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Exploring the Impact of Ambient and Character Sounds on Player Experience in Video Games

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Abstract: Elaborate sound design, including background music, ambient sounds (sounds describing the game world), and character sounds (sounds generated by the character's actions), plays a pivotal role in modern video games. However, the influence of these different types of sound on the player's experience has not been extensively researched. This study examines the influence of these sound types on immersion, avatar identification, fun, and perceived competence. In two experiments, participants played League of Legends under four different sound conditions. The first experiment (N_1 = 32) revealed a non-significant trend in the effect of character sounds on avatar identification. Ambient sounds, however, were limited because the task restricted participants' movement across the game map. Consequently, we adapted the task to allow for a wider variety of ambient sounds in the second experiment (N_2 = 32). Here, a significant impact of character sounds on immersion, avatar identification, and fun was observed, as well as an interaction effect of character sounds and ambient sounds on fun. Furthermore, we observed a trend, though not statistically significant, suggesting that ambient sounds may influence the player's sense of flow. These findings underline the distinct effects of different sound types, and we discuss implications for the design of sound in video games.

Keywords: subjective immersion; avatar identification; video games; ambient sounds; character sounds; soundscape; audio–visual interaction; game experience; sound design

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1. Introduction

The video game industry is a constantly growing field that gains more members and revenue each year. In 2023, more than half of the German population played video games, at least occasionally, and the gaming population was relatively balanced across genders [1]. While the percentage of gamers is higher in the younger age groups (91% among 16–29-year-olds), the enjoyment of video games is not restricted to this age group, and at least 19% of people 65 and older enjoy games, with even larger numbers among middle-aged people [2]. This raises the question of what makes video games so attractive and captivating that more than half the population enjoys them. A major aspect when it comes to the consumption of video games is the game experience. This is largely influenced by the design factors of the game as well as underlying motivations to play [3]. One design factor that has been upgraded in recent years, also due to technical possibilities, is a game's soundscape. This game design aspect has also gained more and more recognition in research; however, it is rarely considered in its separate components. It is, therefore, intriguing to investigate the influence of different sound design components on facets of the game experience.

1.1. Game Experience

The game experience is what players feel when they play a game. It can be influenced by different aspects of the game, such as visual design, gameplay, or sound design, and consists of several different components, including immersion, flow, social engagement, motivation to play, and others [3].

1.1.1. Immersion

Immersion is one of the most important aspects of the game experience [3]. The definitions of immersion are numerous and wide-ranging. One more colloquial definition of immersion is the *sense of being there* in a non-physical world or surroundings [4]. However, there are many more definitions, depending on the media context and the name of the construct. For example, transportation, presence, absorption, and immersion are often used almost synonymously. Agrawal and co-authors have attempted to integrate different definitions of immersion and delimit it from other similar constructs [5]. They define immersion as "a phenomenon experienced by an individual when they are in a state of deep mental involvement in which their cognitive processes (with or without sensory stimulation) cause a shift in their attentional state such that one may experience dissociation from the awareness of the physical world." [5] (p. 6). The construct of transportation is a very similar experience that is focused more on the narrative, while presence can be differentiated from immersion. Presence has been defined as the sense of being in a location other than the exact physical location and, as such, can occur together with immersion; however, both can also occur separately (one does not necessarily feel present in an abstract game like Tetris but can still be immersed, while a recording of a restaurant can make one feel as if they are there but is not necessarily immersive) [5]. The concept of flow as a state of deep involvement in an activity where nothing else seems to matter is also often mentioned in connection with immersion. However, flow is usually an all-or-nothing experience where you have either achieved the state of flow or you have not, whereas immersion can be a gradual experience [5].

One interesting definition of immersion in the context of video games differentiates between three aspects of immersion [6]. *Sensory immersion* concerns the audio–visual presentation of the game and how real-world stimuli are overpowered by the game stimuli, and players become focused solely on the game world; *challenge-based immersion* is achieved when a game contains a satisfying balance of challenges compared to the player's abilities; and *imaginative immersion* describes the feeling of being absorbed in the game's story or connecting to a game character and having the chance to experience the fantasy of the game by contributing to it with your imagination [6].

