Visually Induced Vertigo

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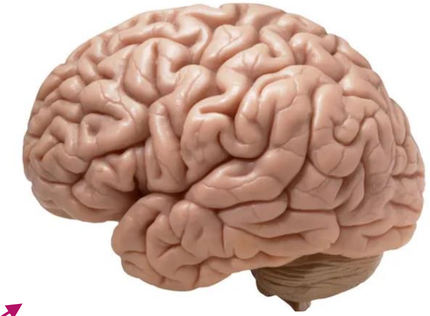
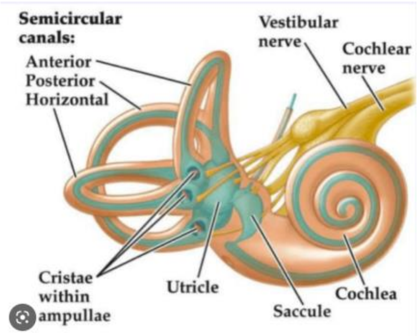
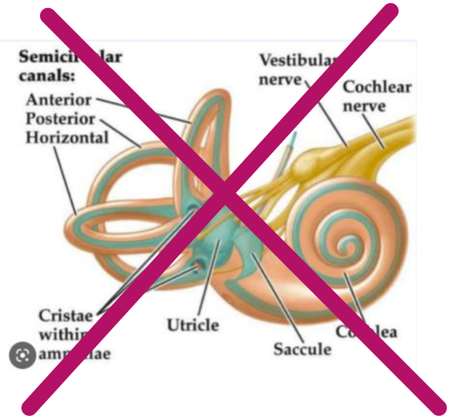
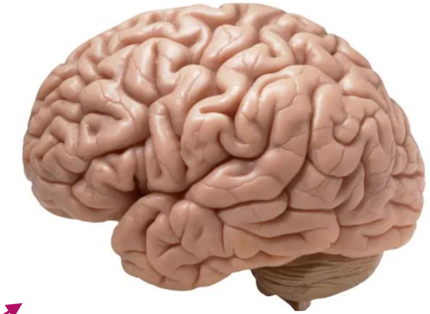
HYPATIA TRAINING

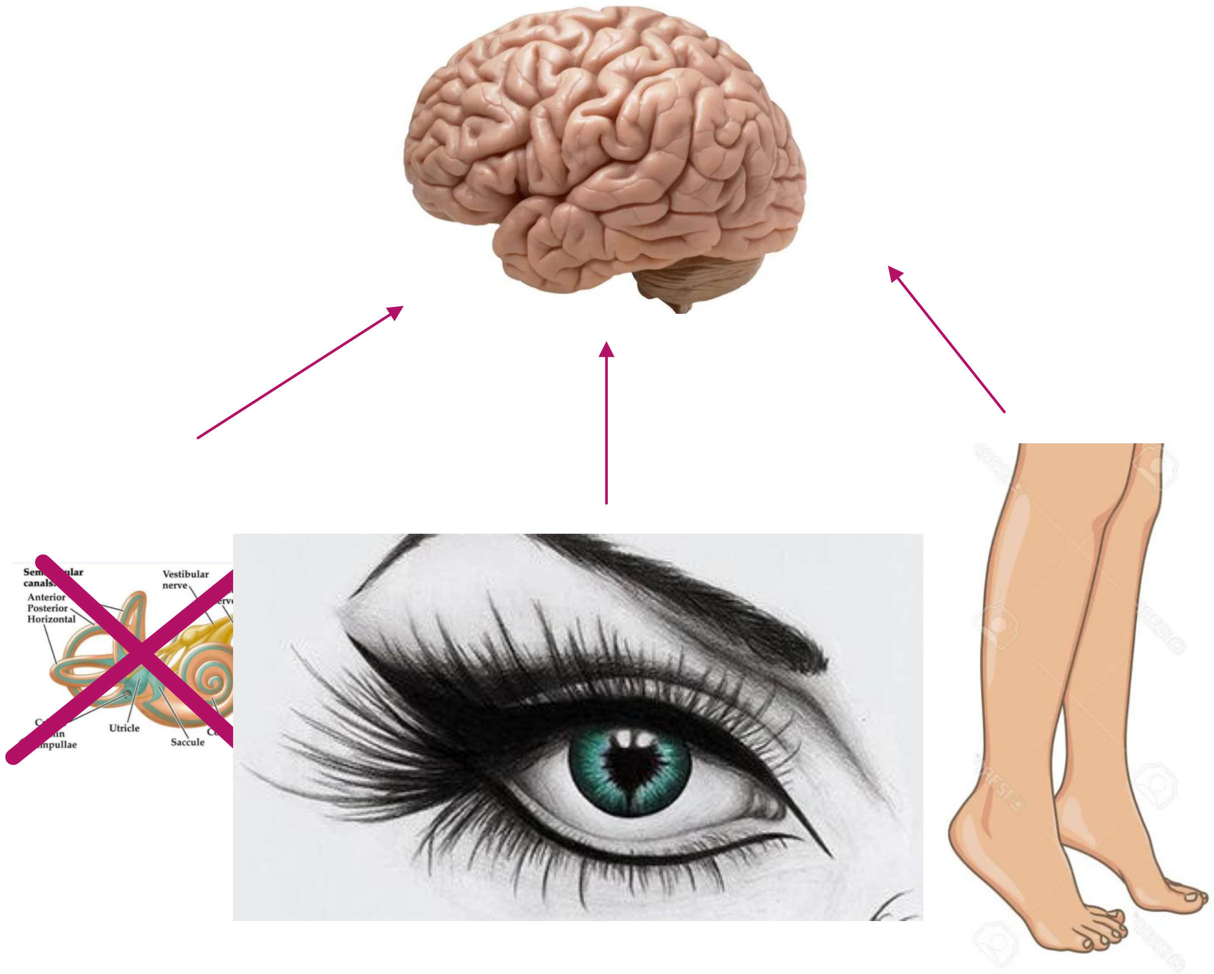
Vertigo as a result of being overstimulated by complex **visual** environments and or seeing movement.




Semicircular canals:
Anterior
Posterior
Horizontal
Vestibular nerve
Cochlear nerve
Cristae within ampullae
Utricle
Saccule
Cochlea


canals:
Anterior
Posterior
Horizontal
nerve
Cochlear
nerve
Cristae
Utricle
Saccule




