Effects & Features of Dizziness in VR

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Introduction

- Covid-19 has grown the usage of VR in education, skill training & education. Future social media like Meta will utilize VR.
- Drawbacks that come with VR usage are discomfort, motion sickness, dizziness, nausea, etc.
- Dizziness in general is caused by 3 factors:
  - **Stress or Anxiety**
    - ➢ Stress amplified will take a toll on people and ultimately start causing dizziness.
  - **Low Blood Pressure**
    - ➢ Sudden change in position will cause late follow up for blood to reach the whole body, causing dizziness.
  - **Visual Vertigo**
    - ➢ Fast movement or constant rotation may cause eventual dizziness in people.

Purpose

The Research is conducted with the hopes of learning VR Systems & what may cause dizziness among the users.

This will eventually show & highlight which factors in a VR video environment may trigger the symptoms of the dizziness disease.

It serves as a warning for future users and creators.

Motivation

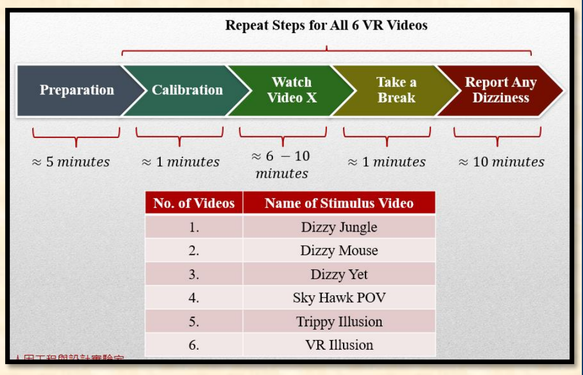
With the necessary information, one will be able to provide ample opportunity for all VR creators to adjust their videos or simulation to be able to be enjoyed & processed by everybody.

This allows the users to be cautious for any potential risks to VR videos
And create an improved environment for future opportunity like Meta.

Methodology

1. Collecting Data

- Data are acquired from 10 participants through VR Systems experiment utilizing 6 different stimulus videos, each with different features to cause dizziness.



No. of Videos	Name of Stimulus Video
1.	Dizzy Jungle
2.	Dizzy Mouse
3.	Dizzy Yet
4.	Sky Hawk POV
5.	Trippy Illusion
6.	VR Illusion

2. Differentiating the Data according to Needs

No	Feature Category	Feature Abbreviation	Description	Features Type		
				Raw Data	Conventional	Complexity
1	Fixation	FPOGX	The X-coordinate of the fixation Point of Gaze (POG), as the percentage of screen width.	V	NA	V
2	Fixation	FPOGY	The Y-coordinate of the fixation POG, as the percentage of screen height (0-1).	V	NA	V
3	Fixation	FPOGD	The duration of the fixation POG in seconds.	V	V	V
4	Fixation	BPOGX	The X-Coordinate of the un-filtered POG, as the percentage of screen width (0-1).	V	NA	V
5	Fixation	BPOGY	The Y-Coordinate of the un-filtered POG, as the percentage of screen height (0-1).	V	NA	V
6	Fixation	LPCX	The X-coordinate of the left eye pupil in the camera image (width 0-1).	V	NA	V
7	Fixation	LPCY	The Y-coordinate of the left eye pupil in the camera image (height 0-1).	V	NA	V
8	Fixation	RPCX	The X-coordinate of the right eye pupil in the camera image (width 0-1).	V	NA	V
9	Fixation	RPCY	The Y-coordinate of the right eye pupil in the camera image (height 0-1).	V	NA	V
10	Pupil	LPD	The diameter of the left eye pupil in pixels.	V	V	V
11	Pupil	RPD	The diameter of the right eye pupil in pixels.	V	V	V
12	Pupil	LPMM	The diameter of the left eye pupil in millimeter.	V	V	V
13	Pupil	RPMM	The diameter of the right eye pupil in millimeter.	V	V	V
14	Pupil	LPS	The scale factor of the left eye pupil, normalized to 1 at the head depth at calibration.	V	NA	NA
15	Pupil	RPS	The scale factor of the right eye pupil, normalized to 1 at the head depth at calibration.	V	NA	NA
16	Blink	BKDUR	The duration of the preceding blink in seconds.	V	V	V
17	Blink	BKPMIN	The number of blinks in the previous 60 second.	V	V	V
18	Saccade	SAC_MAG	Magnitude of the saccade calculated as distance between each fixation (in pixels).	V	V	V
19	Saccade	SAC_DUR	The saccade velocity calculated from saccade between two fixations.	V	NA	V

