MASTERARBEIT / MASTER'S THESIS

Titel der Masterarbeit / Title of the Master's Thesis

„The Beauty of Immersion – Investigating Aesthetic Emotions in a Video Game"

verfasst von / submitted by

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angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of

Master of Science (MSc)

Wien, 2022 / Vienna 2022

Studienkennzahl lt. Studienblatt / degree programme code as it appears on the student record sheet:	UA 066 840
Studienrichtung lt. Studienblatt / degree programme as it appears on the student record sheet:	Masterstudium Psychologie UG2002
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Introduction

Games and Empirical Aesthetics

Video games have become one of the most consumed forms of entertainment, and thus make up a great deal of how people spend their time in the 21st century. These days, there is a large variety of games and game genres, tailored to a wide array of consumer groups. Starting out as a form of 'niche' entertainment almost 50 years ago, video games have come a long way from arcade games like Pong (Atari, 1972) with two-dimensional pixel graphics over the first home consoles to the modern games with hyper-realistic three-dimensional graphics and virtual reality (VR). The technological advancement and accessibility of video games made them evolve into a mainstream phenomenon, with people of all ages playing and consuming video game content all over the world. According to the Newzoo Global Games Market Report, over three billion people have played games on PC, console, or mobile devices worldwide in 2022 (Newzoo, 2022). On top of that, video game live streaming has emerged as another form of video game consumption that integrates traditional broadcasting and online gaming (Li et al., 2020). It is safe to say that nowadays video games are a staple part of our culture just like literature, movies, tv shows and art. Trying to unravel what it is that makes video games so popular and where our enjoyment for them stems from opens many interesting questions that are yet to be answered. Although video games are subject to scientific scrutiny in a variety of fields and disciplines – including different strands of Psychology – there is relatively little empirical research that tries to capture the aesthetic experience of video games.

Most psychological studies looking into video games tend to zoom-in on the negative aspects of gaming, as for example addictive behavior in relation to video games or the effects of violence in games (D. Griffiths et al., 2012; Prescott et al., 2018). Nevertheless, there are some studies that look past the negative connotation that video games might have had in the scientific community and try to study video game play from a different perspective. For example, one study found a small positive correlation between play time and affective well-being for the games Plants vs. Zombies and Animal Crossing (Johannes et al., 2021). Taking on a more holistic approach towards video games is important and necessary to further our understanding of how video games might influence our behavioral tendencies and thought processes. I argue that taking a closer look at the aesthetic perspective of video games and how games might affect our emotions is a genuinely fruitful undertaking for enhancing the understanding of video games in a symmetrical manner. Isn't it interesting how video games can evoke strong emotions, elicit feelings of 'awe' and 'beauty', and move people in a similar fashion that is often associated with the experience of art?

Posing such a question, one is quickly drawn towards the field of empirical aesthetics, which is investigating a broad spectrum of aesthetic phenomena for various modalities like art perception, beauty, and aesthetic emotions. I argue that empirical aesthetics has not been giving video games the attention that they deserve. Just like art, video games provide the viewer with a variety of aesthetic modalities with different art styles and perspectives. In addition to the visual aspect, games also provide a rich auditory, narrative, and kinetic experience that all play a part in the overall aesthetic experience of video games. Aubrey Anable (2018) describes video games as affective systems where players develop a "form of relation" to the game's aesthetic and narrative properties (p. 4). Like the aesthetic experience of 'traditional' pieces of art, the video game experience is dependent on the viewer's opinions, feelings, context, and expertise with the medium. All these modalities influence the viewers' aesthetic experience and can greatly differ from one game to another. Moreover, the experience might even be entirely different within the same video game, as most games feature multiple levels with a variety of rich virtual environments. Thus, I argue, they cannot be condensed into a single snapshot. For video games, it is not only the gaze of the viewer that shifts to different parts of the image, but also the virtual environment that changes rapidly, depending on the players' movement and actions.

An additional factor that is quintessential for the enjoyment of video games and arguably distinguishes them from most other forms of art, is the feeling of being present in a virtual environment, often referred to as immersion. This feeling of being totally encapsulated by another (virtual) reality is what makes video games attractive to many users. It is not unique however, as one could argue that an observer viewing a piece of art in a museum might also be experiencing a similar phenomenon. Mäcklin (2019, p. 13) describes this state of aesthetic immersion as "[…] the experience of being captivated by a phenomenon to the extent of losing one's sense of time, space, and even one's sense of selfhood.". In addition to being in this state of aesthetic immersion, video games make it possible to interact with the virtual environment and being able to explore said environment, even affecting it according to one's own intentions and actions. This is something which is more unique to video games.

This state of being totally absorbed by the virtual environment, where the players forget everything around themselves and shift all their emotional and attentional resources towards the mediated space, can be described by a few different concepts in psychology. In the next section, I give a brief overview of the most common concepts associated with video game immersion, outlining similarities and differences between them.

Flow, Immersion, Spatial presence

Flow

One theory that has been quite popular over the past three decades is flow. Flow is a state of optimal experience arising from intense involvement in an activity that is enjoyable, such as playing a sport, performing a musical passage, or writing a creative piece (APA Dictionary of

Psychology, 2022). The concept of flow has been established by Csikszentmihalyi in the 1970s. Csikszentmihalyi was interested in how people feel when they are getting pleasure out of activities they do for enjoyment. By asking artists, chess players and surgeons what they felt when they had this experience of flow, he compiled a list of 9 dimensions that were mentioned the most: loss of self-consciousness; distorted perception of time; balance between the skills of an individual and the activity's demands; merging of action and awareness; clear goals; immediate and unambiguous feedback; concentration on the task; perceived control over the activity and intrinsic motivation toward an activity (Csikszentmihalyi, 1990).

It is important to note that there is an ongoing debate whether individuals need to fulfill all nine dimensions to establishing flow or if there are certain aspects that are more important than others in achieving flow (Cairns et al., 2014). Michailidis et al. (2018) argue – based on oral reports of people experiencing flow – that the dimensions of flow are more descriptive in nature rather than definitive and that they might not be applicable to every person for every kind of activity.

Immersion

According to Brown & Cairns (2004) , the achievement of immersion can be described in a three-stage-model. Within this proposed model, the first stage is *engagement*, which represents the lowest level of involvement with a game:

> "To lower the barriers to enter this level, the gamer needs to invest time, effort, and attention. Accordingly, an initial barrier for engagement is access." (Brown & Cairns, 2004, p. 1298).

The authors also outline that this level of engagement lacks the emotional level of attachment that is seen in later stages of immersion.

Once the player becomes further involved with the game, he or she enters the next stage: *engrossment*. At this level, "[…] the game becomes the most important part of the gamers' attention, and their emotions are directly affected by the game." (Brown & Cairns, 2004, p. 1299). The next and last stage is *total immersion*. In this stage, the player achieves *presence*, which is a state where "[…] the game is the only thing that impacts the gamer's thoughts and feelings." (Brown & Cairns, 2004, p. 1298).

Spatial Presence

According to Wirth et al. (2007), *spatial presence* means the (psychological) sense of being present in the virtual environment. While the concept originated from Virtual Reality (VR) users describing a feeling of being physically located in the mediated VR environment (Slater & Steed, 2000; Steuer, 1992), occurrences of spatial presence have been reported for a variety of media like television (Bracken, 2009; T. Kim & Biocca, 2006), movies (Wissmath et al., 2009) and video games (Jin, 2011; Ma et al., 2021; Ravaja et al., 2006; Skalski et al., 2010).

Wirth et al. (2007) propose a two-dimensional spatial presence model that consists of the viewer's perceived *self-location* and perceived *possible actions*. In order to establish and maintain spatial presence, the viewer must allocate their attention to the virtual environment and construct a mental model of the mediated space. This so-called spatial situation model (SSM) includes all the properties of the space. After this mental representation is created, the viewer must test the "medium-as-PERF-hypothesis", testing whether this mediated environment is the environment that they are currently present in. If this question is answered with a yes, they shift their Primary Egocentric Reference Frame (PERF) from their actual, physical reality towards the virtual environment. The viewer now perceives himself as located in this virtual environment, all actions and reactions are carried out within the virtual world instead of the real world.

The concept of *spatial presence* cannot be seen as totally distinct from flow and immersion. While flow shares some important pre-requisites with the concept of presence, Brown & Cairns (2004) theory of immersion defines presence as the deciding factor in achieving total immersion. In a review about the conceptual challenges that arise when describing and quantifying immersive experiences during video game play, Michailidis et al. (2018), come to the following conclusion:

> "[…] Immersion and flow do not appear as conceptually distinct, and their proposed differences are not compelling enough to set immersion apart as a different mental state. Although *presence* is enveloped in immersion, it appears to be a distinct mental state, even on a neural level." (p. 5)

When thinking about what the essence of being immersed in a video game might be, *presence* seems to be the common denominator in concepts of video game engagement and immersion. Furthermore, *presence* is thought to be taking place at an earlier stage of video game engagement (Weibel & Wissmath, 2011), which makes it easier to investigate in a laboratory setting, where time is a limiting factor for gameplay sessions.

Presence, emotions, and aesthetics

To a large extent, previous work on presence research in video games has focused on which media variables influence presence. Among others, studies have shown that spatial presence is mediated by image quality and size (Lombard et al., 2000), interactivity (Steuer, 1992) as well as game characteristics (Ravaja et al., 2004). Additionally, the experience of presence is also influenced by different characteristics of the perceiver as well as social aspects.

For example, one study found that playing against another human elicited higher spatial presence when compared to playing against the computer (Ravaja et al., 2006). While this direction is vital to understanding the process of spatial presence formation, I think it is also important to dive deeper into how the *feeling* of being present in a virtual environment affects the perceivers' emotions and aesthetic appreciation of a video game. In this sense, Lull et al. (2016) suggest that "[…] presence amplifies the effects of violent video gameplay, such that the more immersive the gameplay technology, the more present players feel, and in turn the angrier players feel after playing a violent video game." (p. 1). Similarly, Ravaja et al. (2004) found that presence influences the valence and arousal dimensions of emotions.

Spatial presence and the brain

Although the neural correlates of spatial presence have been investigated by trying to find neural patterns that can be functionally linked to those phenomena, the evidence is still lacking. While some evidence suggests that flow, immersion, and presence share mutual neural correlates, the processes are not yet fully understood (Klasen et al., 2012). Of those three concepts, presence has been getting the least attention when it comes to looking at the neural substrates.

In line with the findings of Weibel & Wissmath (2011), Klasen et al. (2012) postulate that "presence may facilitate the emergence of flow and correspond to the aspect of deep immersion which is characteristic for flow in games" (p. 491).

Studies that focused on presence have consistently implicated frontoparietal areas, more specifically the dorsolateral prefrontal cortex (DLPFC) (Baumgartner et al., 2006; Clemente et al., 2014). Baumgartner and colleagues (2008) had participants view either a high-presence or a low-presence version of a virtual roller coaster ride in VR while recording brain activation with functional magnetic resonance imaging (fMRI). They found that the right DLPFC activity was negatively correlated to the experience of presence (i.e., the stronger the DLPFC is activated, the lesser the presence experience). In a review article, the authors suggested that the DLPFC is "recruited as part of a strategy for regulating the experience of presence by constraining the egocentric processing of the roller coaster stimulus display" (Jäncke et al., 2009, p. 54).

Another brain structure that has been implicated in modulating the feeling of residing in one's own body is the right temporo-parietal junction (rTPJ). Multiple studies have found that the TPJ is involved in out-of-body experiences (OBEs) (Blanke et al., 2005; Bos et al., n.d.; Bünning et al., n.d.). During an OBE, people feel like their 'self' is located outside of their physical body. According to the American Psychological Association (APA) dictionary, an OBE is "a dissociative experience during which the individual imagines or feels that his or her mind, soul, or spirit has left the body and is acting or perceiving independently". In line with this, Tsakiris and colleagues (2008) found that disrupting rTPJ with transcranial magnetic stimulation (TMS) made it harder for people to distinguish between their own body and external objects, suggesting that the rTPJ plays an important role in maintaining a coherent sense of one's body. Conforming to those findings, fMRI studies that simulated an out-of-body experience with a virtual body also showed activations in the anterior part of the TPJ (Ehrsson, 2007; Ionta et al., 2011), with Ionta and colleagues (2011) stating that "the TPJ reflects one of the most fundamental subjective feelings of humans: the feeling of being an entity localized at a position in space and perceiving the world from this position and perspective" (p. 363).

Moreover, the TPJ has been linked to the theory of mind and the experience of being the one responsible for your own actions (Decety & Lamm, 2007). With all this evidence of the involvement of the TPJ in self location, perspective taking and agency, it seems plausible to hypothesize that the TPJ should also play a role for the experience of presence. And even though there have been links between presence and TPJ activity (Baumgartner et al., 2008), the underlying processes still remain poorly understood.

Research Questions

Spatial Presence

I hypothesized that actively playing a commercially available 3D diving game (vs. passively watching someone else play) would lead to an increase in self-reported spatial presence (H1).

Aesthetic Experience

I hypothesized that the self-reported ratings for beauty (H2.1), liking (H2.2), and aesthetic emotions (H2.4) are higher in the active condition compared to the passive condition.
Additionally, I hypothesized that the ability to empathize with the character would be greater in the active compared to the passive condition (H2.5).

Game Experience

I hypothesized that positive affect ratings would be higher in the active condition (H3.1). and negative affect ratings would be higher in the passive condition (H3.2).

fNIRS hypotheses

This study aims at replicating previous findings regarding the function of the rDLPFC in the presence experience with using a more ecological valid measurement and a desktop video game instead of VR. As well as expanding the knowledge of how the TPJ activation relates to high-and low-presence experiences in a video game. Previous research has shown links between the IFG and affective empathy, which is the ability of being able to share somebody else's emotional state (Hocke et al., 2018; Kogler et al., 2020; Shamay-Tsoory et al., 2009). I wanted to investigate if there were differences in players' ability to empathize with the character and whether those differences would be reflected in IFG activation when playing a character versus merely watching someone else play the character.

To replicate the findings regarding the function of the DLPFC for the presence experience, I hypothesize that higher subjective experience of spatial presence should correlate with lower activations in the DLPFC (H3).

Furthermore, I hypothesize that there is a difference in brain activation for the lTPJ (H4.1) rTPJ(H4.2), and rIFG(H4.3) between the high-and low-presence conditions.

Methods

Subjects

The final sample consisted of 35 participants (16 female, 18 male and one non-binary) that were recruited by means of the University of Vienna LABS System. All participants were healthy, German speaking adults from 18 to 29 years of age, with the mean age being 21.09 years. Testing took place in May 2022. All participants were given a standardized introduction to the experiment and informed consent was obtained. It was made clear to them that they could always abort the experiment without negative consequences and that all recorded data would be fully anonymized. Participants received LABS credits that are a requirement for some bachelor courses for taking part in this study.

