

Effects of Valence and Arousal on Working Memory Performance in Virtual Reality Gaming

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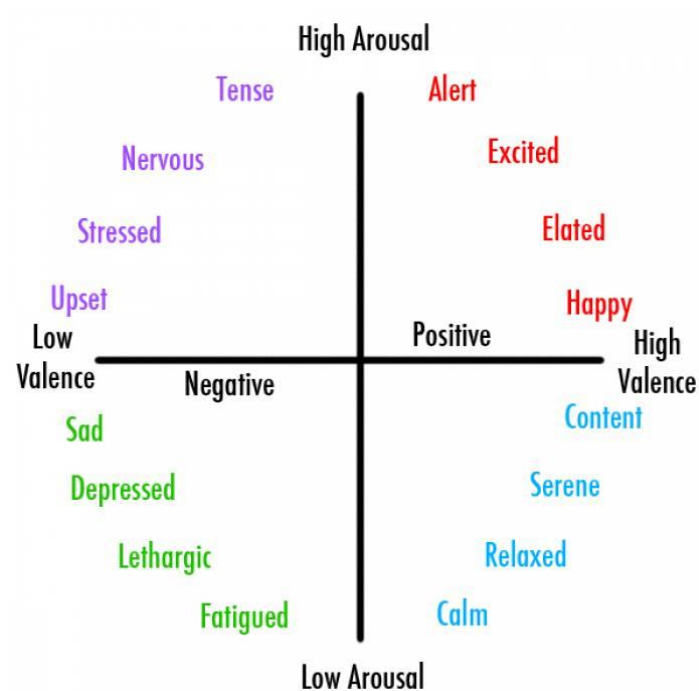
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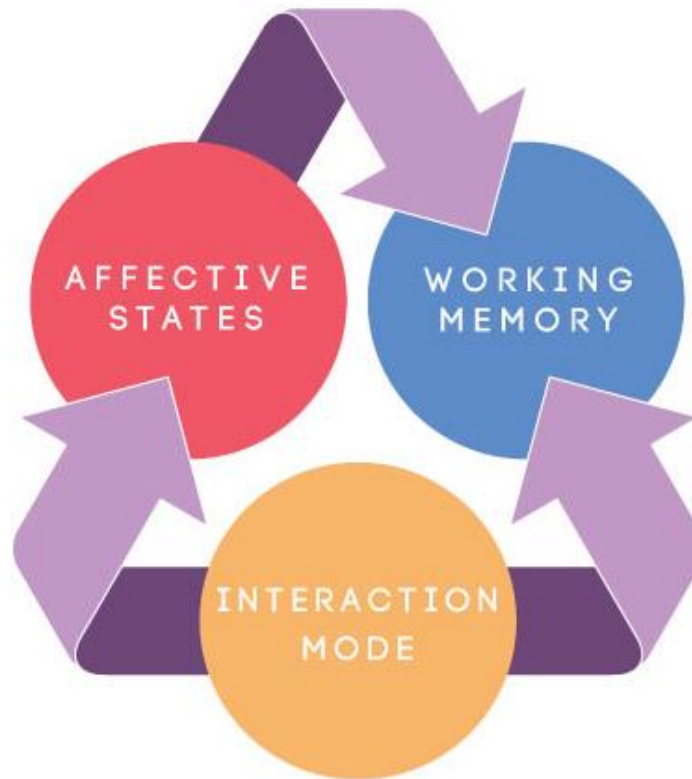
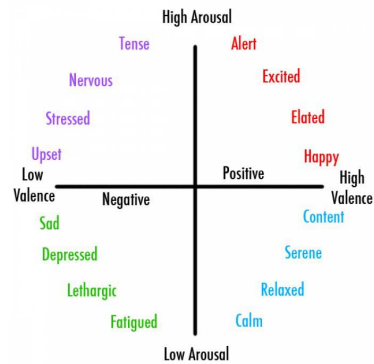
Background

Emotions & Cognition

- **Affective states** change our attention and memory.