Anterior
Posterior
Horizontal
Vestibular
nerve
Utricle
Saccule

Visual-Vestibular in Healthy Subjects

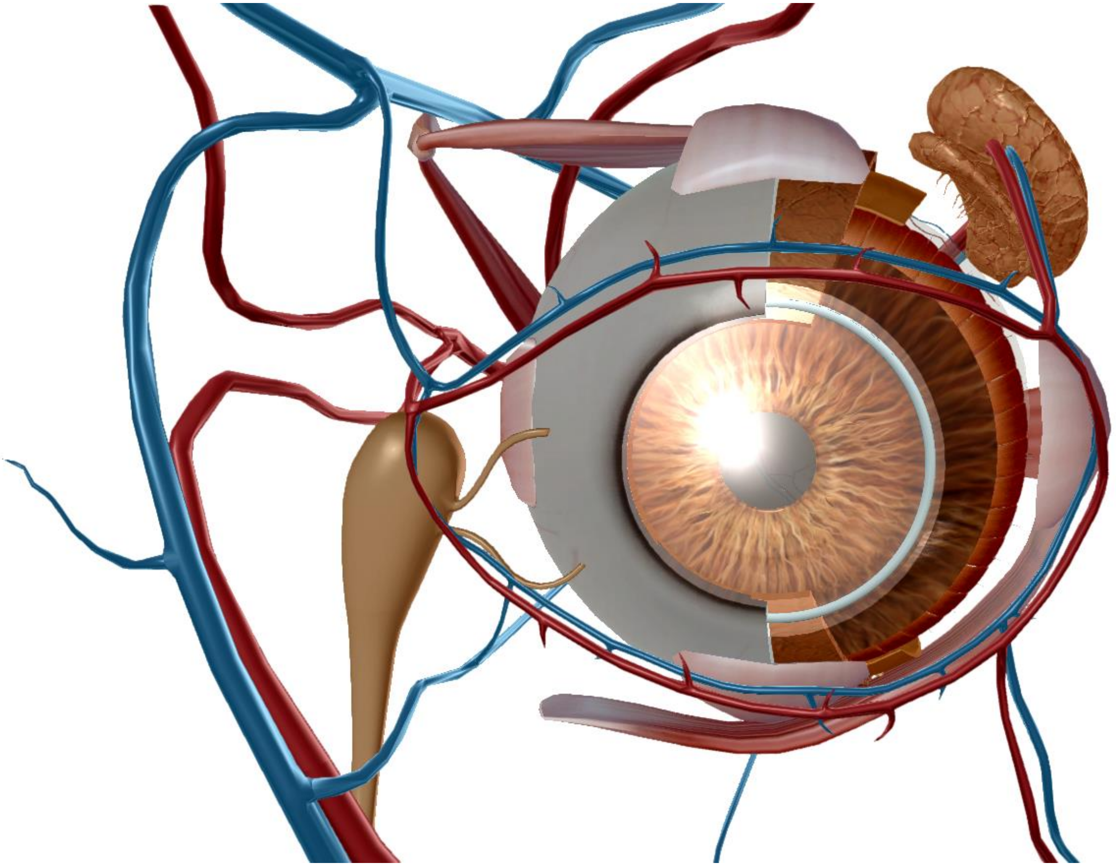
- Healthy Subjects will respond to intensely busy visual environment
- Body sway and pupil size increases when viewing a higher intensity busier environments.
- People with normal vestibular function can feel some discomfort when looking at busier environments.

Wibble T, Södergård U, Träisk F, Pansell T. Intensified visual clutter induces increased sympathetic signalling, poorer postural control, and faster torsional eye movements during visual rotation. *PLoS One*. 2020;15(1):e0227370. Published 2020 Jan 3. doi:10.1371/journal.pone.0227370

Peripheral and Central Vestibular Disorders can cause Vision Induced Vertigo.

BPPV, Vestibular Neuritus, Vestibular Migraine, PPPD, Otolith Dysfunction, Post Concussion Syndrome,
Bilateral Vestibular Loss, Menieres Disease

Hypatia Clinic Liverpool Last 75 patients assessed 61 described some form of Vision Induced Dizziness





