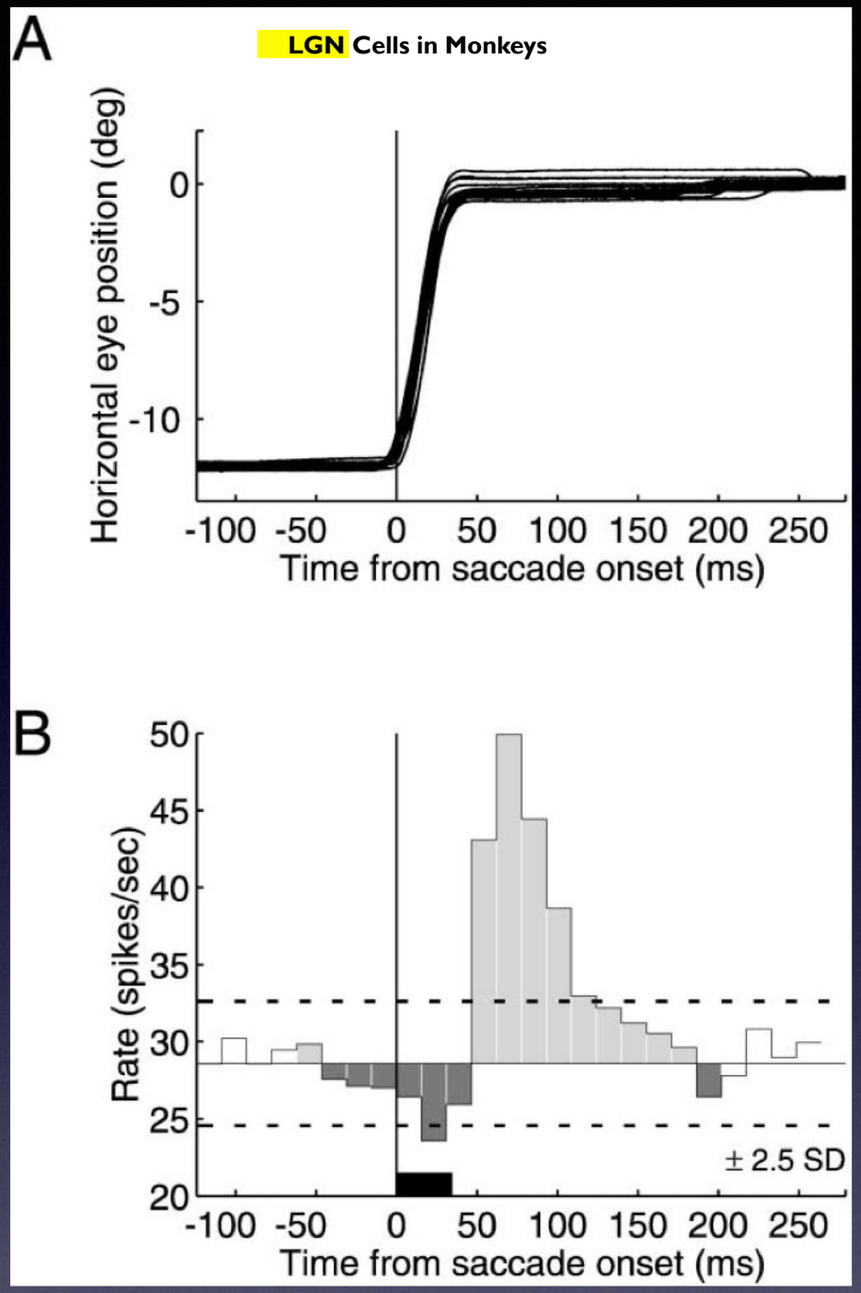

Figure 2. LGN Spike Rate Is Modulated around the Time of a Saccade

The animal made saccades between horizontal target locations 12° apart. (A) The horizontal component of the eye position for a subset of these trials. (B) The *peri-saccadic spike rate* from a single magno-cellular neuron. The solid horizontal line is the mean spike rate produced by the flickering stimulus, measured during periods of fixation; the heavy dotted lines are ±2.5 SD of this value. The average saccade duration was 33.5 ms and is indicated by the horizontal black bar. For the period −75 ms to 200 ms, rate decrements are shaded dark gray, and increments are shaded light gray. The light and dark gray areas correspond, respectively, to the enhancement and suppression indices described in the Experimental Procedures (see also Figure 4B).

Fixational Eye Movements

Shioiri & Cavanaugh,
Vision Research, 1989

Foveation and Visual Memory

Geringswald, Porracin & Pollmann

Journal of Vision, 2016

Reudemann
Kresge Eye Institute Bulletin, 1957

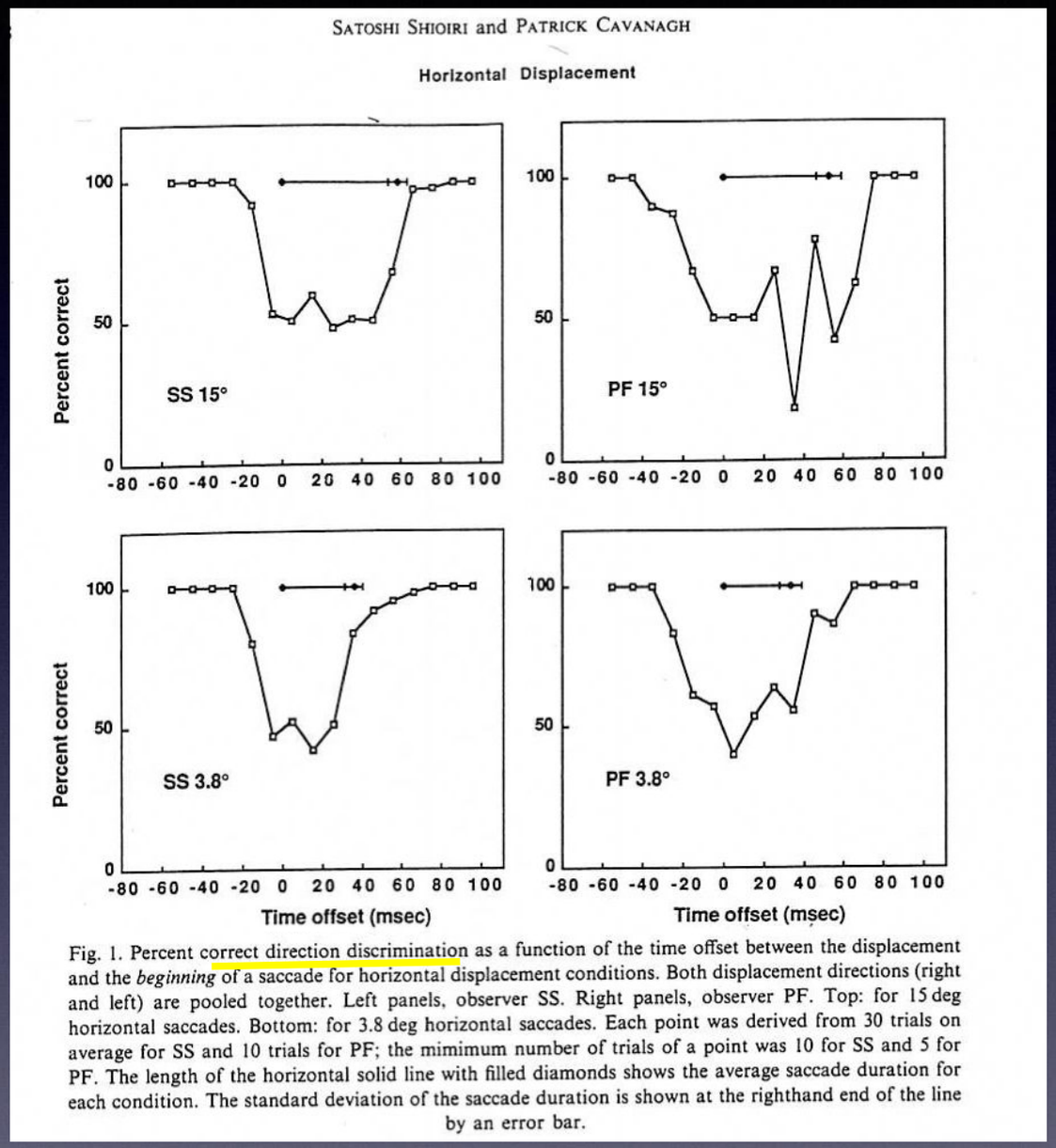

Fig. 1. Percent correct direction discrimination as a function of the time offset between the displacement and the *beginning* of a saccade for horizontal displacement conditions. Both displacement directions (right and left) are pooled together. Left panels, observer SS. Right panels, observer PF. Top: for 15 deg horizontal saccades. Bottom: for 3.8 deg horizontal saccades. Each point was derived from 30 trials on average for SS and 10 trials for PF; the mimimum number of trials of a point was 10 for SS and 5 for PF. The length of the horizontal solid line with filled diamonds shows the average saccade duration for each condition. The standard deviation of the saccade duration is shown at the righthand end of the line by an error bar.