Motivation



The study



VS



EASY

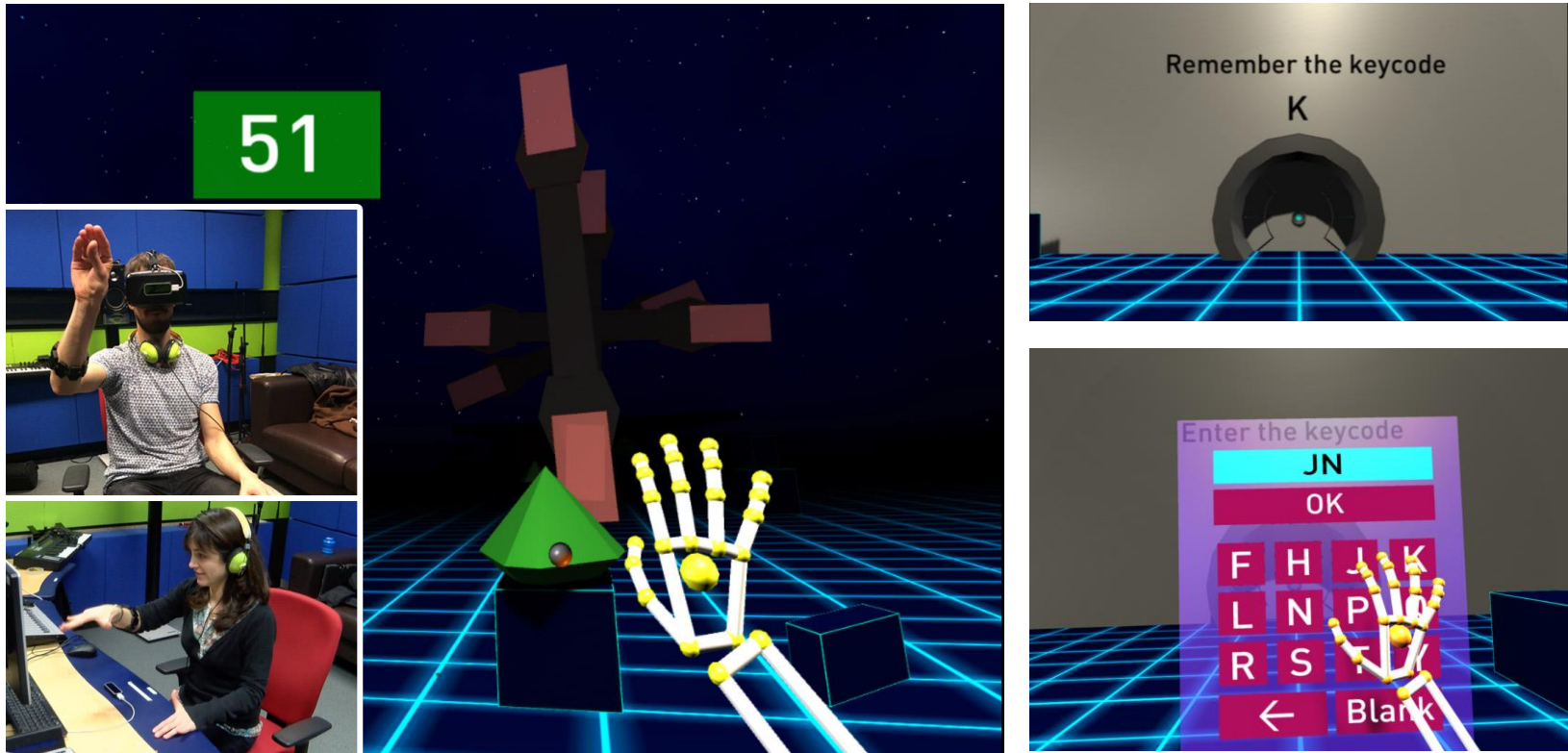
MEDIUM

HARD

Same memory load in every level

Working Memory (WM) capacity: **Operation Span Task**

The game: Memory Break



Results: Participants

30 participants (15 male - 15 female).

