

VIRTUAL REALITY AS NEW CONCERT SPACE

The experience of VR concerts illuminated from the perspective of audience and developers

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ABSTRACT

The COVID-19 pandemic has hit the music sector hard. To prevent further circulation of the virus, social distancing measurements were set in place. Consequently, music events such as concerts and festivals were no longer allowed. The lack of physical concertgoing made way for substitutes, with concerts in Virtual Reality (VR) as one of the fastest-emerging forms. To optimize the experience of VR concerts, this study examined how the audience experiences this relatively new concert form. A survey was conducted with 74 respondents, who all attended at least one concert in VR using (low) immersive VR technology, questioning four themes related to their VR concert experience: motivations of attendance, the (dis)advantages of VR concerts, the feeling of sense of presence and virtual togetherness during the concert, and estimations on the future of VR as concert space. Possible effects caused by technology, frequency of physical concertgoing before the pandemic, and the feeling of missing physical concerts were taken into account in the data analysis. Additionally, a semi-structured interview was conducted with the founder of *Soundstorm*, a Belgian company developing virtual in-game concert venues. Questions probe for his artistic vision, how the company tries to enhance the audience experience, and what the estimations are on the future of his discipline. Overall, outcomes of this research demonstrate that people are motivated the most by the artists, visuals effects and uniqueness of the event, and the least by social motives such as engagement. Accessibility and view are pointed out as biggest advantages of concerts in VR; the lack of social and physical experiences as biggest disadvantages. Sense of presence is generally achieved during the virtual concerts, however, virtual togetherness seems harder to evoke. Although it is expected that VR concerts will become an integral component of the music scene, physical concertgoing is still preferred.

KEYWORDS: music, concertgoing, virtual reality, audience experience, COVID-19

PREFACE

What a year it has been. Not only because of all the hard work to obtain my Master of Arts in Musicology, but foremost because it seems as if life was paused for a while. As a culture lover and frequent concertgoer, the pandemic eliminated much of my favorite leisure activities. It was difficult to find new outlets that could take my mind off things. However, the lack of ‘real’ cultural events introduced me to this new, interesting concert form that takes place in a completely virtual environment: Virtual Reality concerts. They seemed the perfect subject for my master’s dissertation. Based on my personal interests, I chose to focus on the psychological part instead of the technical part, with a main focus on the audience experience of these virtual concerts. Starting with a lot of enthusiasm, it soon became clear that only a few researchers paved the way for my research, resulting in few scientific reference points. Therefore, as a master’s student, this study sometimes felt as a major challenge. At the same time, however, it was obvious that I could add relevant information to the – relatively new – research field of virtual concertgoing. With this dissertation, I hope to enthuse researchers to dig deeper into this subject because there is a lot more to explore.

It goes without saying that I wouldn’t have been able to realize this so-called ‘concluding masterpiece of my university career’ completely on my own. My supervisor, Prof. Dr. Maes, helped me delineating the study into a manageable whole and tantalized me with his insights and personal interest in the subject. Also Edith Van Dyck and Kelsey Onderdijk, two researchers at the Institute for Psychoacoustics and Electronic Music (IPEM), University Ghent, offered me big support through their experience with survey research and statistical analysis.

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Besides all the professional support, I can’t thank enough my close social environment that was always there for me, in euphoric and despondent times; my parents for their reassuring and motivating belief in me, my boyfriend for his uplifting words at times when my study wasn’t going as expected or I was stressing out; my fellow students for the relaxing and ventilating online chat and Teams sessions and real-life coffee breaks; and last but not least, my cat for his unique interpretation of supporting me by napping on my desk while I was writing this dissertation.

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1. INTRODUCTION

In early February 2020, the first infections with the SARS-CoV-2 virus, also known as the coronavirus, were detected in Belgium. The virus is the pathogen of COVID-19; what was initially still compared with a ‘stubborn flu’, soon turned out to be a highly contagious disease that led to a long rehabilitation or even death, unfortunately. To combat the spread of this coronavirus, the federal government declared a national lockdown on March 18, 2020. All stores, schools, restaurants and bars had to close, working from home became the standard and people were prohibited from making ‘non-essential’ trips to avoid as many social contacts as possible. In other words, we all had to stay home in isolation and avoid seeing other people.

Also the cultural sector was affected: museums, theater houses and concert halls closed their doors and all events were canceled or postponed. The festival summer was compromised. Artists and organizers became technically unemployed, without any prospect of better times. For many, this not only meant a loss of income, but also the impossibility of living their passion and sharing it with an audience.

Within the music scene, organizers began to look for alternatives to offer to the public and the fans, something to compensate the loss of physical concerts. They looked for forms of concerts where people did not have to be physically present in a concert hall, but still enjoy some musical entertainment. In that context, concerts in Virtual Reality (VR) had a rapid rise during the past year. The COVID-19 pandemic proved how much potential and future possibilities concerts in VR have; artists can reach fans all over the world through a single platform, and fans are no longer bound to the global tour of artists. A concert with (tens of) thousands of attendees can quickly be expanded to a concert with millions of attendees this way. Such motivations prompted the conception of a new business plan around VR as a new concert space.

In this introduction, a quick lecture into VR as medium is provided, with its definition and main characteristics (cf. 1.1 Virtual Reality), and how it fits into the long history of concert spaces (cf. 1.2 An evolution in concert spaces). Next, the discussion on *liveness* of performances is explained (cf. 1.3 Liveness), since the ‘live aspect’ of VR concert is often questioned. Lastly, the motivations to physically attend concerts, found by previous studies, are illuminated (cf. 1.4 Motivations to attend concerts). These motivations will eventually be compared to the motivations to attend VR concerts in the survey study (Study I) of this dissertation.

