IDC School of Design
अभिकल्प विद्यालय
IIT Bombay

How real is Virtual Reality?

An immersion, interaction and embodiedness study.

Deepak Ranjan Padhi, Sugandha Katoch

Content

- Study Design
- Experiments
  - Research Questions
  - Method
  - Findings
- Conclusion

Study Design

Experiments	Goal	User Types		Type of analysis
		Tech-savvy	Emergent	
Experiment-1: VR "Roller Coaster" Video	To understand the immersive experience	5 (5 m, 0 f)	5 (3 m, 2 f)	Qualitative
Experiment-2: VR "Moon Bird" Game	To understand the embodiedness and embodied interaction	6 (5 m, 1 f)	6 (2 m, 4 f)	Qualitative + Quantitative

* **Immersion:** level of involvement of a person with the virtual environment
* **Embodiedness:** the underlying perception of one's bodily experiences (perspective-taking)
* **Embodied interaction:** Interacting with the VR environment with the body

Myo armband

Img source: https://time.com/4173507/myo-armband-review

Myo armband is an electronic device that can fit on the user's forearm, right below the elbow, and can record positional data using an accelerometer and gyroscope.

The device consists of EMG muscle sensors which can record various other data.

Experiment 1

VR "Roller Coaster" Video

To understand the immersive experience

Exp-1: Research questions

1. How would the participants perceive the **VR experience** as opposed to a **realistic experience**?
2. How would their experience differ from the **beginning to the end** of the task?
3. How does this immersive experience vary **across two sets of users** categorized as tech-savvy users and emergent users?

Tech-savvy	Emergent
5 (5 m, 0 f)	5 (3 m, 2 f)
Age: 24 to 35 years	Age: 25 to 45 years
Graduates and highly exposed to ICTs	Education below 10th standard and hardly exposed to ICTs

Method

Participants were

1. Informed about the study objectives
2. Briefed about the VR headset, affordances and their consent was taken for participation
3. Asked to stand and watch a 360 VR roller coaster ride video wearing mobile VR headsets and Myoband for 4 minutes
4. Asked to narrate their experience while going through it. Think aloud protocol was used.

Qualitative data such as excitements, expressions were collected through participant observation. We conducted a semi-structured interview after each session.

Findings

VR is just like 3D; Nothing more. (tech-savvy)

I got more involved in the middle ; Felt the fear of heights (tech-savvy)

I was not here; I was in another world. (Emergent)

Animation spoiled the reality (tech-savvy)

Felt like falling towards the end (Emergent)

Experiment 2

VR "Moon Bird" Game

To understand the embodiedness and embodied interaction

Exp-2: Research questions

1. How would the participants experience VR when they get to interact with it?
2. How would their experience differ from the beginning to the end of the task?
3. How does this immersive experience vary across two sets of users categorized as tech-savvy users and emergent users?

Tech-savvy	Emergent
6 (5 m, 1 f)	6 (2 m, 4 f)
Age: 24 to 35 years	Age: 25 to 45 years
Graduates and highly exposed to ICTs	Education below 10th standard and hardly exposed to ICTs

Method

Participants were informed about the study objectives and asked to relax for 5 mins before the experiment and in between each stage.

Stage-1 (Pre-imagination)

Participants were

- Asked to stand, close eyes, open their arms and imagine “a bird flying in the sky” for 1 minute
- Asked to narrate whatever they were imagining (think aloud)

Stage-2 (Play the game)

Participants were

- Briefed about the “Moon Bird VR” game objectives, rules and interactions of the game
- Asked to play the game wearing a VR headset for 3 minutes
- Asked to stretch their arms and express themselves while playing (think aloud)

Stage-3 (Post-imagination)

Participants were

- Asked to stand, open their arms and imagine “a bird flying in the sky” for 1 minute
- Asked to narrate whatever they were imagining (think aloud)

