

# Report of The Scientific Study On VR User Engagement

**Context:** With the popularization of AR/VR and 3D technology, immersive media is becoming a new trend which influencing both the current and the future model of storytelling. Various VR technologies and diverse stories deliver different physical and physiological experience to the audience. In order to qualitative and visualize these subtle and invisible differences to present a straightforward and vivid data image. Associated Press and Multimer work together in the NYU Media Lab and provide a scientific study to twelve study participants.

**Experiment:** During the experiment, twelve participants are asked to watch 4 different stories wearing gears including Cardboard, VR headset, and Room-scale VR. Their engagements and brain activities are recorded when consuming immersive media content. The Basic framework of this study contains two parts including the overall attention and overall relaxation, which involves examining the alpha and theta brain waves.

**Challenge:** Francesco states that the examining categories are meant to be suggestive rather than prescriptive and fully descriptive. Robust statistical analysis and repeated data needed to be collected in the context of VR technology.

For example, in the experiment, the media content and the VR equipment both influence the engagement level of the participants and the result we have currently cannot control the variable when collecting and analyzing the data. Therefore, we need more control over the data to get a more accurate result including displaying the same media content to the participants through different VR equipment.

## **Data:**

In order to have a clear structure about how we are going to collect, clean, and understand the data. At the beginning of the study, as Nathan Yau states in his book, we should always consider our audience and purpose of the study and visualization ( Yau 36 ).

## **Purpose:**

Through this study, we want to prove that:

1. whether and how much the immersive media will improve the level of engagement.
2. Observe and compare the different level of engagement with various equipment.
3. Observe and compare the different level of engagement with each content.

## **Target Audience:**

1. Professional and Investors who interest in the field of immersive media and journalism.
2. The beginners and amateurs who interest in media and journalism.

Collecting the data

- The physical data includes the motion data when participants consuming the media content. These data could also be collected as a video format. However, the extensibility of video format is quite limited.
- The physiological data includes heartbeat and brainwave when participants consuming the media content.
- The verbal feedback. The verbal feedback could also be important to understand the data. We can connect the verbal feedback and the data feedback together to analyze the accuracy of the data. The questions being asked are also important. We should always be suspicious of studies and questions we asked. The audience will feel strongly about the topic we just asked but fail to claim what they want to express(Alberto 110).
- The motion data is hard to capture consistently and sometimes a piece of blank motion data was being captured, which somehow will influence the presentation of the result.

	Heart rate	Attention	Relaxation
OPEN-MINDEDNESS	77 BPM	44%	53%
FASCINATION	82 BPM	57%	53%
STIMULATION	82 BPM	50%	50%
POWER / INTENSITY	84 BPM	44%	54%

HANDS-FREE HEADSETS DRIVE HIGHER LEVELS OF ENGAGEMENT.

	Cardboard	VR headset	Room-scale VR
OPEN-MINDEDNESS	2	3	1
FASCINATION	2	3	1
STIMULATION	1	2	3
POWER / INTENSITY	2	1	3

	Conflict "House to House"	Culture and lifestyle "The Second Line"	Beat reporting "Thai Elephants"	Science and environment "The Blu"
OPEN-MINDEDNESS	4	3	2	1
FASCINATION	4	1	2	3
STIMULATION	1	3	2	4
POWER / INTENSITY	1	2	3	4

Cleaning the data

- The Motion capture data is quite large. Considering the feasibility and maintainability both in the server end and in customer end, we have to minimize and optimize the data.
- In order to present a smooth motion graph to the audience. understanding the data. We also need to optimize and filter the human motion data like using fewer keyframes or directly use the "Optical Motion Data" or "Magnetic Motion Data" function in the software.

## ***Visualizing the data.***

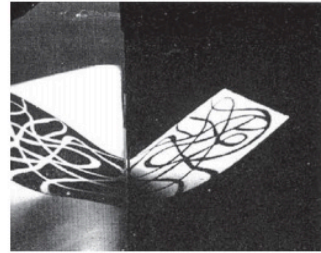
Considering our target audience includes the investors and beginners, we cannot present the visualization in a complex way like directly list the number of heartbeat and brainwave or we may also need the further explanation of our dataset. Therefore, here are four key points to visualize these data

- We have to combine the physical and physiological together so that we can have a straightforward picture of the engagement level of participants. The audience can interpret the number of heartbeat and brainwave by themselves. However, it's hard for readers to know what questions to ask when they don't know anything about the data in front of them. It's our job and responsibility to set the stage. How we design the graphics affect how readers interpret the underlying data.
- When you explore your own data, you don't need to do much in terms of storytelling(Yau 405). We have to present the VR content and the motion capture image at the same time so that the audience can know context better and know what happened to stimulate the participants.
- The visualization has to be interactive so that the audience can go back and forth to understand the data.
- The motion data for some device somehow is limited, which means people hardly move around when they were consuming the content which will lead to a messy and complex visualization. Therefore, how to balance the frame over each equipment is important. We have to scale the motion data to present a clear and simple image.
- The current Frame somehow is not clear and straightforward. The metric is quite close. The average BPM is almost the same. It's somehow hard to understand the attention and relaxation. There is some interaction between each stage of engagement. Especially for the HeartBeat, we have to consider that whether the peak heartbeat or the average heartbeat is more important or an index to show the engagement.

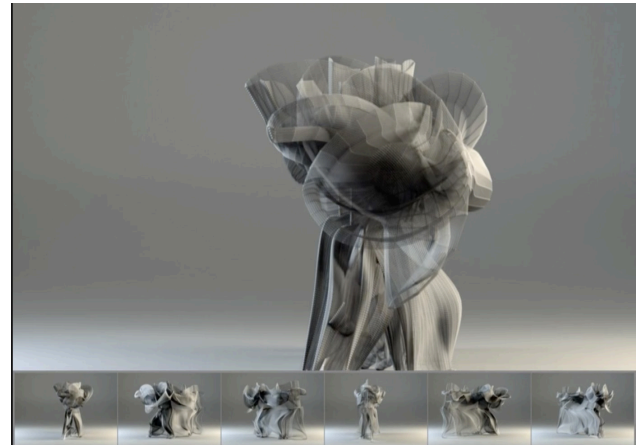
## Visualization Solution

- Solution A: Visualizing the data through video format. The video could be the recording version or may require us to deliver a rendering 3D model. The Heart-Beat and BrainWave could be presented through the wave, color, or sound system. However, the video format is not a great way to do more visualization over the heartbeat and brainwave.

- Solution B: Visualizing through Three.js or some coding base format. There could be hard to visualize. However, we could combine the heartbeat and brainwave to the movement at the same time and define more interactive part. For example, we can combine the size of dots to the heartbeat and the color of dots to the engagement. Like the example of Laszlo, the vision of motion, which was trying to record the motion path(Johanna).



Laszlo  
Moholy-Nagy,  
*Vision in  
Motion* (1946).



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