Table 1

Results of the pre-game Questionnaire. Age, Gender, Handedness and Gaming Expertise

Variable	N	M	SD	Range
Age	35	21.09	2.44	[18-29]
Expertise	35	2.86	1.44	[1-5]
Female	16			
Male	18			
Non-Binary	1			
Left-handed	3			
Right-handed	32			

Note. N represents sample size, M and SD represent mean and standard deviation, respectively.

Task and Design

The experiment consisted of sessions of playing video game and watching a recording of someone else playing the same game. In the high presence condition, participants played the video game for 6 minutes, whereas in the low presence condition, participants had to watch a pre-recorded gameplay video for the same duration. For the sake of accounting for possible learning effects, the experiment was split into four segments of either playing the game or watching the video. Additionally, the order of watching and playing was counterbalanced so that half of the subjects started with playing the game while the other half started with watching the gameplay video.

At first, each participant was given a brief introduction and 3 minutes of playtime to get familiar with the game and learn the controls. To minimize learning effects, the tutorial was kept at 3 minutes. Next, participants were asked to answer the initial pre-game questionnaire. After that, the participants' head circumference was measured to determine the size and positioning of the NIRS-cap. Once the cap was fixed in the correct position, the sources and detectors were placed in the respective positions on the scalp. Before calibration, the light was turned off to reduce dark noise. Subsequently, the fNIRS was calibrated for signal optimization, and each channel was checked for signal quality. For channels where data quality was not sufficient, optode placement was performed again until signal quality was acceptable for every channel of interest. In some rare cases, the experiment had to be continued even though some channels were not meeting that criterion because it was not possible to achieve a high-quality signal, even after re-placing the optodes multiple times.

Before starting the experiment, baseline brain activity was recorded for 60s. During this period, participants were instructed to just sit still and relax while looking at a blank screen with a fixation cross. After that, participants started with the first 6-minute session of either playing or watching, during which brain activity was recorded. After each session (either gameplay or video), participants answered the post-game questionnaire. When participants had completed the questionnaire, the next 6-minute session was started. In total, every participant completed 2 sessions of gameplay and 2 sessions of watching the gameplay video. After the experiment, participants were debriefed and any open questions regarding the experiment were answered.

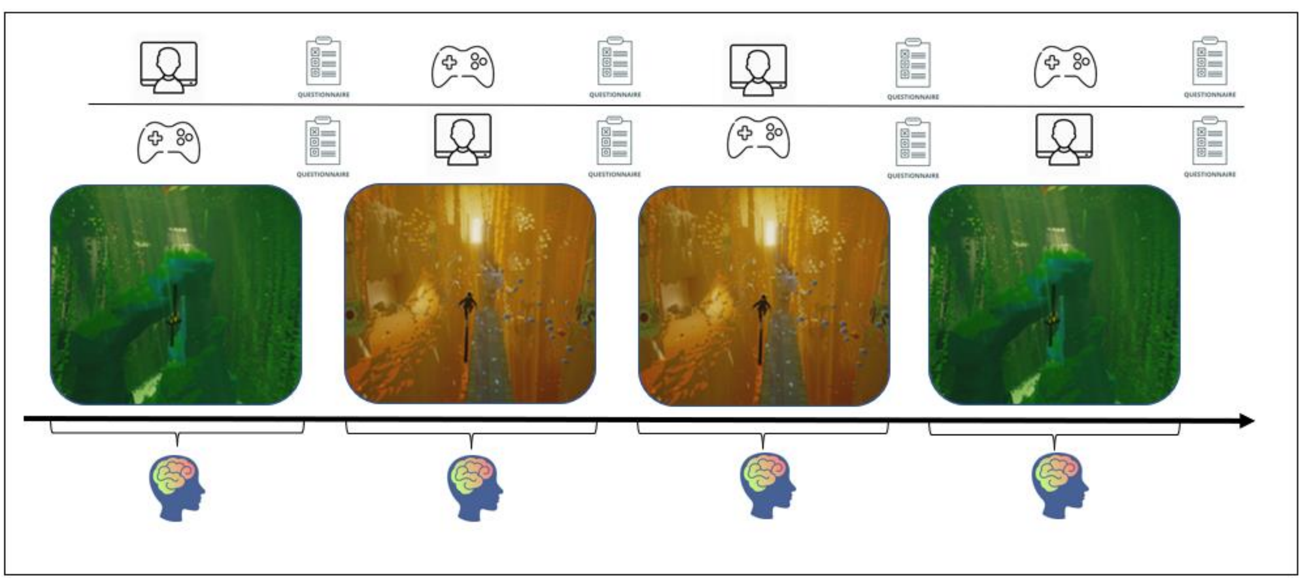

Figure 1. Study design.

Behavioral Measures

Game Experience Questionnaire (GEQ)

The Game Experience Questionnaire (GEQ) was designed by IJsselsteijn et al. (2013). It assesses game experience on seven different factors: Immersion, Flow, Competence, Positive and Negative Affect, Tension and Challenge. It is measured with a 5-point Likert scale that ranges from "extremely" to "not at all". In this study, I used a modified version of the in-game GEQ that features 10 items with 2 items per component (Competence, Positive and Negative Affect, Tension and Challenge).

Spatial Presence Experience Scale (SPES)

The Spatial Presence Experience Scale (SPES) is a short self-report measure that assesses spatial presence according to the process model of spatial presence formation (Wirth et al., 2007) with its two dimensions: *self-location* and perceived possible actions. (Hartmann et al., 2016). It is measured with a 5-point Likert scale that ranges from "I do not agree" to "I fully agree".

Aesthetic Emotions Scale (AESTHEMOS)

The Aesthetic Emotions Scale (AESTHEMOS) is a self-report tool that is based on 21 subscales with two items each (Schindler et al., 2017). For the present study, I used the subscales relaxation aesthetic emotion and prototypical aesthetic emotion. It is measured with a 5-point Likert scale that ranges from "extremely" to "not at all".

Additional Questions

In addition to the questionnaires mentioned above, I added items that assessed how much the players could empathize with the character (while playing) and with the other player (watching the video). In the watching condition, I rephrased some of the GEQ questions, so participants had to rate the success and skill of the person that controlled the character in the video (for example "The player was skillful ", „It was difficult for the player" etc.). In the pre-game questionnaire, I placed one item that asked participants about their video game expertise, to check whether 'being a gamer' played a role for spatial presence formation and the game experience.

Physiological Measures

fNIRS data acquisition

A continuous-wave NIRSport2 device with 8 sources and 8 detectors (NIRx Medizintechnik GmbH, Berlin, Germany) was used to collect the hemodynamic responses through oxygenated hemoglobin (oxy-Hb), deoxygenated hemoglobin (deoxy-Hb), and total hemoglobin (total-Hb). The wavelengths of the light emitting LED sources were 760nm and 850nm. All data was collected with Aurora fNIRS 2021.4.1-1 (NIRx Medizintechnik GmbH, Berlin, Germany) using a sampling rate of 10.17 Hz. To ensure standardized optode positioning, the 16 optodes were mounted in the respective regions of interest (ROI) on an fNIRS cap according to the international 10-20 system (Klem et al., 1999).

fNIRS montage

To create an optimal montage with the goal of having at least 4 channels per ROI, I looked at the setups of fNIRS studies investigating the same ROIs (Chen et al., 2020; Gier et al., 2020). Additionally, I used fOLD (fNIRS Optodes' Location Decider, Morais et al., 2018), a tool that allows you to efficiently place the fNIRS optodes in different anatomical regions of interest by using a variety of brain parcellation atlases. The final arrangement of 8 sources and 8 detectors was able to yield 4 Channels each in the rDLPFC, rIFG and bilateral TPJ. Figure 2 shows the optode location of each source (red), detector (blue) and channel (purple).

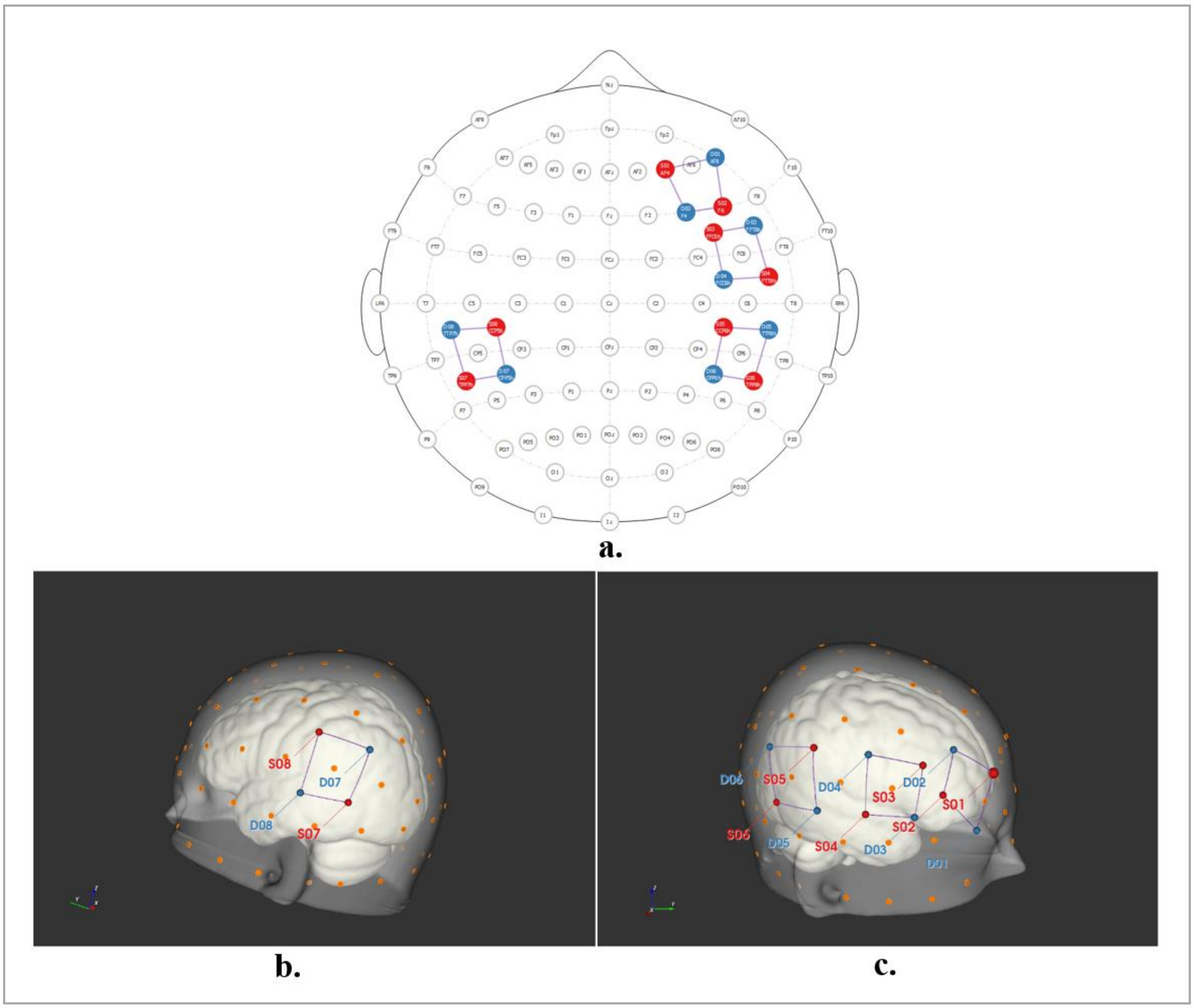

Figure 2. fNIRS montage: (a) optode position in the 10-10 system. (b,c) optode position on the left and right scalp

Stimuli

One of the problems with analysing video games from an aesthetic perspective is the emphasis on rule-driven and purposeful activity that is inherent to the majority of video games

(Juul, 2018). Hence, I chose a game where this is kept to a minimum, leaving the player enough space to fully engage with the game without having to spend a lot of time to learn the mechanics and controls first. Using a game that doesn't require a lot of previously acquired skills and knowledge about game mechanics should make it easier to focus on exploring the virtual environment. Additionally, I sought to choose a game that features strong aesthetic elements and can offer a rich experience even when only being played for a limited amount of time. That game ended up being ABZÛ (abzugame.com, 23.09.2022), a commercially available third person diving game that, according to its' description, offers an "epic descent into the depths of the sea, where players will explore beautifully rendered ocean environments with fluid swimming controls" (abzugame.com, 23.09.2022).

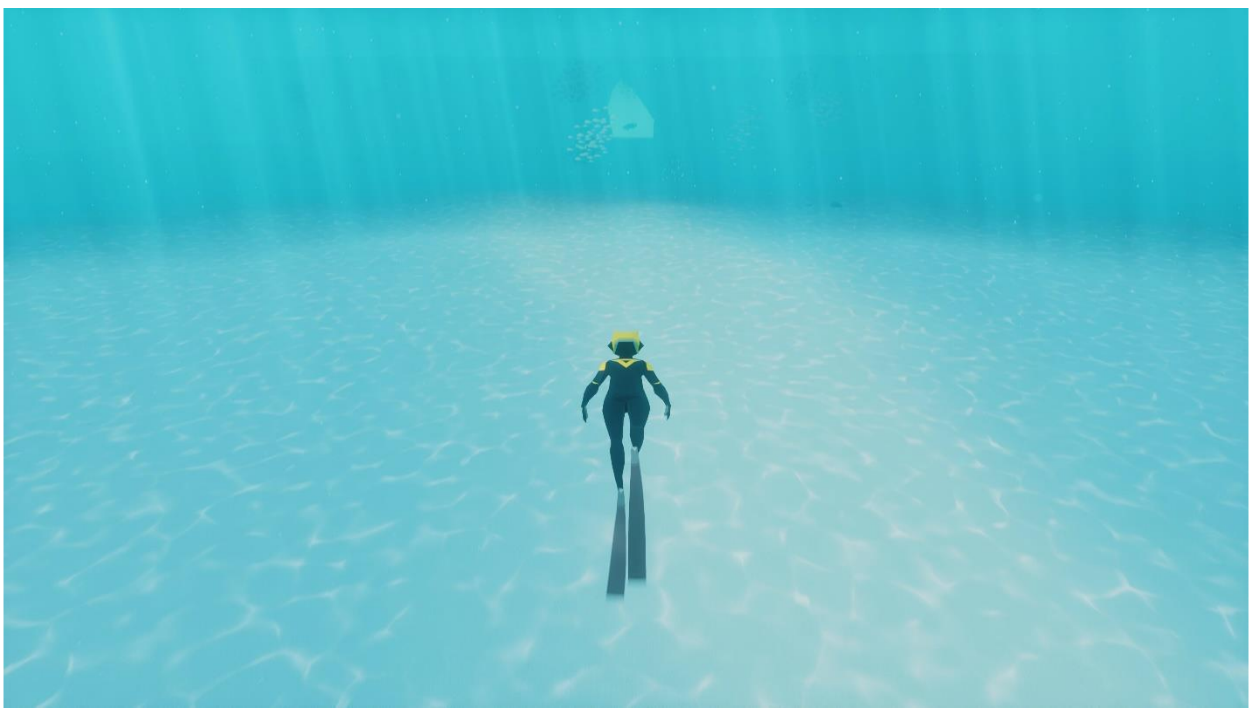

Figure 3. Screenshot of ABZU. First chapter, featuring the tutorial.