While there have been attempts to investigate immersion using physiological indicators, the most frequently used measures are questionnaires that gauge subjective experiences [5,7], one of which is the Game Experience Questionnaire (GEQ) [8], which also measures aspects such as flow, perceived competence, or negative and positive affect.

As immersion is the experience of being deeply involved in a fictional world, it in itself already creates one of the motivations to play video games, as people often report playing video games to discover new things, create a new persona, and escape real-world problems through the game [9].

1.1.2. Avatar Identification

A similar function of creating or adopting a new (fictional) persona is fulfilled by avatar identification, which is another important aspect of the game experience. The most prominent definition of avatar identification is taking over a character's identity and perspective [10]. It differentiates between four different aspects of avatar identification: the cognitive aspect of taking over a different perspective, the motivational aspect of internalizing the goals and motives of the character, the empathic aspect of sharing the character's emotions, and the aspect of absorption as losing awareness of oneself [10].

A pilot study by Hefner and co-authors has shown that interactivity in a game can increase avatar identification and that higher identification is connected to more fun during gameplay [11]. Other authors have also argued that higher identification with the character makes one's own reality fade into the background, which satisfies the escape from reality as a motive for playing and also increases the fun during gaming [9,12]. This underlines the importance of avatar identification for a good gaming experience. It has been shown that identification can be increased through aspects of the game design, such as avatar customization [13], and this raises the question of whether sound design can also be used to increase avatar identification.

1.2. Audio in Games

Modern video games feature increasingly elaborate soundscapes, making it intriguing to investigate how various components of these soundscapes affect different aspects of the game experience.

Audio backgrounds in most video games can be split into three different types of sounds: background music, which sets the atmosphere of the game scene; ambient sounds, which are all sounds displaying the surroundings in the game (such as wind or birds); and character sounds, which are all sounds evoked by the action of a character (such as steps or attacks). The influence of background music is relatively well explored, owing to its long-standing research interest in the film industry [14]. In games, background music has been found to lead to higher immersion [15,16], enhanced emotions and enjoyment [17], and increased experiences of flow [18]. The thematic overlap between music and games is also important for the experience of atmosphere and immersion [19,20].

However, the distinct impacts of character and ambient sounds, separately, have not gained much attention yet. While sound effects in general have received some recognition, it remains unclear which specific sound effects have been evaluated. In general, sound effects have been linked to higher immersion and fun [21,22], but there has been no differentiation between which type of sound influences which aspect of the game experience. To our knowledge, the first study, which investigated the different influences of ambient and character sounds, found a significant increase in immersion through ambient sounds and higher avatar identification with character sounds in a puzzle-platformer game [23]. Therefore, examining these differential effects of different sound types on players' game experiences in other game genres to assess their generalizability is an important next step.

1.3. The Present Study

In this study, we address the research question: Do different sound types in a video game have differential effects on various aspects of the game experience? The present study consists of two experiments that were constructed to investigate the influences of ambient and character sounds on several aspects of the gaming experience when participants play the multi-player online battle arena (MOBA) game League of Legends [24]. Participants played League of Legends' single-player training mode in four different sound conditions (all combinations of ambient sounds on/off and character sounds on/off) and reported on different aspects of the game experience after each gaming phase. The first aspect is immersion, and higher values indicate that the participant experiences a stronger sense of being a part of the virtual game world. The second aspect is avatar identification, where higher values indicate that the participant feels a stronger connection to their avatar by adopting its perspective and identity. The third aspect is fun, and higher values indicate an overall more enjoyable game experience.

Considering the ever-growing field of professional e-sports in which performance is paramount, we explored a possible connection between sound condition and performance by using a performance-related task and assessing in-game performance and perceived competence. In contrast to in-game performance, which objectively quantifies how successfully a participant completes the game task, higher perceived competence scores indicate that the participant felt subjectively more capable of completing the game task.

As the use of ambient sounds is meant to create a more realistic game world and better spatial–visual–auditory integration [25], we assume that by creating a more realistic game world, ambient sounds lead to higher immersion into the game world. Furthermore, due to the similarity between the constructs [5], we also assume that ambient sounds lead to more flow. Similar results have been found in a previous study using a puzzle-platformer game, where ambient sounds increased self-reported flow [23].