1.1 Virtual Reality

Definition

Virtual Reality (VR) encompasses a broad range of definitions and conceptualizations that were formulated over the years. However, the definition provided by Sherman & Craig in their book *Understanding Virtual Reality* (2019) was found to be one of the more accurate ones for this dissertation. They explain VR as:

a medium composed of interactive computer simulations that sense the participant's position and actions and replace or augment the feedback to one or more senses, giving the feeling of being mentally immersed or present in the simulation (a virtual world). (Sherman & Craig, 2019, p.16)

Main characteristics

This above definition can be decomposed into some main characteristics of VR: a virtual world, immersion and interactivity. Each of these characteristics is of importance to evoke a *sense of presence* and *virtual togetherness*, two experiences that are generally pursued by VR developers. Sense of presence and virtual togetherness are discussed in the next paragraph.

Virtual world. In literature, virtual worlds are defined in various ways, e.g., as imaginary spaces (Bittarello, 2014; Sherman & Craig, 2019), as alternative realities (Gandolfi, 2019; Sherman & Craig, 2019; Zheng et al., 1998), or as simulated environments (Girvan, 2018). They could represent an existing or non-existing environment in the physical world. Although in this dissertation focus is put on digital virtual worlds, one may also consider a novel, movie, painting or theater play as a virtual world (Bittarello, 2014; Sherman & Craig, 2019). Virtual worlds must always be translated through a medium (i.e., actors, music, VR systems, language etc.) that inevitably activates the imagination of its users (Bittarello, 2014; Sherman & Craig, 2019).

Immersion. Immersion is as a very ambiguous term that has been used very inconsistently in the different research areas, resulting in trivial definitions (Cummings & Bailenson, 2016; Nilsson et al., 2016). Roughly we can distinguish two main interpretations of immersion appearing in literature: immersion as experience and immersion as technology (Nilsson et al., 2016). Within the former, immersion is interpreted subjectively as a psychological state of VR users who feel absorbed by and caught up in the virtual world (Blascovich et al., 2009; Loureiro et al., 2019; Loveridge, 2020; McMahan, 2003; Mütterlein, 2018; Witmer & Singer, 1998). Within this conceptualization, the term is often used interchangeably with other concepts such as presence, engagement or involvement. The latter, immersion as technology, applies an objective interpretation of immersion as measurable property of VR systems mediating the experience (Bowman & McMahan, 2007; Bulu, 2012; Kahani & Beadle, 1997; Linder, 2017; Mendes et al., 2019; Oh et al., 2019; Schubert et al., 1999, 2001; Sherman & Craig,

2019; Zhao et al., 2020). It concerns the extent to which technology can deliver a qualitative, vivid virtual environment to the user that evokes an illusion of reality (Cummings & Bailenson, 2016; Schubert et al., 2001). This dissertation chooses to follow the objective interpretation of immersion as technology. Here, sense of presence is not deemed as synonymous with immersion but as possible result or consequence of it, and will thus be handled separately.

In the context of immersion as technology, a distinction between *low immersive VR* and *immersive VR* is often made (Blascovich et al., 2002; Bowman & McMahan, 2007; Gandolfi, 2018; Kahani & Beadle, 1997; Linder, 2017; Mendes et al., 2019; Zhao et al., 2020;). *Low immersive VR*, sometimes called *desktop VR*, indicates virtual worlds mediated via 2D displays such as desktop, laptop or smartphone screens. Users are able to see the virtual world in 360 degrees on their display, and move the world by using navigation interfaces like mouses and keyboards (Linder, 2017; Zhao et al., 2020). *Immersive VR*, by contrast, allows users to be completely surrounded by the 360 degree virtual world and requires the use of specific technological devices such as a head-mounted display (HMD) or large projections. Instead of users moving the world (cf. low immersive VR), the virtual world itself adapts to the movements of the users (e.g., head orientation, physical position), using various body tracking sensors (Zhao et al., 2020; Sherman & Craig, 2019). Features such as a wide field of view, stereoscopic vision and multiple sensory modalities (Cummings & Bailenson, 2016) contribute to the level of immersion. In turn, immersive VR systems facilitate stronger experiences of being present in the virtual environment (Gandolfi, 2018; Kahani & Beadle, 1997; Steuer, 1992; Zhao et al., 2020) and emotional investment (Linder, 2017).

Interactivity. To obtain a feeling of being involved and present in the virtual world, VR users should be able to interact with that world and consequently influence the form or content of the environment (Mütterlein, 2018; Scarborough & Bailenson, 2014; Sherman & Craig, 2019; Zheng et al., 1998). Instead of passively perceiving pictures, users' inputs or commands need to be answered by corresponding computer actions (Scarborough & Bailenson, 2014; Sherman & Craig, 2019). According to Regenbrecht & Schubert (2002), users can interact in different ways with the virtual world: "navigation of the own point of view and body", on the one hand, and "interactions with inanimate and animate characters" on the other hand (p. 425). Through interactivity, users are given the opportunity to be the cocreators of their experience (Sherman & Craig, 2019) and users' sense of presence is enhanced (Regenbrecht & Schubert, 2002; Witmer & Singer, 1998). The responsiveness of the virtual world is thus key.