It is a game that starts with a diver that awakes in the open sea and just lets the player explore the mysterious underwater world. In a review by the online video game media outlet IGN, Jose Otero writes: "From seaweed swaying in the current to mysterious sunken shrines, each area shows off Abzu's fantastic art direction, attention to detail, and an impressive sense of scale as you swim through enormous chasms under the sea." (IGN, ign.com, 23.09.2022).

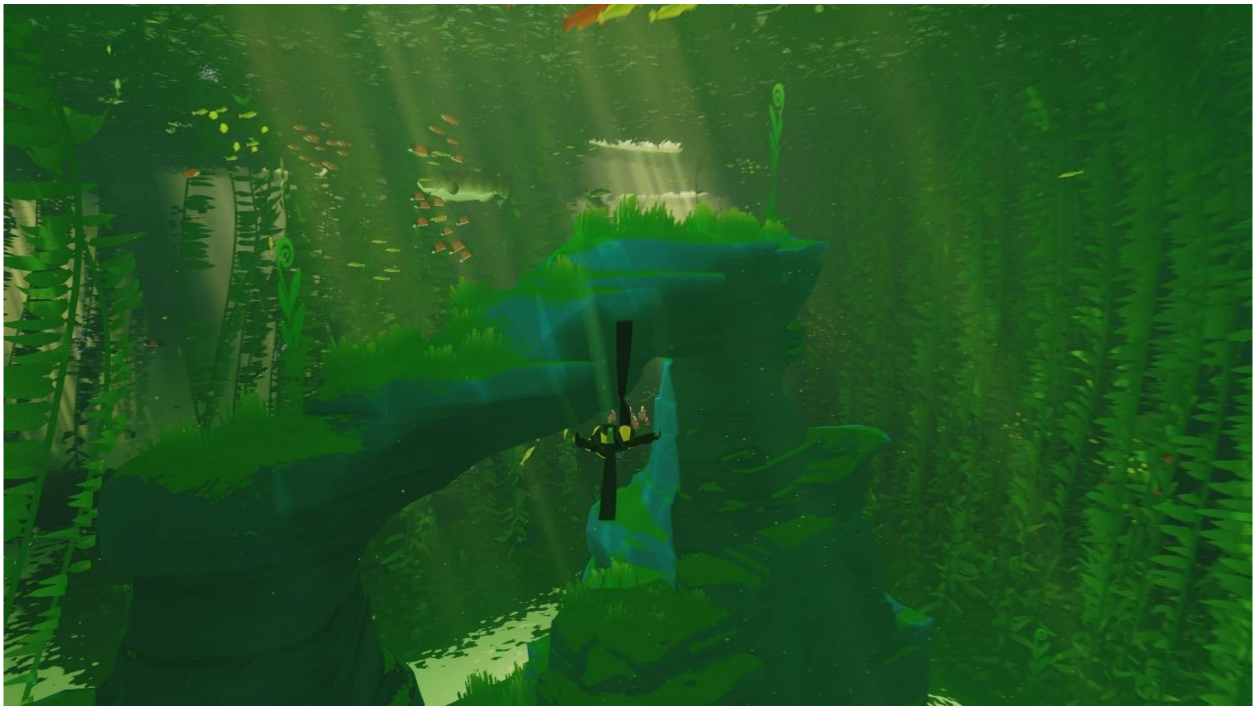

Figure 4. Screenshot of ABZU. Second chapter.

While exploring this underwater world, players can interact with the environment and hold on to the various fish and swim alongside them. There are also some shells that can be picked up by players. And that is all the gameplay mechanics this game features – at least in the chapters that were chosen for the purpose of this study. Consequentially, the focus of (these parts of) this game lies solely on experiencing the virtual environment and taking in the aesthetics of the artwork, movements, and music.

Figure 5. Screenshot of ABZU. Third chapter.

Chapters

To make the gameplay experience in the laboratory as close to how players would experience the game in a real-world setting, I chose three different chapters for the players to explore (see Figure 2). This way, there would be a sense of progression with each trial. The first chapter was the tutorial, where participants would learn the controls and get a short introduction into the game world. This also represented the first encounter with the game for every participant.

The second and third chapter both featured an area where the participants got to explore and interact with the virtual environment. Although the two environments differed in color-scheme, environmental features, plants, marine life and music, gameplay was analogue between all chapters. Every particpant started the game from the same in-game position, and had 6 minutes of uninterupted gameplay before the game was paused by the experimenter.

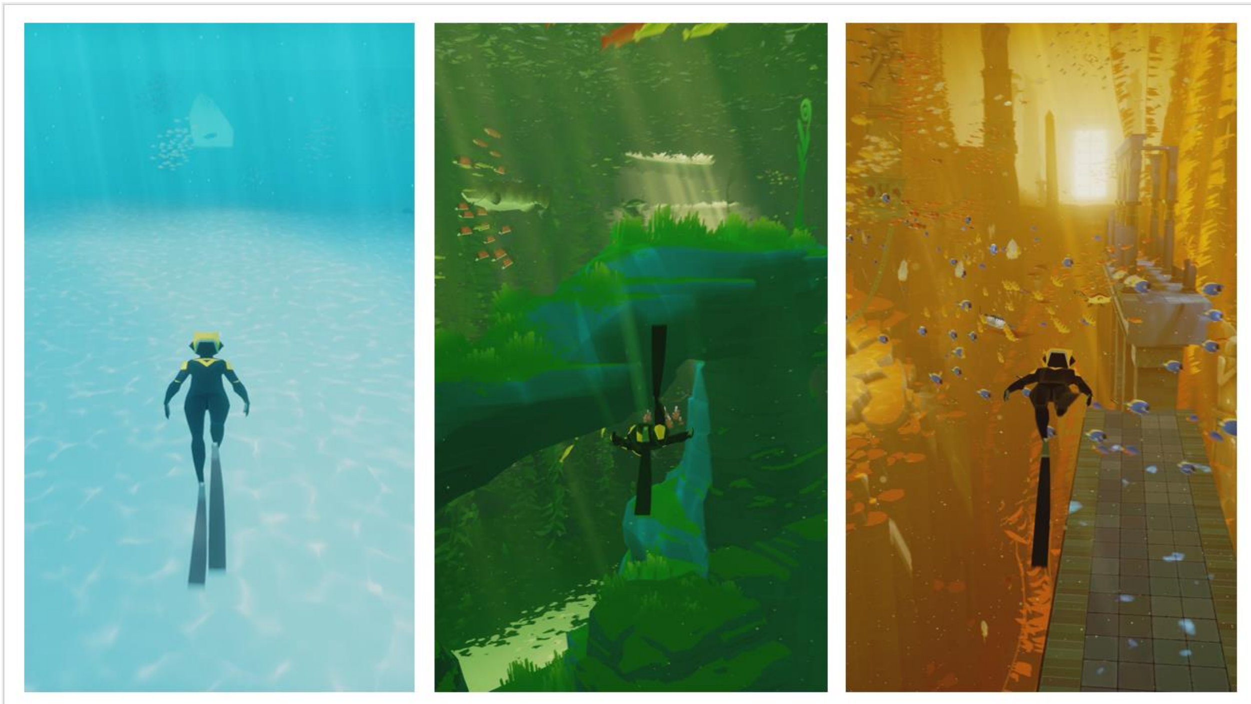

Figure 6. Stimuli: The three different environments.

Gameplay videos

The gameplay videos were displayed in 4k (3840x2160 pixels) with 60Hz, the same resolution and framerate as the players would experience during the gameplay sessions. The pace and camera movement were kept at similar levels across all videos. Each video was started at the same exact position that the participants also started in their gameplay sessions. By reviewing gameplay sessions of people with different gaming experience, I aimed to recreate a playstyle that would be comparable to that of a player with average gaming experience exploring the game for the first time. The duration of each video was 6 minutes, to match the duration of gameplay sessions.

Analysis

Behavioral Data

Questionnaire data was cleaned and analyzed using R 4.2.1 (R Core Team, 2022) with RStudio 2022.7.1.554 (RStudio Team, 2022). Data from the SPES was averaged per trial for each subject building a SPES-score, depicting the subjective sense of spatial presence for each subject. For the AESTHEMOS, we looked at each aesthetic emotion individually. Due to an error in data collection, the data from the AESTHEMOS was lost for session 3 across all participants. Hence, analysis for this questionnaire was done only for sessions 1 and 4 to maintain a balanced design. The GEQ-data was summed up into the respective factors and looked at individually.

Physiological Data

The fNIRS data was analyzed in MATLAB version 9.10.0 (R2021a) (The MathWorks Inc, 2022) with the HomER 3 toolbox (Huppert et al., 2009) First, the raw data was pre-processed on a subject-level. For cases where the fNIRS recording was stopped after taking off the NIRS-cap, data was cut so that only data that was recorded during the experiment would be analyzed. Channels were pruned by visual inspection of the complex wavelet transformation (CWT) plots and line plots to identify cardiac oscillations. If the CWT plots show cardiac oscillations, it is a good index that the signals are coupled with hemodynamic response of the participant (Hocke et al., 2018). Consequently, channels that did not show cardiac oscillations were excluded from further analysis. After visual inspection of the data, channels were pruned automatically by applying a filter with a datarange of [0.3 – 2.5] and a signal-to-noise-ratio threshold of 10. Then, wavelength data was converted to optical density. In cases where motion artefacts were detected, a spline interpolation was applied. Then, a bandpass filter with a range of 0.2 Hz to 0.01Hz was applied for all channels. Following that, the optical density data was converted to relative hemoglobin concentrations according to the modified Beer-lambert law. This was done by applying differential path length factors of 7.3 (for 760 nm) and 6.4 (for 850 nm). This yielded oxygenated hemoglobin (HbO), deoxygenated hemoglobin (HbR) and total hemoglobin (HbT) values for all active channels. This data was then exported as a .csv-files and imported with RStudio for further analysis.

Note that only HbO data was used for further analysis, as evidence of previous studies points towards this being the most sensitive and reliable measure for fNIRS(Strangman et al., 2003). First, the baseline was calculated as the average of HbO values per channel for each participant during the baseline recording. Then, a Z-transformation was conducted for all channels across participants using the mean and SD from the baseline. Finally, Z-scored HbO channel values were averaged for the respective ROIs for each condition for all participants.

Results

SPES (Spatial Presence Experience Scale)

Table 2
Paired t-test results for all 8 SPES items

Item	play		watch		*t*(69)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
SPES_01	3.22	1.19	2.59	1.04	4.03	>.001	0.49
SPES_02	3.77	1.18	2.26	1.07	9.53	>.001	1.15
SPES_03	2.88	1.18	2.23	1.04	5.43	>.001	0.65
SPES_04	2.78	1.16	2.18	0.92	4.78	>.001	0.57
SPES_05	3.74	0.95	2.97	1.23	4.88	>.001	0.59
SPES_06	4.16	0.96	2.53	1.29	8.78	>.001	1.06
SPES_07	4.17	0.94	2.81	1.34	7.33	>.001	0.88
SPES_08	3.29	1.02	2.20	1.03	7.12	>.001	0.86

Note. N represents sample size, M and SD represent mean and standard deviation, respectively.

First, the SPES-score was calculated from the 8 items of the SPES for each session for all participants. To check whether the subjective sense of presence differed between conditions, a paired t-test was conducted, showing a significant difference in SPES-score between watching and playing the game t(69) = 9.19, $p < .001$, $d = 1.10$.

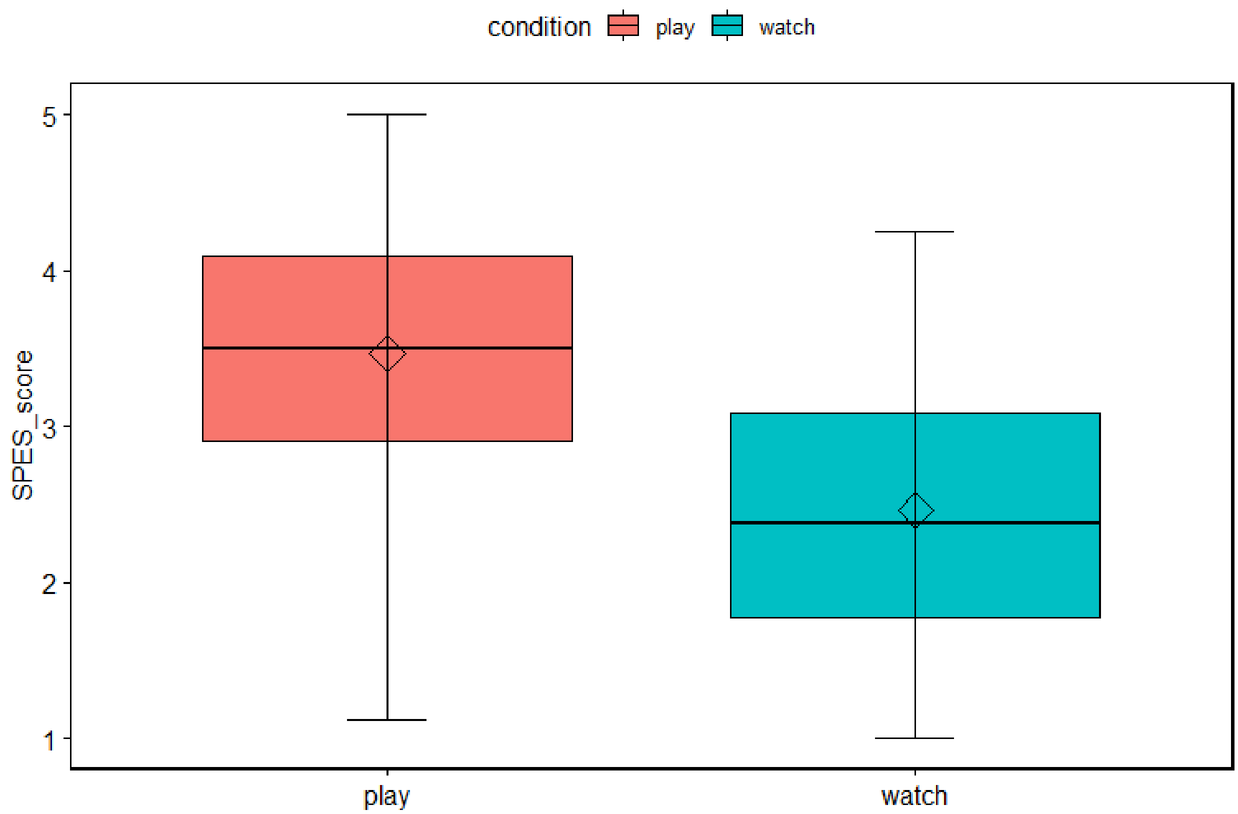

Figure 7. Boxplot for SPES_score for each condition across all participants.