Regarding character sounds, we expected higher avatar identification. In fields beyond video gaming, research has shown that coordination of movements based on an avatar is more effective with both auditory and visual feedback than with visual feedback alone [26]. This suggests that auditory feedback from actions aids in learning and might enhance players' sense of control over the avatar, thereby increasing their identification. Results from an earlier study also support this notion [23].

As previous studies have identified links between fun, avatar identification, and immersion [11], we propose that both types of sounds exert a direct or indirect influence on the fun during the game. To further examine the connections between the different aspects of the gaming experience, we calculated repeated measures correlations between selected variables.

2. Experiment 1

Please note, this Experiment has been previously published in a conference proceeding [27].

2.1. Method

2.1.1. Participants

A total of 32 students participated in this experiment (*M* = 21.2 years, *SD* = 3.3, 69% female). Due to technical problems, one participant was excluded and replaced by another. An a priori power analysis with G*Power [28] revealed that this sample size was sufficient to detect medium-sized effects with a power of 0.80. All participants reported normal or corrected-to-normal hearing and vision and provided written informed consent for participation in this experiment. Of all participants, 59% had prior experience with video games, and 34% had played League of Legends before.

2.1.2. Material and Task

League of Legends: In our study, we used the MOBA game League of Legends (LoL). To ensure comparability between participants, we used the single-player training mode. This offers control over several different settings, such as the type of enemies and settings, e.g., soundscape settings. To ensure comparable playing conditions and allow for a performance measure, participants were asked to stay in the middle lane of the map, Summoner's Rift, and not stray into the outer parts. When players died in the training mode, they automatically respawned after six seconds at the starting point of the map.

LoL includes different types of characters, with the most frequent ones being small soldiers with no special skills, so-called minions. These non-player characters (NPCs) act automatically and are not controlled by players. Enemy minions are always red, while the player's own are blue. To ensure comparable playing conditions, all participants played with the same avatar (Lux), and all sounds other than character and ambient sounds were also turned off for the duration of the experiment.

Participants were instructed to land as many *last hits* as possible. A *last hit* is counted when a player takes the last bit of health from an enemy minion, dealing a fatal blow. The number of *last hits* is automatically counted by the game and was used as a performance measure in the same manner as in a previous study [13]. This task was employed to ensure similar playing behavior in all participants and to be able to investigate possible influences of sound conditions on their performance.

Questionnaires: Five of the six dependent variables were assessed with different questionnaires. Subjective immersion into the video game was assessed with four items from the sensory and imaginative immersion scale of the game experience questionnaire (GEQ) [8] and flow as a neighboring construct with five items from the flow scale of the GEQ [8]. While the GEQ's validation status and its factor loadings have been criticized [29], the scales used in this experiment have performed relatively well in other validation analyses. Avatar identification was captured with six items of the embodied presence scale and one item of the similarity identification scale of the player identification scale (PIS) [30]. To assess perceived competence, five items of the competence scale of the GEQ [8] were used. Only one item of the positive affect scale of the GEQ [8] was used to assess fun during gameplay. All items were rated on a five-point Likert scale ranging from "not at all" (1) to "very" (5) (an overview of all items can be found in Table S1). Self-translated German versions were used for all items and presented on paper to complete after each gaming phase.

2.1.3. Procedure and Design

The study followed a 2 × 2 within-subject design with character sounds (on/off) and ambient sounds (on/off) as independent variables and was conducted in a soundproof booth (Studiobox premium) using a Lenovo Ideapad Flex 5 laptop (Lenovo, Hong Kong) and Valco VMK20 headphones (Valco, Tampere, Finland). The experiment was split into two parts for each participant, each part containing two gaming phases lasting ten minutes each. Character sounds varied across the two parts, being turned on in one and off in the other, while ambient sounds varied within each part but across gaming phases, being turned on in one and off in the other phase. The order of sound variations was counterbalanced across all participants. Due to the high obtrusiveness of the character sound variation, participants listened to a piece of classical music (3 ½ minutes of Chopin's Nocturne op.9 no.1 in B-flat minor) in the break between the first and second parts, making it less likely that they would remember the earlier sound conditions. The music piece was chosen because it does not contain lyrics or display a mood or theme similar to the game. The sound volume was kept at a constant and comfortable level for all participants.