Mean **age**: 26.43

Liked the game:



100%



90%

Interaction **difficult** to control:



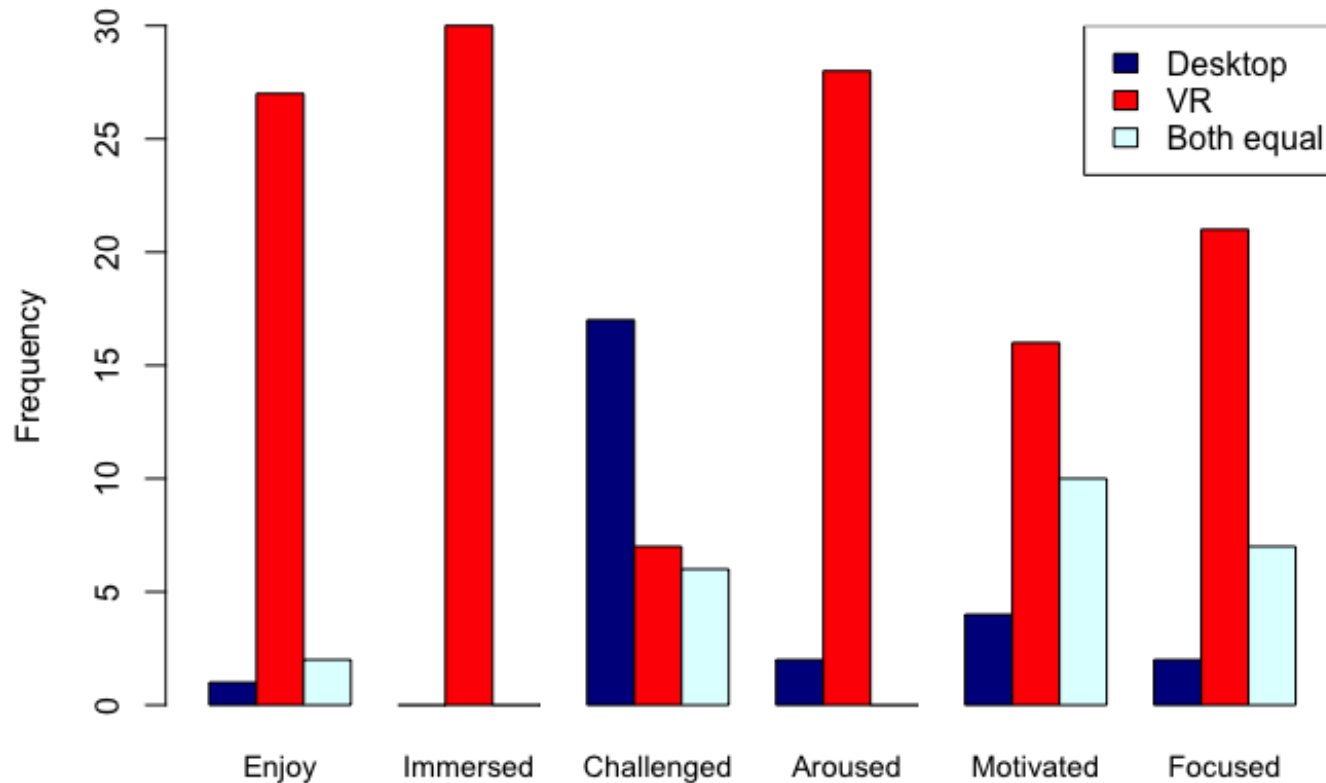