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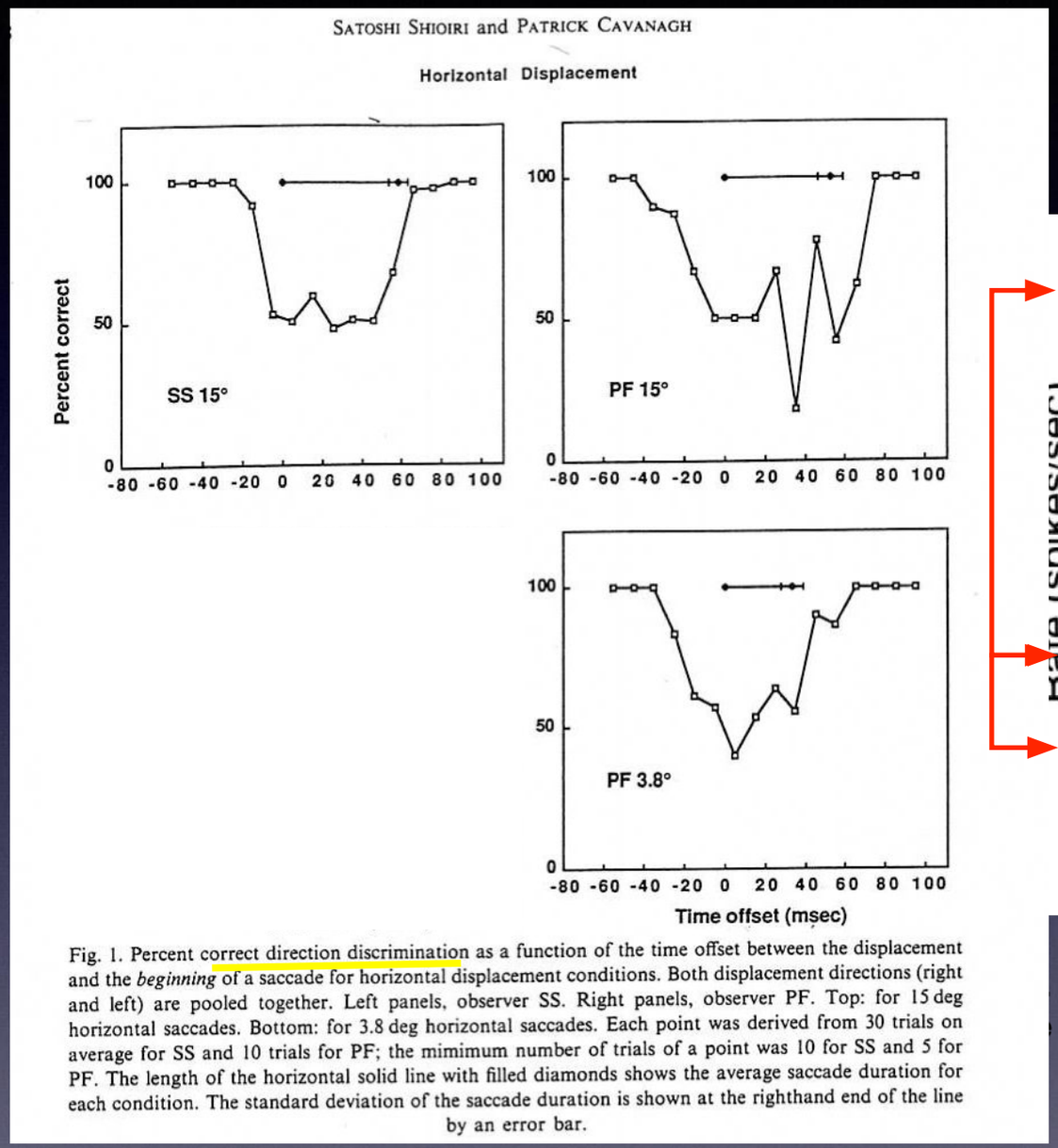
McCamy, Macknik &

Martinez-Conde J Physiol 2014



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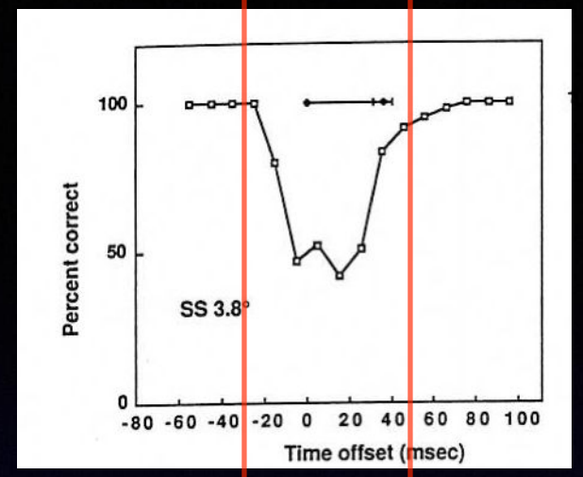
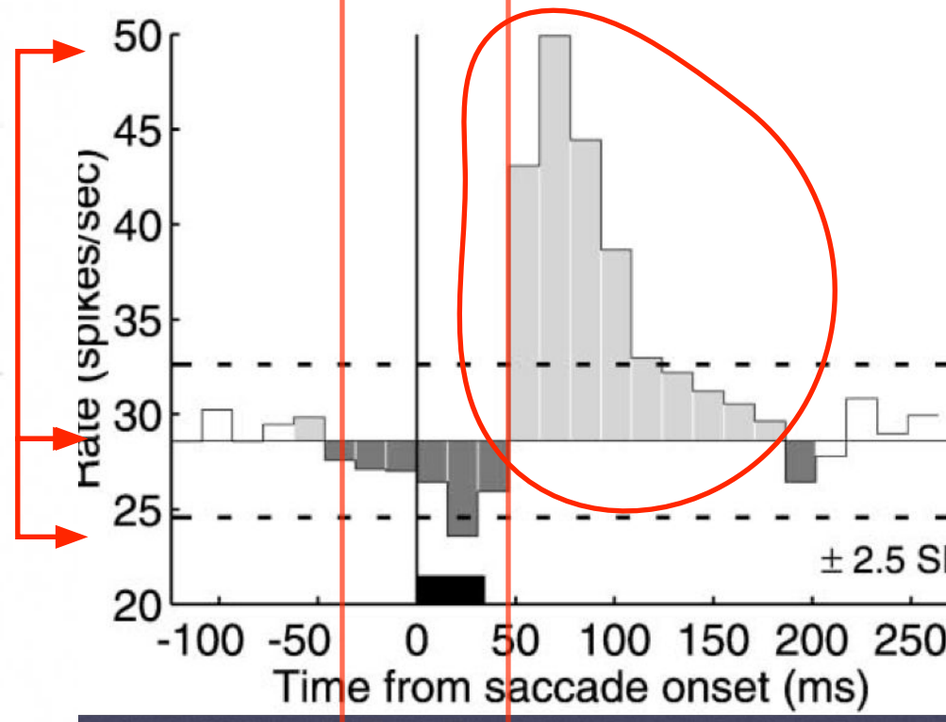
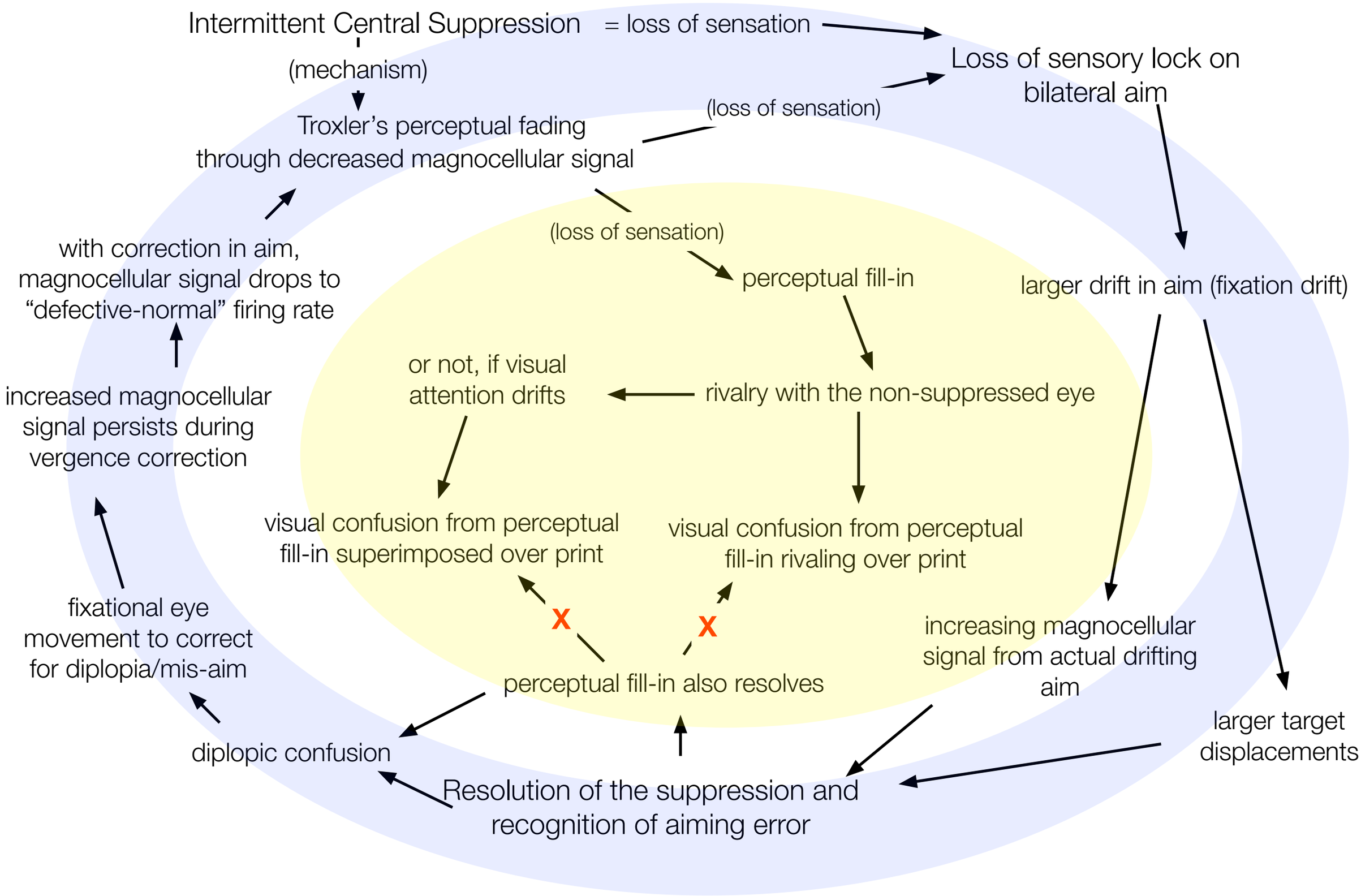




LGN Spike Rate Is Modulated around the Time of

Fixational Eye Movements



The 5-second Spin-Cycle of ICS and Reading

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Special Case of Alzheimer's
(actual injury)

create rivalry with the other eye

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Alzheimer's selectively injures
the magnocellular pathway

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How long does the image dropout take
when the pathway is actually injured?

The loss of the image interferes with fixation

And how does the signal get strong
enough to bring the image back?

If motion (or positional error) exceeds the threshold, the
image comes back

aging. However, this should be tested. It will require a sophisticated test paradigm since ICS testing is subjective and the picture is confused with other anomalies of aging such as cataracts and macular degeneration.

If this view is accurate, further M-pathway deterioration in Alzheimer's suggests some wide reaching inferences. As M pathway deterioration progresses, image fading in the P pathway would be more extensive. An advanced Alzheimer's patient may be descending into a completely unstable visual world as vision literally shuts off more and more frequently, perhaps even for longer periods of time. Perhaps memory is not always the problem in recognition of faces. The faces may actually not be visible in any norm

Hussey ES: Binocular visual sensation in reading II: Implications of a unified theory. Journal of Behavioral Optometry 2002; 13(3):66-70

WEDNESDAY, April 13, 2016 (HealthDay News) -- A new study sheds light on what is often called one of the cruelest effects of Alzheimer's disease -- the patient's inability to recognize loved ones.

Family members need to understand the necessity of identifying themselves verbally at every be surprised if recognition varies day to day.