At the beginning of the study, participants first gave informed consent and supplied sociodemographic information as well as information about their gaming experience. Before the first gaming phase, participants received a short explanation of the game, explaining the controls and reminding them of the goal to kill as many enemy minions as possible with a *last hit*. Each gaming phase started anew at the starting point of the map, and after each of the four gaming phases, participants filled in the questionnaires on immersion, flow, avatar identification, fun, and perceived competence. The questionnaires were laid out in front of the laboratory so participants would not notice the experimenter changing the sound settings for the next gaming phase. In the short break between the two parts, participants listened to a piece of classical music. At the end of the experiment, participants were additionally asked how important sound was for them in general and in video games specifically.

2.2. Results

Statistical significance was tested at $\alpha = 0.05$. Six 2 × 2 repeated-measures ANOVAs with character sounds and ambient sounds as independent variables were calculated to analyze the data, one for each dependent variable. Analysis was conducted with IBM SPSS Statistics Version 27 (https://www.ibm.com/products/spss-statistics, accessed on 10 May 2023).

2.2.1. Immersion

The analysis on immersion revealed no significant main effect of ambient sounds ($F(1,31) = 0.06$, $p = 0.82$, and ${\eta_p}^2 = 0.00$) and character sounds ($F(1,31) = 1.77$, $p = 0.19$, and ${\eta_p}^2 = 0.05$), as well as no significant interaction effect ($F(1,31) = 0.91$, $p = 0.35$, and ${\eta_p}^2 = 0.03$). However, on average, the immersion scores were also quite low ($M = 2.66$ to 2.83 on a scale from 1 to 5).

2.2.2. Flow

The analysis on flow also showed no significant main effect of ambient sounds ($F(1,31) = 0.45$, $p = 0.51$, and ${\eta_p}^2 = 0.01$), character sounds ($F(1,31) = 2.35$, $p = 0.14$, and ${\eta_p}^2 = 0.07$), or the interaction between the two ($F(1,31) = 0.27$, $p = 0.61$, and ${\eta_p}^2 = 0.01$).

2.2.3. Avatar Identification

The analysis on avatar identification revealed no significant main effect of ambient sounds ($F(1,31) = 1.07$, $p = 0.31$, and $\eta_p{}^2 = 0.03$). However, the main effect of character sounds revealed a non-significant trend ($F(1,31) = 3.54$, $p = 0.07$, and $\eta_p{}^2 = 0.10$), with higher avatar identification when character sounds were present than when they were absent ($M = 2.07$ vs. 2.21 on a scale from 1 to 5). The interaction between ambient and character sounds was not significant ($F(1,31) = 0.60$, $p = 0.31$, and $\eta_p{}^2 = 0.03$).

2.2.4. Fun

The analysis on the fun during gameplay revealed no significant main effect of ambient sounds ($F(1,31) = 0.61$, $p = 0.44$, and $\eta_p{}^2 = 0.02$), character sounds ($F(1,31) = 1.90$, $p = 0.18$, and $\eta_p{}^2 = 0.06$), or the interaction between the two ($F(1,31) = 2.21$, $p = 0.15$, and $\eta_p{}^2 = 0.07$).

2.2.5. Perceived Competence

The analysis on perceived competence revealed no significant main effect of ambient sounds ($F(1,31) = 1.58$, $p = 0.22$, and $\eta_p{}^2 = 0.05$) or character sounds ($F(1,31) = 0.09$, $p = 0.22$, and $\eta_p{}^2 = 0.05$). The interaction between the two showed a marginally significant trend ($F(1,31) = 3.97$, $p = 0.06$, and $\eta_p{}^2 = 0.11$). The perceived competence was higher with ambient sounds on compared to off when character sounds were turned on ($M = 3.51$ vs. 3.30 on a scale from 1 to 5)—$t(31) = 2.27$, $p = 0.03$, and Cohen's $d = 0.40$—but no such difference was found when character sounds were turned off—$t(31) = -0.41$, $p = 0.68$, Cohen's $d = -0.07$.