Findings

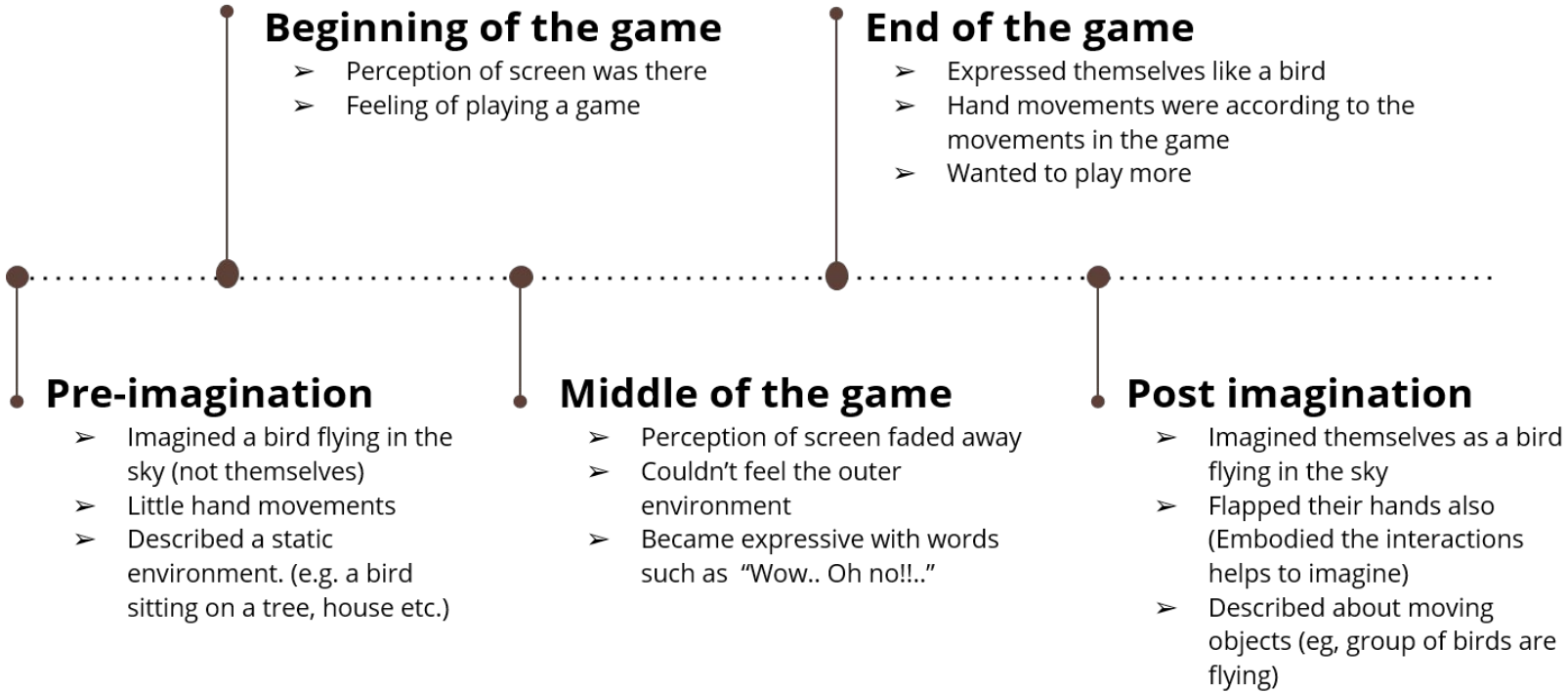


Figure: Journey map of a tech-savvy user

Findings

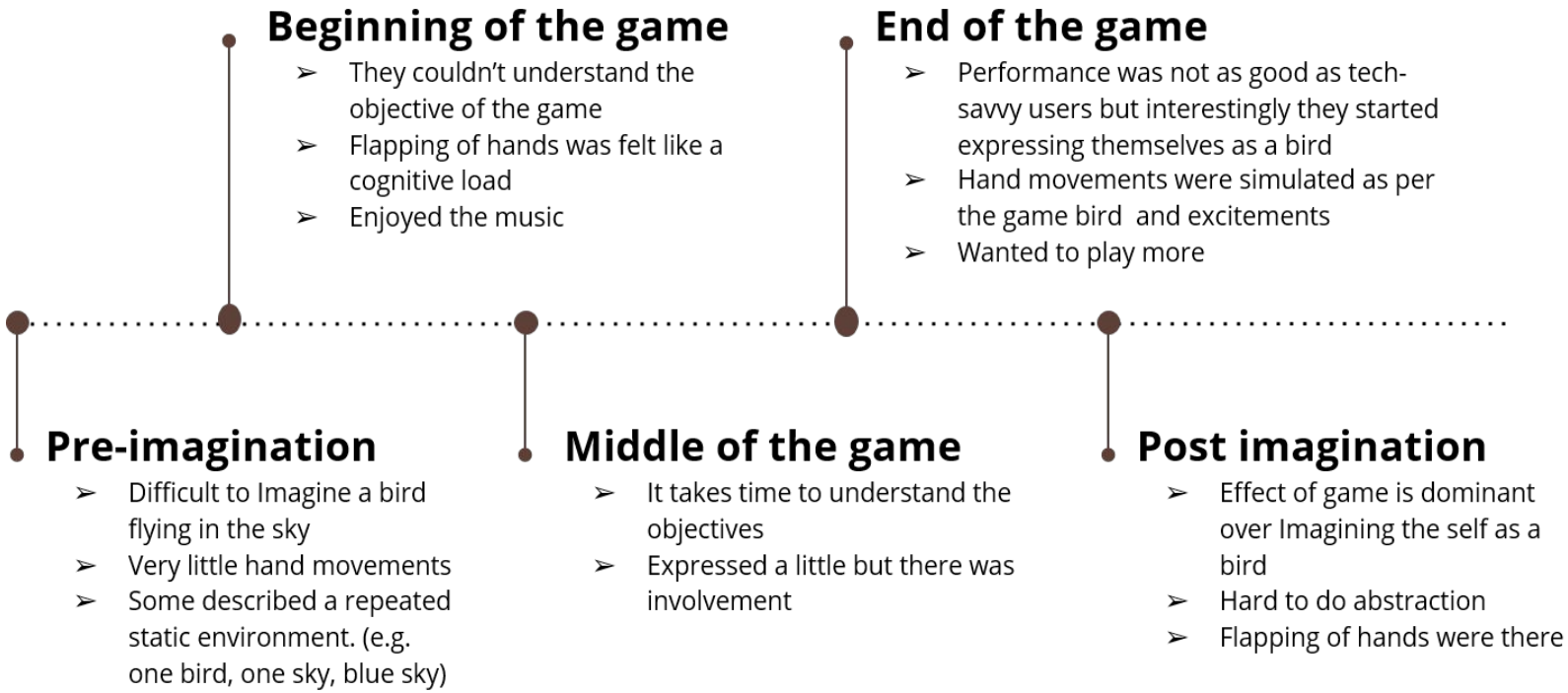


Figure: Journey map of an emergent user

Quantitative analysis

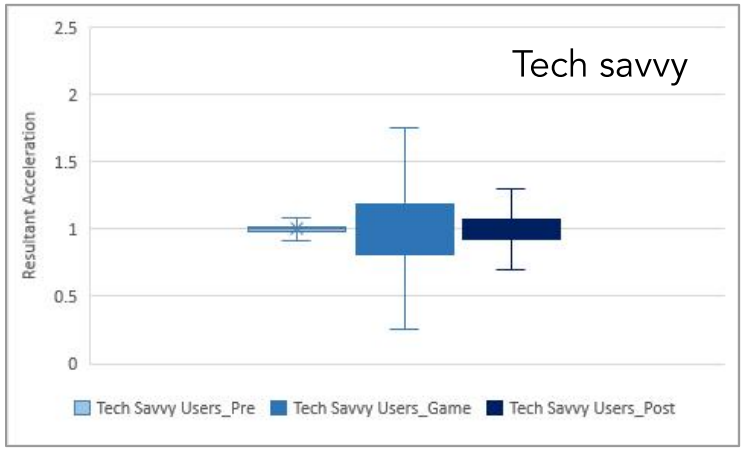
We analyzed the acceleration data collected from the Myo Armband.

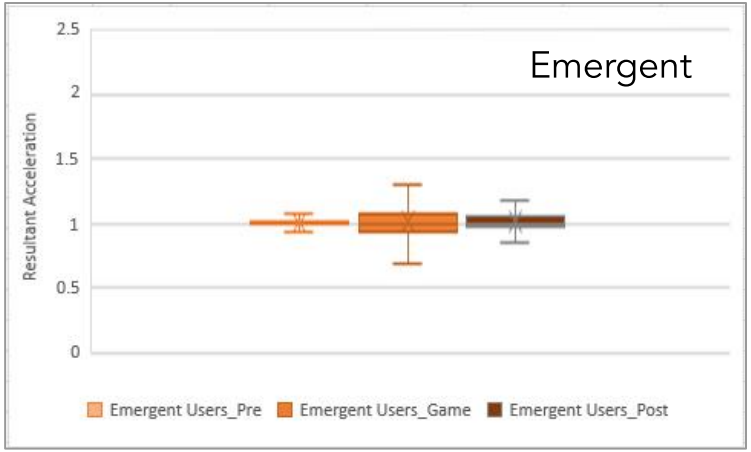
$$\text{Res.\_Acc} = \sqrt{(x^2 + y^2 + z^2)}$$

We then plotted the Box-whisker plot to look over the variation in the hand acceleration across the three different phases and between two user groups.

Quantitative analysis

	Pre-imagination Phase	Playing the Game Phase	Post-imagination Phase
Tech Savvy Users	Upper Whisker:1.084 Upper Hinge:1.021 Median:1.000 Lower Hinge:0.978 Lower Whisker:0.915	Upper Whisker:1.750 Upper Hinge:1.190 Median:1.004 Lower Hinge:0.815 Lower Whisker:0.253	Upper Whisker:1.304 Upper Hinge:1.075 Median:1.003 Lower Hinge:0.922 Lower Whisker:0.693
Emergent Users	Upper Whisker:1.069 Upper Hinge:1.017 Median:1.003 Lower Hinge:0.983 Lower Whisker:0.931	Upper Whisker:1.305 Upper Hinge:1.076 Median:0.998 Lower Hinge:0.923 Lower Whisker:0.693	Upper Whisker:1.166 Upper Hinge:1.044 Median:1.000 Lower Hinge:0.962 Lower Whisker:0.840
t-test	df = 40317, p=0.292938, t critical= 1.96	df = 44909, p=0.376256, t critical= 1.96	df = 38302, p=0.781177, t critical= 1.96





Conclusion

Tech-savvy users have a strong distinction between the virtual and real (tech-savvy)

Emergent users could engage themselves better when there is only a perception of the virtual environment (Emergent)

Flapping hands acted as a cognitive load (Emergent)

Embodied interactions and embodiedness enhanced the immersiveness (tech-savvy)

Users were upset about the heaviness of the VR headset (General)

Thank You

Deepak Ranjan Padhi
Email: deepak.padhi@iitb.ac.in

Sugandha Katoch
Email: sugandhakatoch@iitb.ac.in

IDC School of Design
अभिकल्प विद्यालय
IIT Bombay