Sense of presence

This derives from *telepresence*, a term coined by Marvin Minsky at the end of the 20th century in the context of teleoperation systems that facilitate operations in distant environments, for example space (Coelho et al., 2012). According to Minsky, telepresence can be experienced by an operator who manipulates or controls remote, physical objects through a robotic system that provides visual and auditory feedback (Coelho et al., 2012). This feedback generates the feeling that the operator is controlling the objects himself, as if the robotic system is not there and the operator is present himself in the remote environment (Loveridge, 2020; Steuer, 1992). In the following years, the idea of telepresence was opened to other contexts than teleoperations, defined as *presence* or *sense of presence*.

Sense of presence is generally understood as a psychological, subjective experience of being in a virtual environment that is presented by technology, even though physically you are in another, real environment (Baños et al., 2008; Bowman & McMahan, 2007; Bulu, 2012; Linder, 2017; Mütterlein, 2018; Riva & Waterworth, 2014; Sherman & Craig, 2019; Schubert et al., 1999; Witmer & Singer, 1998; Steuer, 1992). This experience is related to the perceptual illusion of non-mediation (Lombard & Ditton, 1997 as cited in Schultze & Brooks, 2019); the impression that the medium through which you perceive the virtual world disappears. The extent to which one experiences sense of presence in a virtual world depends on different aspects; technological characteristics, e.g., level of immersion (Gandolfi, 2018; Kahani & Beadle, 1997; Steuer, 1992; Zhao et al., 2020); media content characteristics, e.g., presented plots and contents (Baños et al., 2008; Riva et al., 2007); and individual characteristics of the user, e.g., gender (Felnhofer et al., 2012), cognitive processes (Schubert et al., 2001) and personality (Wallach et al., 2010; Laarni et al., 2004).

Overall, sense of presence can be divided in three components: spatial presence, involvement, judgement of realness.

Spatial presence. This first component is a result of the relation between the virtual space and the user's body (Schubert et al., 1999), and largely encompasses what is generally understood as sense of presence. Spatial presence implies a mental representation of the body being physically situated within the virtual world and its ability to move and act in that world (Coelho et al., 2012; Cummings & Bailenson, 2016; McMahan, 2003; Riva & Waterworth, 2014; Schultze & Brooks, 2019; Schubert et al., 2002, 2001, 1999). The experience is strongly and positively correlated to the degree of interactivity that is possible. Interactivity enhances the user's sense of agency and control, and will therefore evoke the subjective impression of being present in the virtual world (Riva & Waterworth, 2014; Sherman & Craig, 2019). Although, to obtain this spatial presence, it is of importance that all actions of the user are immediately followed by reactions in the virtual world (Coelho et al., 2012; Sherman & Craig, 2019;

Witmer & Singer, 1998). The more delay, the less feeling of spatial presence and, consequently, sense of presence.

Involvement. This second component illuminates the attention that is required in order to obtain a sense of presence (Schubert et al., 1999; Witmer & Singer, 1998). When the virtual world succeeds to attract the attention of a fully concentrated user who, consequently, forgets about his real environment, the user will feel involved (Coelho et al., 2012; Schubert et al., 1999; Witmer & Singer, 1998). The more a user feels involved, the more sense of presence is experienced. Factors such as motion sickness, personal problems or disturbing elements in the real environment can distract users and hinder their involvement with the virtual world (Albuquerque & Velho, 2002; Coelho et al., 2012; Witmer & Singer, 1998).

Judgement of realness. Next to spatial presence and involvement, judgement of realness is subtracted as third component that determines the experience of sense of presence. This component involves a comparison between the virtual world and the real world. When the virtual world is represented very accurately and credibly compared to the real world, the feeling of ‘being there’ will increase (McMahan, 2003; Sherman & Craig, 2019; Schubert et al., 1999). Judgement of realness not only concerns objects, actions and environment, defined as “perceptual realism” by McMahan (2003, p. 75), but also the realness of social interactions, defined as “social realism” (McMahan, 2003, p.75). For the perception of virtual worlds as being realistic, richness in quality and logical consistency are considered as key concepts (Cummings & Bailenson, 2016; Witmer & Singer, 1998).

Virtual togetherness

Virtual togetherness, sometimes nominated as *social presence*, was conceptualized by Durlach and Slater (2000) as “the sense of being with other people in a shared virtual environment” (p.214). To experience virtual togetherness, users need to meet some requirements:

Feel present in the common virtual world (Durlach & Slater, 2000). This refers to the sense of presence discussed in the above paragraph. The more users experience presence in the virtual world, the more likely it is to experience a sense of being together as well (Bulu, 2012; Durlach & Slater, 2000; Schultze & Brooks, 2019). This influence also applies in the opposite direction: the feeling that other people share the virtual world with you increases the realism of the virtual world, and consequently, the sense of presence (Coelho, 2012; Schultze & Brooks, 2019).

Have a mutual awareness of users in the common virtual world (Bulu, 2012; Coelho, 2012). Sometimes indicated as *co-presence* (Bulu, 2012; Schultze & Brooks, 2019). With virtual togetherness, it’s not only of importance that users are aware of other users sharing the environment with them. Also

the impression that others are “actively perceiving” you enhances the feeling of being part of a bigger, social group in the virtual world (Bulu, 2012, p.155). This mutual awareness can be specifically facilitated using personalized avatars as a way of virtual representation and embodiment (Scarborough & Bailenson, 2014).

