Comparison of Virtual Reality Exergames and Nature Videos on Attentional Performance: A Single-Session Study

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INTRODUCTION & AIM

In recent years, the use of advanced technologies such as video games and immersive virtual reality (**VR**) has gained importance in the field of cognitive training, especially for improving attentional functions (Szczepocka et al., 2024). **Exergames** like *Beat Saber* have proven to play a significant role in enhancing **executive functions** (Serrano et al., 2018). Additionally, **natural environments** have also shown significant improvements in attentional restoration (González-Espinar et al., 2023) .

AIM

The aim of the research is to assess **reaction time** and **response accuracy** through the **Flanker** and **Attentional Blink tasks**, where significant post-test improvements are expected in the experimental groups (VR Exergame Group and Nature Video Group). It is anticipated that **Beat Saber**, characterized by its high level of engagement and the combination of mental and physical activity, will specifically enhance rapid cognitive processing and executive functions (Rodríguez-Rodríguez et al., 2024).
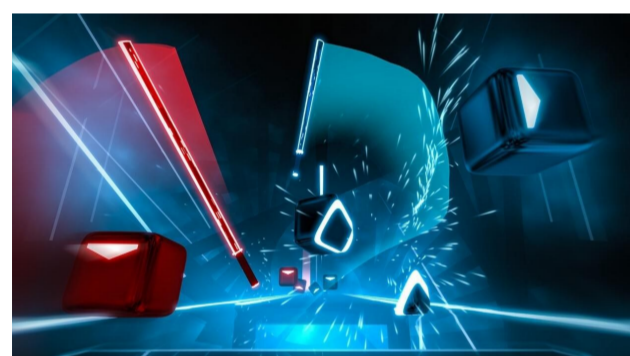

Figure 1. Experimental group. Beat Saber Videogames (Oleaga, 2021)

Figure 2. Experimental group. Ireland 4k ((Scenic Relaxation, s/f)

Figure 3. Control Group

METHOD

39 Participantes → (30 women and 9 men) aged 19 to 25 years. Psychology students from the University of Almeria

Exergame Group (n = 14) **Nature Video Group** (n = 13) **Control Group** (n = 12)

Flanker Task

Participants are required to identify a target stimulus while ignoring distracting stimuli , which can be either congruent or incongruent with the target (Eriksen & Eriksen, 1974) .
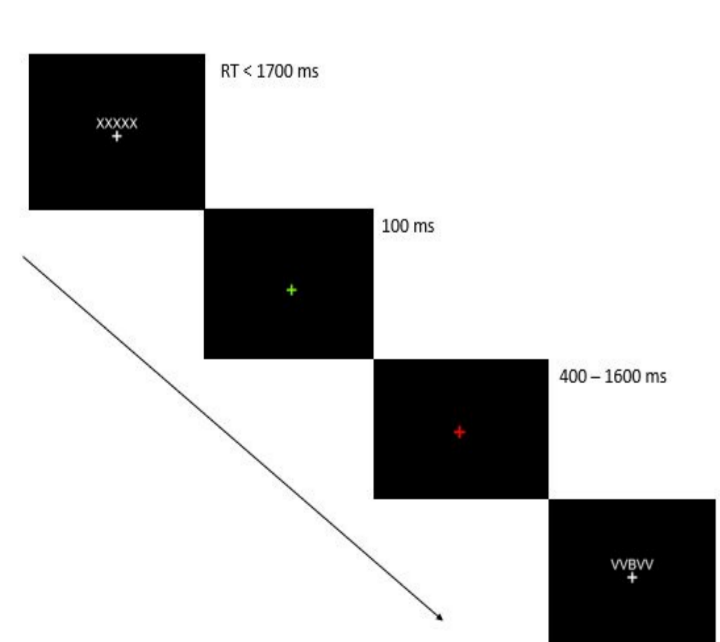
Attentional Blink (AB) Task