2.2.6. Performance

Last Hits: The analysis on the number of last hits revealed no significant main effect of ambient sounds ($F(1,31) = 0.63$, $p = 0.44$, and $\eta_p{}^2 = 0.02$), character sounds ($F(1,31) = 2.25$, $p = 0.14$, and $\eta_p{}^2 = 0.07$), or the interaction between ambient and character sounds ($F(1,31) = 0.17$, $p = 0.68$, and $\eta_p{}^2 = 0.01$).

Deaths: The analysis on the number of times a player died and respawned also revealed no significant main effect of ambient sounds ($F(1,31) = 0.00$, $p = 0.99$, and $\eta_p{}^2 = 0.00$), character sounds ($F(1,31) = 1.21$, $p = 0.28$, and $\eta_p{}^2 = 0.04$), or their interaction ($F(1,31) = 0.53$, $p = 0.47$, and $\eta_p{}^2 = 0.02$).

2.2.7. Repeated Measures Correlations

We also calculated the repeated measures correlations [31] between several of the dependent variables with R [32] to examine how different aspects of the gaming experience are connected. To correct for multiple testing, all p-values were compared with a Bonferroni corrected $\alpha = 0.017$.

The correlations between immersion, avatar identification, and fun revealed a significant positive correlation between immersion and fun, which falls in line with previous assumptions and results [21,23] (Table 1). The correlations between the number of last hits, the number of deaths, and the perceived competence reveal a significant positive correlation between the number of last hits and the perceived competence. They also show significant negative correlations between the number of deaths and the number of last hits, as well as the number of deaths and perceived competence (Table 2). This indicates that players seem to have an accurate assessment of their performance.

Table 1. Repeated measures correlations between immersion, avatar identification, and fun in Experiment 1.

	Immersion	Avatar Identification	Fun
Immersion	1		
Avatar identification	0.16	1	
Fun	0.27 **	0.17	1

Note. ** $p < 0.010$.

Table 2. Repeated measures correlations between perceived competence, number of kills, and number of deaths in Experiment 1.

	Perceived Competence	Last Hits	Deaths
Perceived competence	1		
Last Hits	0.34 ***	1	
Deaths	−0.39 ***	−0.43 ***	1

Note. *** $p < 0.005$.

2.3. Discussion

The goal of this first experiment was to investigate the influence of different sound types in a video game on the players' gaming experience. As a previous study had shown a significant influence of ambient sound on immersion and character sounds on avatar identification in a puzzle-platformer game [23], this was the first attempt to replicate these results in a different game genre while at the same time investigating possible connections to game performance.

Unfortunately, in this experiment, we did not find any significant effects of sound conditions on aspects of the game experience or performance. We did find a non-significant trend in the effect of character sounds on avatar identification, which points in alignment with earlier results, as well as significant correlations between immersion and fun, as previously found [23], and between perceived competence and performance measures, which suggests that players seem to have a relatively accurate perception of their actual performance.

There are several possible reasons for this lack of significant effects. It is, of course, possible that there are simply no effects of sound on the game experience at all in LoL or that they are so small that this experiment did not have enough power to find them. Seeing as the effects of sound have been found in other games, however [22,23], this seems rather unlikely. Another possible reason is the task used, which allowed us to measure gaming performance but also impacted the soundscape. As participants were instructed to stay exclusively in the middle lane of the map, the types of ambient sounds they heard were restricted to mostly wind noises compared to the forest sounds that are present in the jungle parts of the map, for example. This might have made the existing ambient sounds too inconspicuous to have an effect. The task might also have had another effect: as participants were instructed to land as many *last hits* as possible, their attention might have been completely focused on the task at hand, limiting the cognitive resources available for a deeper experience of the game world around them.

To investigate whether similar effects of sound as found in other studies can be observed in LoL without the gameplay restriction, we conducted a second experiment where participants were free to explore the entire map of LoL.

3. Experiment 2

3.1. Method

In this experiment, we used the same game and measurements, except we gave participants a different task and did not include the performance measurement. The two parts of the experiment were also split up into two separate sessions.