Communicate and engage with other users in the common virtual world (Bakardjieva, 2003; Durlach & Slater, 2000). Interaction and “joint activities” (e.g., dancing, clapping, chatting) contribute to the sense of togetherness because users share “a common focus of attention” (Schultze & Brooks, 2019, p.38; Vandenberg et al., 2021). Especially when users collaborate to interact with the virtual world, and consequently change its form and content, togetherness is strongly initiated (Durlach & Slater, 2000). Togetherness is also enhanced when users can hear each other voices (Albuquerque & Velho, 2002), confirming the other is real.

1.2 An evolution in concert spaces

The romantic idea of the composer as a genius creator of music is a way of thinking that is still present these days. It assumes the composer feeling an irresistible urge to translate his inner state and emotions into music, disregarding external and contextual factors. So, music is shaped completely autonomously according to his creative inspirations.

This view does not quite hold true though. Of course, the composer has a major input into how the music is created. However, the idea that he is completely independent of other factors in doing so, is not right. One of those factors that has great influence on the way music sounds, is the architectural space in which the music is performed. Consequently, the composer must consider the kind of space in which his music will be heard and often needs to start composing with this thought in mind (Beranek, 2004). Therefore, Forsyth (1985) states, one may say that architecture and acoustics guided the development of Western music. David Byrne describes this interaction between music and space in his book *How music works* (2012), indicating that inventiveness and ideas of music makers are always determined by the acoustic possibilities. From the point of view of the audience, Kronenburg (2014) explains that performance venues also determine the expectations and experience of the concert.

In the following part, an overview of various main concert spaces over time is given; starting with the Middle Ages and its impressive cathedrals and churches, ending in the twenty-first century with VR as newest concert space.

The Middle Ages and Renaissance (until c. 1600)

Because the transition from The Middle Ages to the Renaissance cannot be determined unambiguously as concerns music, both periods are discussed together in the next paragraph. In doing so, we connect with Richard Taruskin's opinion that there has never been a renaissance in the evolution or history of music (Maes, 2019).

During the Middle Ages, large churches and cathedrals were the most common concert spaces, since music had a mainly liturgical function. Music of that time is known as Gregorian chant and consisted mainly of simple vocal lines. The form responded to the liturgical function; chants supported prayer, enhanced emotions of devotion and sacredness, and created a spiritual atmosphere (Maes, 2019).

Characteristic of the architecture of those churches and cathedrals was the very long reverberation time, often more than four seconds (Byrne, 2012). Therefore, it was not advisable for composers to write music with fast rhythms and complicated harmonic progression. This would lead to a dissonant and unpleasant whole. The music form best suited for the church architecture were slow melodies built from long notes (Byrne, 2012). Given the main concert space and its architectural features, complex music was thus eliminated.

From the fifteenth century on, the power and authority of the church diminished and aristocratic courts began to form the heart of the society. This shift mainly had an impact on the concert spaces of secular music, which were from now on located in the courts themselves.

Baroque period (c. 1600-1750)

The large and highly reverberant churches remained important performance spaces for religious music throughout the seventeenth and eighteenth century. Therefore, music of earlier times, such as the Gregorian chants, were still prevalent in these churches (Beranek, 2004).

Although, there were two main changes as concerns the performance space of religious music. Firstly, religious music was composed more often on demand of the aristocrats, with the smaller court chapels where the music would be heard in mind (Beranek, 2004). Compared to the monumental churches, these chapels had a lower reverberation time. Secondly, the new Lutheran churches made their entrance. Protestant religion attaches greater importance to the spoken word compared to the Catholics (Long, 2006). These churches integrated balconies, galleries and drapes; these lower the reverberation time and consequently improve the intelligibility of speech, as Forsyth writes (1985).

In the seventeenth century, secular music left the private aristocratic spheres and became mostly a public matter (Maes, 2019). Next to the ballrooms of courts or palaces, orchestral music was played in baroque theaters. Characteristic for these concert spaces was their horseshoe-shape (Forsyth, 1985).

The smallness of scale, heavy drapery in the theater, and the people with impressive costumes filling the space resulted in a short reverberation time (Beranek, 2004; Forsyth, 1985). Consequently, this made the music sound more intimate.

These new, more intimate concert spaces of chapels, salons, theaters, ballrooms etc. implied that details and ornaments in music became audible. Composers such as Johann Sebastian Bach (1685 – 1750) took the leap and wrote music consisting of swifter tempi and more harmony changes (Forsyth, 1985). Additionally, contrapuntal works with more vibrant and intertwining melodies found their entrance (Beranek, 2004), there was an advent of the fugue, concerto and other complex musical forms (Long, 2006), and impressive baroque arias demonstrated the highly ornamented character of the new music (Forsyth, 1985). The old church modes of the Middle Ages were replaced with the modern tonality; from now on, music was based on creating contrasts and evoking tension by playing with dynamic features and modulating keys (Maes, 2019).

Classical period (c. 1750-1820)

For the first time in history, buildings built for music as sole purpose were constructed (Long, 2006). Formal concert halls appeared from the second half of the eighteenth century. With the arrival of these autonomous venues, music was no longer attached to a strict sacred or courtly function (Baumann, 2011) and their accompanying “prescribed architectural setting” (Forsyth, 1985, p.129).

The first concert halls were mostly narrow and rectangular, and could only seat a relative small audience of 400 persons on average (Long, 2006). The rectangular shape reduced the reverberation time by early reflections coming from its side walls (Beranek, 2004). This generated “acoustic clarity” and “extreme acoustic intimacy” (Forsyth, 1985, p.131), as was the case with the former theaters and court rooms in the Baroque. Some of the concert halls were lined with wooden panels. This way, lower tones and basses could be reduced, resulting in more fine acoustics (Long, 2006).