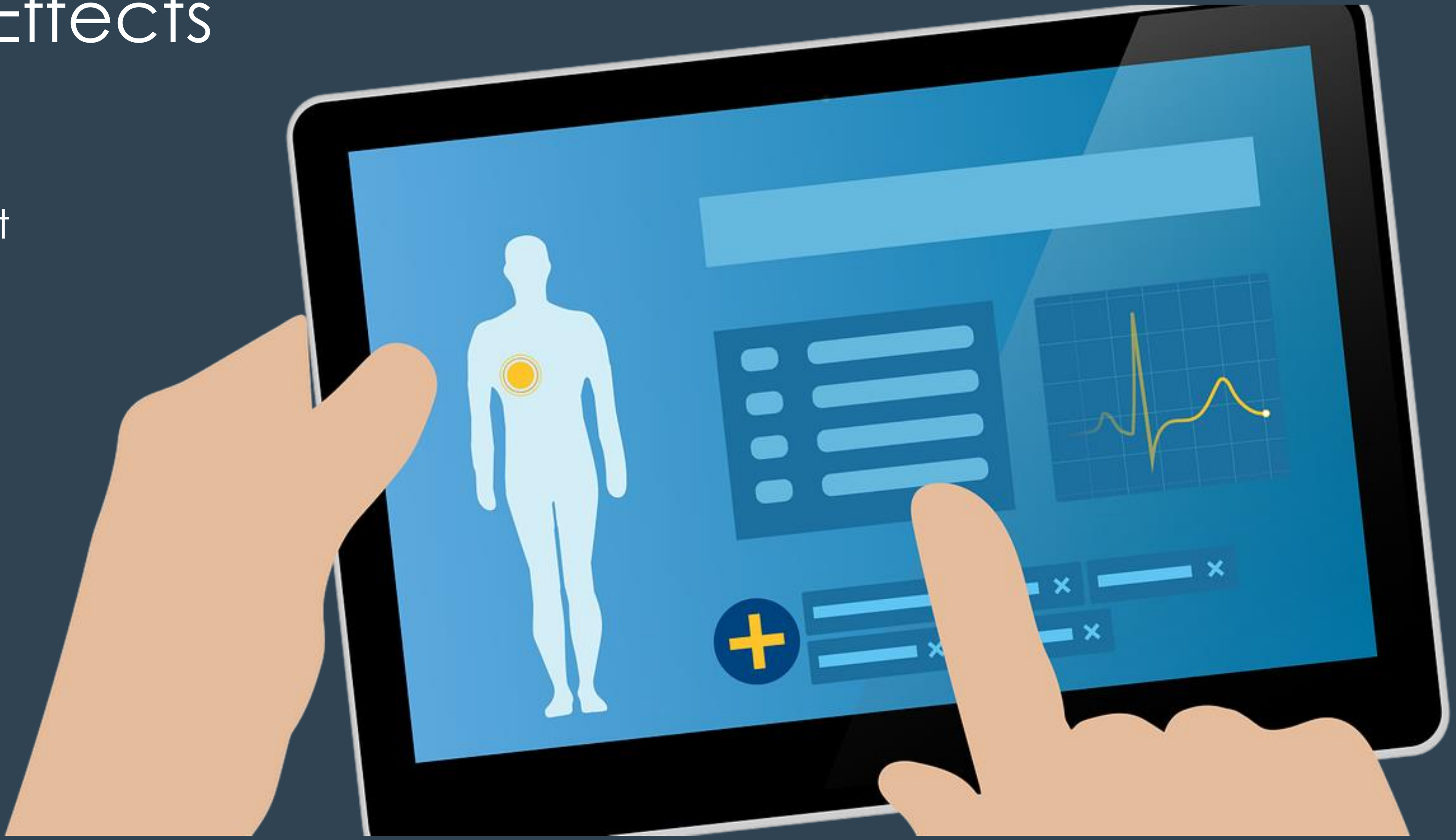
CORONA
IS THE
NEW
NORMAL

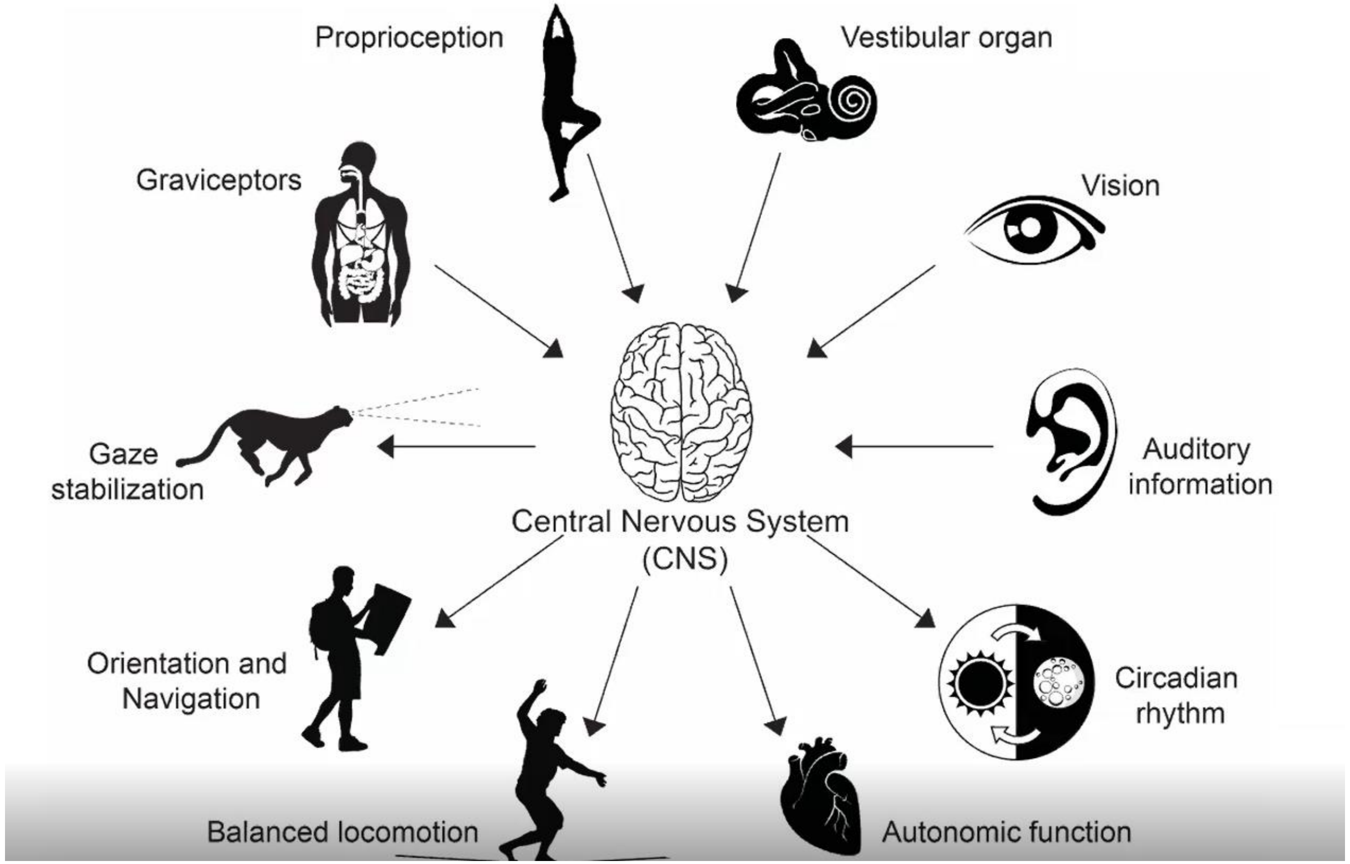
MinTour Locations
Minneapolis Sculpture Garden
Cultural Landmark
1.2 mi
Weisman Art Museum
Cultural Landmark
7.6 mi

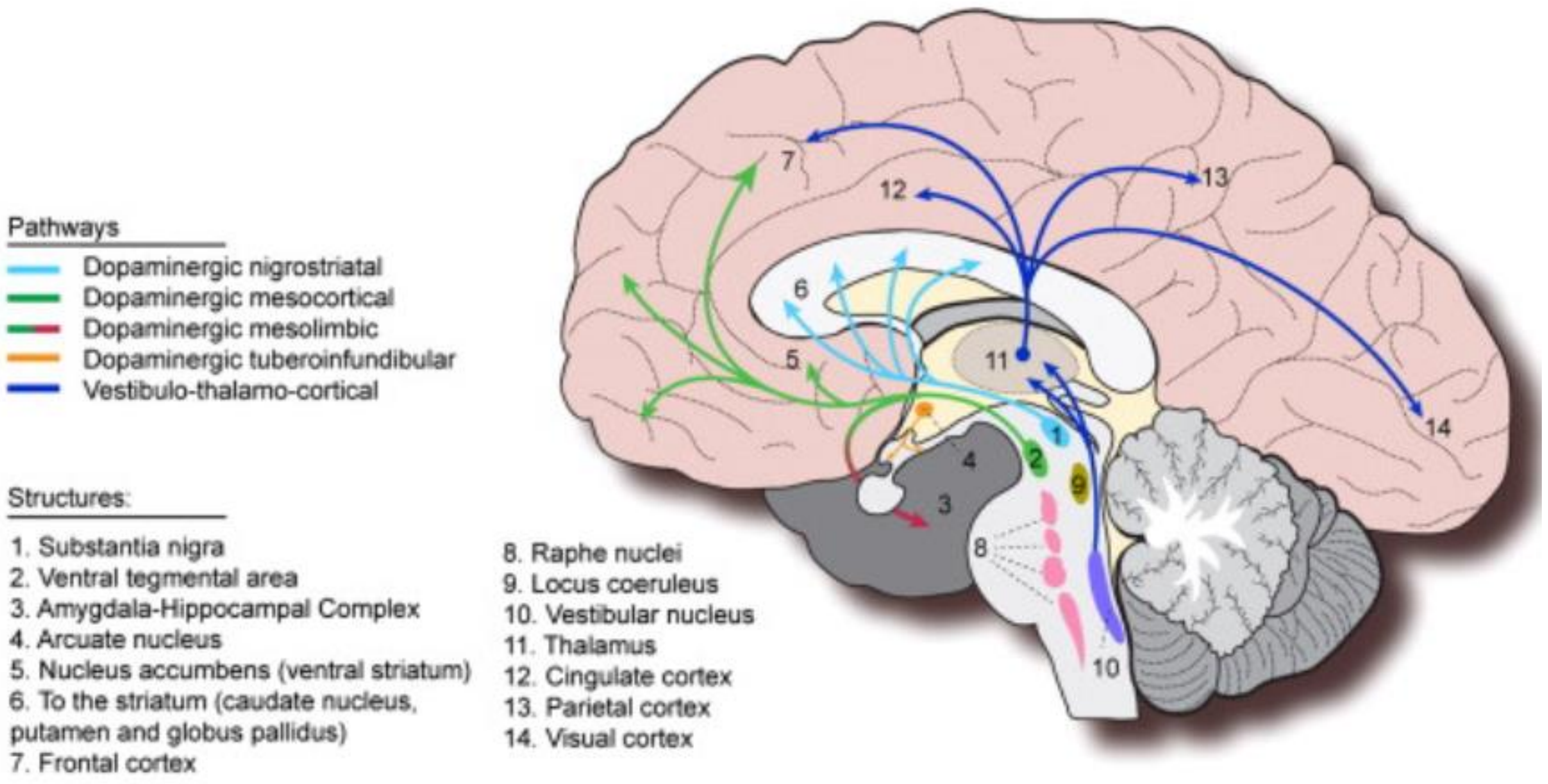
Visually Induced Dizziness Secondary Effects

- Disorientation
- General Discomfort
- Postural Instability
- Restricted Head Movement
- Excessive Fatigue
- Brain Fog
- Agoraphobia
- Anxiety