Table 3

SPES_score means and standard deviations by condition

Variable	*M*	*SD*
1. play	3.47	0.84
2. watch	2.46	0.86

To examine the effects of condition and session on SPES_score, I conducted a two-way repeated measures ANOVA. There was a statistically significant interaction between session and condition on SPES_score, (F (3,132) = 4.33, $p < 0.01$, $\eta p2 = 0.09$, 95% CI [.02, .16].

Consequently, an analysis of simple effects was performed. The results revealed that the effect of condition was statistically significant for session two, (F (1,33) = 26.4, $p < 0.001$, $\eta p2$ = 0.45, 95% CI [.18, .61], session 3, (F (1,33) = 18.8, $p < 0.001$, $\eta p2$ = 0.36, 95% CI [.11, .55], session four, (F (1,33) = 15.6, $p < 0.001$, $\eta p2$ = 0.32, 95% CI [.08, .52]. Interestingly, session one showed no significant difference in self-reported SP between conditions.

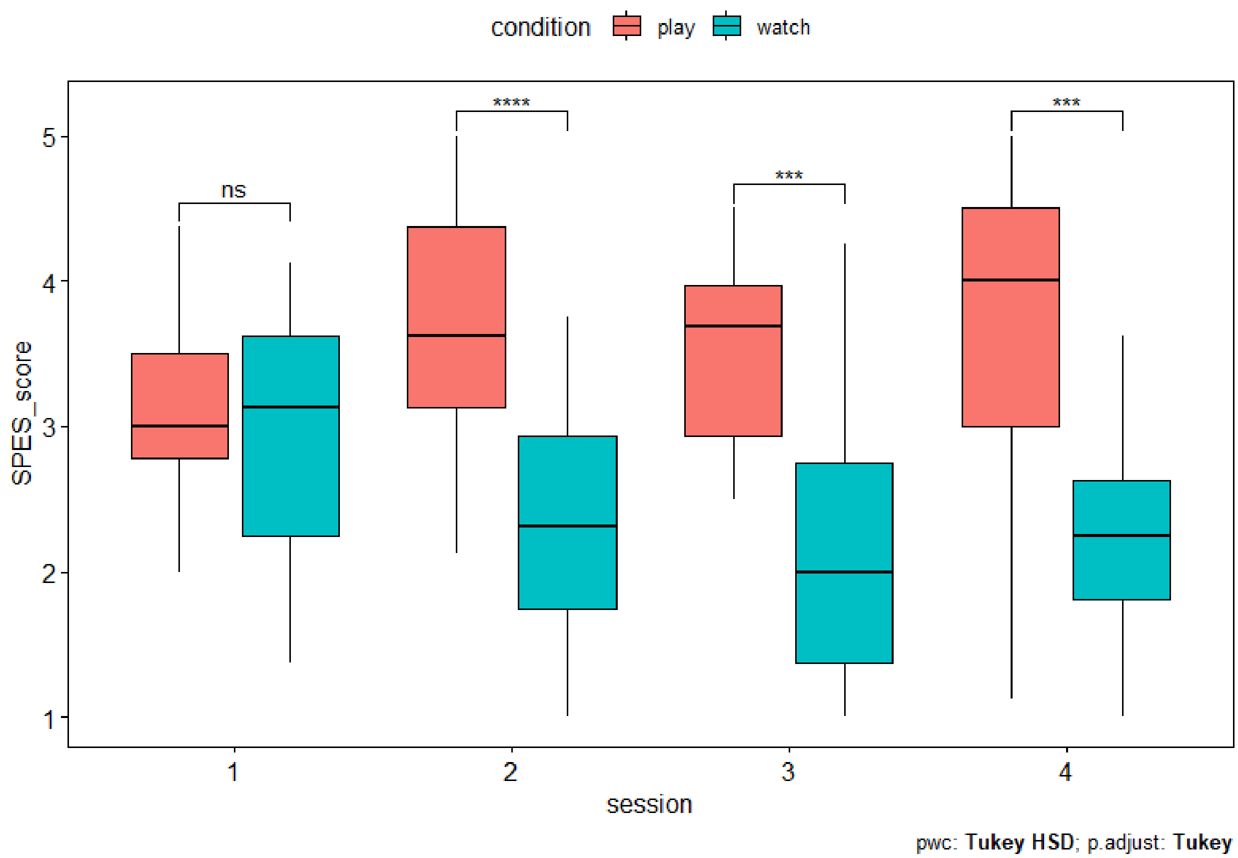

Figure 8. Boxplot for SPES_score for each session and condition across all participants.

Table 4

Fixed-Effects ANOVA results using SPES_score as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1235.23	1	1235.23	1790.49	.000		
condition	35.38	1	35.38	51.28	.000	.28	[.18, .37]
session	0.56	3	0.19	0.27	.845	.01	[.00, .02]
condition x session	8.96	3	2.99	4.33	.006	.09	[.02, .16]

Error	91.06	132	0.69				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively.

When excluding session 1 from the analysis, the interaction term fails to reach significance.

Table 5
Fixed-Effects ANOVA results using SPES_score as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	908.37	1	908.37	1202.27	.000		
condition	44.12	1	44.12	58.40	.000	.37	[.25, .47]
session	0.21	2	0.10	0.14	.871	.00	[.00, .02]
condition x session	0.07	2	0.04	0.04	.957	.00	[.00, 1.00]
Error	74.80	99	0.76				

Aesthetic Emotions Scale (AESTHEMOS)

To examine effects of condition on aesthetic emotions, paired sample t-tests were conducted for each AESTHEMOS item.

Table 6
Paired t-test results for all 17 AESTHEMOS items

Item	play		watch		*t*(34)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
AES_confused	2.17	1.07	1.91	0.92	1.46	.152	0.25
AES_awe	3.57	0.92	3.37	0.97	1.13	.268	0.19
AES_curious	4.14	0.81	3.71	0.93	2.77	.009*	0.47
AES_relax	3.71	1.13	3.97	0.79	-1.30	.203	-0.22
AES_moved	2.46	1.19	2.43	1.12	0.14	.886	0.02
AES_ugly	1.06	0.24	1.06	0.24	0.00	>.99	0.19
AES_beauty	4.37	0.81	4.23	0.69	1.04	.304	0.18
AES_like	4.23	0.81	4.00	0.80	1.44	.160	0.24
AES_oppressive	1.49	0.78	1.46	0.66	0.22	.831	0.04

AES_meaning	2.14	1.12	1.97	0.89	1.06	.295	0.18
AES_mental_challenge	2.37	1.33	2.26	1.01	3.01	.005**	0.51
AES_sentimental	3.57	0.92	3.37	0.97	0.60	.554	0.10
AES_drive	3.60	1.27	3.34	1.11	1.46	.152	0.25
AES_happiness	3.66	0.90	3.26	0.92	2.59	.014*	0.44
AES_calm	3.77	1.03	3.57	0.78	1.02	.314	0.17
AES_ fascinating	3.89	0.87	3.57	1.00	2.34	.026*	0.39
AES_ sadness	1.11	0.40	1.20	0.41	-1.14	.263	-0.19

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. For *p*-values, * indicates $p < .05$. ** indicates $p < .01$.

There was no significant difference for AES_beauty t(34) = 1.04, $p = .304$, $d = 0.18$, AES_like t(34) = 1.44, $p = .160$, $d = 0.24$. However, there was a significant difference for the items :"It made me curios" with t(34) = 2.77, $p < .05$, $d = 0.47$, "It challenged me intellectually" with t(34) = 3.01, $p < .01$, $d = 0.51$, "It made me happy" with t(34) = 2.59, $p < .05$, $d = 0.44$ and "I found it fascinating" with t(34) = 2.34, $p < .05$, $d = 0.39$. Additionally, I checked the correlation between AES items and SPES_score (Table 7).

Table 7

Correlations of AES items and SPES_score

Means, standard deviations, and correlations with confidence intervals

Variable	*M*	*SD*	1
1. SPES_score	2.98	0.95	
2. AES_confused	2.04	1.00	-.09 [-.32, .15]
3. AES_awe	3.47	0.94	.47** [.26, .63]
4. AES_curios	3.93	0.89	.39**

			[.18, .58]
5. AES_relax	3.84	0.97	.21 [-.03, .42]
6. AES_moved	2.44	1.15	.46** [.25, .63]
7. AES_ugly	1.06	0.23	-.08 [-.31, .15]
8. AES_beauty	4.30	0.75	.33** [.10, .52]
9. AES_like	4.11	0.81	.39** [.17, .57]
10. AES_oppressive	1.47	0.72	-.16 [-.38, .08]
11. AES_meaning	2.06	1.01	.28* [.04, .48]
12. AES_mental_challenge	2.20	0.84	.30* [.07, .50]
13. AES_sentimental	2.31	1.17	.37** [.14, .55]
14. AES_drive	3.47	1.19	.34** [.11, .53]
15. AES_happiness	3.46	0.93	.38** [.16, .56]
16. AES_calm	3.67	0.91	.19 [-.05, .41]
17. AES_fascinating	3.73	0.95	.42** [.20, .59]
18. AES_sadness	1.16	0.40	-.09 [-.32, .15]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$.

Overall, there seems to be a low to medium positive correlation between and aesthetic emotions and SPES-score for most positive emotions and low negative correlations for negative emotions like ‘sadness’, ‘oppressive’, ‘ugly’, and ‘confused’.

Game Experience Questionnaire (GEQ)

Negative Affect

A two-way repeated measures ANOVA was performed to evaluate the effects of condition and session on the self-rated negative affect (Table 8).

Table 8

Fixed-Effects ANOVA results using negativeaffect_score as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	690.92	1	690.92	965.86	.000		
condition	39.84	1	39.84	55.70	.000	.30	[.19, .39]
session	2.88	3	0.96	1.34	.263	.03	[.00, .07]
condition x session	8.30	3	2.77	3.87	.011	.08	[.01, .15]
Error	94.43	132	0.72				

There was a statistically significant main effect for condition with F (1,132) = 55.7, $p < .001$, *ηp2* = 0.30, 95% CI [.19, .39] and a significant interaction for condition x session with F (3,132) = 3.87, $p < .05$, *ηp2* = 0.08, 95% CI [.11, .15]. After performing an analysis of simple effects, the simple main effect of condition was not significant at session one ($p = .2$) but becomes significant at session two ($p < .001$), session three ($p < .01$) and session four ($p < .001$).

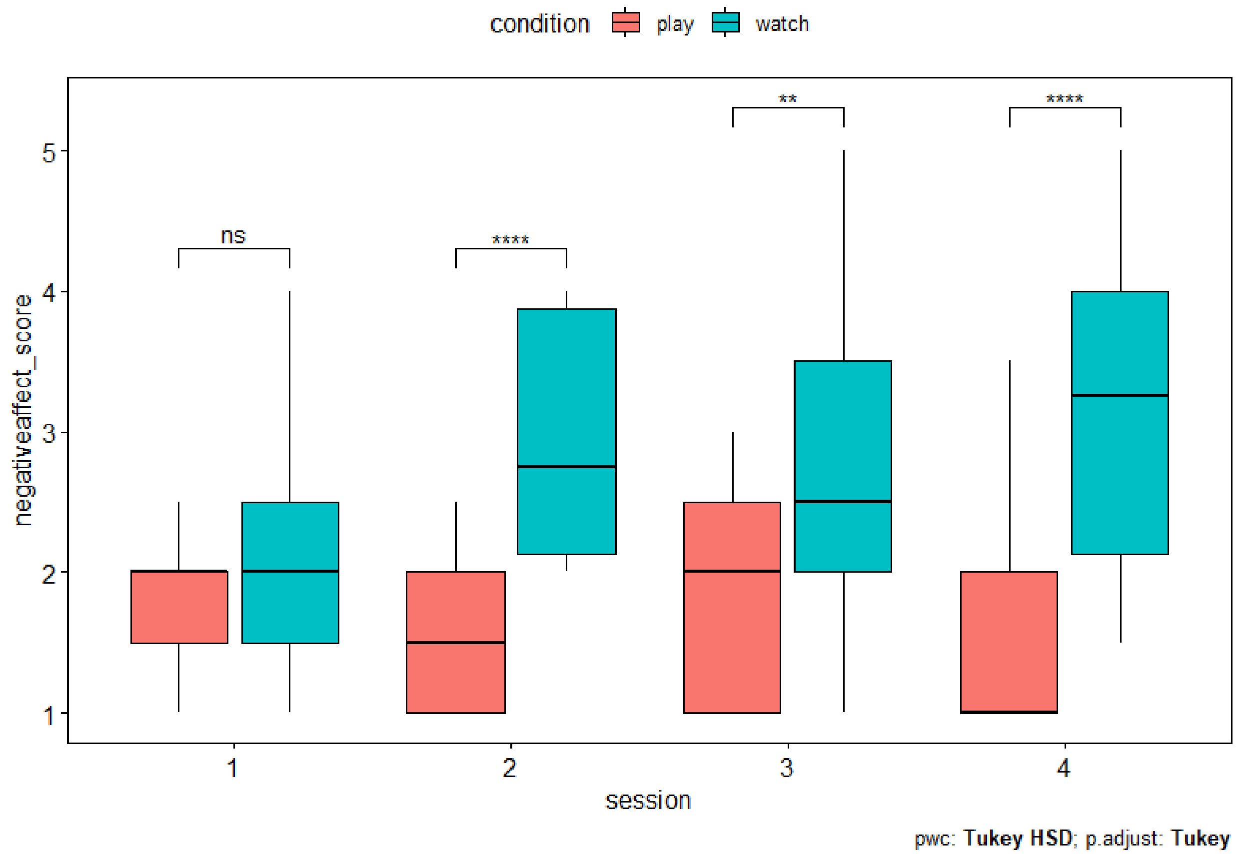

Figure 9. Boxplot for negativeaffect_score for each session and condition across all participants.