3.1.1. Participants

A total of 32 people participated in the second experiment (*M* = 22.36 years, *SD* = 2.78, 59% female). Two participants were excluded due to technical difficulties, and one participant was excluded due to insufficient motivation shown towards the experimenter during the experiment, with only the worst possible options picked in the questionnaires in all conditions. All three participants were replaced by new ones. An a priori power analysis with G*Power [28] revealed that this sample size was sufficient to detect medium-sized effects with a power of 0.80. All participants reported normal or corrected-to-normal hearing and vision and provided written informed consent for participation in this experiment. Of all participants, 84% had prior experience with video games, and 41% had played LoL before.

3.1.2. Material

The material used in this experiment was the same as the material used in Experiment 1, with only slight changes. Most importantly, we changed the task, eliminating the performance measure and lifting the restriction of players to the middle lane of the map. Instead, players were encouraged to explore the map freely, which means they could also leave the lanes entirely and venture into the jungle. As measuring fun with just one single item in Experiment 1 might not have been reliable enough, we decided to measure fun by using a combination of five items from the negative and positive affect scales of the GEQ [8] (an overview of all items can be found in Table S1).

3.1.3. Procedure and Design

The procedure and design were also the same as in Experiment 1, with only slight changes. Seeing as the performance measure was excluded, participants were not instructed to land as many *last hits* as possible and were instead encouraged to roam through the map and explore the game. To further obscure the sound manipulation, we decided to split the experiment into two sessions with two gaming phases each instead of just giving the participants a small music break in between the two parts. The time between session one and session two was roughly a week. The laptop used was a Lenovo ThinkPad T570 (Lenovo, Hong Kong), all other equipment was the same.

3.2. Results

Statistical significance was tested at $\alpha = 0.05$. Five 2×2 repeated-measures ANOVAs with character sounds and ambient sounds as independent variables were calculated to analyze the data, one for each dependent variable. Analysis was conducted with IBM SPSS Statistics Version 27 (https://www.ibm.com/products/spss-statistics, accessed on 10 November 2023).

3.2.1. Immersion

The analysis on immersion revealed a significant main effect of character sounds, ($F(1,31) = 7.19$, $p = 0.01$, and ${\eta_p}^2 = 0.19$), with higher immersion ratings when character sounds were present compared to when they were absent ($M = 3.13$ vs. 2.83 on a scale from 1 to 5). The main effect of ambient sounds ($F(1,31) = 1.23$, $p = 0.28$, and ${\eta_p}^2 = 0.04$), as well as the interaction ($F(1,31) = 0.59$, $p = 0.45$, and ${\eta_p}^2 = 0.02$), were not significant.

3.2.2. Flow

The analysis on flow revealed a non-significant trend for ambient sounds ($F(1,31) = 3.08$, $p = 0.09$, and ${\eta_p}^2 = 0.09$), with flow being higher in the presence of ambient sounds compared to when they were absent ($M = 3.70$ vs. 3.56 on a scale from 1 to 5). The main effect of character sounds ($F(1,31) = 1.71$, $p = 0.20$, and ${\eta_p}^2 = 0.05$) as well as the interaction ($F(1,31) = 0.78$, $p = 0.39$, and ${\eta_p}^2 = 0.02$) were not significant.

3.2.3. Avatar Identification

The analysis on avatar identification revealed a significant main effect of character sounds ($F(1,31) = 7.56$, $p = 0.01$, and ${\eta_p}^2 = 0.20$), with higher avatar identification in the presence of character sounds compared to their absence ($M = 2.73$ vs. 2.37 on a scale from 1 to 5). The main effect of ambient sounds ($F(1,31) = 1.32$, $p = 0.26$, and ${\eta_p}^2 = 0.04$) as well as the interaction ($F(1,31) = 0.39$, $p = 0.54$, and ${\eta_p}^2 = 0.01$) were not significant.