27%



87%

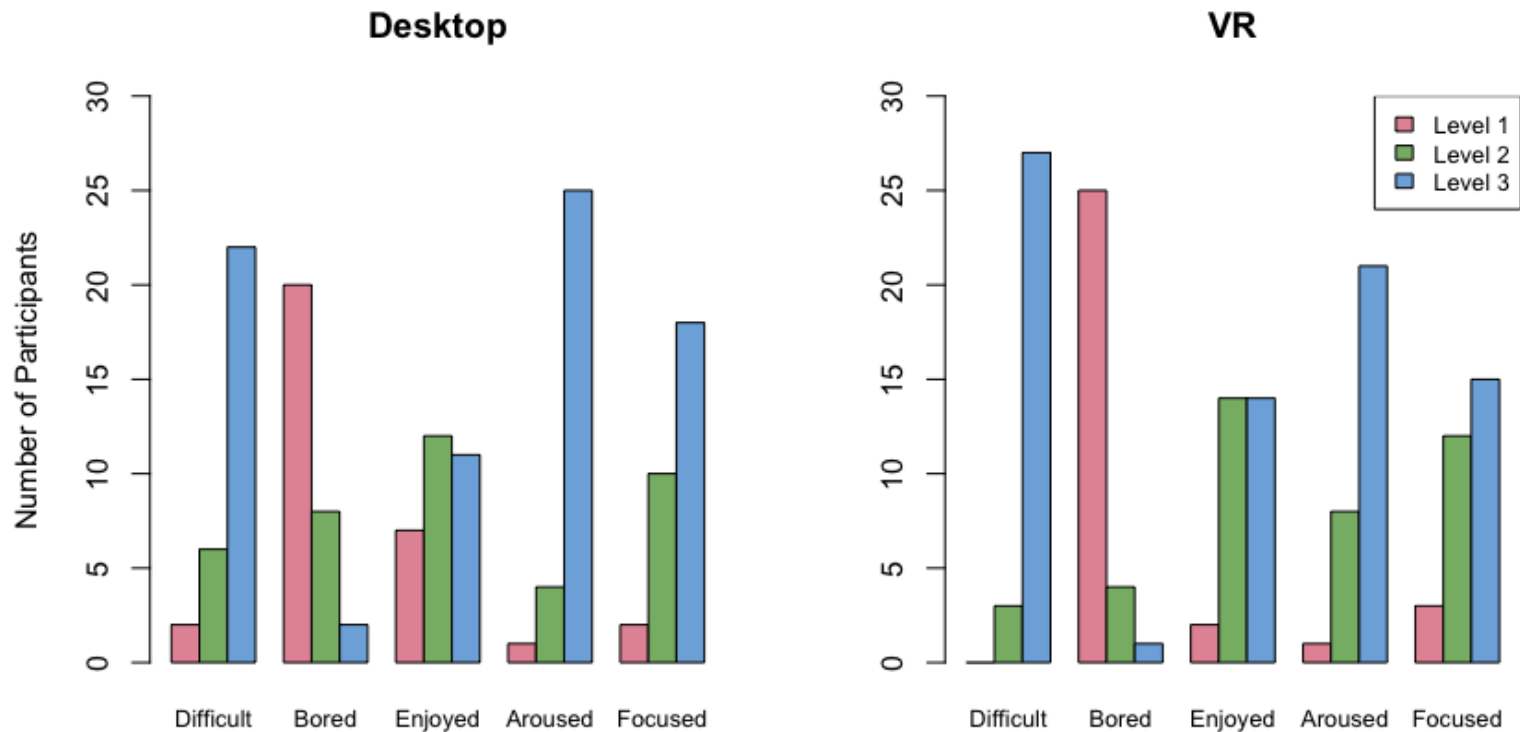
Results: Questionnaires

In which interaction mode did you feel most...?