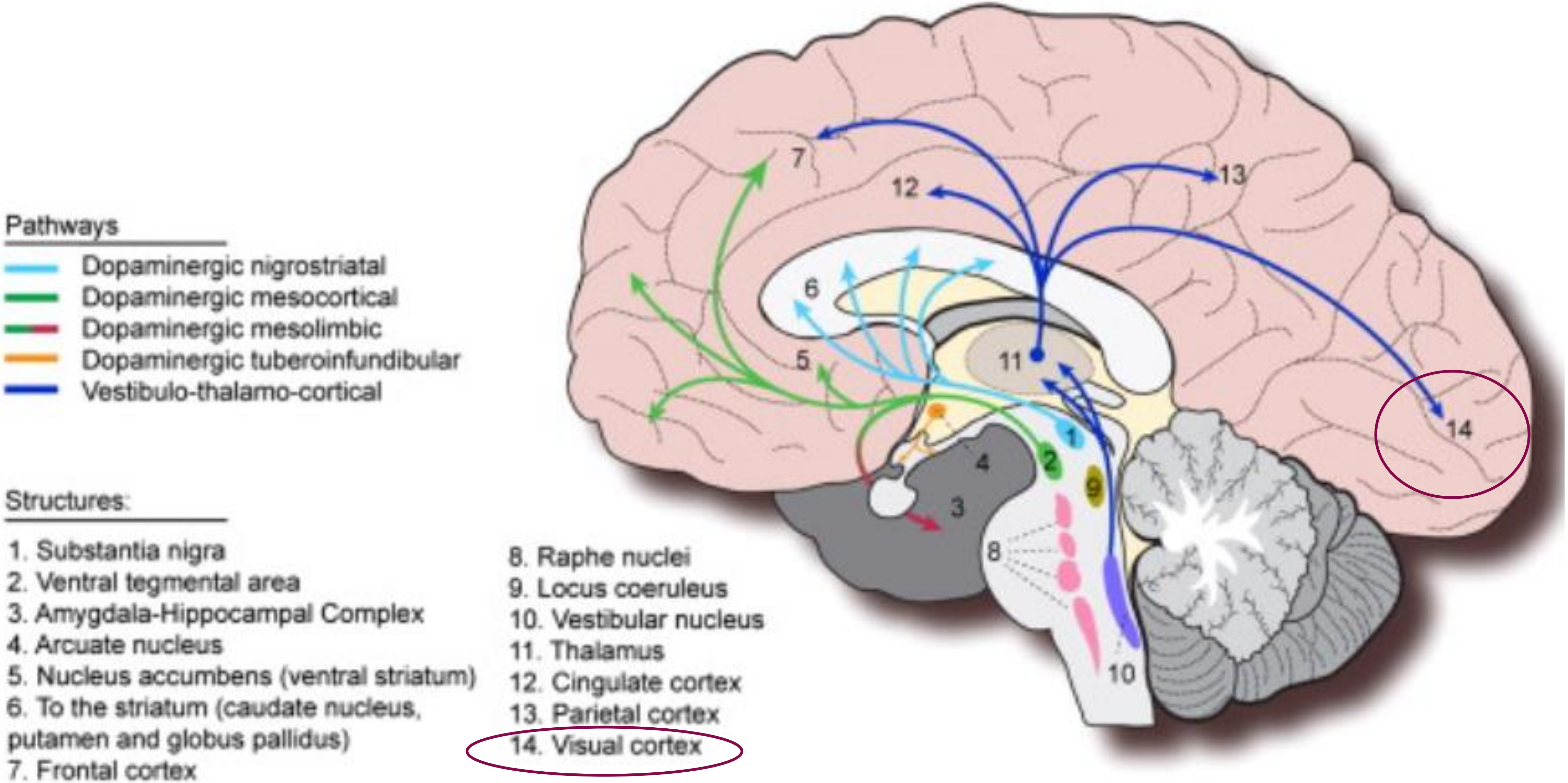
Worsening Vestibular Symptoms




Proprioception
Vestibular organ
Graviceptors
Vision
Gaze
stabilization
Auditory
information
Central Nervous System
(CNS)
Orientation and
Navigation
Circadian
rhythm
Balanced locomotion
Autonomic function



Gurvich, Caroline & Maller, Jerome & Lithgow, Brian & Haghgooie, Saman & Kulkarni, Jayashri. (2013). Vestibular insights into cognition and psychiatry. Brain research. 1537. 10.1016/j.brainres.2013.08.058.



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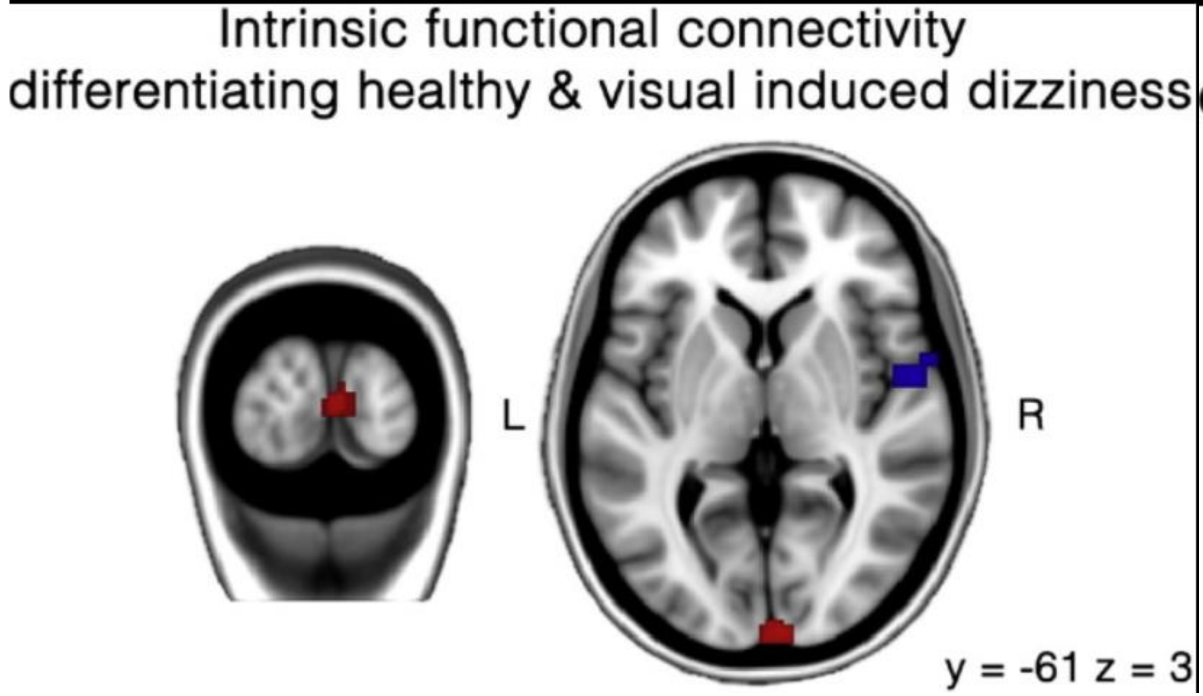