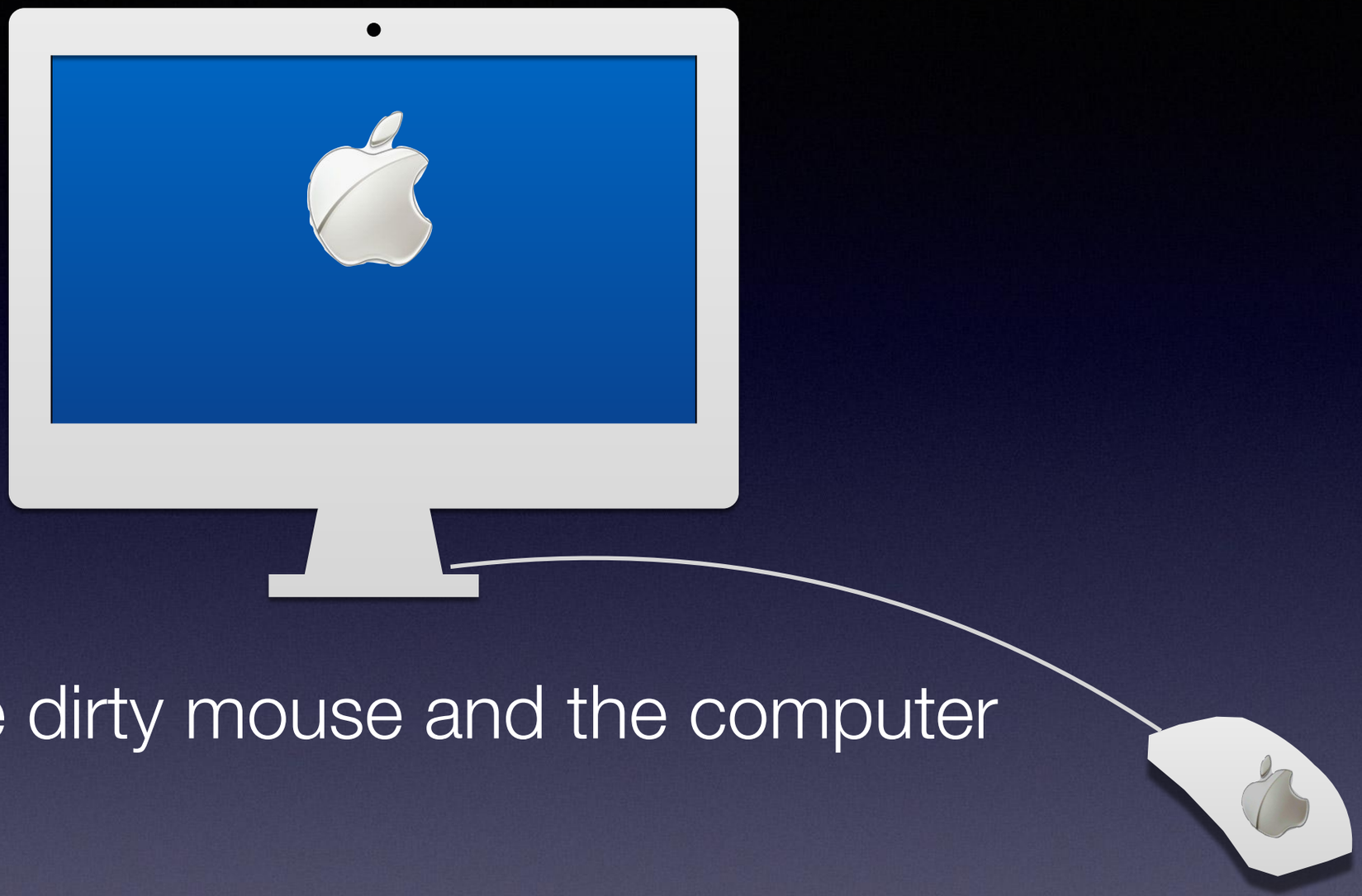
Researchers report that along with causing memory loss, Alzheimer's also seems to affect people's visual perception -- specifically their ability to recognize faces.

For example, because impaired facial recognition may be due to a visual perception problem -- and not a general memory problem -- strategies such as voice recognition might help Alzheimer's patients recognize loved ones for a longer time period, the researchers said.

The findings were published April 12 in the Journal of Alzheimer's Disease

the start: my worries about face detection - kids

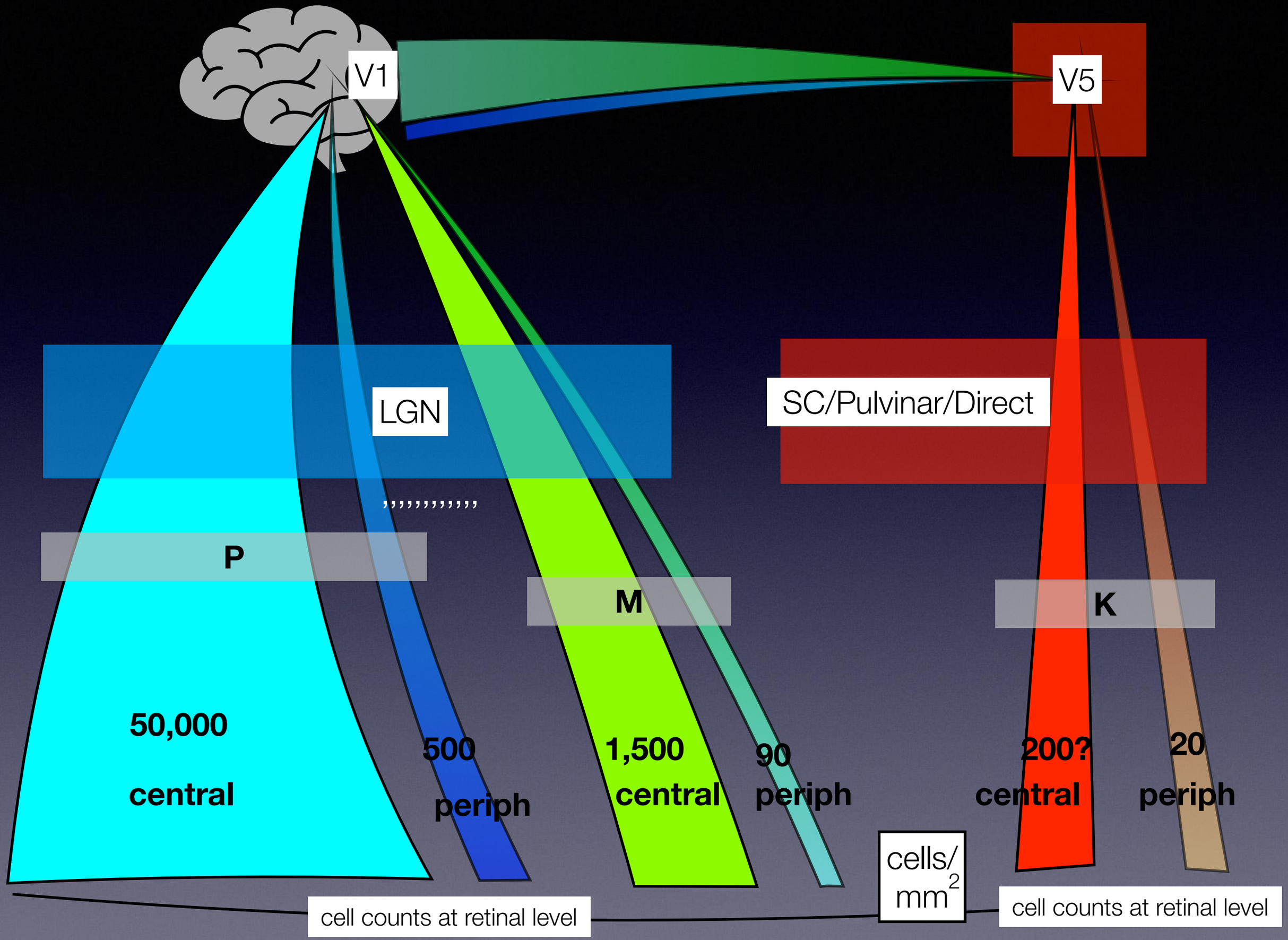
(https://content.iospress.com/articles/journal-of-alzheimers-disease/jad151027?resultNumber=6&totalRes

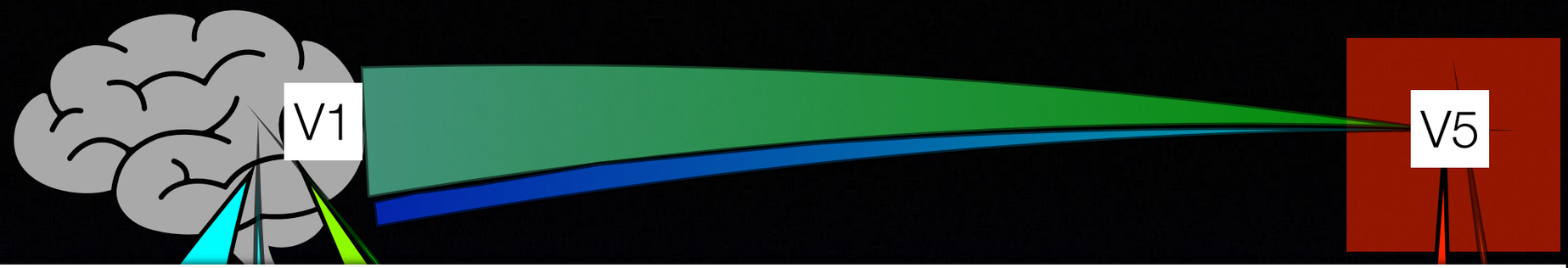


The dirty mouse and the computer

If the M- Pathway fails, the P- Pathway fades

And some wondering about Motion Sensitivity in Alzheimer’s


V1
V5
LGN
SC/Pulvinar/Direct
P
M
K
50,000
central
500
periph
1,500
central
90
periph
200?
central
20
periph
cells/
mm2
cell counts at retinal level
cell counts at retinal level