Music of the Classical period steps away from the contrapuntal style and follows “the operatic idea of accompanied melody” (Beranek, 2004, p.10). There was a main melody, carried most of the time by strings or woodwinds, and this melody was supported by the rest of the orchestra that provided a harmonic base. In line with the 18th century intellectual movement known as The Enlightenment, Classical music was characterized by a clear, big and full sound (Beranek, 2004). It was based on reason, translating itself in specific musical forms as logic and formal foundation of music (Forsyth, 1985). The most important Classical forms were the sonata form, symphony, concerto and rondo (Long, 2006). Thus, the acoustics of the concert halls that excluded undesirable, disruptive effects caused by reverberation and provided clarity were complementary to the Classical music.

Romantic period (c. 1815-1920)

Towards the end of the eighteenth century, public concerts gained more popularity among the wider population. But due to the disappearance of patronage, financial means were limited. Baumann (2011) describes how the construction of larger concert halls lagged, resulting in overcrowded, smaller concert halls. From the nineteenth century onwards, concert venues grew. Consequently, the larger size brought along a longer reverberation time.

Moreover, a fundamental shift in music criticism took place in the nineteenth century. Focus was no longer on the compositions themselves, but on how compositions were performed (Baumann, 2011). In this context, acoustics became crucial as they had big influence on the performance and perception of music. Composers started to write music for specific concert venues (Beranek, 2004). Some even built their own venue to make sure the acoustic conditions perfectly supported their music. The most well-known example is Richard Wagner who built his own opera house, *Festspielhaus* in Bayreuth, in the 1870s for his musical dramas.

The new architecture of larger, often impressive concert venues matched the musical developments of the Romantic period. Composers started to experiment with the size of the orchestra, tone colors and expression (Beranek, 2004). Music was conceived as “more personal, emotional, and poetic” from now on (Long, 2006, p.24), leaving behind the formal identity and constructions of the Baroque and Classicism. Accordingly, the construction of instruments changed; not only did the instruments have to sound more powerful to fill the larger halls, they also needed to adapt to the new musical aesthetics requiring a larger range and new colors (Baumann, 2011). Forsyth (1985) describes the new interaction between Romantic music and large concert halls as followed:

Music of the Romantic period is best heard in a relatively reverberant hall, [...]. The blending effect of reverberance is like the brush strokes in an Impressionist painting, which obscure the subject so that the onlooker is induced to project his senses and emotions into the work in order to perceive the image. (p.17)

Twentieth century

At the beginning of the 1910s, an evolution in classical music took place. Composers started experimenting with music; trying to broaden the expressive capabilities of it (Forsyth, 1985) by bringing forth new harmonies and new, unconventional instruments (Beranek, 2004). There was Arnold Schoenberg (1874 – 1951) who introduced the new twelve-tone scale to provide a wider musical color palette; Luigi Russolo (1885 – 1947), a Futurist painter and composer who plead for the introduction of noise of modern cities in music; and Igor Stravinsky (1882 – 1971) who returned to primitive rhythms, strengthening the music with energy.

Consequently, concert halls of the twentieth century were especially suited as performance spaces for this new contemporary, often intellectual music characterized by “dissonances, emphasized rhythm and high content of percussive sound” (Forsyth, 1985, p.259). With their low reverberation time, music sounded very clear. That little reverberation was due to the accommodation of larger audience, which caused that the audience became the most important component to absorb sound (Forsyth, 1985). These modern concert halls are also called “hi-fi” halls (Beranek, 2004, p.14). It is the abbreviation of *high fidelity*, which refers to their truthful reproduction of music that was possible through the lack of distortion or other unwanted acoustic side-effects.

As concerns popular music, one of the most striking evolutions in performance venues was the construction of arenas with a capacity up to ten thousands of people (Kronenburg, 2014). It induced a new genre called *arena rock* or *stadium rock* that covered “rousing, stately anthems” (Byrne, 2012, Recorded Music). Characteristic was – and still is – the mass singing-along with the catchy and easy songs.

However, the most profound innovation regarding concert spaces was the advent of technology, with the invention of the phonograph by Edison (1870s) as precursor. From the 1920s on, electroacoustic devices such as microphones, amplifiers and loudspeakers appeared (Long, 2006). All these inventions extinguished the obligation to go to specific venues to enjoy music and enabled private consumption (Earl, 2001). Consequently, as David Byrne states in his book, “technology had turned the living room or any small bar with a jukebox into a concert hall” (Byrne, 2012, Recorded Music). The recording and reproducing of sound caused that music sounded very precise, almost excellent; technology had the potential to transcend the live performance conditions, providing the people with a superior listening experience (Long, 2006).

Music adapted to these new advancements, especially popular music (Byrne, 2012). For instance, electronic recordings enabled more intimate songs, with singers known as *crooners* groaning and whispering in the microphones (Keunen, 2015). As a listener, it seemed as the performers were standing next to you, singing directly into your ears. Music never sounded so intimate. Listening to music became a private matter which became even more prevalent with the arrival of the Walkman portable cassette player and the MP3s at the end of the twentieth century (Byrne, 2012; Earl, 2001). Concluding on the advantages of these new technologies with the words of David Byrne:

[...] you can hear and appreciate extreme detail and subtlety, and the lack of uncontrollable reverb inherent in hearing music in a live room means that rhythmic material survives beautifully and completely intact; it doesn't get blurred or turned into sonic mush as it often does in a concert hall (2012, Contemporary Music Venues).