NA: Not Applicable

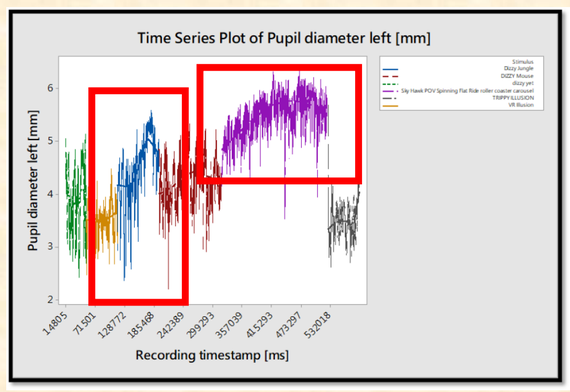
3. Analyzing Data & Video

The data is split into 2 seconds interval to make processing simpler. Depending on the needs, Data is processed into Conventional Data or Complexity Data with features listed above. Once done, the videos are examined closely to pinpoint which part the and the reason the dizziness starts occurring.

That way, one can reason out the likely causes of dizziness.

Results

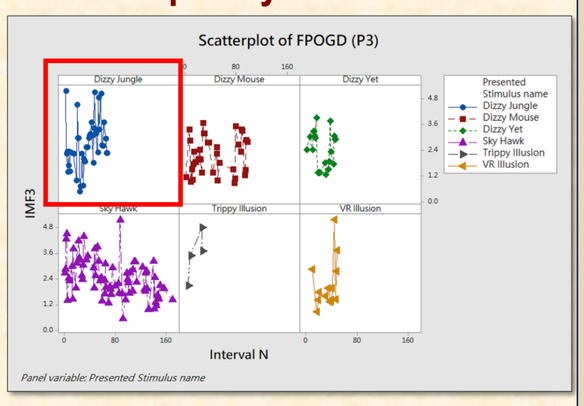
1. Conventional Data

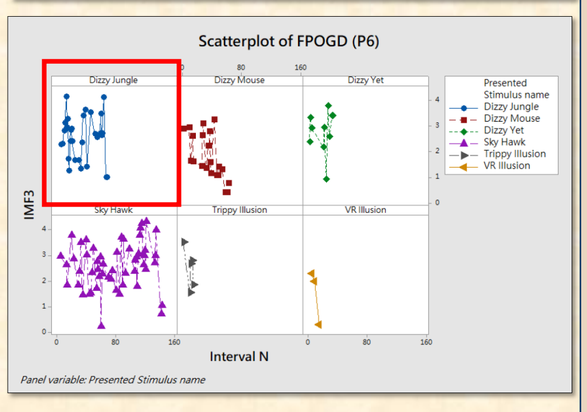


The blue (Dizzy Jungle) & purple (Sky Hawk) showed an increasing trend of pupil size diameter during the duration of the experiment.

- ➢ This is due to Dizzy Jungle having a constant rotation and extreme lighting changes in the video, causing a steep upwards trend.
- ➢ Sky Hawk shows a slow accumulation of rotation, causing culmination of sickness and dizziness in the eye, eventually increasing the diameter of the eye.