3.2.4. Fun

The analysis on fun revealed a significant main effect of character sounds ($F(1,31) = 5.32$, $p = 0.03$, and $\eta_p^2 = 0.15$), with more reported fun when character sounds were present compared to when they were absent ($M = 3.92$ vs. 3.66 on a scale from 1 to 5). The main effect of ambient sounds showed a marginally significant trend ($F(1,31) = 3.44$, $p = 0.07$, and $\eta_p^2 = 0.10$), with more reported fun when ambient sounds were present compared to when they were absent ($M = 3.84$ vs. 3.73 on a scale from 1 to 5). The interaction between ambient and character sounds was also significant ($F(1,31) = 4.36$, $p = 0.045$, and $\eta_p^2 = 0.12$). Post hoc t-tests revealed that the presence of ambient sounds led to more fun compared to their absence when character sounds were turned off—$t(31) = -2.72$, $p = 0.01$, and Cohen's $d = 0.48$ ($M = 3.78$ vs. $M = 3.54$ on a scale from 1 to 5). No such difference was found when character sounds were turned on—$t(31) = 0.38$, $p = 0.71$, and Cohen's $d = 0.07$.

3.2.5. Perceived Competence

The analysis on perceived competence revealed no significant main effect of character sounds ($F(1,31) = 1.98$, $p = 0.17$, and $\eta_p^2 = 0.06$), ambient sounds ($F(1,31) = 1.61$, $p = 0.22$, and $\eta_p^2 = 0.05$), or the interaction ($F(1,31) = 0.09$, $p = 0.77$, and $\eta_p^2 = 0.00$).

3.2.6. Repeated Measures Correlations

We also calculated the repeated measures correlations [31] between several of the dependent variables with R [32] to examine how some parts of the gaming experience are connected. To correct for multiple testing, all p-values were compared with a Bonferroni corrected $\alpha = 0.017$.

The calculations between immersion, avatar identification, and fun revealed a significant positive correlation between immersion and fun, which falls in line with previous assumptions and results [21,23] (Table 3). They also show a significant positive correlation between avatar identification and fun, as well as avatar identification and immersion, which also fall in line with previous results [11,13,23]. The calculations on avatar identification, immersion, and perceived competence also showed significant positive correlations between immersion and perceived competence, as well as avatar identification and perceived competence (Table 4), which indicates that aspects such as immersion and avatar identification could influence a player's perceived competence. There was also a significant positive correlation between flow and immersion ($r = 0.56$, $p < 0.001$), which further highlights the similarity of the two constructs [5].

Table 3. Repeated measures correlations between immersion, avatar identification, and fun in experiment 2.

	Immersion	Avatar Identification	Fun
Immersion	1		
Avatar identification	0.54 ***	1	
Fun	0.56 ***	0.58 ***	1

Note. *** $p < 0.005$.

Table 4. Repeated measures correlations between immersion, avatar identification, and perceived competence in Experiment 2.

	Immersion	Avatar Identification	Perceived Competence
Immersion	1		
Avatar identification	0.54 ***	1	
Perceived competence	0.47 ***	0.57 ***	1

Note. *** $p < 0.005$.

3.3. Discussion

The goal of the second experiment was to investigate whether the effects of different sound types on the gaming experience could be found in LoL when participants were not restricted in their gameplay.

In this experiment, we found significant effects of character sounds on immersion, avatar identification, and fun, along with a trend in the effect of ambient sounds on flow and fun. Previous studies have already found connections between sound effects in general and immersion without making the distinction between ambient and character sounds [21,22]. It is possible that character sounds aid in creating a more realistic game world by acting as auditory action feedback and, as such, helping to create a clear relationship between actions and their outcomes [6]. Contrary to our expectations, we again did not find a significant influence of ambient sounds on immersion. This might be because the ambient sounds in LoL are generally too subtle, which is supported by the observation that several participants reported not noticing the manipulation of ambient sounds. As changes in variables should be discernible to alter immersion [5], this might explain why no significant effects were observed.

The effect of character sounds on avatar identification supports earlier findings [23,27]. Previous studies outside the video game context have shown that auditory feedback leads to improved movement coordination with an avatar [26], and in video games, a more interactive experience leads to higher avatar identification [11]; this could explain why higher realism and auditory feedback provided through character sounds increase identification with the avatar.