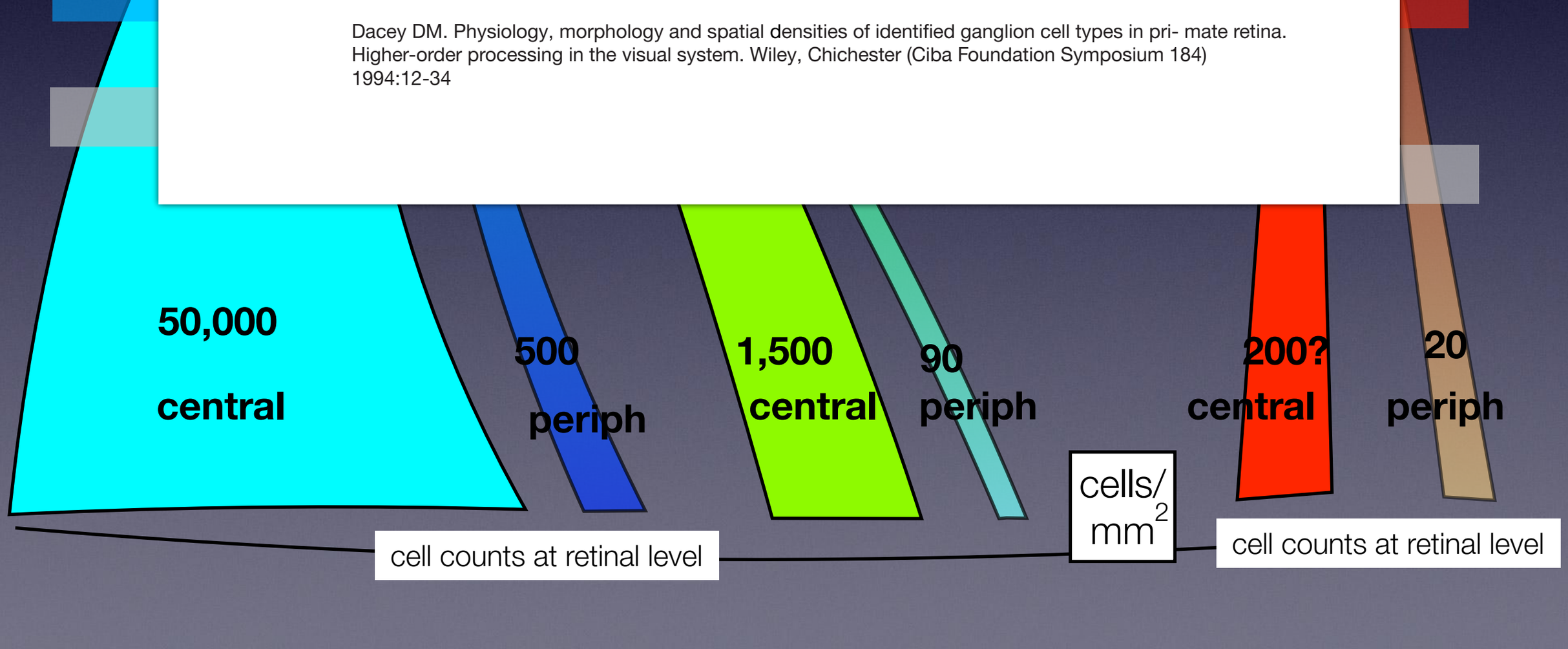
Gomes, Silveira, Saito, Yamada. Density, proportion and dendritic coverage of retinal ganglion cells of the common marmoset. Brazilian J Med & Biol Research (2005) 38:915-924.

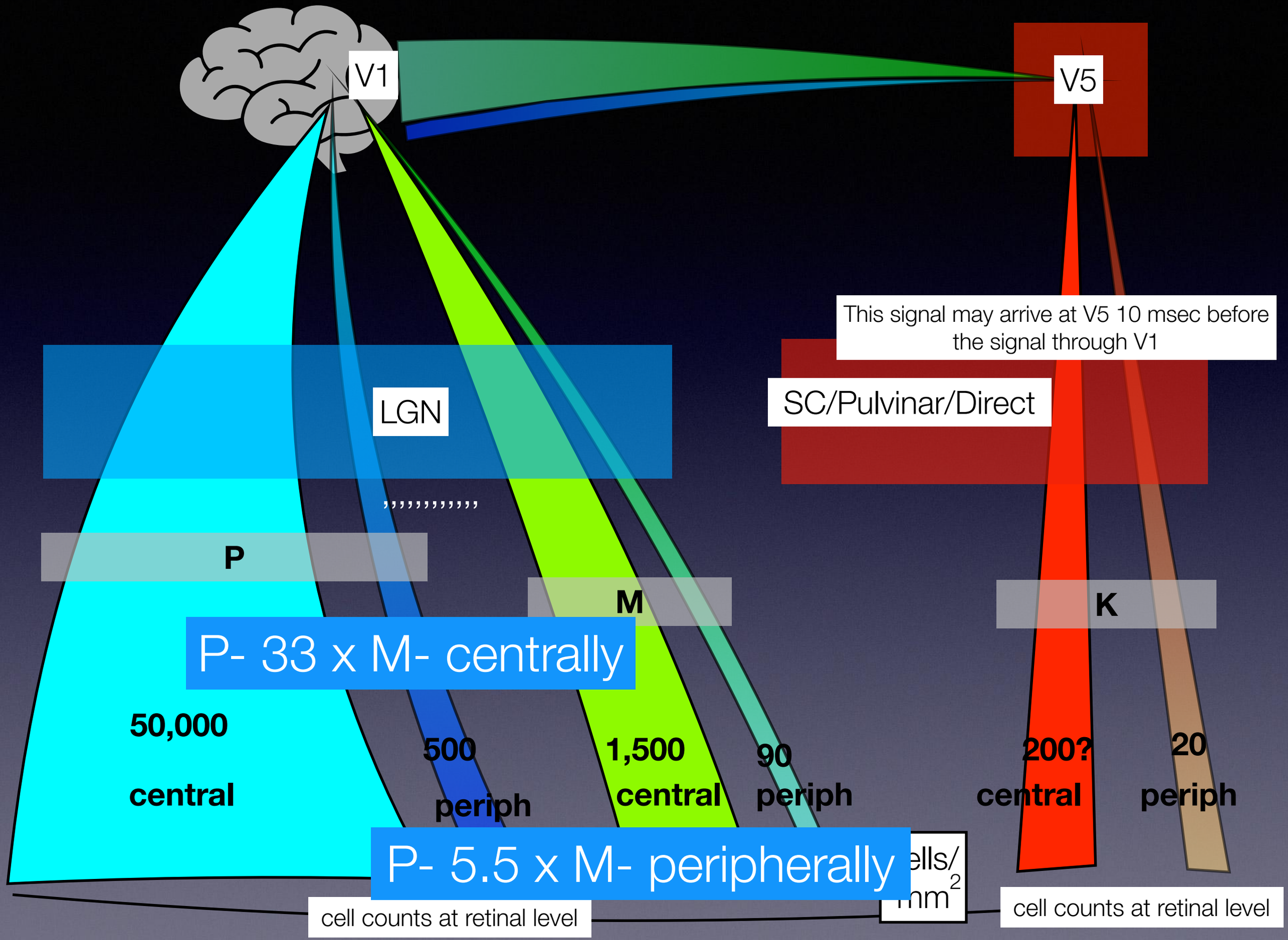
Azzopardi, Jones, Cowey. Uneven mapping of magnocellular and parvocellular projections from the lateral geniculate nucleus to the striate cortex in the macaque monkey. Vision Research 39 (1999) 2179–2189

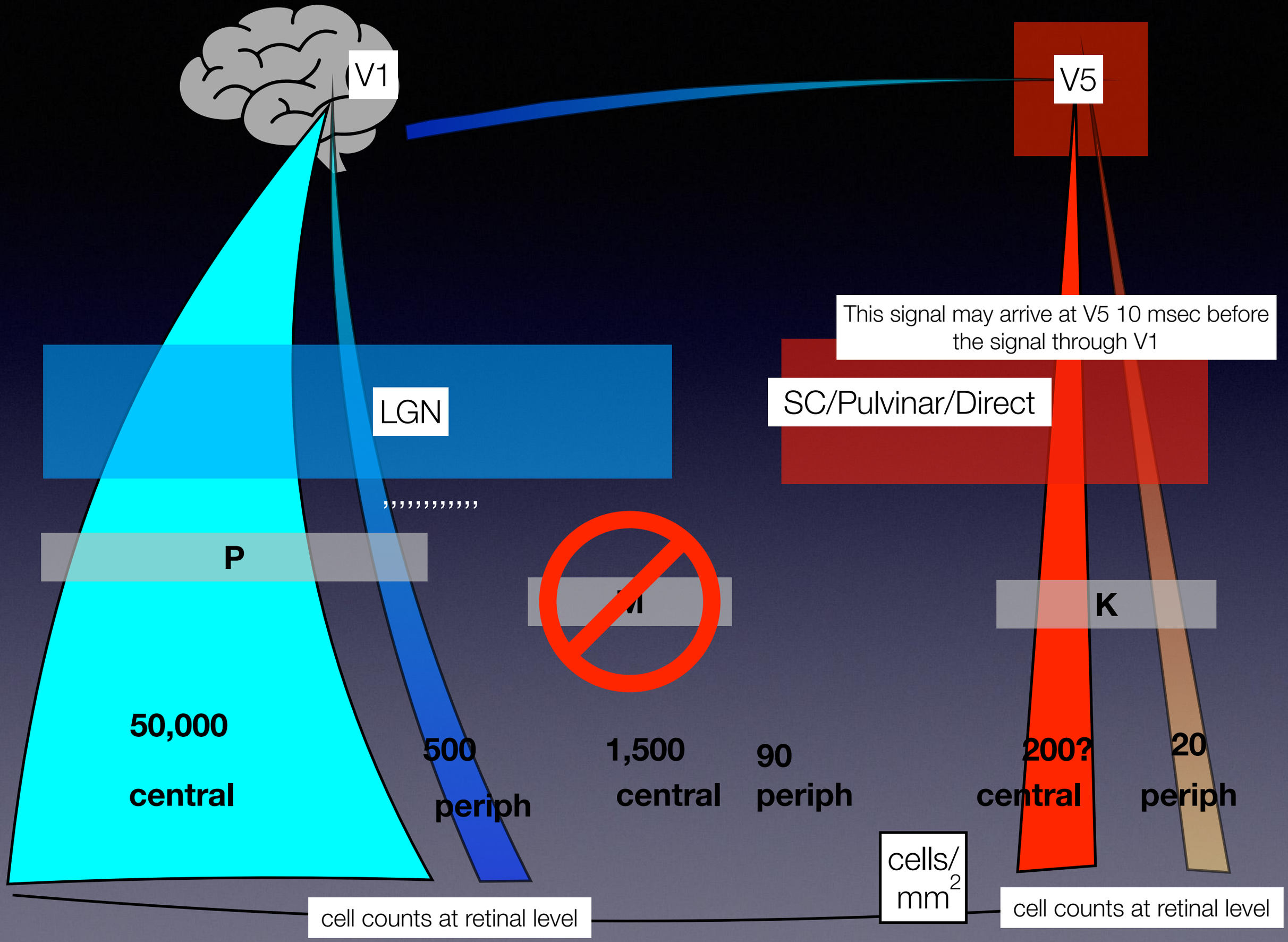
Gilaie-Dotan S. Visual motion serves but is not under the purview of the dorsal pathway. Neuropsychologia

89 (2016) 378–392

Dacey DM. Physiology, morphology and spatial densities of identified ganglion cell types in pri- mate retina. Higher-order processing in the visual system. Wiley, Chichester (Ciba Foundation Symposium 184) 1994:12-34




V1
V5
This signal may arrive at V5 10 msec before the signal through V1
LGN
SC/Pulvinar/Direct
P
M
K
P- 33 x M- centrally
50,000
central
500
periph
1,500
central
90
periph
200?
central
20
periph
P- 5.5 x M- peripherally
cell counts at retinal level
cell counts at retinal level


V1
V5
This signal may arrive at V5 10 msec before the signal through V1
LGN
SC/Pulvinar/Direct
P
M
K
50,000
central
500
periph
1,500
central
90
periph
200?
central
20
periph
cells/
mm2
cell counts at retinal level
cell counts at retinal level

ICS and extreme motion sensitivity

diplopia at near and on lateral excursions, things moving in periphery, sensitive to moving lights, variable focus

prior to shock, “bullseye shot” and great at determining land slopes by sight

flew 10 feet - “lawn dart” - whiplash??

jumped when I changed lenses in the phoropter, couldn’t do rotations, moving lights bother - his vision and symptoms “get worse with busy visual backgrounds, stores/crowds and movement.”