Participants have to detect two target stimuli presented in rapid succession within a stream of visual stimuli. The second target is often missed if it appears shortly after the first one, reflecting a brief period during which attention is "blinking" and unable to process new information (Raymond et al., 1992).
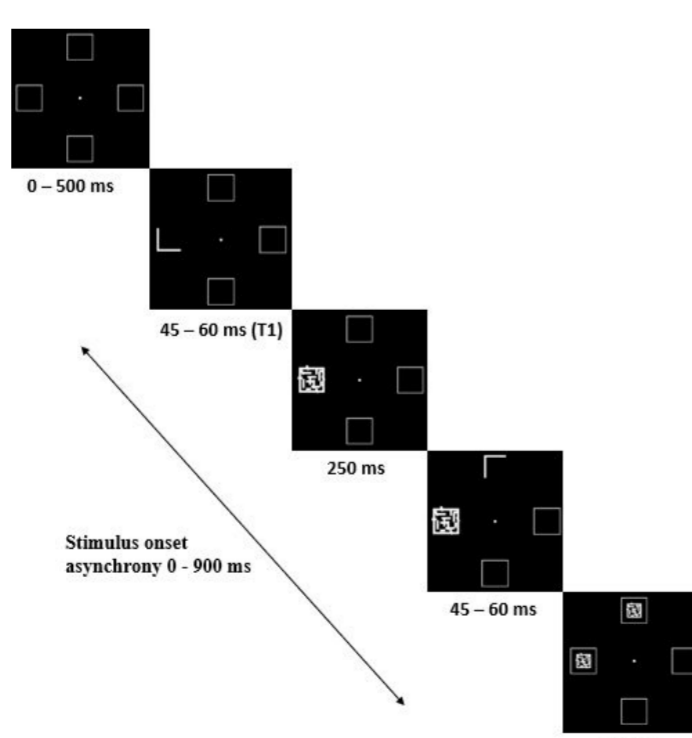

Figure 4. Stimuli and target conditions. Experimental process

Figure 5. Stimulus sequence. Test where the target symbol with shape of L is present in the first stimulus (T1)

RESULTS

Normality tests (Shapiro–Wilk) and homogeneity of variances tests (Levene test) have been conducted, and repeated measures ANOVA has been performed for both tasks.

FLANKER TASK

<u>RT</u>: Significant differences in **Time** ($F(1,36) = 35.68$, $p < 0.001$, $\eta p^2 = 0.498$), with participants taking less time to respond in the **post-test**. <u>Accuracy</u>: Significant differences were also found in **Time** ($F(1,36) = 8.280$, $p = 0.007$, $\eta p^2 = 0.187$), with participants scoring higher in the post-test, regardless of type and group.