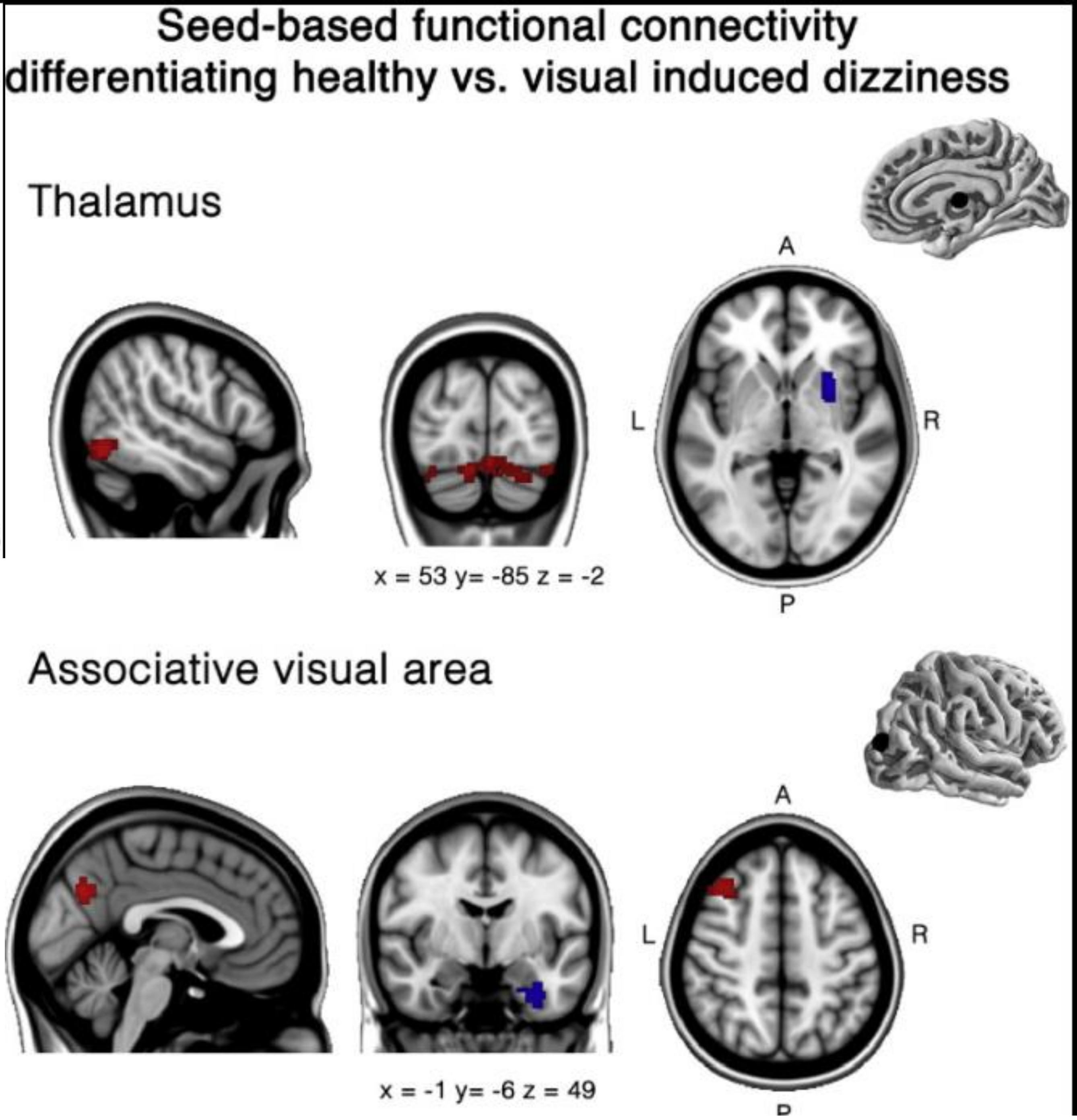

Visually Induced Vertigo –functional changes in brain.

Van Ombergen A, Heine L, Jillings S, et al. Altered functional brain connectivity in patients with visually induced dizziness. *Neuroimage Clin*. 2017;14:538-545. Published 2017 Feb 28. doi:10.1016/j.nicl.2017.02.020

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School of Optometry & Vision Science

Vision Related Dizziness questionnaire (VRD-25)

Instructions

Please complete the following questions, using a tick as in the example below.

1. **Example: Does your dizziness cause you to have difficulty watching moving traffic or trains and / or crossing roads?** (*please answer for whichever activity causes the most dizziness*)

Never	Occasionally (e.g. 1-2 times a month)	Quite often (e.g. once a week)	Very Often (e.g. 2-6 times per week)	All the time (at least once per day)	Activity not applicable to me
		✓			

Example: How severe is the dizziness that you experience when you are watching moving traffic or trains and / or crossing roads?

Not at all	Mild – minimal problems caused	Moderate – but I cope	So severe I have reduced doing this	So severe I have stopped doing this	Activity not applicable to me
	✓				

………

When thinking about any dizziness you have had over the past month……..

Visual Vertigo Analogue Scale

(Adapted from Longridge et al., 2002)

Indicate the amount of dizziness you experience in the following situations by marking off the scales below.

0 represents no dizziness and 10 represents the most dizziness

Walking through a supermarket aisle

0 ———————————————— 10

Being a passenger in a car

0 ———————————————— 10

Being under fluorescent lights

0 ———————————————— 10

Paediatrics

- Vision induced Dizziness is common in children with a primary concussion, migraine, or vestibular diagnosis.
- The PVID is a valid measure for identifying the presence of ViD in children and should be used to identify and quantify these symptoms, which require specific management.

- Pavlou M, Whitney SL, Alkathiry AA, et al. Visually Induced Dizziness in Children and Validation of the Pediatric Visually Induced Dizziness Questionnaire. *Front Neurol*. 2017;8:656. Published 2017 Dec 5. doi:10.3389/fneur.2017.00656

Management of Visual Induced Vertigo

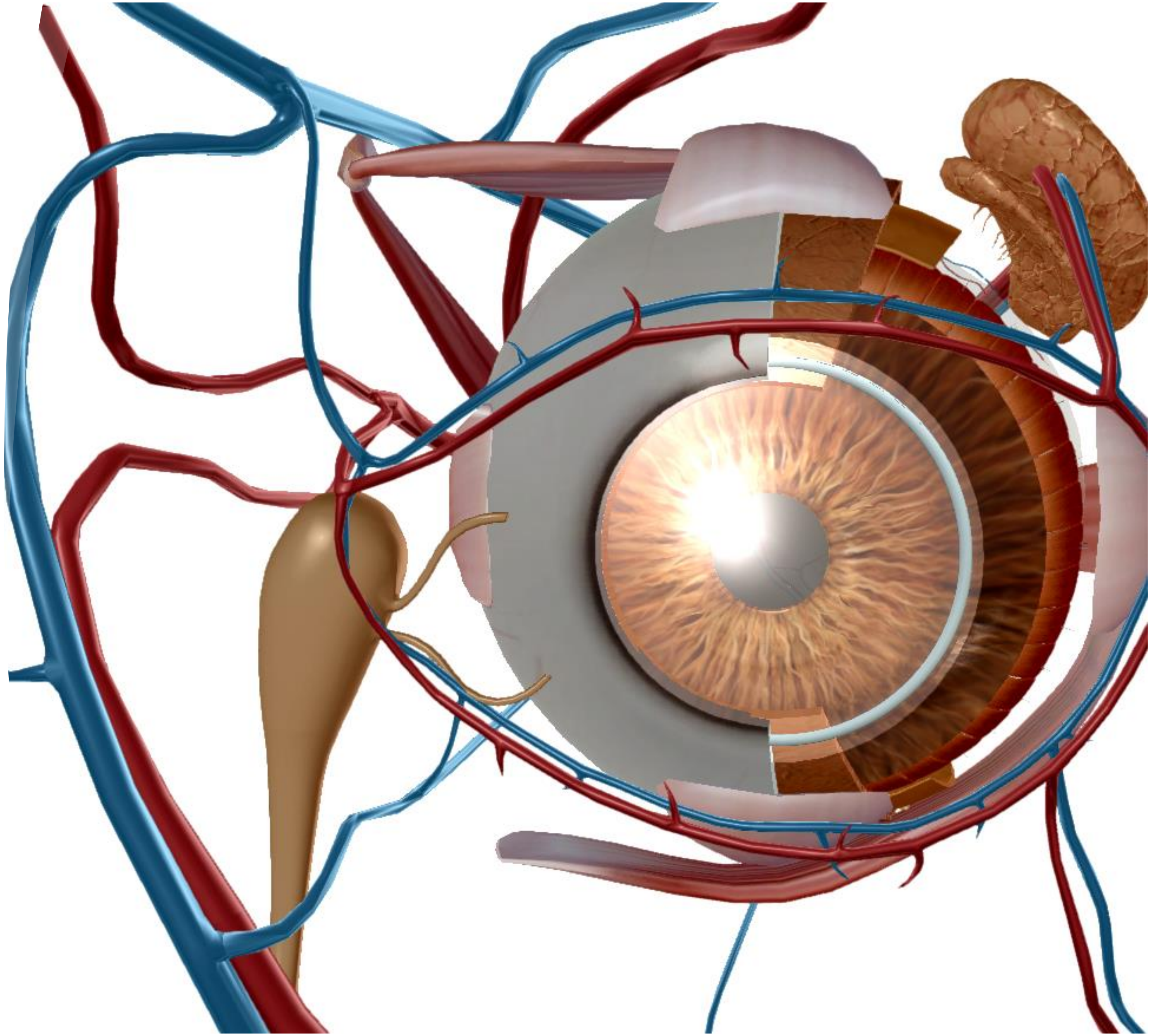
- Vestibular Rehabilitation
- Ocular motor and OPK Work
- Postural and Proprioceptor training
- Pharmacology
- Behavioural Aspects of Avoidance
- Emotional Support – CBT Mindfulness
- DVA
- New - Virtual Reality