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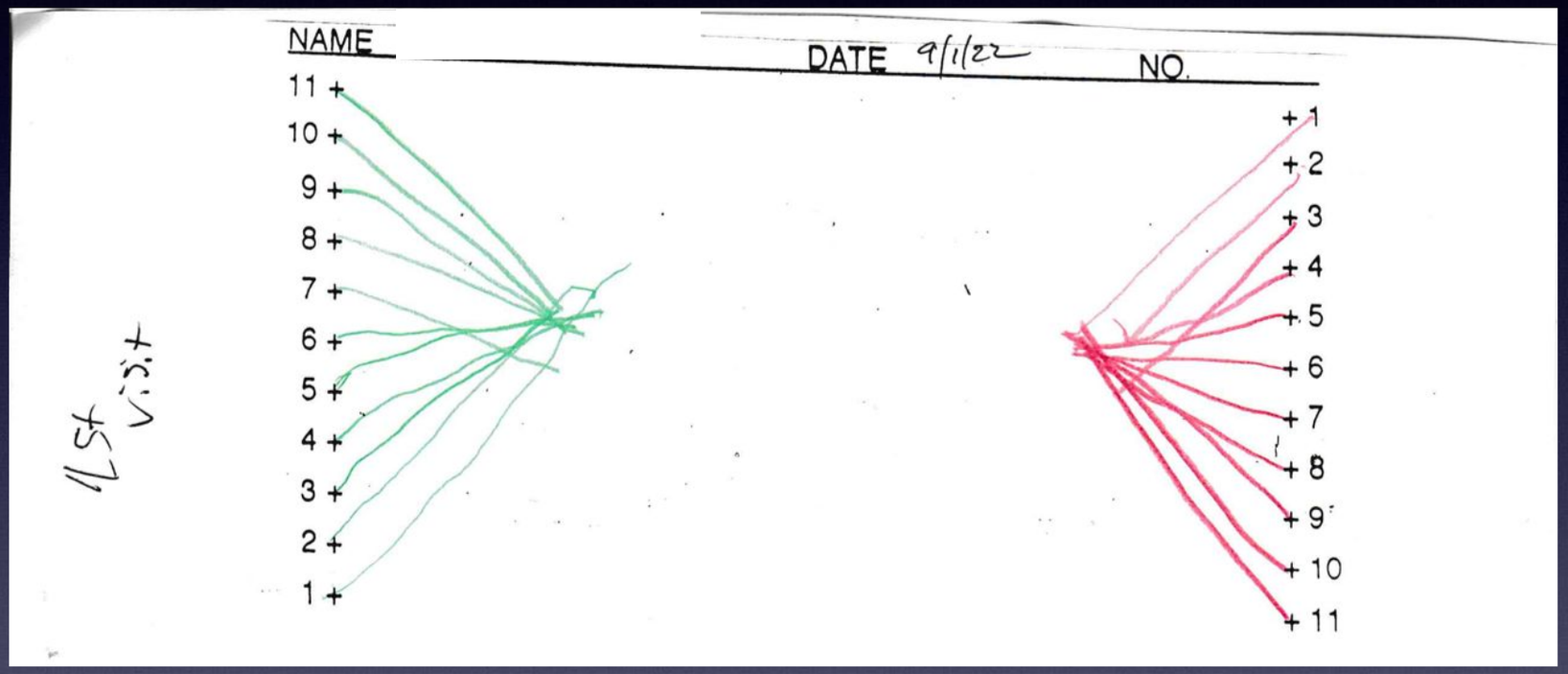
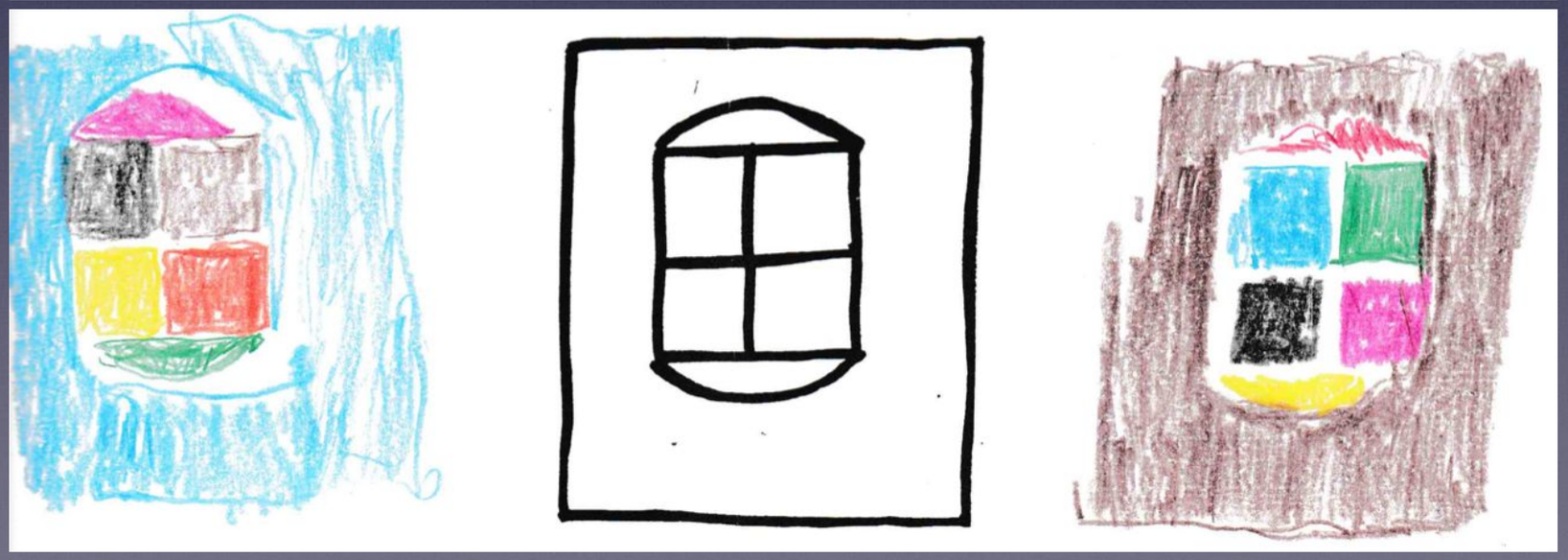


lost pencils & lines toward center "only hands"



lost pictures & pencils – outlined

Alzheimer’s and infant face detection in the current panic

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Rational Ground

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And it may not be repairable Brownstone

A second pretty clean case of the genesis of suppression (ICS) after whiplash

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Intermittent Central Suppression caused by Cervical Trauma - Whiplash

Whiplash producing ICS without field change

Table 1. Summarization of Post-Trauma Vision Finding Changes

PATIENT	First Exam Date/ Second Exam Date	Changes in Accom-modation, Convergence or Motility Findings	Vectographic Tests Showing Newly Developed Suppression Post-Trauma
RM	1987/1989	Small decrease BI duction recovery. Small decrease BO duction break	OD near fixation disparity, split diamond, dist. fixation disparity; alternation on distance acuities

A second pretty clean case of the genesis of suppression (ICS) after whiplash

Christie - most recent exam 5/17/2022
Rear-ended at a stop sign December 2021
Prior exams 2013, 2016, 2017

52yo white female
Hx: MVA and concussion(?) ~14 years prior to 1st exam

Whiplash producing ICS
Christie - most recent exam 5/17/2022

	Refractive status/VA	Cover Test	Maples Pursuit	Confrontation Field/IOPs	Near Phorias	Near Vergence	Distance Stereo	ICS
Earlier	-0.25-0.75x110 20/20 OD,OS -1.00-1.00x90	ortho	5s head movement, ability & accuracy	field normal	2 exo 2013	30/6 BO	4 of 4, 60-73” arc	None
				14,11	12 exo 2016-17	12/6 BI		None
2022	-0.75-1.00x95 20/25 OD,OS -0.75-1.25x75	ortho	2 head movement, 4 accuracy maybe a trail after bead	field normal	15 exo	too sick BO	questionable 2 of 4, ~200” arc	Alternates on distance alternate letter line
				11,14		12/2 BI		

Prior exams 2013, 2016, 2017

LASIK 2006

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complaint: blur, diplopia

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				14,11	12 exo 2016-17	12/6 BI		
2022	-0.75-1.00x95 20/25 OD,OS -0.75-1.25x75		2 head					Alternates n distance alternate letter line

“The glasses made a big difference. I can see! It made me feel really badly for blind people.”