2. Complexity Data



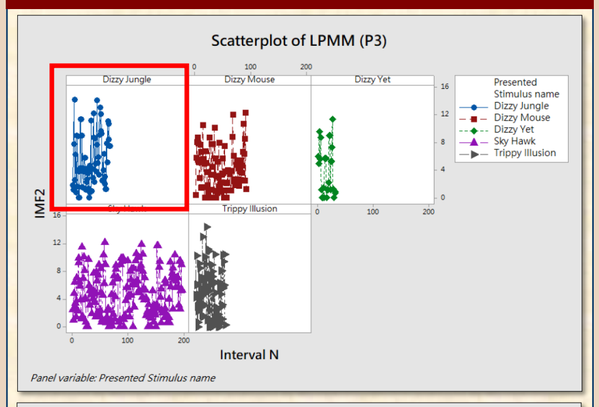


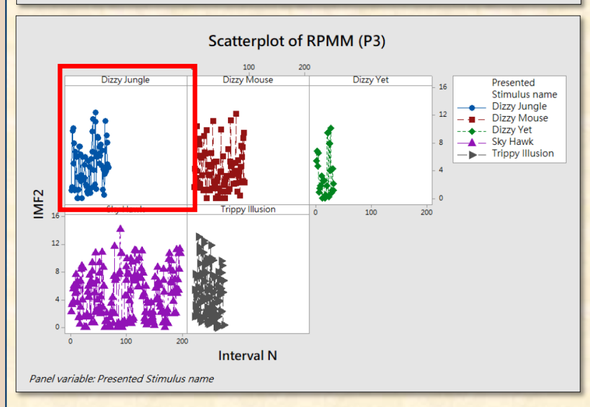
The graph above showed the eye fixation's duration during the experiment. The Dizzy Jungle part especially showed an increasing trend, proving the rising amount of time participants tried to fixate their eyes on the stimuli.

This is due to a theory exclaiming the stimuli will force the participant to enter ***"Alertness System"*** where one will fixate on a specific part of the screen, dilating their pupil size.

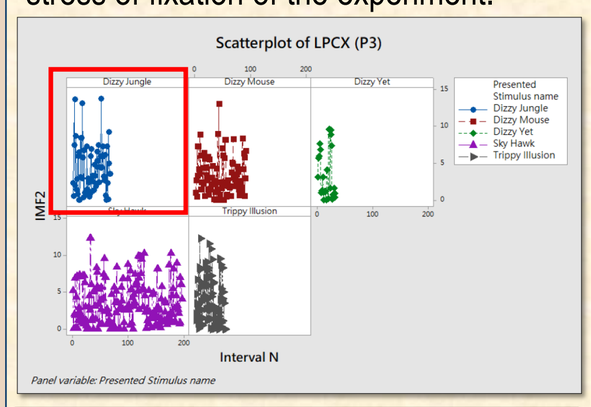
This will cause the participants to a ***"nystagmus"*** (rapid movement of the eye), leading to a dizziness called ***"Vertigo"*** (Dizziness where everything spins around).

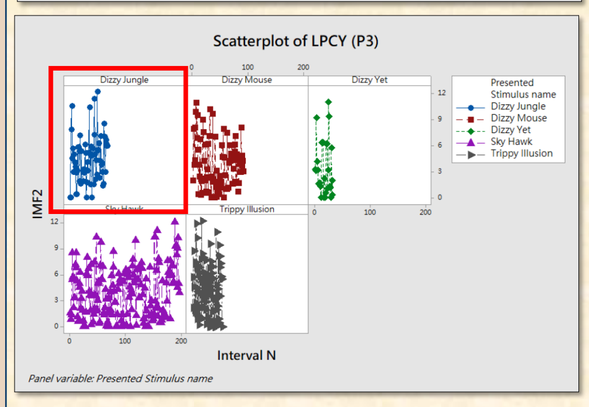
Results





As theorized, the pupil size of the participants in both eyes showed an upward trend, increasing due to the stress of fixation of the experiment.





This further corroborate the claim that after the pupil size increases, a person will enter ***nystagmus*** which should cause a quickened movement of the eye.
The graph above showed just that, the eyes are moving in extreme highs and lows during the duration of the experiment.

Conclusion & Future Research

In summary, VR does show an effect to cause dizziness in particular the Vertigo. This is because of the increased stress and pressure that our eyes felt which cause fixation and ultimately lead to dizziness, shown well by Dizzy Jungle.

This research will be useful as a reference for future experimentation and analysis in this area to further improve the quality of VR performance & people's general knowledge.