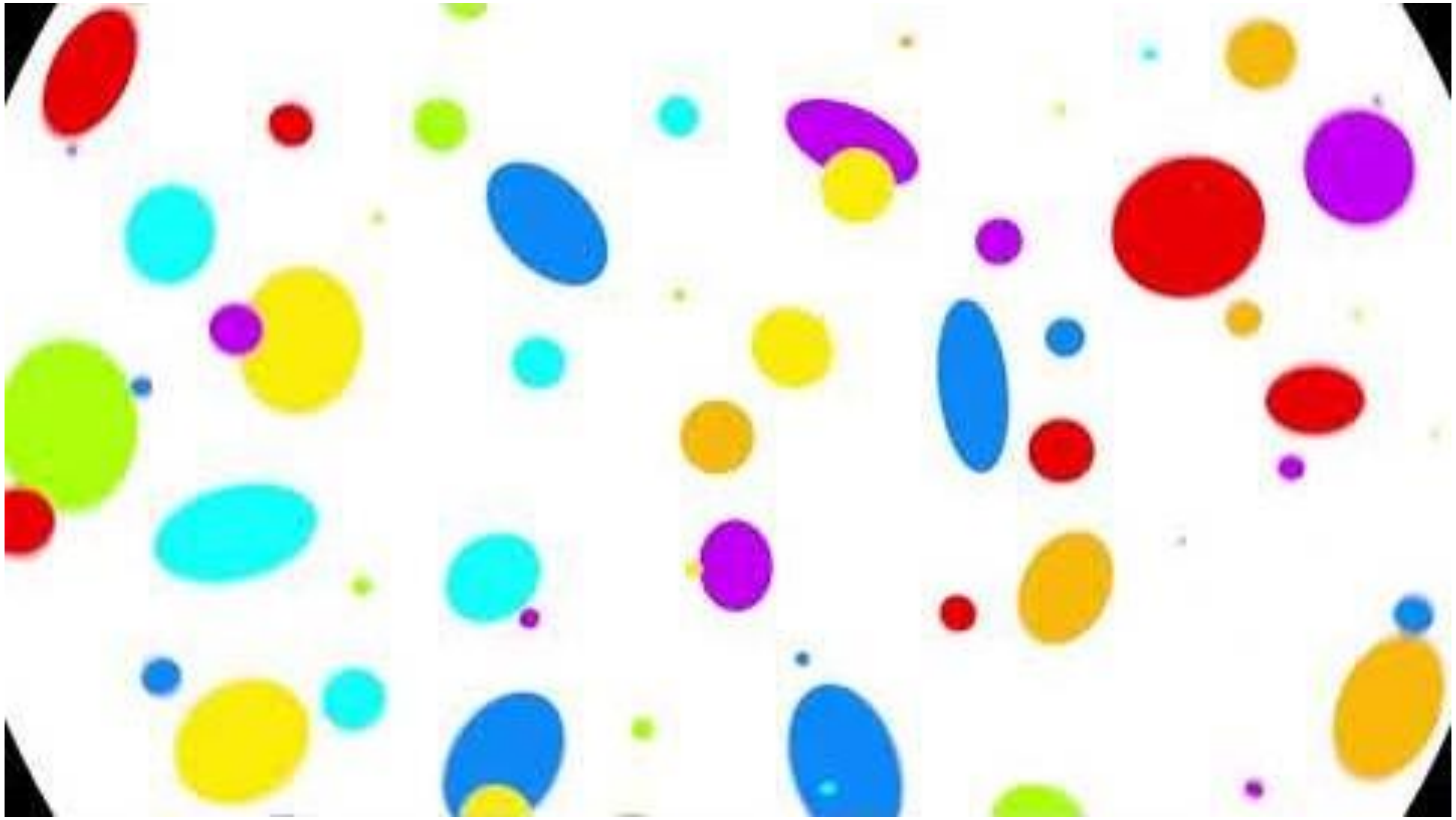
- **Multidisciplinary Therapy**

Vestibular Rehabilitation – Habituation

- Repetitive provocation of triggers
- Desensitize patients over a period of time
- Daily Life = full of triggers
- Push patients past avoidance techniques

- Neuroplasticity ???





Virtual Reality Rehabilitation

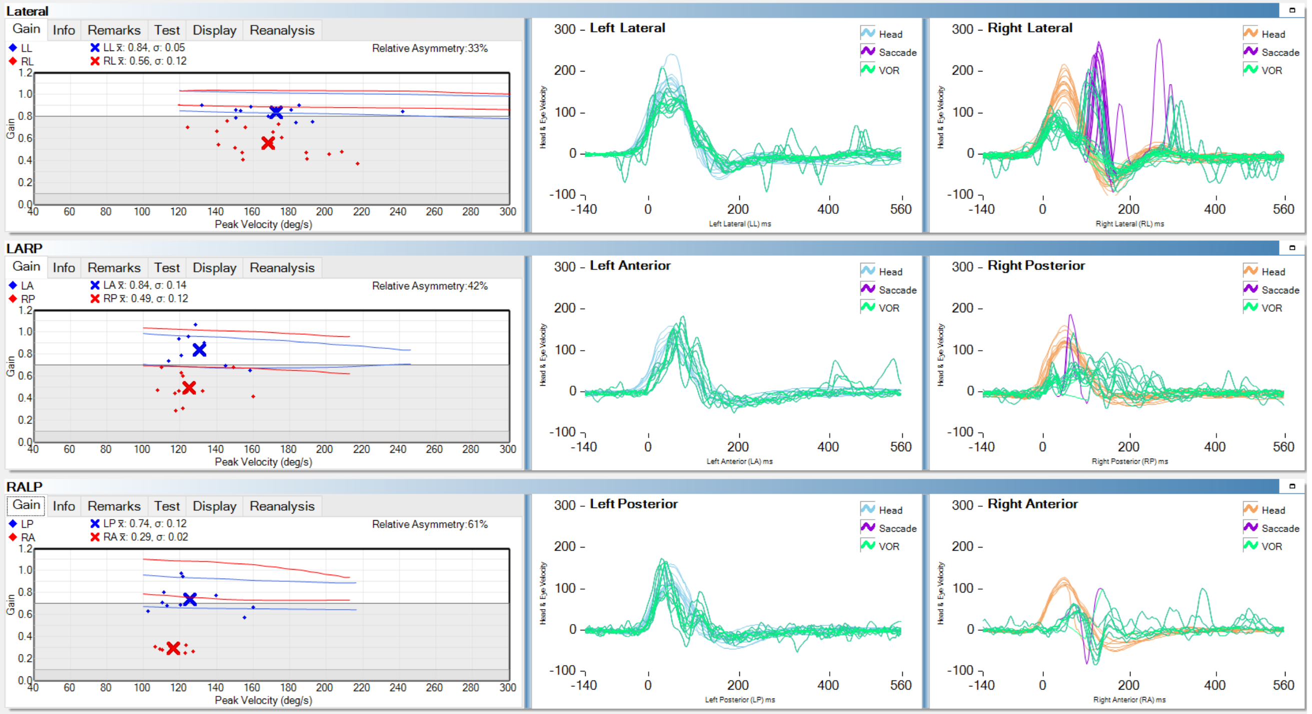
- Controlled Stimulus
- Can slowly increase difficultly
- Can isolate visual exercise or provide complex sensory integration exercises.
- Take away proprioceptors
- Take away vestibular inputs
- Patient is in control
- Can't fall if seated
- Increases confidence
- Can be completed at home
- Can be managed in a telemedicine environment
- Can co-inside with traditional VOR rehabilitation.
- Evidence is starting to emerge…