Results: Questionnaires

Difficulty levels



Results: Affective States

Desktop Vs VR

AROUSAL

$F=12.73$ $p<0.01$

VALENCE

$F=19.70$ $p<0.01$

Results: Working Memory

Working Memory (WM) performance

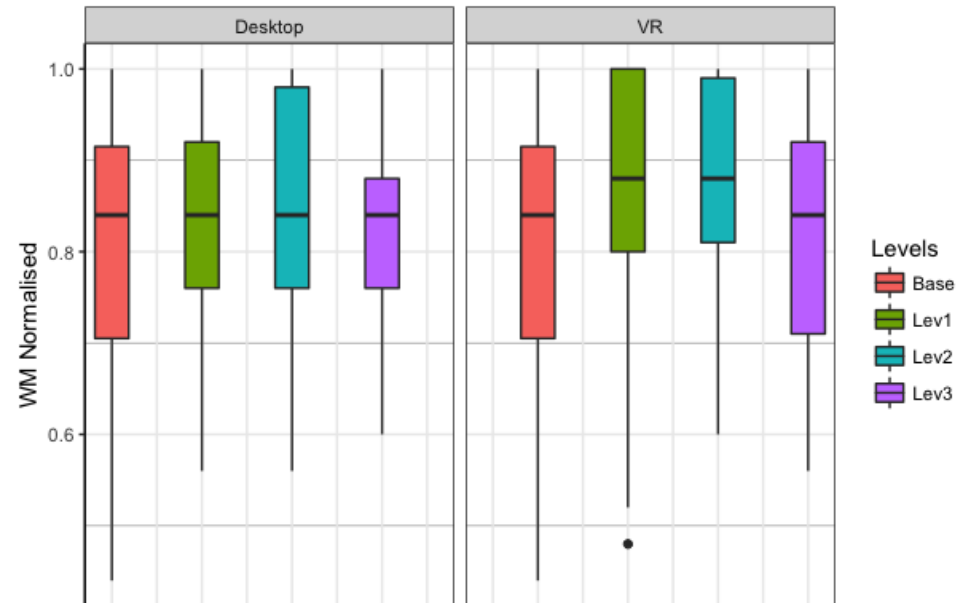
Between difficulty levels

Desktop

$F=0.52$ $p=0.67$

VR

$F=2.20$ $p=0.09$



Results: Working Memory

Correlations

WM & Immersion

Rho=0.13, p=0.08

WM & Valence

Rho=0.19, p<0.01

VR

Rho = 0.21, p<0.05

Desktop

No correlation

Results: Low vs High WM

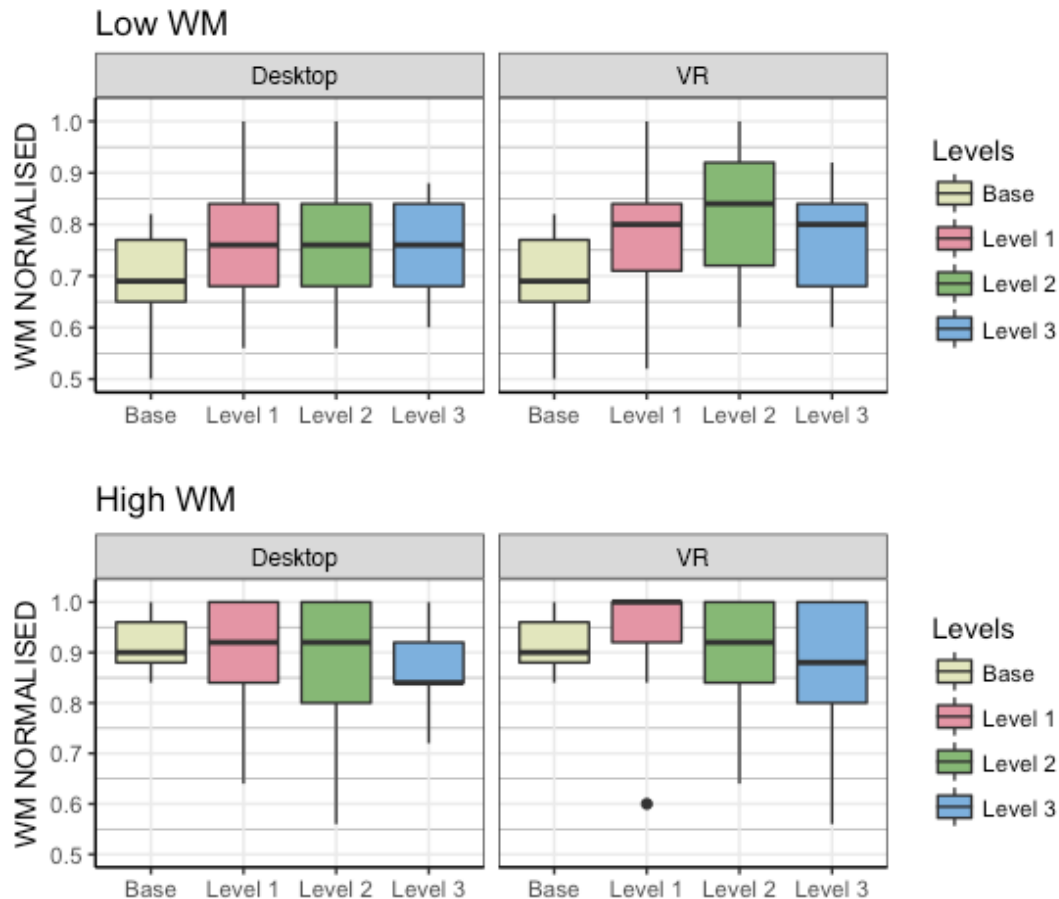
Low vs High WM

2 groups: 13 subjects in Low, 17 in High.
(based on the AOSPAN score.)