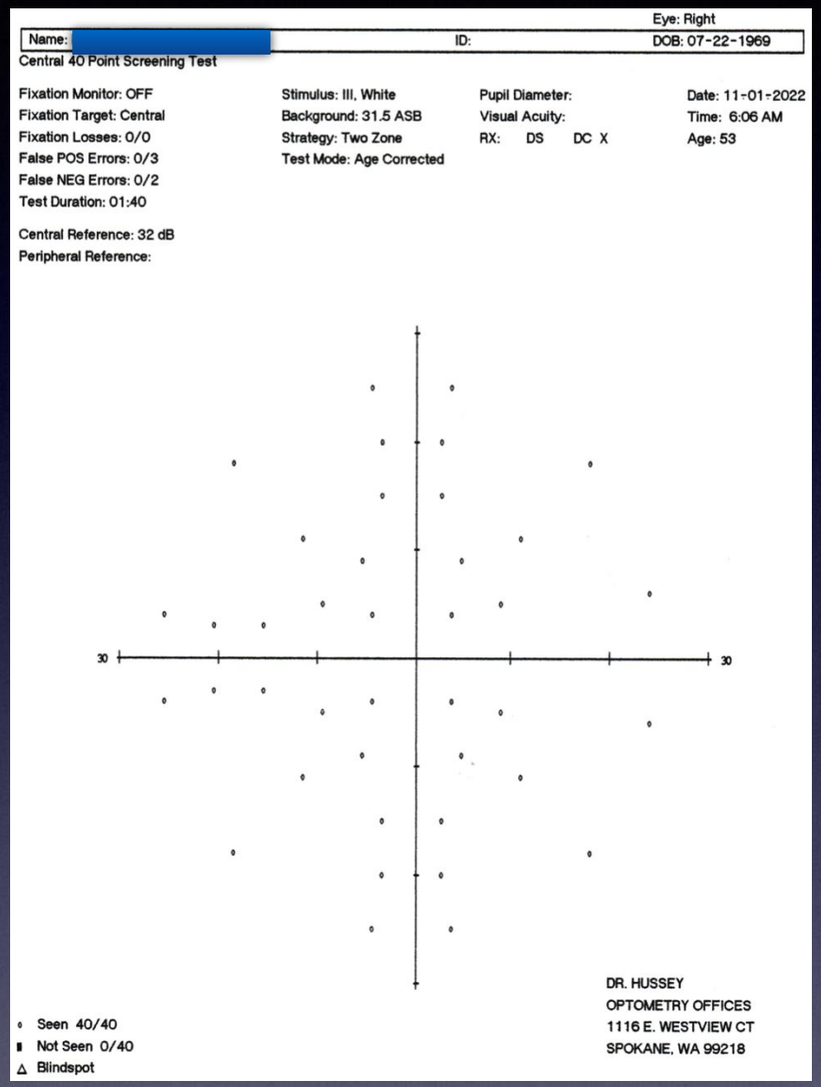
Prior exams 2013, 2016, 2017

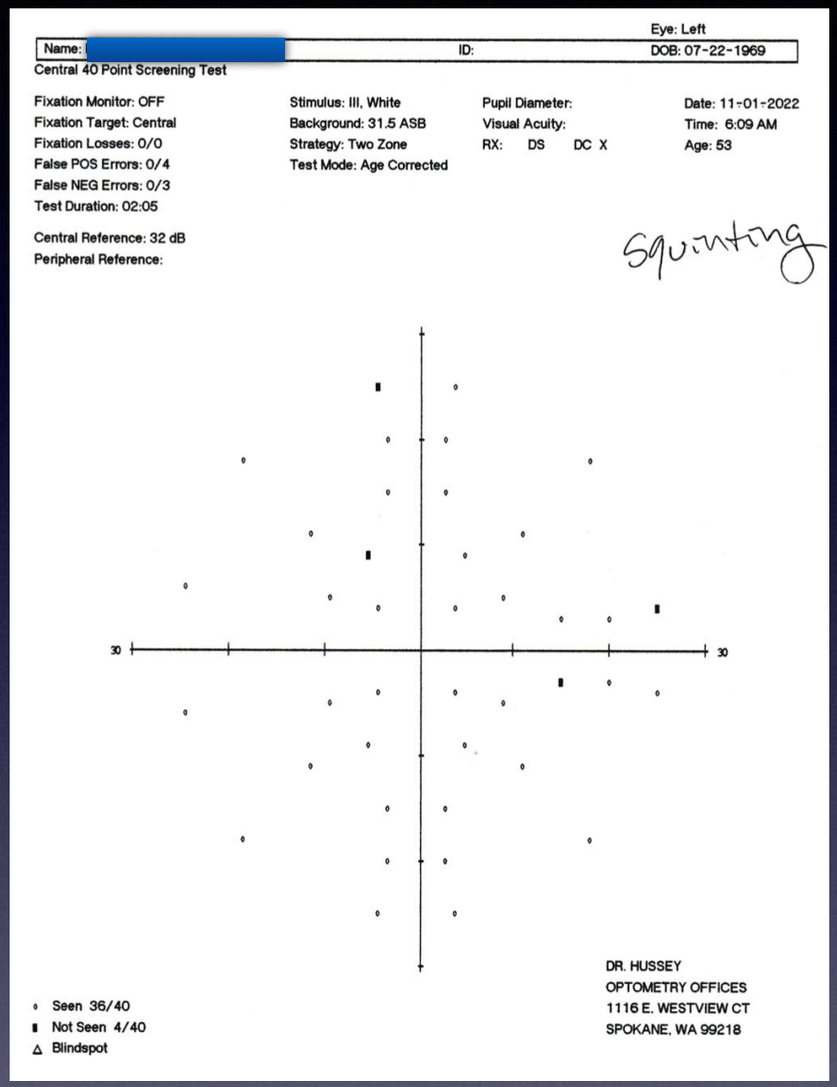
LASIK 2006

Rear-ended at a stop sign December 2021

complaint: blur, diplopia

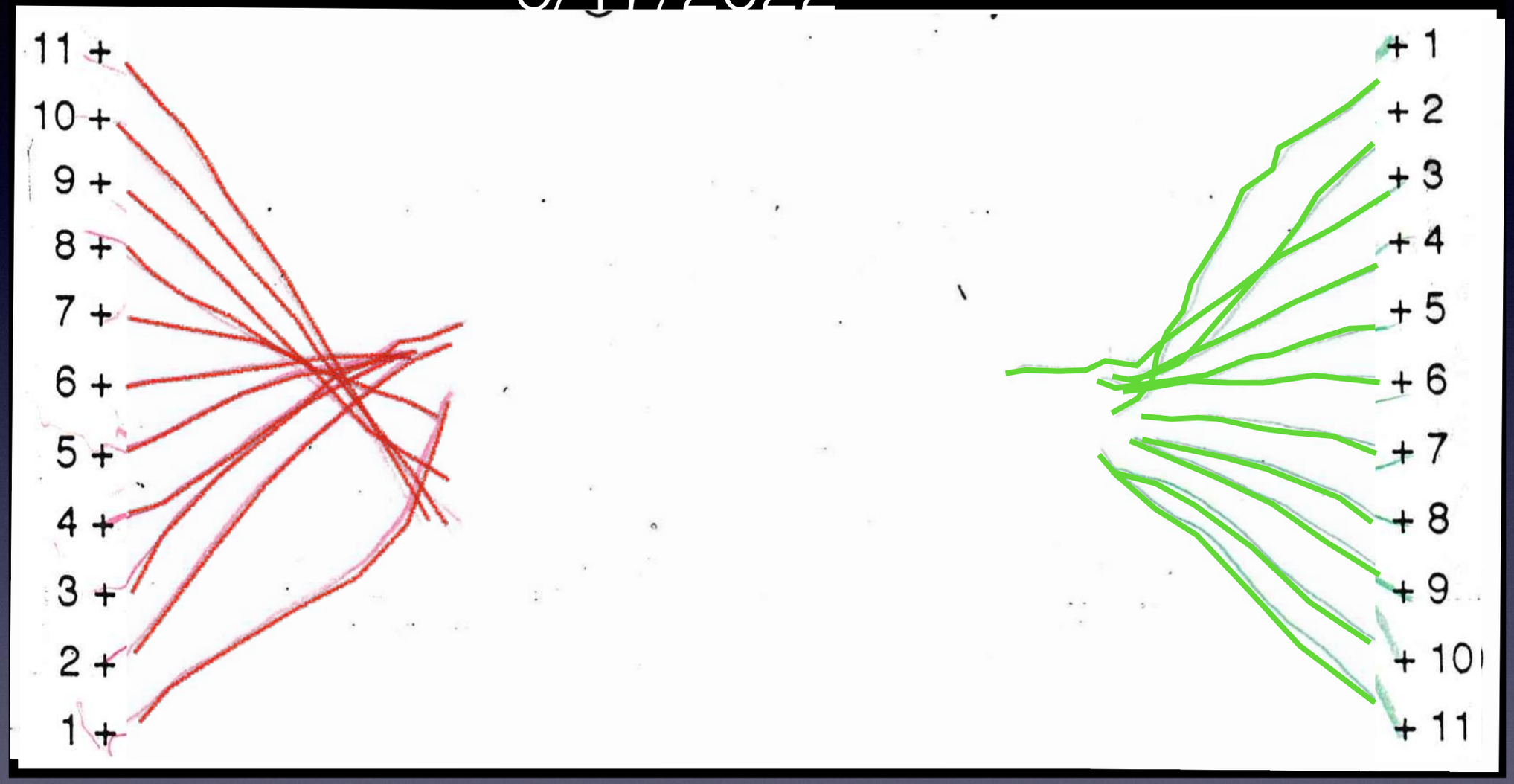
Screening fields, just for completeness





No complaints of field loss

Whiplash producing
ICS
Christie - most recent exam
5/17/2022



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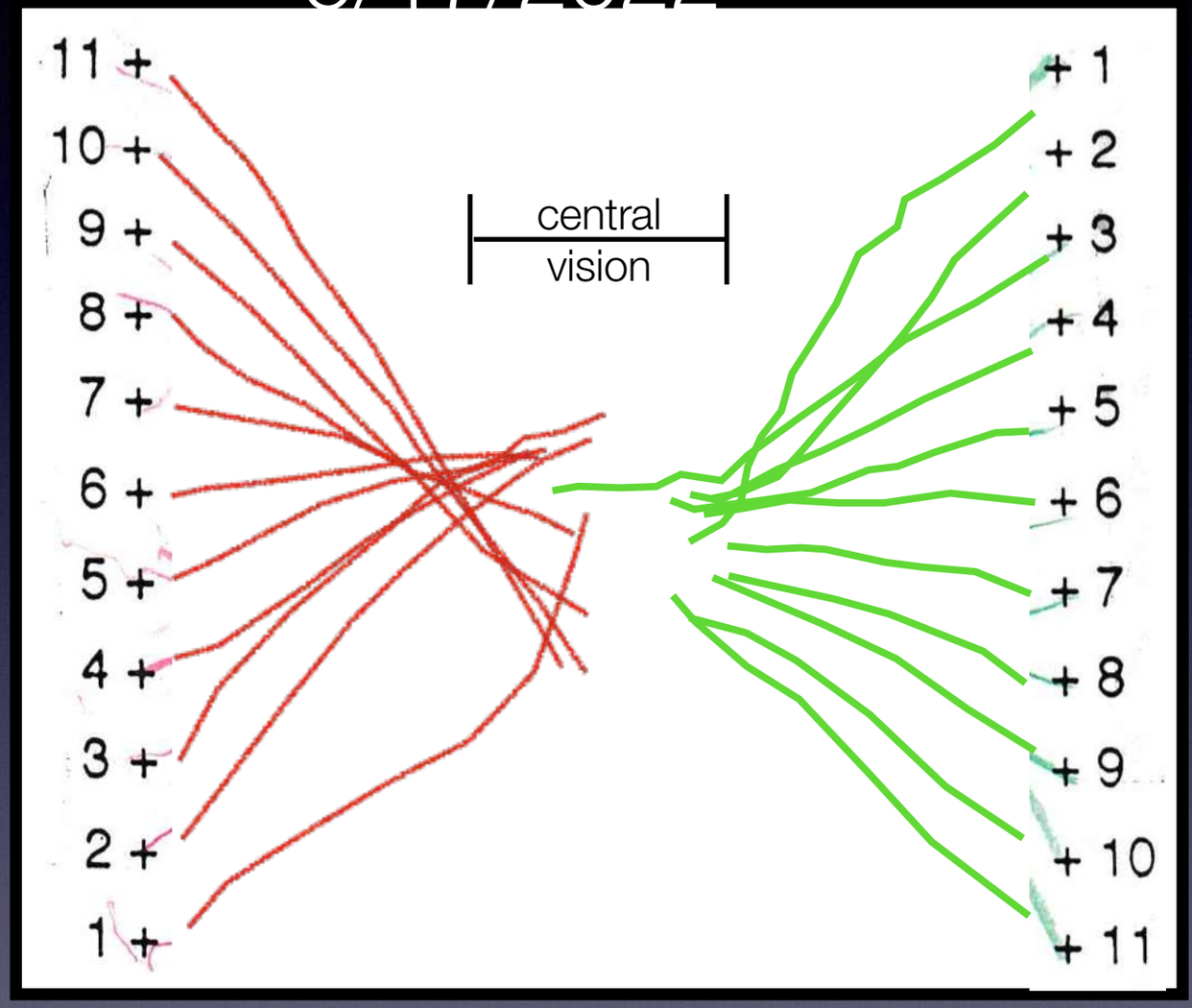

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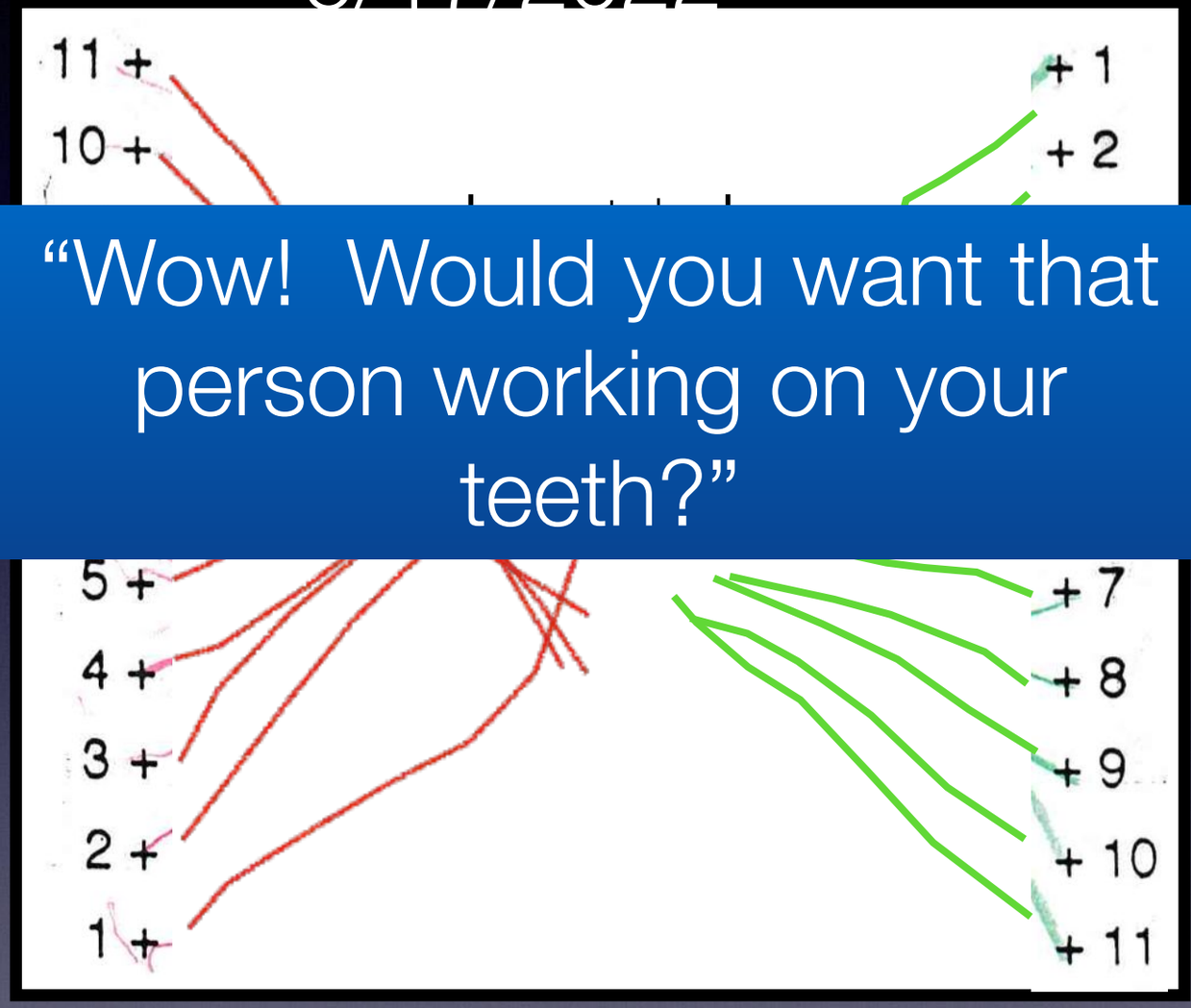