Even though technology could be considered as ‘competitor’ of live performances, these technological developments nevertheless provided benefits for concert venues as well. In the second half of the twentieth century, it was expected from concert halls that their acoustics could vary according to different musical styles (Forsyth, 1985); both the clear and detailed music of the eighteenth century, and the highly reverberant and expressive music of the nineteenth century should be able to be played in the most optimal acoustic conditions. Next to mechanical adjustments (e.g., sound-absorbent banners or curtains), electronic devices such as loudspeakers could be deployed for assisted resonance (Forsyth, 1985).

Twenty-first century

Thanks to the appearance of the Internet at the end of the 1990s, performance spaces could break with their physical, geographical and temporal boundaries. Although live performance remains essential, the virtual form occupies an important position in this digital era, generating new business models for music and concerts (Breese, 2020). According to Decesare & Wang (n.d.), this digital evolution of performances can be explained by “consumers and makers of music (who) now demand more and more immersive and interactive experiences”.

Here, focus is put on three virtual concert spaces that emerged in the last two decades and played a key role during the COVID-19 lockdown periods: livestreams, games and VR apps. Important to emphasize is that these virtual concert spaces are no direct dangers to the ‘live’ performances and physical concert spaces. The two exist separately from each other and will not cause the other one’s downfall, confirmed by Vergauwen (2021).

Livestream concerts. These found their way into the digital world with the Internet, more specifically social media platforms (e.g., Facebook Live, YouTube Live, Twitch) functioning as concert venue. During the corona pandemic, it was one of the main mediums of artists to keep the connection with their fans (Breese, 2020). Through livestreaming, fans are given the opportunity to attend a real-time concert from a distance, rewatch a concert, or enjoy an occasional acoustic session recorded live from the living room of the artist. However, examples like Billie Eilish’s *Where Do We Go? The Livestream* (2020)¹ prove that the concept can be more than just a ‘simple’ video recording. During the online show, a XR-environment (i.e., Extended Reality; an umbrella term that encompasses Augmented, Virtual, and Mixed Reality) changed with every song performed; from giant spiders surrounding Eilish (‘you should see me in a crown’) (see Image 1, p.103), to flying geometrical figures (‘my strange

¹ <https://www.youtube.com/watch?v=t7g1EbYYnBk&list=PLKEvX8Ded3j6P8ZWIFqZq458HELgda-Jq>

addiction'), and videos of fans attending the livestream concert filling up the stage ('everything i wanted').

Games. Besides livestreams, the music scene and gaming world drew closer to each other. This resulted not only in soundtracks composed specifically for games, but also in concerts organized in virtual game world (i.e., in-game concerts). Back in 2006, *Second Life* introduced itself as new virtual concert venue with performances of the American singer-songwriter Suzanne Vega and the British new wave band Duran Duran. Over a decade later in 2018 and 2019, *Minecraft* organized two complete virtual in-game festivals: Coalchella and Fire (Vergauwen, 2021). However, in 2020, *Fortnite* broke all records with its exclusive concerts of the American DJ Marshmello² (see Image 2, p.103) and rapper Travis Scott³ (see Image 3, p.104) who attracted millions of people, gamers and non-gamers alike (Breese, 2020). For these events, the developer *Epic Games* created a virtual world within the game especially for music and theater performances. *Fortnite* can be downloaded for free, but revenue came from costumes, gadgets and dance moves people could purchase for the concerts. As Vergauwen (2021) describes, games and virtual music concerts are a perfect match since a major part of young fans are also gamers.

VR apps. Since the last few years, VR apps facilitate immersive concert experiences. It started back in 2015 with 360-degree videos of concerts that appeared for the first time, giving users the opportunity to watch the concert environment in every possible direction (Decesare & Wang, n.d.; Mileva, 2019). These videos are most of the time available on YouTube or other social media platforms, but for the 'ultimate' experience one could watch them with a VR headset via apps such as *MelodyVR*, launched in 2016. VR can simulate a front-row experience at the concert, even though the user is sitting back home in his comfortable couch. Some apps take it one step further, offering multiple viewpoints one never gets at a concert with physical attendance; backstage, behind the sound booth or even on stage with the band (Sing, 2020). However, in comparison with games and livestreams, these apps requiring VR headsets are still a niche market today.

These livestreams, in-game concerts and VR apps give people who cannot afford expensive concert tickets or live abroad, for example, the opportunity to tune in anyway (Decesare & Wang, n.d.; Vergauwen, 2021; Mileva, 2019). Going virtual is also a means for artists to reach millions of fans all over the world; an audience that would not be possible in real life. Steven Hancock, co-founder of *MelodyVR*, is aware that people will always choose physical shows first, but he is also very confident in the advantages of VR concerts, as stated in following quote:

² <https://www.youtube.com/watch?v=NBsCzN-jfvA>

³ <https://www.youtube.com/watch?v=wYeFAIVC8qU>

If (someone can) go to a show (they) always will," he said. "But for all of the limiting factors as to why people can't get to live shows, be it geographical restrictions, age restrictions, or cost ... we realized there might be an opportunity to smash all those barriers and truly globalize music (Hancock as cited in Sing, 2020, *The Future for VR*).

Thinking about the future opportunities VR has to offer for the music industry, Decesare & Wang (n.d.) describe how the medium could play a significant role in music creation too; it would allow artists and DJ's to avoid expensive recording equipment by simulating the process in a virtual recording studio that has the capabilities as a physical recording studio. Furthermore, the artist's persona could take on a whole new dimension through VR. At the BPI / Music Ally insight session 'Reality Check', on the use of AR and VR by labels and artists (December 2020), the panel saw a big potential for "flesh-and-boon musicians creating new, digital representations of themselves – which don't have to be realistic recreations", giving them "more chances and the ability to express themselves in different ways" (Reality Check, 2020).