The effect of ambient sounds on flow was not significant, but the observed trend is in line with previous findings. The similarity in the constructs of flow and immersion has led to some overlap in the measurement of both. Considering the results of previous studies [23], we might conclude that ambient sounds support a deeper involvement in the game overall. The significant correlation between flow and immersion underlines the similarities between the two constructs; however, the results also support the notion that they are nevertheless influenced by different aspects of the sound design.

We have also found that fun ratings were higher in the presence of both types of sounds. Earlier studies have found similar effects, where a game was experienced more positively and less negatively when sounds were present [22]. The interaction between ambient and character sounds revealed that the effect of ambient sounds was only significant when character sounds were turned off, not when they were turned on. This might be explained by the inconspicuousness of the ambient sounds. As character sounds were much more noticeable than ambient sounds, they might have overshadowed their effect.

The positive correlations between immersion, avatar identification, and fun are in line with previous findings [11,13,21,23] and might also indicate that the effect of character sounds on fun is mediated by immersion and avatar identification. The positive correlations between immersion, avatar identification, and perceived competence are also in line with earlier findings [11,13] and might indicate that a higher identification with an avatar leads to the impression that it is easier to control and, therefore, increases a player's perceived competence [13]. Higher immersion might also prevent shifts of attention away from the game and contribute to a higher perceived competence. However, as we are looking at correlational data here, no causal relationships can be inferred.

4. Limitations

There are several limitations to this study as well, which should be considered when interpreting the results. First, the game settings created in these experiments are quite artificial and do not match those of a realistic LoL session. Originally, LoL is a multi-player game, which means that players can interact with each other, and factors such as voice chat could further overlap with the game sounds. This could be especially relevant for participants who have prior experience playing LoL and are therefore used to its usual settings. Second, LoL applies a third-person perspective rather than a first-person perspective. This might especially influence avatar identification as players act more through the avatar in a first-person perspective rather than controlling the avatar from a distance as in a third-person perspective. It might therefore be interesting to focus on first-person games in the future where sounds may be more relevant for the immersive experience, such as simulators.

5. Conclusions

The two experiments presented here were conducted to examine the influence of character and ambient sounds on different aspects of the gaming experience in LoL, namely immersion, avatar identification, fun, and perceived competence. Both experiments used different tasks within the game, leading to different results. While the first experiment did not find any significant effects of the different sound types at all, the second experiment revealed significant effects of character sounds on immersion, avatar identification, and fun. Furthermore, both studies revealed interesting correlations between the observed variables. Comparing both experiments, it seems likely that the type of gameplay is crucial for the influence of sounds on the gaming experience. When given freedom to explore the game world, sounds seem to be overall more relevant to the gaming experience compared to a performance-based task. Future investigations should further investigate games that are non-competitive and less focused on performance. Such games could be designed solely for exploration or to create an immersive game world, such as role-playing games (RPGs) or simulators. Effects on immersion are likely more pronounced in games like this and are, therefore, easier to investigate. At the same time, game developers should consider the nature of their game when making decisions about the game's soundscape. For competitive games, the design of ambient sounds may be less important to the game experience than for simulation or role-playing games. This information can help developers make decisions about allocating budgets to different aspects of game development.

Another very interesting type of game to examine would be serious games. These are games designed specifically to educate people or lead to attitude changes concerning specific topics. Serious games are not necessarily performance-driven but can also include explorative gameplay. In this context, it would be extremely useful to examine if different sound types can not only influence the game experience but also help in conveying the game's underlying message and lead to successful attitude changes.

The results of this study therefore offer very interesting new insights into the effects of ambient and character sounds on facets of the game experience, such as immersion, avatar identification, and fun, which should be considered by game designers when designing the soundscape of a specific game. Considering the continuous growth of the video game industry and its broad demographic base, our findings emphasize the importance of nuanced sound design for a diverse gaming audience. The significant effects of character sounds on immersion and avatar identification in our experiment also offer new insights into these theoretical concepts and their role in deepening the gaming experience. Our results represent a foundation on which future studies can build to delve deeper into the influence of sound types on the game experience and on gaming outcomes such as game performance or attitude changes.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/app14020583/s1, Table S1: Questionnaires. References [8,30] are cited in the Supplementary Materials.

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