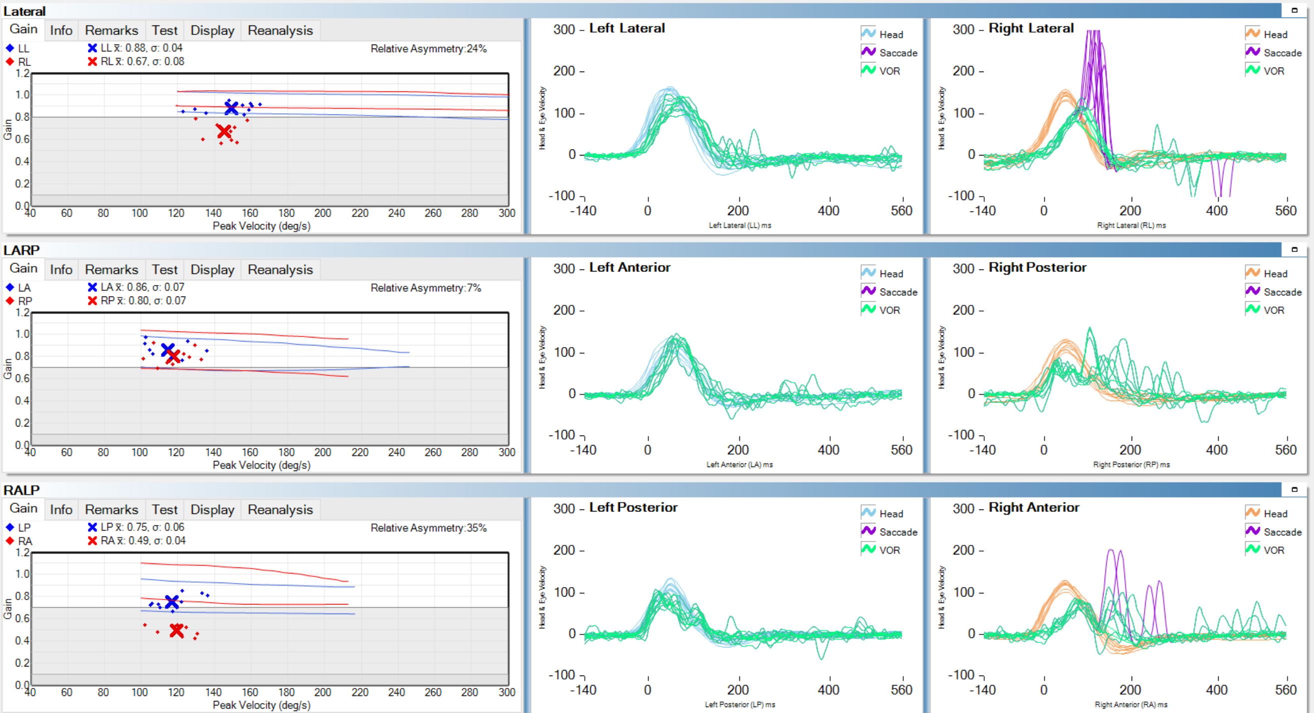
Jiao Y, Lin Y, Zhang X, Wu Y, Wang J, Liang Z. *Lin Chung Er Bi Yan Hou Tou Jing Wai Ke Za Zhi*. 2020;34(5):447-451. doi:10.13201/j.issn.2096-7993.2020.05.015

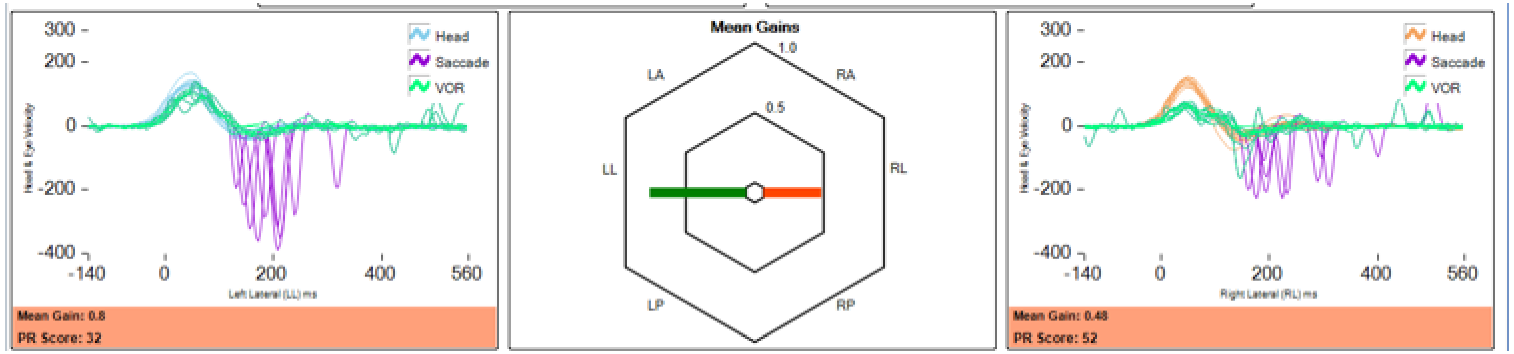
Virtual Reality Rehabilitation

- Ninety-eight vestibular dysfunction patients were assigned into the experimental group n=73 and the control group n=25
- The experimental group received immersive virtual reality assisted VRT treatment, while the control group received conventional VRT treatment.
- After treatment, there were statistically significant differences in total VSS-C score（$P<0.01$） and balance correlation score
- After 12 weeks of treatment, there were statistically significant differences between the groups in open-eye state,
- **Conclusion:**The introduction of VR technology by VRT can provide interesting interactions for patients in training and encourage patients to actively participate in various repetitive rehabilitation exercises that are boring, achieving good effect. The effect of VR on subjective balance rehabilitation without visual impairment is better than that of conventional.

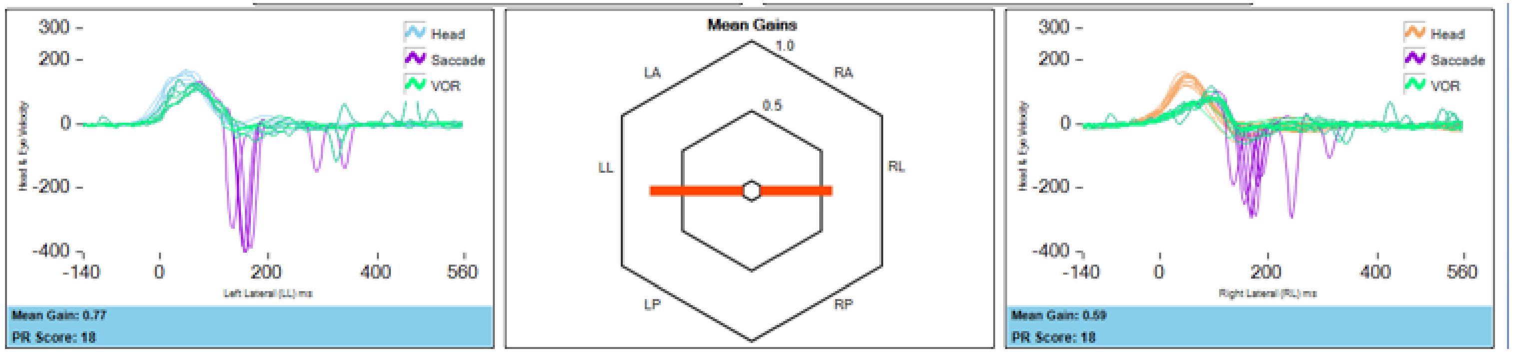
29 Year old Male
Labrynthine Concussion
PPPD traits
Vision Induced Vertigo
Virtual Reality Therapy







	Left	Right	Asymmetry Ratio
Saccadic Amplitude	294	178	40%
PR Score	32	52	
Saccadic Classification	Scattered	Scattered	



	Left	Right	Asymmetry Ratio
Saccadic Amplitude	308	211	23%
PR Score	18	18	
Saccadic Classification	Gathered	Gathered	


4K
ULTRA HD

Stott's Motion Sickness Rules

Stott proposed a useful set of rules which, if broken, will lead to motion sickness.

- Rule 1. Visual-vestibular: motion of the head in one direction must result in motion of the external visual scene in the opposite direction.
- Rule 2. Canal-Otolith: rotation of the head, other than in the horizontal plane, must be accompanied by appropriate angular change in the direction of the gravity vector.
- Rule 3. Utricle-Saccule: any sustained linear acceleration is due to gravity, has an intensity of 1 g and defines "downwards."