1.3 Liveness

"Can VR concerts be categorized as live events like physical concerts?", a question that probably concerns many people. Arguments for doubts are that there is no longer a shared space or time with the performing artists; VR concerts take place at the homes of the audience, and sometimes the concert can be (re)watched at a later time. The question also implies that VR concerts are usually compared to concerts one physically attends and consequently deemed inferior.

This is exactly what the topic of *liveness* is about: the meaning of live performances and the values attributed to it. The discussion concerning this subject took hold at the end of the twentieth century and stems from the field of performance studies. But also in the broader field of art and cultural studies it keeps many thinkers and researchers busy to this day.

At the heart of the debate lies the socio-historically constructed distinction between the two ways of experiencing a performance: live on the one hand, and as reproduction through a medium (i.e., mediatized) on the other. The main voices in the debate are Peggy Phelan (*Unmarked: The politics of performance*, 1993) and Philip Auslander (*Liveness: Performance in a mediatized culture*, 2008), both professors in Performance Studies. Phelan places live performance and mediated performance in direct opposition to each other; Auslander, by contrast, wants to get rid of this hostile dichotomy and raises the notion of "mutual dependence" between both forms of experience (Auslander, 2008a, p.11).

The rise of (mass) media was the basis for this distinction between live and mediatized. Photography, TV, radio etc. flooded the society with images and reproductions at the beginning of the twentieth century (Auslander, 2008a). These new media gave people the opportunity to consume art and

culture without being bound by time and space. In the case of music, this resulted in sound recordings, gramophones and the radio, which ensured that one could listen to his favorite records from the comfort of his couch at any time. In addition to this greater accessibility, theorists say, technological developments also automatically fostered a new type of performance: the mediatized performance, which refers to audio or video recordings of performances that circulate on media such as TV and radio (Auslander, 2008a). From the 1930s on, a dichotomy emerged, and 'live' has been used ever since as antithesis for mediated performances (Holt, 2010).

Peggy Phelan, who represents the traditional view on the idea of liveness, determines live and mediatized performances as hostile and contradictory. Both kinds of performances gain meaning through their opposition; live performances are *immediate* due to the absence of media, mediatized performances are *mediate* due to the absence of living bodies (Phelan, 1993). According to Phelan, those living bodies are an indispensable feature of live performance; with their unique aura, they lend authenticity to the whole (Dixon, 2007). Furthermore, live performances are more unique in that only a few people can experience the performance at that specific time and in that specific space (Phelan, 1993). From the moment one wants to reproduce the performance through mass media, its immediacy and intimacy disappears. There is essentially no more performance then. As stated by Phelan (1993):

Performance's only life is in the present. Performance cannot be saved, recorded, documented, or otherwise participate in the circulation of representations of representations: once it does so, it becomes something other than performance (p.146).

Auslander (2008a) declares that "classic liveness" (p.61), with Phelan as representative, approaches liveness from an ontological perspective. They define live performances based on immutable, inherent characteristics which they juxtapose with mediated experiences (Auslander, 2008a). Consequently, this results in a strong binary thinking that leaves no room for possible intermediate and mixed forms (Auslander, 2008b). Moreover, Phelan's way of thinking encourages connotations such as 'real and authentic' in live performances and 'second-rate and artificial' in mediated performances (Dixon, 2007).

Philip Auslander wants to get rid of the hostile dichotomy between live and mediated, as well as the connotations of authentic and artificial that ensue from it. To begin with, Auslander (2008a,b) states it is wrong to think that live performances are more authentic because they allegedly precede mediated performances. Basically, live performances are only a century old; they came into being with the rise of mass media and should therefore be seen as its historical consequence, Auslander clarifies (2008a,b). Whenever technology and media evolve, "the idea of what counts culturally as live experience" inevitably evolves and expands along with them (Auslander, 2012, p.3).

Furthermore, Auslander (2008b) corrects the classic view on liveness by pointing out that the characteristics they attribute to live performances - immediacy, intimacy, authenticity - are things

experienced by the audience and the performers. Thus, they should be dealt with as consequences rather than inherent features of liveness. The significance of the direct, living bodies who facilitate this authenticity and immediacy of live performances according to Phelan, is wiped out due to technological innovations (Auslander, 2008a). As a spectator, there is no longer a need to be physically and temporally present at the performance since live and mediated elements are increasingly combined (Auslander, 2008b). Think of live broadcasts on TV where you are temporally co-present as a spectator but not physically. Or a CD or DVD with live recordings where in addition to the lack of physical presence, there is no longer a shared temporality; you can listen or watch whenever and wherever you want to, and yet the recordings remain live since they took place during a concert and not in the studio (Auslander, 2012).

Concluding, live and mediated should not be treated as independent and strictly separate, as the classic view within Performance Studies does, Auslander defends (2008a,b). Both forms influence each other and mingle, blurring the boundaries and creating a hybrid form (Auslander, 2008b). A strict ontological distinction between live and mediated is thus untenable.

Digital liveness

In 2012, Auslander published an article in response to the second edition of his book *Liveness: performance in a mediatized culture* (2008). It is dedicated to a new category of liveness: *digital liveness*, which defines the meaning of liveness in times where The Internet has taken over the dominant function of mass media as previously discussed.