Rear-ended at a stop sign December 2021

Suppression doesn't just go away, but treatment might change a VOstar - Case Series Retrospectives

Whiplash producing
ICS
Christie - most recent exam
5/17/2022



"Wow! Would you want that person working on your teeth?"

Prior exams 2013, 2016, 2017

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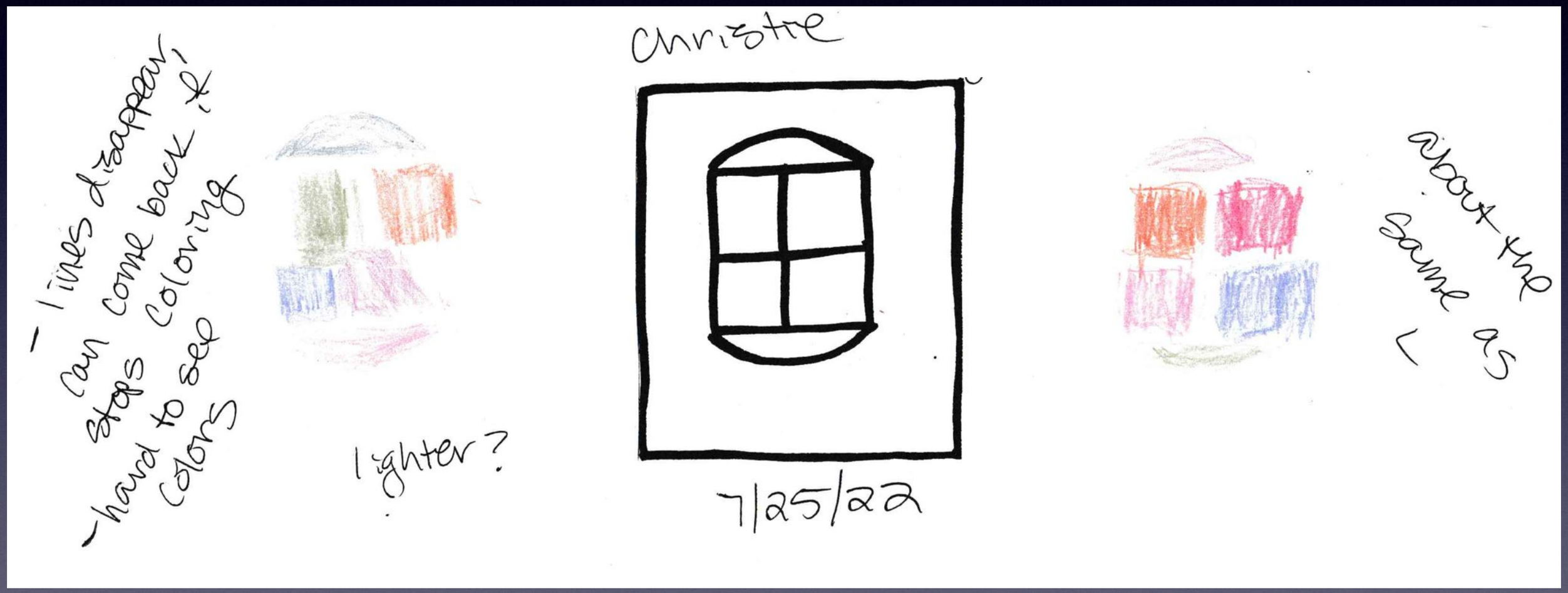
Suppression doesn't just go away, but treatment might change a VOstar - Case Series Retrospectives

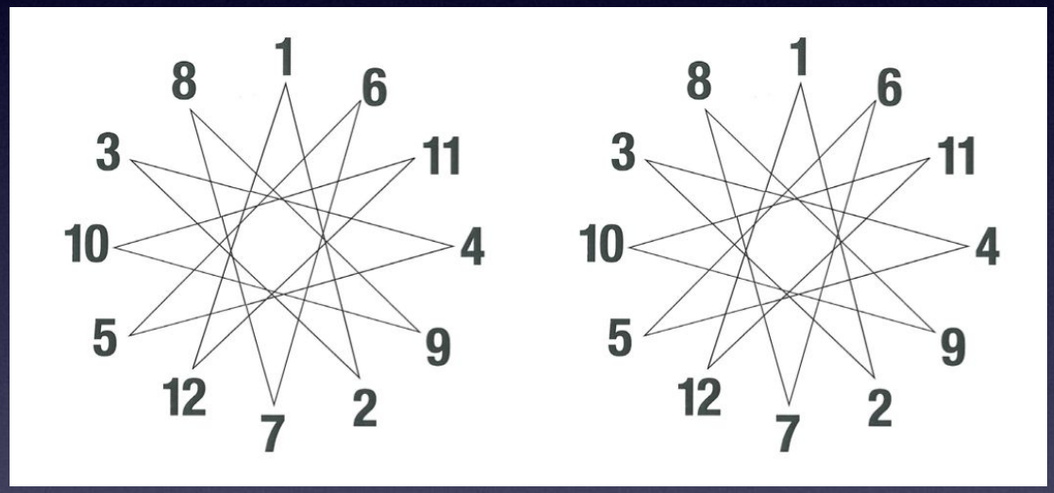
Whiplash producing ICS
Christie - 1st therapy visit
7/25/2022