Additionally, a post-hoc paired t-test was conducted to check the overall direction of the main effect on negative affect ratings with t (69) = -7.72, *p* < .001, *d* = -0.92.

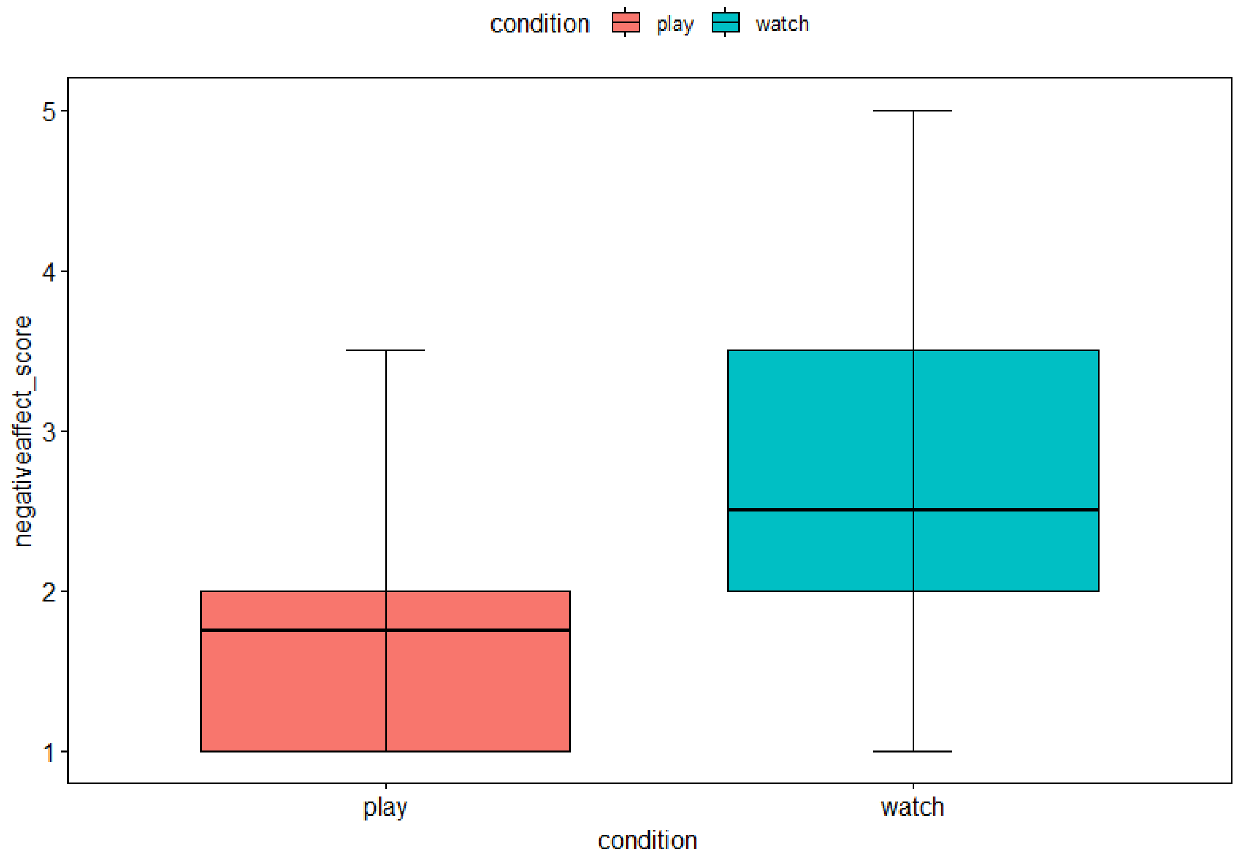

Figure 10. Boxplot for negativeaffect_score for each condition across all participants.

Positive Affect

A two-way repeated measures ANOVA was performed to evaluate the effects of condition and session on the self-rated positive affect (Table 9).

Table 9

Fixed-Effects ANOVA results using positiveaffect_score as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1938.75	1	1938.75	4083.48	.000		
condition	5.48	1	5.48	11.54	.001	.08	[.02, .16]
session	2.17	3	0.72	1.52	.212	.03	[.00, .08]
condition x session	4.84	3	1.61	3.39	.020	.07	[.01, .13]
Error	62.67	132	0.47				

There was a statistically significant main effect for condition with F (1,132) = 5.48, p = .001, $\eta p2$ = 0.08, 95% CI [.02, .16] and a significant interaction for condition x session with F (3,132) = 3.39, p < .05, $\eta p2$ = 0.07, 95% CI [.01, .13]. After performing an analysis of simple effects, the simple main effect of condition was not significant at session one (p = .34) and two (p = .097) but becomes significant at session three (p < .01) and session four (p < .05).

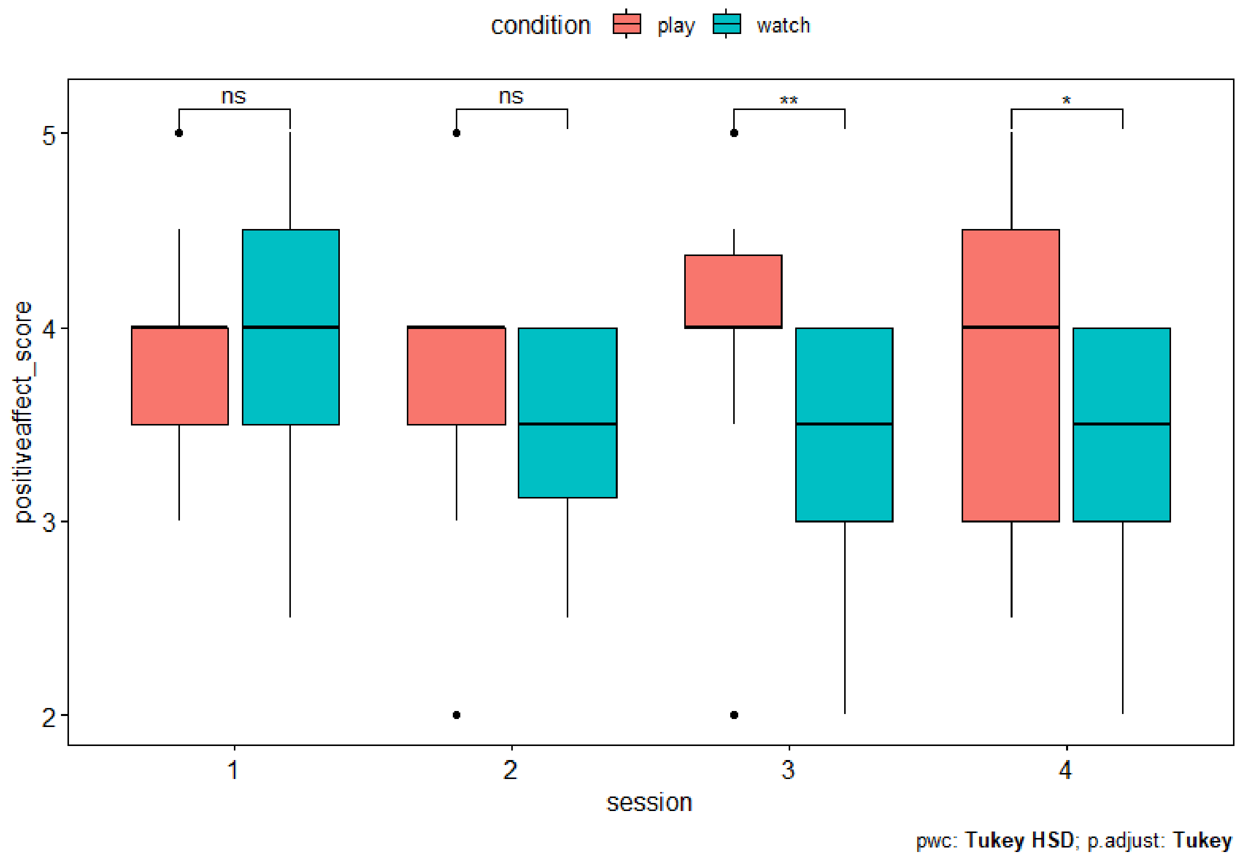

Figure 11. Boxplot for positiveaffect_score for each session and condition across all participants.

Additionally, a post-hoc paired t-test was conducted to check the overall direction of the main effect on positive affect ratings with t (69) = 3.55, p < .001, d = 0.42.

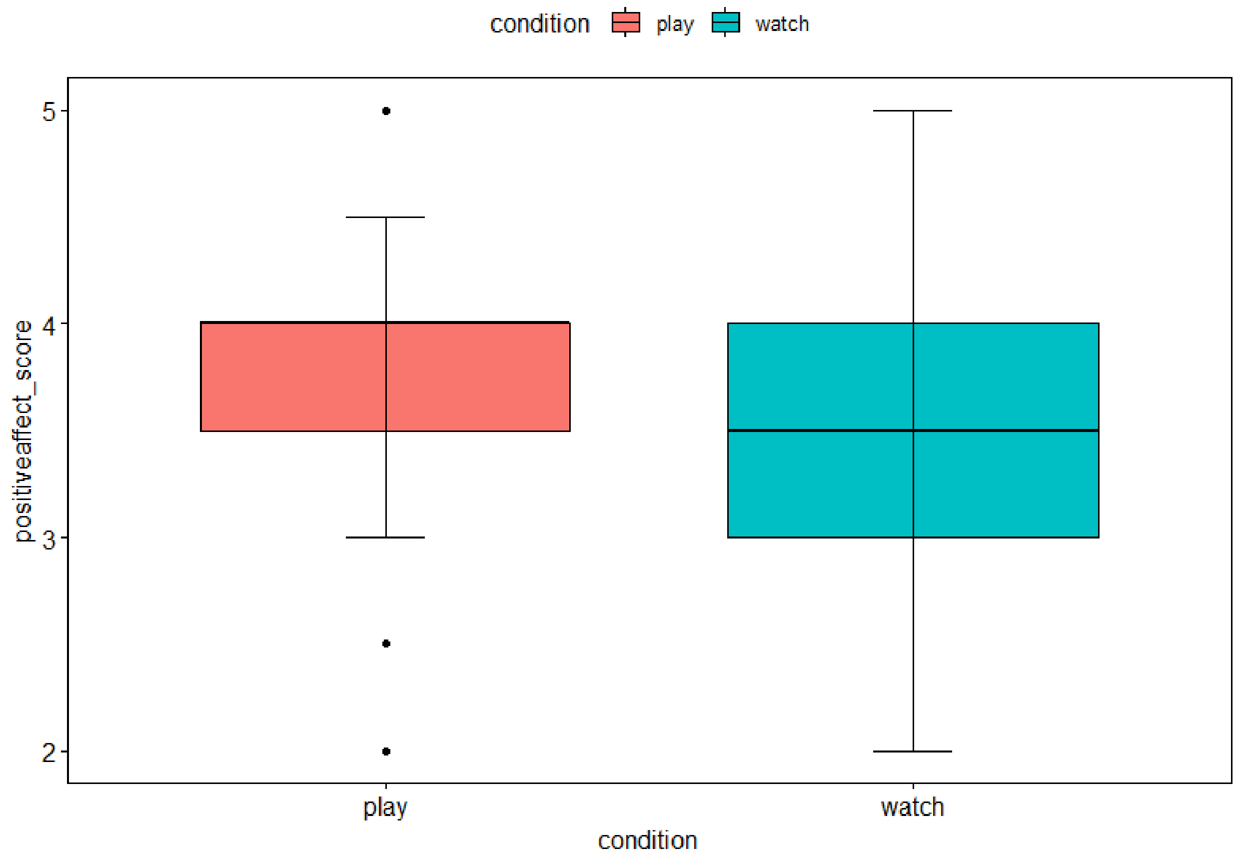

Figure 12. Boxplot for positiveaffect_score for each condition across all participants.

Competence

A two-way repeated measures ANOVA was performed to evaluate the effects of condition and session on the self-rated competence (Table 10). To clarify, the question was aimed at rating one's own competence in the playing condition and to rate the competence of the player in the gameplay video in the watching condition. There was a statistically significant main effect for condition (*F* (1,132) 18.53, *p* = < .001, *ηp2* = .12, 95% CI [.05, .21]. There was no significant effect for session. However, there was a significant interaction with condition * session (*F* (1,132) 5.39, *p* = < .01, *ηp2* = .11, 95% CI [.03, .18].

Table 10

Fixed-Effects ANOVA results using competence_score as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1698.83	1	1698.83	2217.14	.000		
condition	14.20	1	14.20	18.53	.000	.12	[.05, .21]
session	4.61	3	1.54	2.01	.116	.04	[.00, .10]
condition x session	12.38	3	4.13	5.39	.002	.11	[.03, .18]
Error	101.14	132	0.77				

An analysis of simple effects revealed that there was a significant effect of condition for session one (p < .001) and session two (p < .001), but there was no significant effect for sessions three and four.

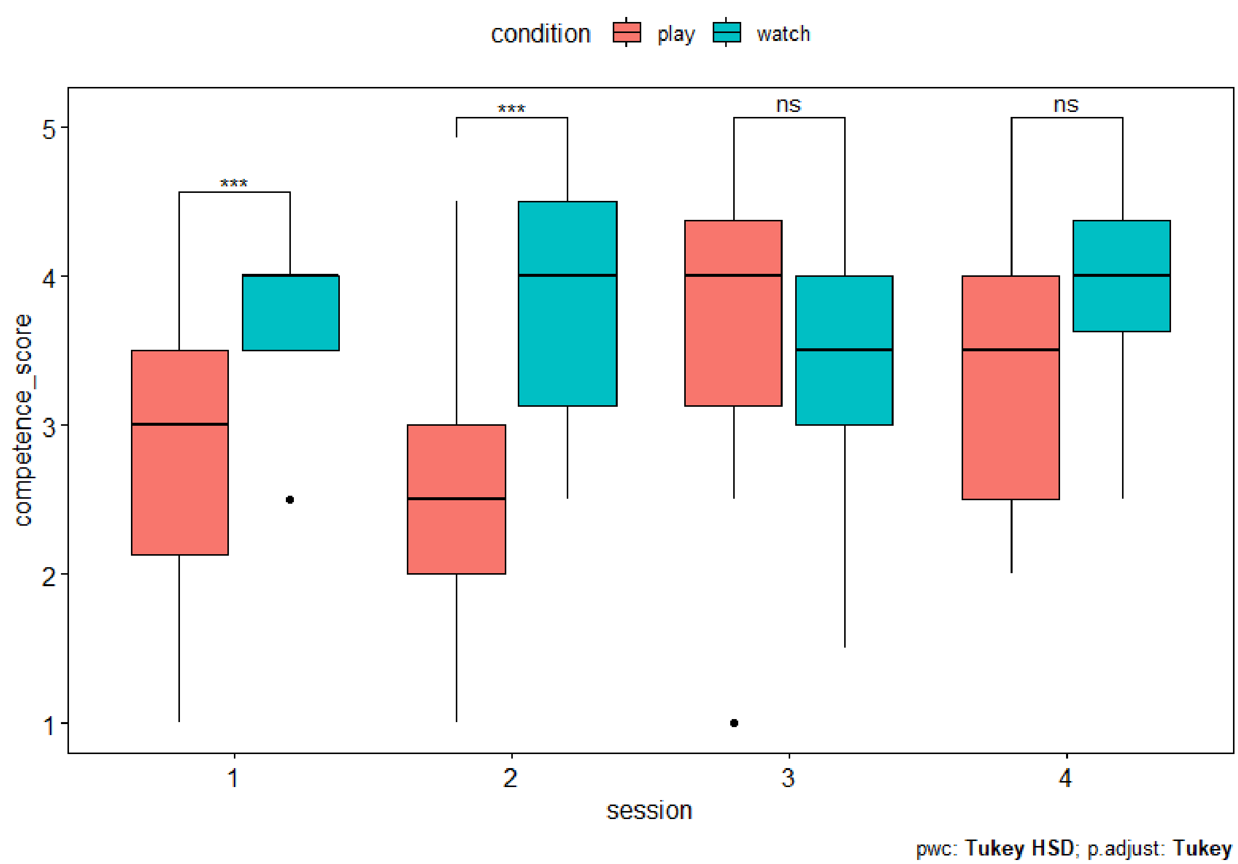

Figure 13. Boxplot for competence_score for each session and condition across all participants.