- **Low WM** group (<0.83) improved their WM performance in **VR**, specially in Level 2
- **High WM** (>0.83) did **not** significantly improved their WM performance.

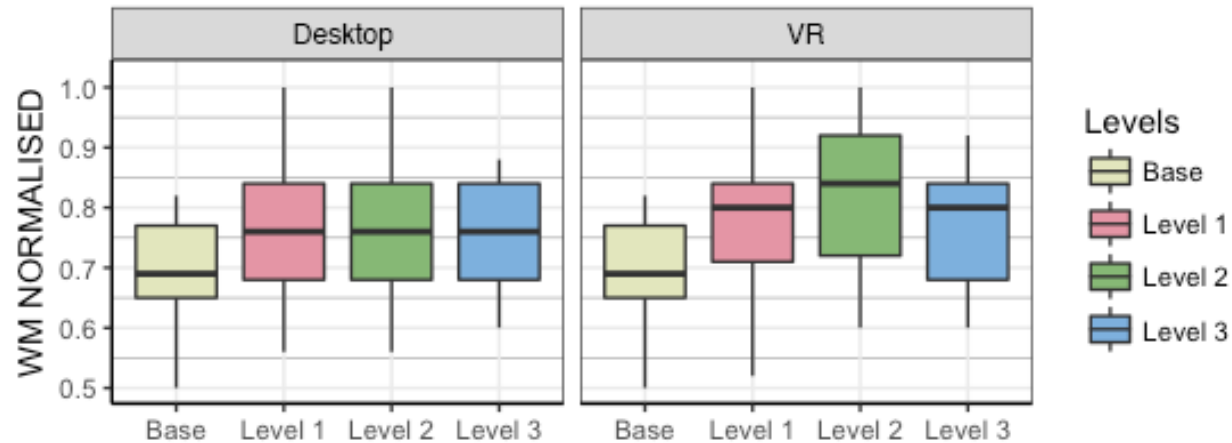
Results: Low vs High WM

WM performance



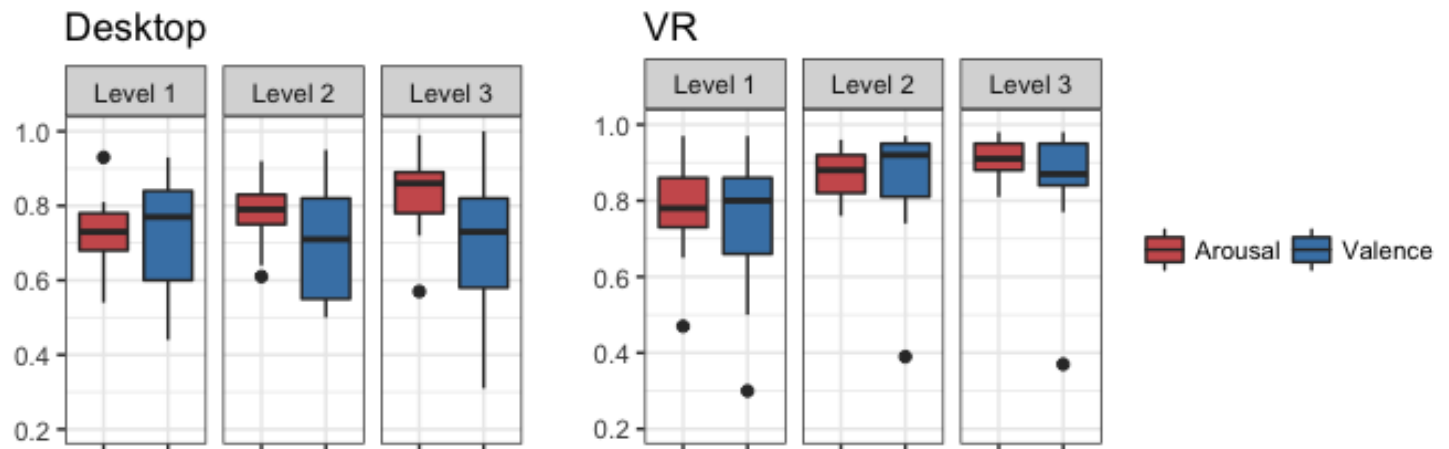
Results: Low WM group

WM performance



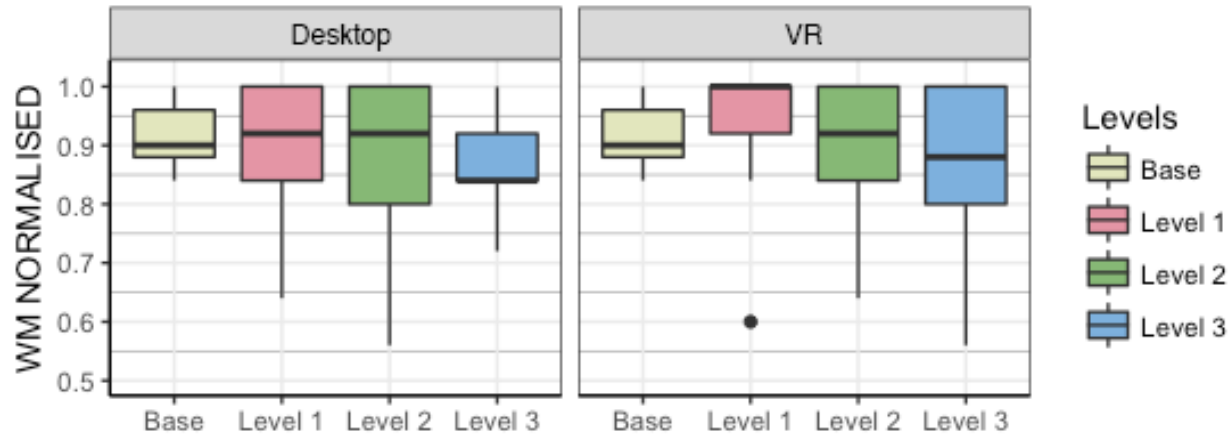