Stott JRR. Mechanisms and treatment of motion illness. In: Davis CJ, Lake-Bakaar GV, Grahame-Smith DG, eds. Nausea and Vomiting: Mechanisms and Treatment. Berlin: Springer-Verlag; 1986:110–129

Case Study Concussion

- Professional Ice Hockey Player
- 25-year-old male
- Three Concussions 2015, 2017, 2018
- VID and reduced gaze stabilization identified
- Combination of Vestibular Rehabilitation and OPK

Mucci V, Meier C, Bizzini M, Romano F, Agostino D, Ventura A, Bertolini G and Feddermann-Demont N (2019) Combined Optokinetic Treatment and Vestibular Rehabilitation to Reduce Visually Induced Dizziness in a Professional Ice Hockey Player After Concussion: A Clinical Case. *Front. Neurol.* 10:1200. doi: 10.3389/fneur.2019.01200

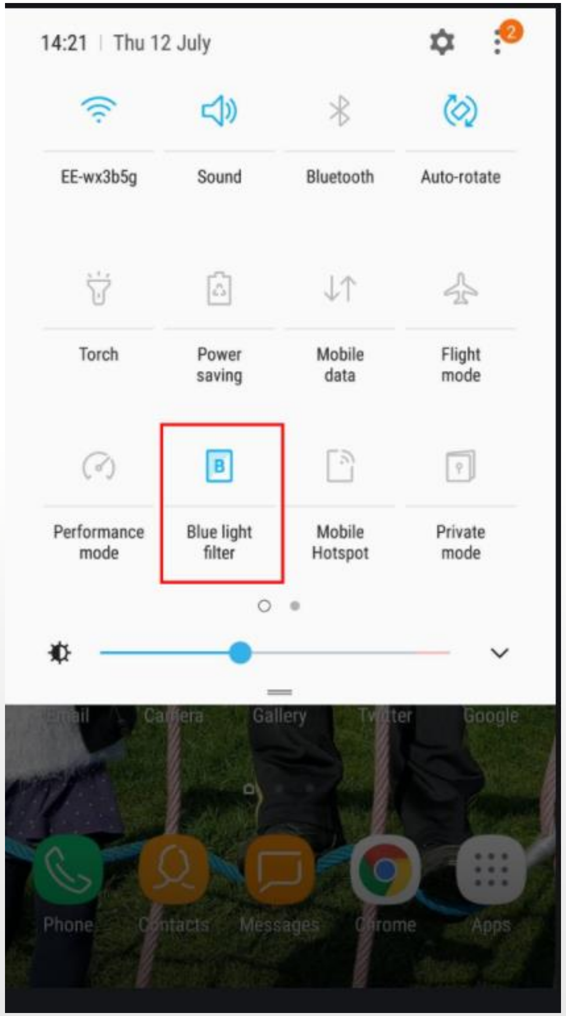
Therapy day	Vestibular rehabilitation	Optokinetic training
1	Horizontal and vertical saccadic training: 3 times for 30 s Binocular view and convergence training Vestibular exercises: gaze stability while moving the head (YAW)	Optokinetic training
2	Ocular-motor (OC) exercises: Vergence/accommodation training	Optokinetic training
Break		
Break		Behavioral task (exposure to real life stimuli)
Break	OC exercises at home (see day 2 for details)	
Break		
3	OC + VR: Gaze stability and vergence/accommodation training. Capturing a moving visual target while turning 180 degrees on a trampoline. Balance training on unstable surfaces (Foam, BOSU) with changing tasks	Optokinetic training
4	OC + VR: Gaze stability and vergence/accommodation training while walking Gaze stability and capturing a moving visual target while turning fast Gaze stability and postural orientation while moving in the transverse plane. Balance training on unstable surfaces (Foam, BOSU) with changing tasks	Optokinetic training
5	OC + VR: Gaze stability and vergence/accommodation training while walking Gaze stability and capturing a moving visual target while turning fast Gaze stability and postural orientation while moving in the transverse plane. Balance training on unstable surfaces (Foam, BOSU) with changing tasks	Optokinetic training

Questions VVAS	Pre	Day 5	Spearman's rank correlation coefficient	*p*-value Spearman correlation	α-value (Holm–Bonferroni correction)
(1) Walking through supermarket aisle	7	0.5	0.95	0.014	0.01
(2) Being a passenger in a car	6	0.4	0.81	0.05	0.012
3) Being under fluorescent lights	5	0.5	0.82	0.088	0.044
(4) Watching traffic at a busy intersection	4	0.3	**0.94**	**0.005**	**0.008**
(5) Walking through a shopping mall	7	0.5	0.87	0.054	0.018
6) Going down an escalator	4	0	0.71	0.182	0.182
7) Watching a movie at the movie theater	3	0	**0.98**	**0.005**	**0.008**
(8) Walking over a patterned floor	8	0.2	**0.99**	**0.001**	**0.006**
(9) Watching action television	6	0	**1**	**0.001**	**0.006**

The Spearman's rank correlation coefficients and their p-values are showed in the fourth column. The significant p-values are highlighted when are lower than the respective alpha values (corrected using the Holm-Bonferroni correction procedure, last column).

Patient Tips

- Continual avoidance will delay recovery
- Set yourself small tasks and goals and gradually increase
- Limit leisure screen time and gradually increase
- Minimise contrast when looking at screens.
- Schedule rest time in between tasks and activities.
- Some mild-moderate discomfort expected during rehab
- VID improves slowly – be patient
- See resources for tips with any emotional triggers
- Don’t overwork your system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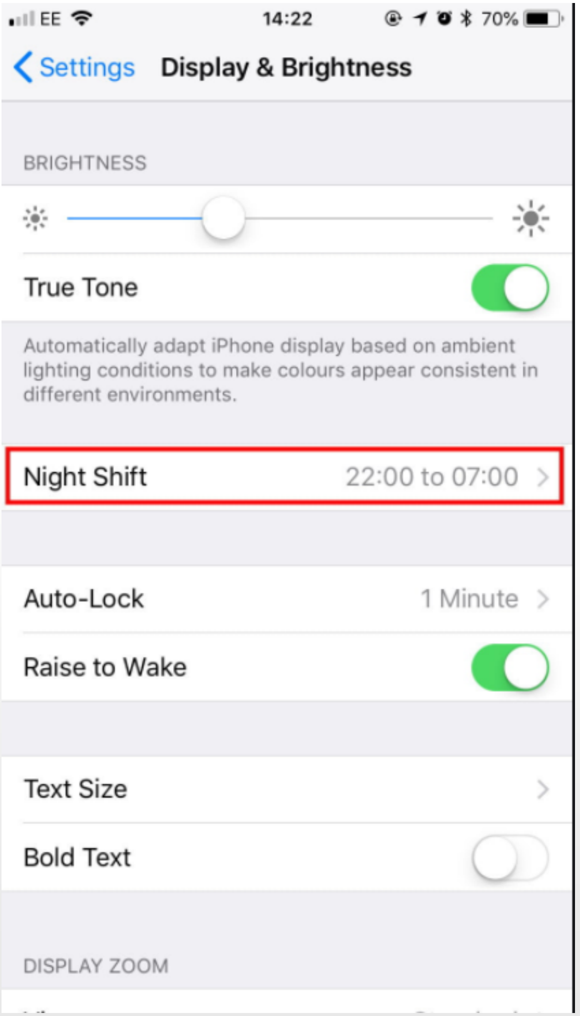
EE-wx3b5g
Sound
Bluetooth
Auto-rotate
Torch
Power saving
Mobile data
Flight mode
Performance mode
Blue light filter
Mobile Hotspot
Private mode
Phone
Contacts
Messages
Chrome
Apps


EE
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Settings
Display & Brightness
BRIGHTNESS
True Tone
Automatically adapt iPhone display based on ambient lighting conditions to make colours appear consistent in different environments.
Night Shift
22:00 to 07:00
Auto-Lock
1 Minute
Raise to Wake
Text Size
Bold Text
DISPLAY ZOOM

Clinician Tips

- Assess for Visual Vertigo as part of your history
- Use outcome measures for monitoring
- Set expectations for slow but gradual improvement
- Goal orientated rehab
- If using Virtual Reality work in real world environment first
- Small bursts of stimulus initially and gradually increase
- Change and increase stimulus in small increments
- Avoid overloading the patient

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Thanks & Declarations

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