Additionally, a post-hoc paired t-test was conducted for the main effect of condition on competence ratings with t (69) = -3.51, *p* < .001, *d* = -0.4

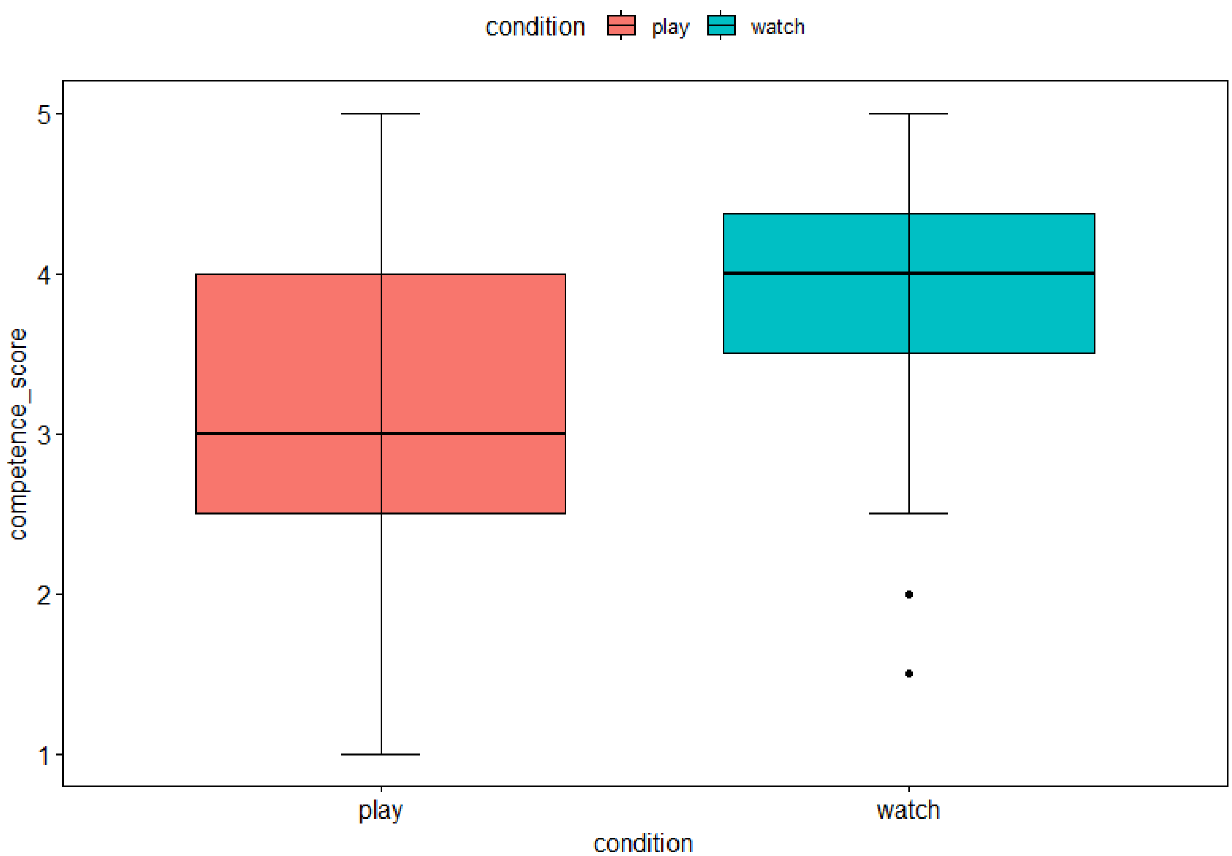

Figure 14. Boxplot for competence_score for each condition across all participants.

Tension

A two-way repeated measures ANOVA was performed to evaluate the effects of condition and session on the self-rated tension (Table 11). No statistically significant main effects or interactions were found for this scale.

Table 11

Fixed-Effects ANOVA results using tension_score as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	549.42	1	549.42	679.09	.000		
condition	2.02	1	2.02	2.50	.116	.02	[.00, .07]
session	5.06	3	1.69	2.08	.105	.05	[.00, .10]
condition x session	2.25	3	0.75	0.93	.429	.02	[.00, .06]
Error	106.79	132	0.81				

Challenge

A two-way repeated measures ANOVA was performed to evaluate the effects of condition and session on the self-rated challenge (Table 12). No significant difference between conditions was found. There was a statistically significant main effect of session with $F\,(1{,}132) = 5.21$, $p < .01$, $\eta p2 = 0.11$, 95% CI [0.03, 0.18].

Table 12

Fixed-Effects ANOVA results using challenge_score as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	834.18	1	834.18	1263.10	.000		
condition	1.96	1	1.96	2.97	.087	.02	[.00, .08]
session	10.32	3	3.44	5.21	.002	.11	[.03, .18]
condition x session	0.83	3	0.28	0.42	.739	.01	[.00, .03]
Error	87.18	132	0.66				

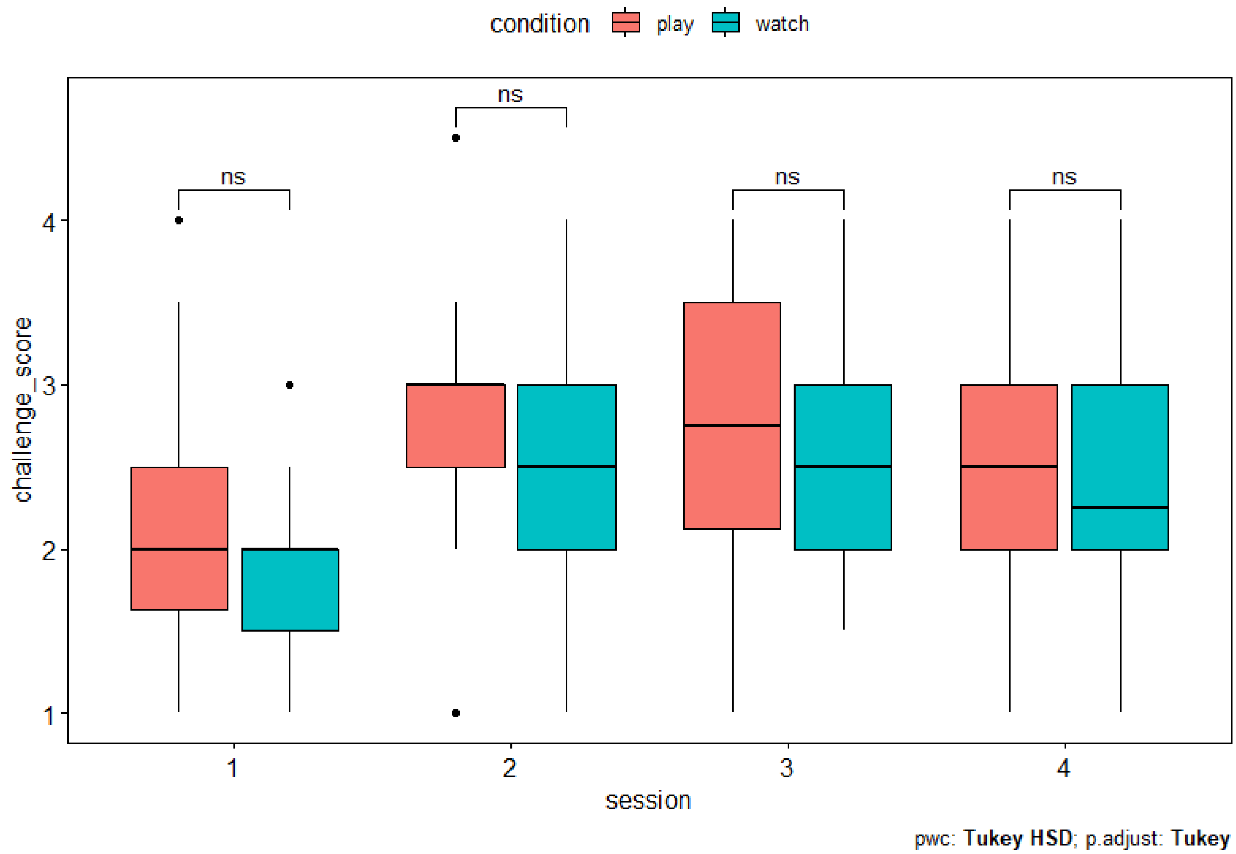

Figure 15. Boxplot for challenge_score for each session and condition across all participants.

Additional Items

Feeling into character

A two-way repeated measures ANOVA was performed to evaluate the effects of condition and session on the self-rated competence (Table 13). There was a statistically significant main effect for condition (F (1,132) = 12.75, p < .01, $\eta p2$ = 0.07, 95% CI [0.02, 0.15], indicating that participants could empathize more with the character during active gameplay than during passive viewing.

Table 13
Fixed-Effects ANOVA results using feeling_into_character as the criterion

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η^2	partial η^2 90% CI [LL, UL]
(Intercept)	1018.96	1	1018.96	772.73	.000		
condition	12.75	1	12.75	9.67	.002	.07	[.02, .15]
session	3.89	3	1.30	0.98	.403	.02	[.00, .06]
condition x session	10.56	3	3.52	2.67	.050	.06	[.00, .11]
Error	174.06	132	1.32				

Additionally, a post-hoc paired t-test was conducted: t (69) = 4.24, p < .001, d = 0.51.

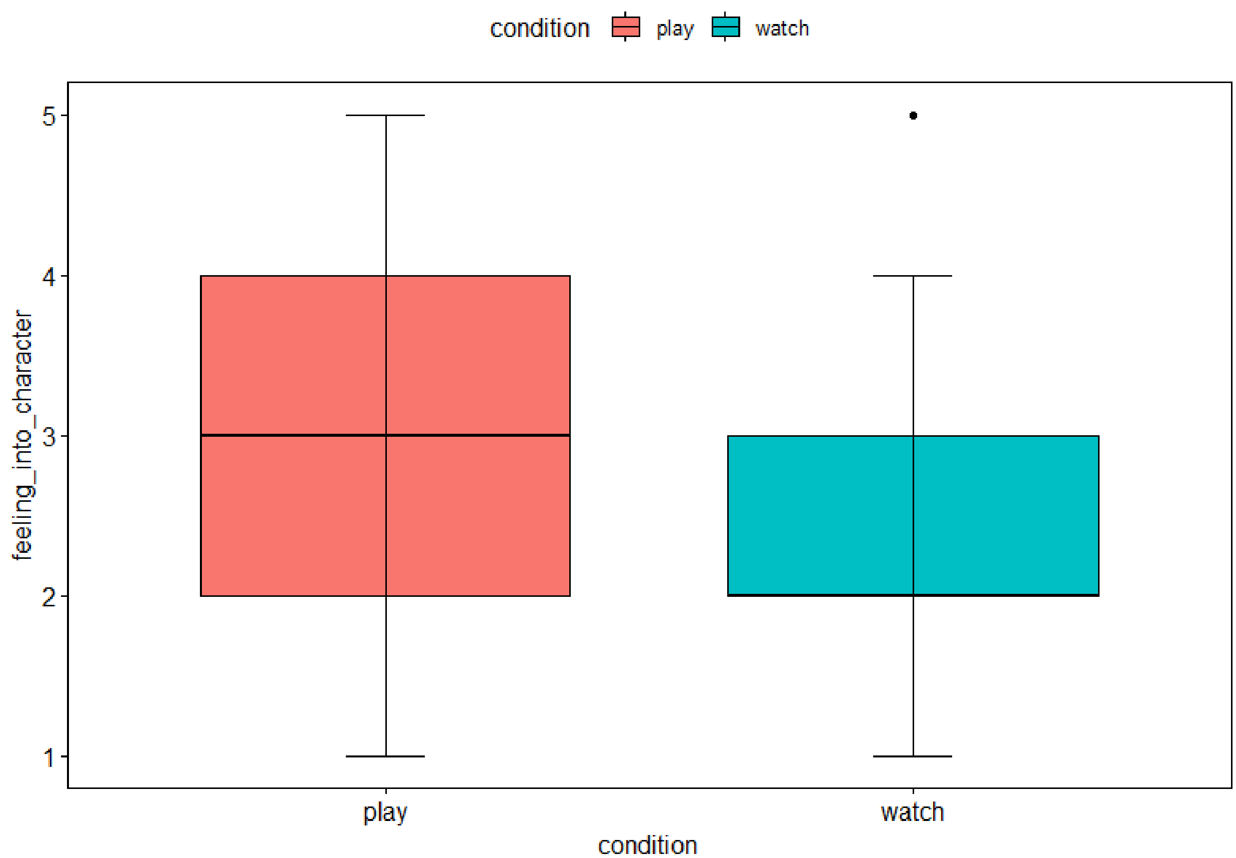

Figure 16. Boxplot for feeling_into_character for each condition across all participants.

fNIRS Results

Spatial Presence and the right DLPFC

At first, I wanted to test whether rDLPFC activation differed between active and passive gameplay. A paired t-test with t(61) = -0.48, *p* = .630, *d* = -0.06 revealed that there was no significant difference between conditions.