Arousal & Valence

Low WM



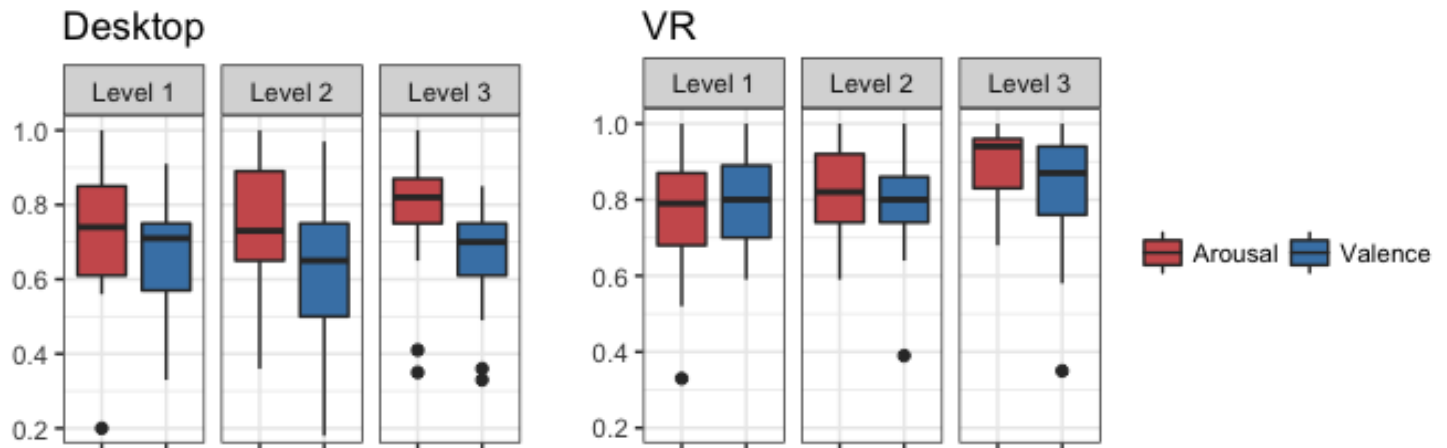
Results: High WM group

WM performance



Arousal & Valence

High WM



Conclusions

1. Higher immersion and arousal in VR
2. VR had a significant effect on WM performance
3. People with Low WM capacity can benefit more of VR affective gaming for cognitive training than those with High WM

THANK YOU!