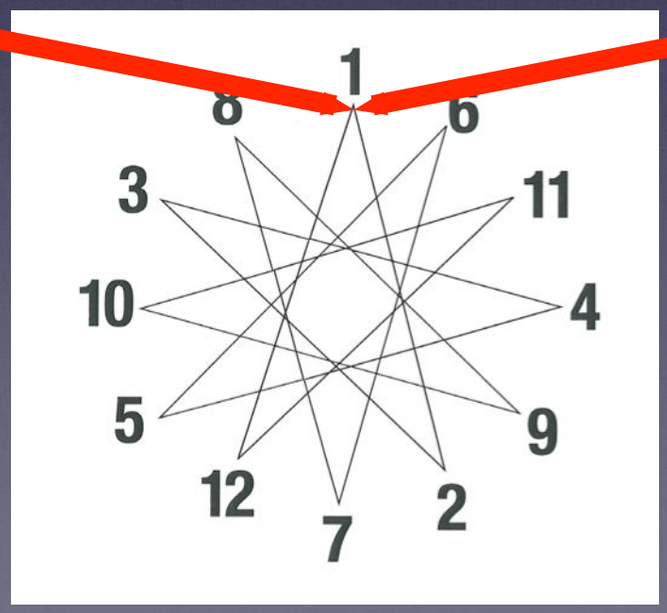
(almost 10-weeks post-exam)



Whiplash producing ICS
Christie - later therapy visit

Repeat VO stars: “Left pencil disappears more than the right”





Whiplash producing ICS Christie - later therapy visit

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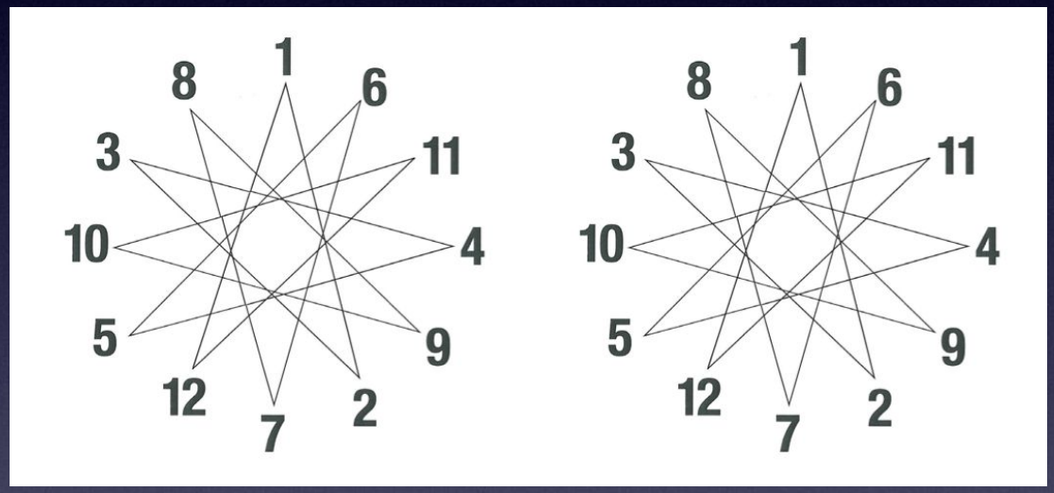

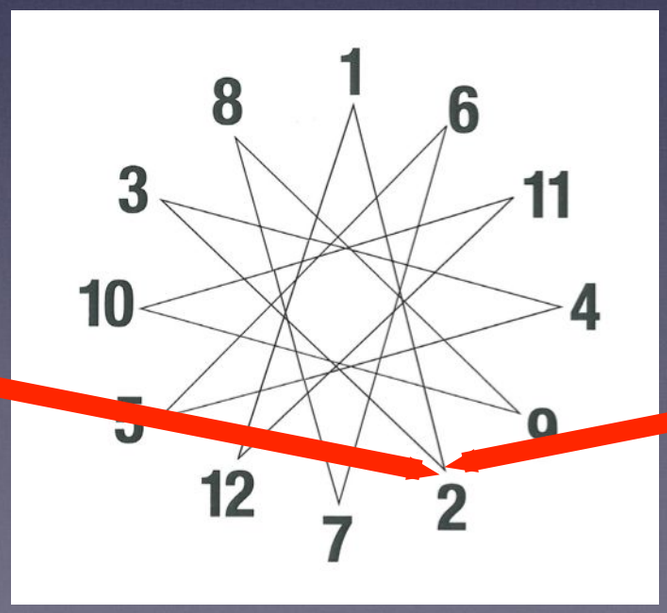

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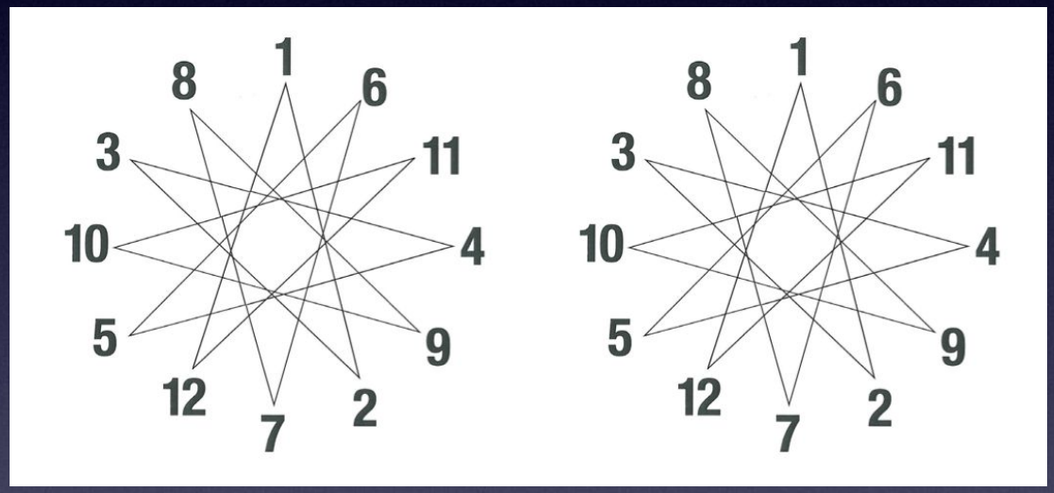
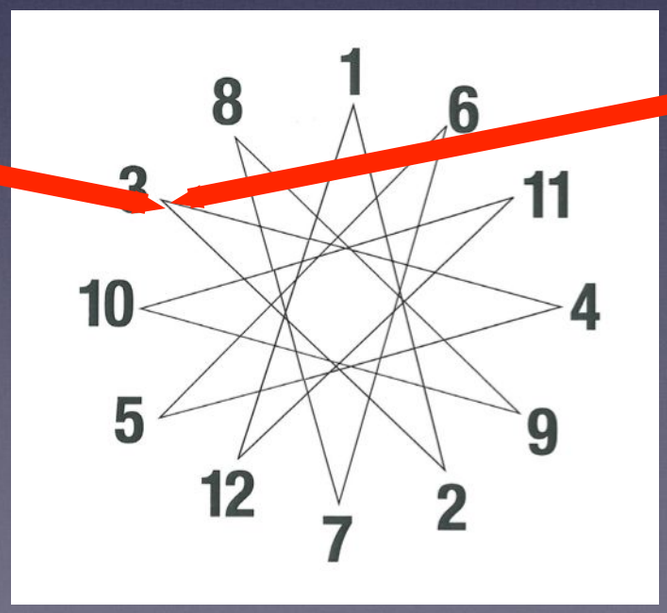
Repeat VO stars: “Left pencil disappears more than the right”





lines, numbers and pointers come and go

Whiplash producing ICS

Christie - ICS Re-Ex 8/18/2022 for more information for Social Security

	Refractive status/VA	Cover Test	Maples Pursuit	Confrontation Field/IOPs	Near Phorias	Near Vergence	Distance Stereo	ICS
Earlier	-0.25-0.75x110 20/20 OD,OS -1.00-1.00x90	ortho	5s head movement, ability & accuracy	field normal 14,11	2 exo 2013 12 exo 2016-17	30/6 BO 12/6 BI	4 of 4, 60-73” arc	None None None
5/2022	-0.75-1.00x95 20/25 OD,OS -0.75-1.25x75	ortho	2 head movement, 4 accuracy maybe a trail after head	field normal 11,14	15 exo	too sick BO 12/2 BI	questionable 2 of 4, ~200” arc	Alternates on distance alternate letter line
8/2022 - 3 short therapy visits accomplished	-0.75-1.00x95 20/25 OD,OS -0.75-1.25x75	pretty constant head tremor and rt arm & hand tremor			12 exo	distance stereo 3/4 but flattens to 2/4 (200” <-> 100”)		Alternates on near fd, loss L diamond, alternates dist acuities 20/20 & 20/15

main differences in ICS 5 & 8/2022 are probably due to a little better ability to withstand testing

Since we're talking about trauma - yes, there is some success in treating ICS in trauma

	Initial Visit	Prog 1, 20% improvement	Prog 2, 40% improvement	Prog 3, 90% improvement	Prog 4, 99% improvement	6 Month ReEx
BCVA, vectographic chart OD	20/30	20/25 -	20/25+	20/20	20/20+	20/20+
BCVA, vectographic chart OS	20/40	20/30 -	20/30+	20/20	20/20	20/20
Vectographic Targets showing ICS* *not all subtests were done at each visit	Alt: nfd, dia, dcd L>R: dac	L>R: dia, dac Alt: nfd, dcd L: dfd	Alt: dia, dcd dac: bilateral presentation only	No ICS, but also no stereo	No ICS	No ICS
ICS periodicity diamond (avg sec) suppressed / not suppressed	2/2	1.5/3	1.5/7	No ICS	No ICS	No ICS
Distance stereo, vectographic	0/4	0/4	0/4	0/4	4/4	4/4

Table 1: vectographic tests- nfd=near fixation disparity on Borish near card; dia=(modified with polarizers) diamond target on Borish near card; dac=distance acuity targets; dcd=distance clock dial; dfd=distance fixation disparity; R=suppression of right eye's image, L=suppression of left eye's image, Alt=alternates, L>R=alternates, but suppresses left eye's image much more than right eye's image

Rough Landing

A second pretty clean case of the genesis of suppression (ICS) after whiplash

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Intermittent Central Suppression caused by Cervical Trauma - Whiplash