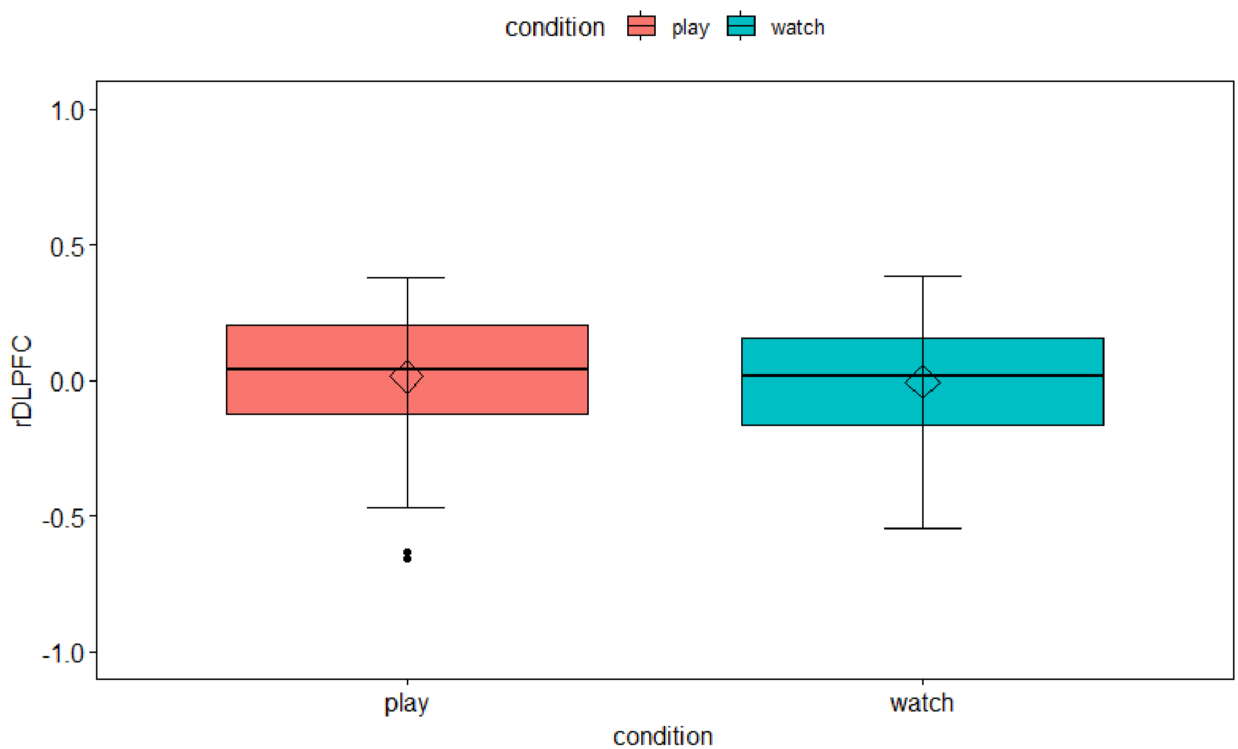

Figure 17. Mean rDLPFC activation during active play and passive watching.

To check whether I could find the same negative correlation with DLPFC activation and spatial presence ratings, like those that Baumgartner et al. (2008) found, I correlated the difference in brain activation in the DLPFC with the difference of the subjective experience of presence (SPES_score) between conditions. There was a very weak negative correlation that failed to reach significance (Figure 18).

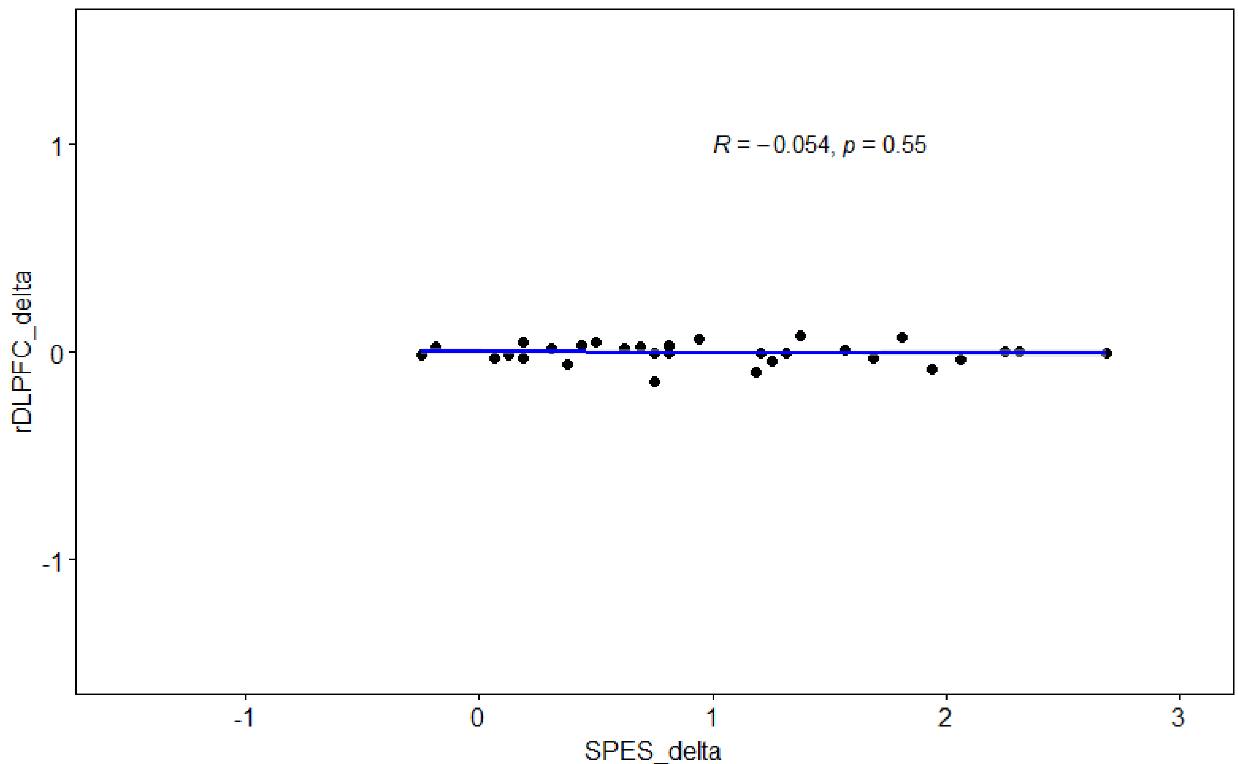

Figure 18. Scatter plot depicting the correlation of the change in rDLPFC activation and SPES_score.

Spatial Presence right IFG and bilateral TPJ

To test, if activation in the rIFG differed between active and passive video game play, a paired t-test was conducted. The results showed that there were no significant differences in IFG activation between the conditions $t(61) = 1.12$, $p = .268$, $d = 0.14$.

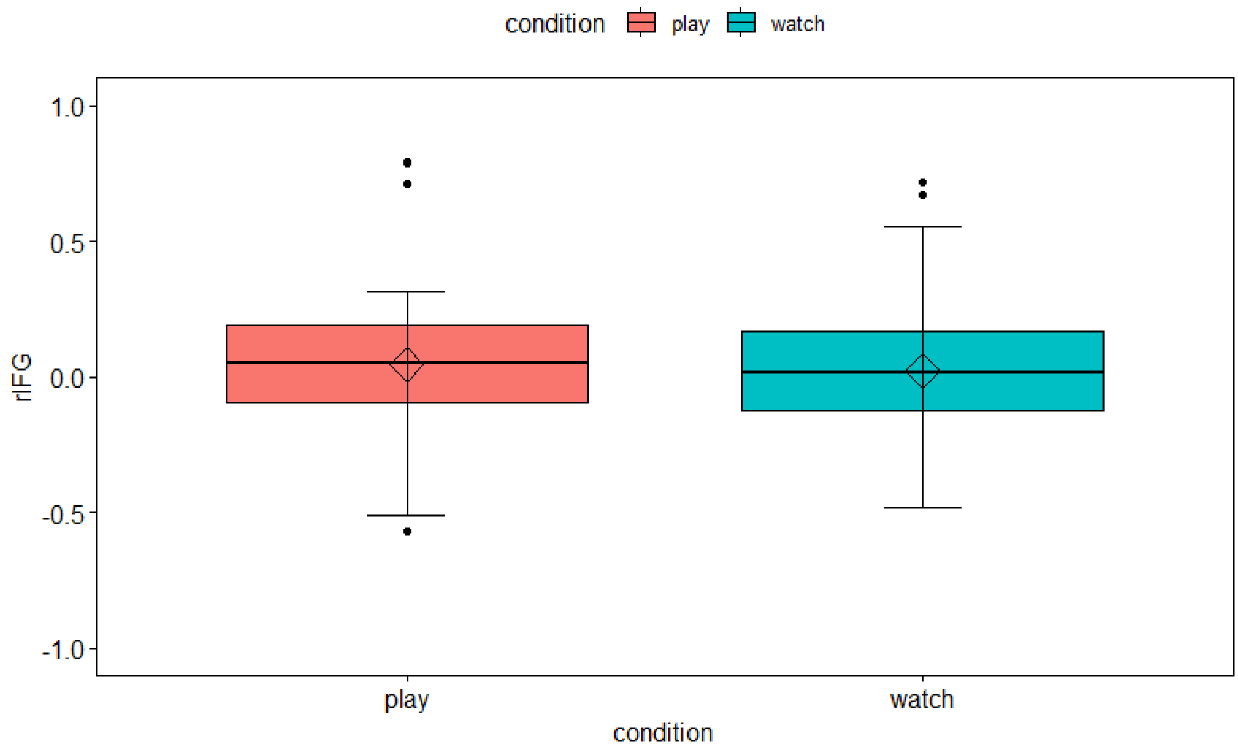

Figure 19. Mean rIFG activation during active play and passive watching.

Additionally, I conducted paired t-tests to check whether there was a difference in activation in the bilateral TPJ between active and passive video game play. The results showed that there were no significant differences in activation for left TPJ t(59) = 0.50, p = .622, d = 0.06 and right TPJ t(59) = -1.68, p = .099, d = -0.22.

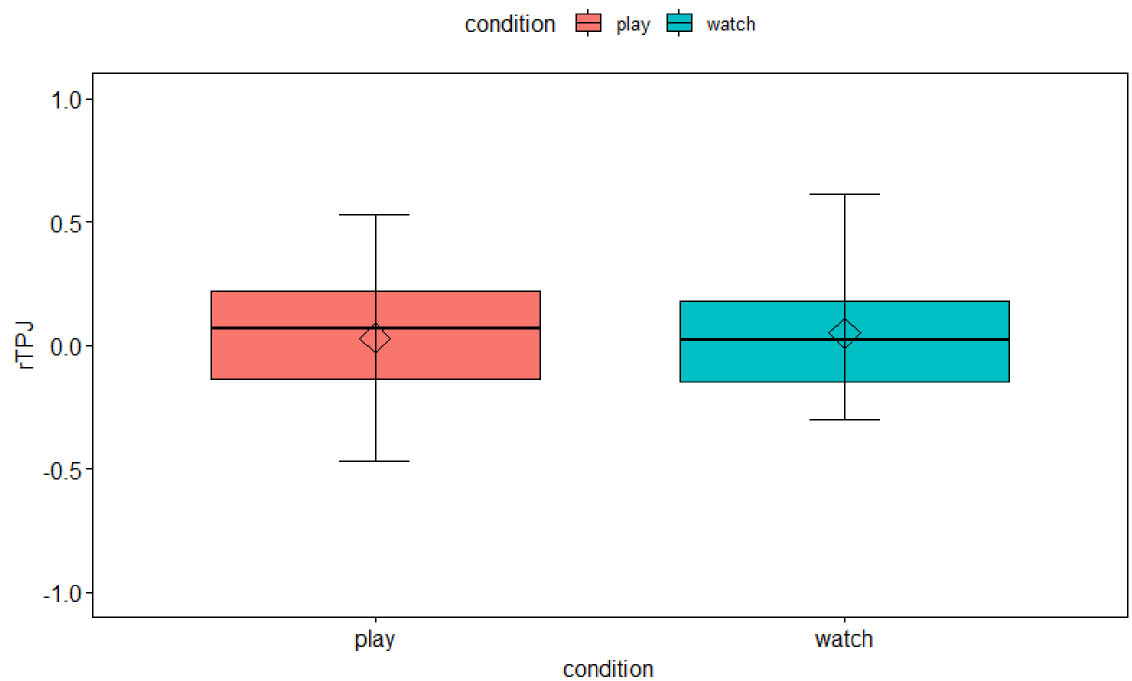

Figure 20. Mean rTPJ activation during active play and passive watching.

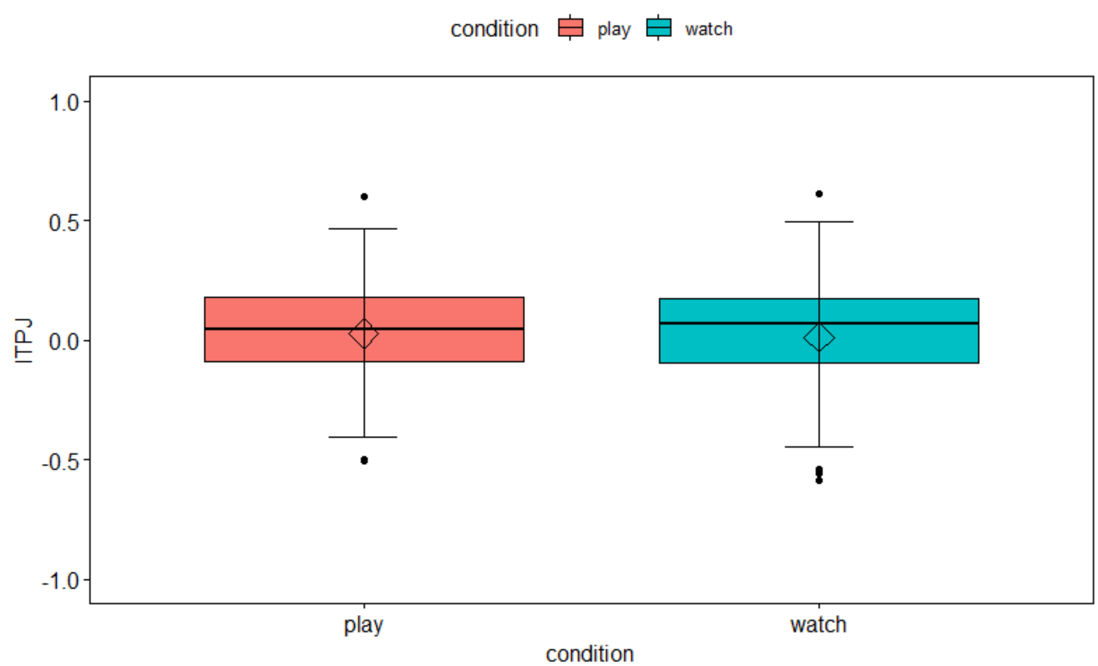

Figure 21. Mean lTPJ activation during active play and passive watching.