AB

Significant differences show **greater accuracy** in responses in the **experimental groups** compared to the control group ($F(2,36) = 3.74$, $p = 0.033$, $\eta p\,2 = 0.172$) . However, no significant differences were found between the two experimental groups.
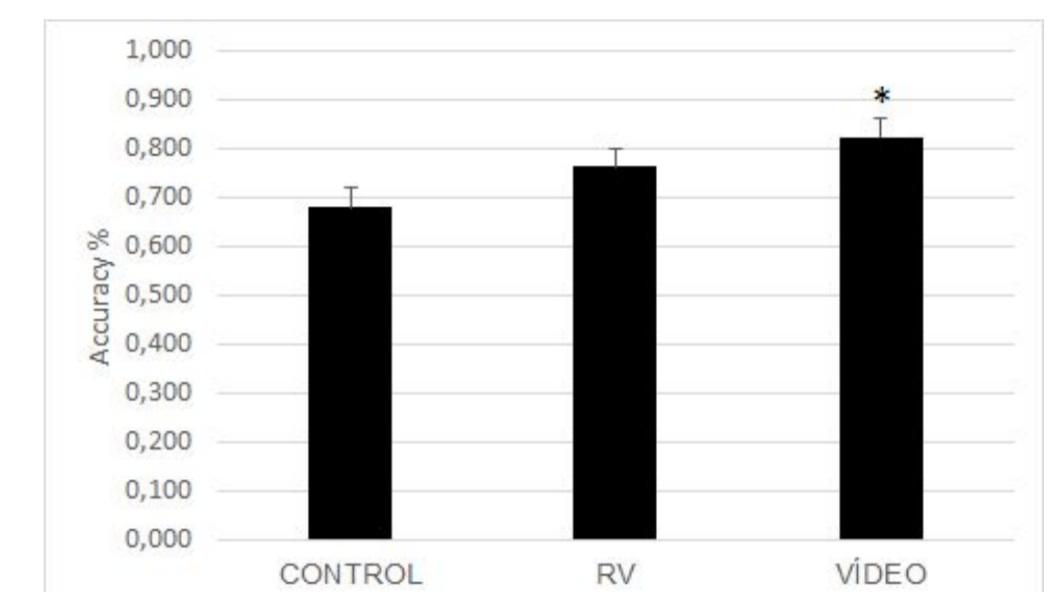
Significant differences were found in the **Type** of stimulus ($F(3,34) = 41.503$, $p < .001$, $\eta p^2 = 0.786$) and in **Time** ($F(1,36) = 39.95$, $p < 0.001$, $\eta p^2 = 0.526$), but not in Group. The distribution of mean response times based on group and type of stimulus is shown in Fig. 7.
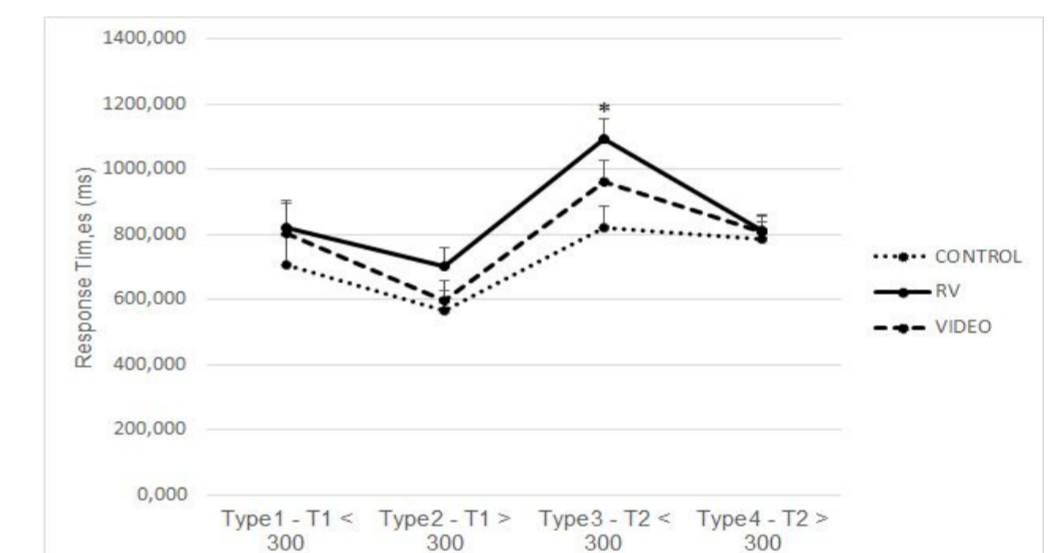

Figure 6. Accuracy between groups

Figure 7. Analysis of the Type x Group interaction

DISCUSSION & LIMITATIONS

- **Beat Saber Intervention:** Did not improve Flanker task performance, likely due to its focus on inhibitory control and selective attention, which may not be influenced by Beat Saber's demands.
- **4K Nature Environment:** Enhanced accuracy on the Attentional Blink task, particularly with shorter stimulus intervals, indicating that nature exposure can boost sustained attention and reduce cognitive fatigue.
- **Training Effect:** Improvements in response times and accuracy are likely due to task familiarity, reduced anxiety, and adaptation to cognitive demands.
- **Impact of SOA:** Shorter intervals in stimulus-present trials hindered detection speed. The VR video group showed better accuracy, while the VR exercise games group faced challenges with processing speed.

Limitations and Future Research Directions

The study found no significant improvements in attentional performance after brief exposure to virtual reality (VR), highlighting the challenge of attentional blink (AB). It suggests that VR interventions should be longer and more personalized, incorporating more complex tasks and repeated sessions to address these limitations. The sample, composed of psychology students, may have influenced the results, so a larger and more diverse sample is recommended. Additionally, it's important to investigate the long-term effects and the underlying neural mechanisms of cognitive improvements.

CONCLUSION

This study examined the effects of Beat Saber and a nature video on attention performance using the Flanker and Attentional Blink tasks. Significant improvements in response times and accuracy were observed across all groups, highlighting the training effect over specific interventions. Key factors like stimulus asynchrony (*SOA*) and target presence influenced performance. Future virtual reality interventions could benefit from more challenging tasks and adjusted stimulus intervals to enhance attention.

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