Discussion

With this study, my aim was to open a new direction of research for the field of empirical aesthetics. I intended to investigate video games from an empirical aesthetics point of view. After an extensive literature review, I concluded that Spatial presence (SP) is the factor that distinguishes video games and art in the traditional sense. In combining questionnaires of game experience, aesthetic emotions, and spatial presence with fNIRS, I chose a multi method approach. This facilitated the possibility to replicate existing evidence in spatial presence research and to explore possible new links between the gaming experience and the brain.

Regarding the achievement of SP, I confirmed preexisting evidence with the data showing that overall, participants reported higher SP when playing the game than when watching a gameplay video (H1). Although I found an interesting interaction where there is a significant difference between conditions in self-reported SP for all sessions but session 1. This might be attributed to a novelty effect, in the sense that the stimulus is new and immersive not irrespective of whether it is experienced by playing or just watching a gameplay video. Furthermore, it could also mean that people needed a baseline to judge their sense of SP between the two conditions. But this effect should be somewhat thwarted because every participant started out with playing the tutorial. It is interesting to keep in mind that session one seems to yield different results for multiple variables.

Contrary to my hypothesis, participants did not rate the game as more beautiful in the active vs. the passive condition (H2.1). Nor did they like the game more when playing compared to watching (H2.2). These results could be explained by a lack of statistical power due to the loss of data for the AESTHEMOS questionnaire that was mentioned in the results section.

However, there were a small to medium effects on ratings for the items:” It made me curios”, “It challenged me intellectually”, “It made me happy” and “I found it fascinating”. With higher ratings in the active condition. Additionally, I found low to medium positive correlations for aesthetic emotions and SPES-score for most positive emotions and low negative correlations for negative emotions like ‘sadness’, ‘oppressive’, ‘ugly’, and ‘confused’. Although most aesthetic emotions did not show a significant difference between conditions, subjective SP and aesthetic emotions ratings seem to be connected.

Likewise, the GEQ subscale ‘positive affect’ was rated significantly higher for active gameplay (H3.1). and ‘negative affect’ was rated significantly higher in the passive condition (H3.2). This indicates that participants felt more content and happier while playing than while watching the gameplay video. I want to note that the ‘negative affect’ consisted of two items “I found it tiresome” and “I felt bored”. While it might be linked to SP, those findings could also just mean that watching a video is more tiring and less exciting than playing the game yourself. So, the implications for SP might be limited. Nonetheless, those results are in line with previous research on SP in video games.

There seems to be a significant difference in competence ratings when judging ones’ own skill versus the other players’ skill at the game for earlier sessions. At the beginning of the experiment, participants tend to rate the other player’s competence higher than their own, but this difference fails to reach significance for later sessions. This indicates that there is a learning effect, in the sense that people generally get better at the game, the more they play while the player in the video plays at the same level.

Moreover, results revealed that participants’ ability to empathize with the in-game character was higher when playing than when watching the video. This suggests that the sense of SP increases the emotional involvement and facilitates feeling the emotions that the character is feeling. It also confirms what (Bachen et al., 2016) found when looking at the relationship between presence and game-specific empathy in a serious video game. These results also fit with Brown and Cairns theory of immersion and their definition of the final stage of immersion, namely total immersion. As mentioned in the introduction, Brown and Cairns define achieving presence as the deciding factor in reaching total immersion. They also found that players that did not feel total immersion displayed a lack of empathy and transfer of consciousness (Brown & Cairns, 2004). Investigating this relationship between presence and empathy towards a game character that could be a starting point for future studies on presence and immersion.

With regards to neuronal correlates of SP, I couldn't find any significant differences in either rDLPFC, rIFG and bilateral TPJ between conditions. Furthermore, the data revealed no significant correlation between the change in self-reported SP and the change in brain activation in the rDLPFC. Thus, I couldn't confirm that the strong negative correlation between the presence rating and the rDLPFC that Baumgartner et al. (2008) found. This could be the case for various reasons. Firstly, Baumgartner et al. (2008) used a VR device to present a virtual roller coaster ride whereas the present study had participants play and watch a third-person 3D diving game. It could be that the effects found by Baumgartner and colleagues are specific to watching VR content and cannot be generalized to other platforms. Secondly, this study used fNIRS instead of fMRI, to increase ecological validity by recreating a more natural gaming setting (Kim et al., 2017). And while it is possible to measure the relevant ROIs with fNIRS, this method could also not be suited to detect effects like those found by Baumgartner et al. (2008).

All in all, this thesis shows that more research is needed in order to get a clearer picture of the relationship of spatial presence and emotions in video games. While this study could replicate some behavioral results as well as discover new findings regarding affective empathy in video games, the lack of effects on the neuronal level poses questions regarding the generalizability of previous results. The connection between SP and the DLPFC might not be as clear as suggested by Baumgartner et al. (2008).

For future research on video game aesthetics, it will be important to also include and compare different games of different genres and art styles. Although there is literature on how perspective and agency influence the formation of SP, it would also be interesting to look into the relationship between art style, game genre and SP. There is a lot of potential for new research directions in empirical aesthetics regarding video game research.

Limitations

Of course, this study had some limitations that must be mentioned. The most obvious one being that some of the AESTHEMOS data was lost due to an error in the OpenSesame script. This was not only a hindering factor for investigating effects of time. It also greatly lowered the statistical power for the statistical tests that were based on results of the questionnaires affected by data loss. This means one major reason for a lack of significant results could be due to simply not having enough power to detect true effects.

fNIRS data on the other hand was not affected by this and thus statistical power should have been sufficient to detect effects of SP on brain activity. It must be said that one could have incorporated systemic physiological signals like heart rate, respiration rate or skin conductance as regressors in a GLM as suggested by Yücel et al., (2021). Additionally, I could have applied different preprocessing methods and statistical models in order to see if the lack of effects stems from any of those factors. But this would have gone beyond the scope of this master's thesis and could be something that future studies could investigate.

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Appendix

Abstract

Video Games have been neglected by Empirical Aesthetics research. With the rising popularity of video games, it becomes more and more important to zoom in on the aesthetic qualities that this medium offers. Just like art, video games provide the viewer with a variety of aesthetic modalities with different art styles and perspectives. One of the most important factors for video game enjoyment is *spatial presence*, or the feeling immersion. With this fNIRS study I take a neuroaesthetical approach towards investigating what role *spatial presence* (SP) plays for the *aesthetic experience of* video games. By manipulating agency (active play vs. watching a gameplay video) in a commercially available diving game, I investigate how the feeling of presence changes the way that people experience video games both behaviourally and neuronal level. As expected, presence ratings were significantly higher for active gameplay than for watching a gameplay video. But contrary to my hypothesis, the game was not experienced as more beautiful nor was it liked

more in the active condition. However, ratings could show that active gameplay was rated as being more fascinating, made the players more curios and happier, posed a bigger intellectual challenge. Overall, the results also show a correlation between self-reported SP and aesthetic emotions. As predicted, results revealed that participants' ability to empathize with the in-game character was higher when playing than when watching the video. On a neuronal level, we could not replicate the negative correlation between SP and rDLPFC activation. There were also no significant differences in activation between conditions for rIFG and bilateral TPJ.

Keywords: neuroaesthethics, aesthetics, video games, emotion, liking, visual, immersion, engagement, spatial presence

Abstract German

Videospiele wurden von der empirischen Ästhetikforschung bisher vernachlässigt. Mit der steigenden Popularität von Videospielen wird es immer wichtiger, die ästhetischen Qualitäten, die dieses Medium bietet, näher zu betrachten. Genau wie die Kunst bieten Videospiele dem Betrachter eine Vielzahl von ästhetischen Modalitäten mit unterschiedlichen Kunststilen und Perspektiven. Einer der wichtigsten Faktoren für den Genuss von Videospielen ist die räumliche Präsenz bzw. das Gefühl der Immersion. Mit dieser fNIRS-Studie verfolge ich einen neuroästhetischen Ansatz, um zu untersuchen, welche Rolle die räumliche Präsenz (SP) für die ästhetische Erfahrung von Videospielen spielt. Durch die Manipulation der Handlungsfähigkeit (aktives Spielen vs. Betrachten eines Videos) in einem Videospiel untersuche ich, wie das Gefühl der räumlichen Präsenz die Art und Weise verändert, wie Menschen Videospiele sowohl auf Verhaltens- als auch auf neuronaler Ebene erleben. Wie erwartet, war die subjektiv erlebte räumliche Präsenz beim aktiven Spielen signifikant höher als beim Betrachten eines Videos. Entgegen meiner Hypothese wurde das Spiel jedoch in der aktiven Bedingung weder als schöner empfunden, noch wurde es mehr gemocht. Allerdings konnten die Ratings zeigen, dass das aktive Spiel als faszinierender, neugieriger und glücklicher empfunden wurde und eine größere intellektuelle Herausforderung darstellte. Insgesamt zeigen die Ergebnisse auch eine Korrelation zwischen selbstberichteten SP und ästhetischen Emotionen. Weiters zeigten die Ergebnisse, dass die Fähigkeit der Teilnehmer, sich in die Spielfigur einzufühlen, beim Spielen höher war als beim Betrachten eines Videos. Auf neuronaler Ebene konnten wir die negative Korrelation zwischen SP und rDLPFC-Aktivierung nicht replizieren. Es gab auch keine signifikanten Unterschiede in der Gehirnaktivität zwischen den Bedingungen für rIFG, und TPJ.

Table 14

SPES – Questionnaire with translation

Item	Statement	Translation
SPES_01	„Ich hatte das Gefühl, dass ich in der Umgebung des Spiels tatsächlich dabei war.“	“I felt like I was actually there in the environment of the presentation.”
SPES_02	„Es schien, als ob ich tatsächlich an der Handlung des Spiels teilnahm“	“It seemed as though I actually took part in the action of the presentation”
SPES_03	„Es war, als ob sich mein wahrer Standort in die Umgebung des Spiels verlagert hätte“	“It was as though my true location had shifted into the environment in the presentation”
SPES_03	„Ich hatte das Gefühl, als wäre ich in der Umgebung des Spiels physisch anwesend“	“I felt as though I was physically present in the environment of the presentation”
SPES_05	„Die Objekte im Spiel gaben mir das Gefühl, dass ich mit Ihnen interagieren konnte.“	“The objects in the presentation gave me the feeling that I could do things with them”
SPES_06	„Ich hatte den Eindruck, dass ich im Spiel aktiv sein konnte.“	“I had the impression that I could be active in the environment of the presentation”
SPES_07	„Ich hatte das Gefühl, mich zwischen den Objekten des Spiels bewegen zu können“	“I felt like I could move around among the objects in the presentation”

SPES_08	„Ich hatte den Eindruck, dass ich in der Umgebung des Spiels alles tun konnte, was ich wollte“	„It seemed to me that I could do whatever I wanted in the environment of the presentation“

Note. Only the German version was used in this study. The translation is for the reader.

Table 15

GEQ – Questionnaire with translation

Item	Statement	Translation
feelgood	“Ich fühlte mich gut.”	“I felt good”
content	“Ich fühlte mich zufrieden.”	“I felt content”
tiresome	“Es war ermüdend.”	“I found it tiresome”
irritable	“Ich fühlte mich gereizt.”	“I felt irritable”
frustrated	“Ich fühlte mich frustiert.”	“I felt frustrated”
bored	“Ich fühlte mich gelangweilt.”	“I felt bored”
skillful_player	„Der Spieler hat sich geschickt angestellt.“	“I felt skillful”
difficult_player	„Es war schwierig für den Spieler.“	“It was difficult for the player”

successful_player	„Der Spieler war erfolgreich.“	“The player felt successful”
effort_player	„Der Spieler musste sich anstrengen.“	“The player had to put a lot of effort into it”
challenge_player	„Es war eine Herausforderung für den Spieler.“	“The player felt challenged”
skillful	„Ich habe mich geschickt gefühlt.“	“I felt skillful”
difficult	„Ich fand es schwierig.“	“It was difficult for me.”
successful	„Ich fühlte mich erfolgreich.“	“I felt successful”
effort	„Ich musste mich anstrengen.“	“I had to put a lot of effort into it”
challenge	„Ich fühlte mich herausgefordert.“	“I felt challenged”

Note. Only the German version was used in this study. The translation is for the reader.

Table 16

AESTHEMOS – Questionnaire with translation

Item	Statement	Translation
AES_calm	“Es beruhigte mich.”	„It calmed me“

AES_sentimental	„Weckte sentimentale Gefühle in mir.	„It made me feel sentimental”
AES_beauty	„Ich empfand es als schön.“	„I felt it was beautiful “
AES_like	“Es gefiel mir.”	„I liked it.“
AES_awe	“Ich war beeindruckt.”	„I was impressed“
AES_moved	“Ich fühlte mich berührt.”	„I felt touched“
AES_relax	“Es entspannte mich.”	“It relaxed me”
AES_sadness	“Es stimmte mich traurig.”	„It made me sad“
AES_oppressive	“Wirkte auf mich beklemmend.”	“It felt oppressive”
AES_happiness	“Machte mich glücklich.”	„It made me happy“
AES_fascinating	“Ich fand es faszinierend.”	„I found it fascinating“
AES_confused	“Ich fühlte mich verwirrt”	“I felt confused”

AES_drive	“Weckte meinen Tatendrang.”	„It awakened my drive“
AES_curios	“Machte mich neugierig.”	“It made me curious”
AES_mental_challenge	“Ich war geistig gefordert.”	“I was challenged mentally”
AES_meaning	„Ich fühlte einen tieferen Sinn.“	„I felt a deeper meaning”
AES_ugly	„Ich empfand es als hässlich.“	„I found it ugly“

Note. Only the German version was used in this study. The translation is for the reader.

Table 17

Additional Questions

Item	Statement	Translation
feeling_into_character	„Ich konnte mit der Spielfigur mitfühlen.“	“I could empathize with the character.”
intention_character	„Die Intention der Spielfigur war mir bewusst.“	„The intention of the character was clear to me.”
feeling_into_player	„Ich konnte mit der spielenden Person mitfühlen.“	“I could empathize with the player.“

intention_player	„Die Intention des Spielers war mir bewusst.“	“I was aware of the player's intention.”

Note. Only the German version was used in this study. The translation is for the reader.