So far, liveness was mostly discussed in the context of interaction and connection between individuals (i.e., performer-spectator). However today, liveness extends far beyond the mere interaction and co-presence of performer and spectators, as Phelan's classic view claims. The examples of live recordings and live broadcasts already demonstrated that audience and artist no longer need to share the same space or temporality. Since the advent of the Internet, this trend has only been reinforced. One could argue that in digital times liveness made a content shift to “always being connected to other people known and unknown” (Auslander, 2012, p.6), facilitated through technological mediation. Additionally, digital liveness includes the interaction between individuals and computers, the Internet or virtual environments (Auslander, 2012).

Margaret Morse was one of the first researchers to interpret liveness from the human-machine relationship and their connection and interaction. Morse (as cited in Auslander 2012) writes that machines such as computers can generate a sense of liveness through their feedback on human input to the machine. Because computers and the Internet respond to the user's commands in real time, they feel 'live'. Although Auslander stated this conceptualization by Morse in his book about liveness (2008a),

he nuances this in the context of his new theory on digital liveness. Not all technologies involving real-time feedback may be considered “causal agents in the experience of digital liveness” (Auslander, 2012, p.6), only those that make specific *claims of liveness* on us, an idea derived from Gadamer (2004). Auslander emphasizes the choice of the user to respond to this claim as live event or not. If one decides to interact with the technology or virtual world, he must take its claim of liveness very seriously to bring the medium and accompanying experience “into full presence for ourselves” (Auslander, 2012, p.8). So, thinking of VR concerts; one will never experience a VR concert as live or real if he does not take the medium seriously and/or is not willing to fully connect and interact with it.

1.4 Motivations to attend concerts

Note. When speaking of *live* concerts in the following paragraphs, it always concerns concerts in physical venues (i.e., physical concerts).

Despite the democratization of music that has reached its peak through streaming, downloads and digital media platforms, the popularity of live concerts remains and even grows (Charron, 2017; Frith, 2007; Holt, 2010). In fact, Frith (2007) believes that the digital revolution in music has caused the cultural and social value of music concerts to be even more illuminated. Considering the ever-increasing ticket prices, one may suggest that live music offers an added value that cannot be found in mediated forms (i.e., recordings) and people are willing to pay for (Holt, 2010).

Researchers tried to map out this added value by exploring the different motivations to attend live concerts; with motivation understood as “an internal factor that arouses, directs, and integrates a person’s behavior” (Murray, 1964, p.6). Gaining insight in this as concert organizer allows for more effective planning and marketing of events, since concertgoers base their evaluations of attended concerts on the extent to which their motivations and expectations are satisfied (Kulczynski et al., 2016).

In the following pages, we explain four possible categories of motivations: *experience*, *engagement*, *novelty* and *practical*. These are drawn from the survey research of Steven Brown and Don Knox, conducted in 2017. They queried 249 participants on their motivations to attend pop concerts. Other literature and studies, both on pop concerts (Holt, 2010; Kulczynski et al., 2016; Melamed, 2018; Mulder & Hitters, 2021; Kronenburg, 2014; Radbourne et al., 2014; Tarumi et al., 2017) and classical concert attendance (Dearn & Price, 2016; Pitts, 2014) are illuminated departing from these four categories of motivations. Insights from Philip Auslander (2008a, 2008b, 2012) supplement and nuance the findings of these studies on audience’s motivations.

Experience

According to the results of Brown & Knox (2017), *experience* is the most prominent category as concerns the motivations to attend live concerts. It includes “the uniqueness of the event”, “the proximity to musicians” and “visual stimulation” (Brown & Knox, 2017, p.238).

Uniqueness of the event. The live concert is viewed as a unique event by the audience, a once-in-a-lifetime experience that can never be relived the same way again (Brown & Knox, 2017; Kronenburg, 2014; Mulder & Hitters, 2021). The concert takes place in real-time and real-space, and therefore, audiences assign a value of authenticity to it (cf. 1.3 Liveness). Accordingly, this vision of uniqueness and authenticity is driving the expectations and perceptions of the attendees (Radbourne et al., 2014). Surprisingly, many concertgoers describe the uniqueness of live events in terms of aspects that are in se unpleasant or uncomfortable (e.g., high temperatures, loud music, people pushing against each other, sweating); without these, the ‘real’ concert experience cannot be obtained (Earl, 2001; Holt, 2010; Kronenburg, 2014).

Proximity to musicians. Seeing your favorite artists in person inherently contributes to how you experience a live concert. Tarumi et al. (2017) declare that it is an “unusual experience” to be in the same place as the artists (p.17). According to them, this unusualness is an important motivator. Several studies distinguish *hero worship* as one of the main reasons why people attend live concerts; paying a homage to the artists (Breese, 2020; Earl, 2001; Kulczynski et al., 2016; Mulder & Hitters, 2021). Some fans buy tickets to be able to meet or touch their idol, while others derive great satisfaction from observing the musicality and virtuosity of the artist (Brown & Knox, 2017; Kulczynski et al., 2016). In addition, seeing the interaction and gestures between the musicians and with the audience adds not only an extra dimension to the musical event, but also keeps the attention of the listeners (Pitts, 2014).

Visual stimulation. Unlike music recordings, live concerts come with a (spectacular) show that captures the imagination of the audience and adds an extra dimension to the experience of music. Projections, lighting, costumes, props ... all make the experience much more intense (Earl, 2001). Music is not only heard, but perceived with the entire body. As Earl (2001) expresses:

[...] I might have attended many concerts by, say, Pink Floyd to experience in full their visual dimensions (flying pigs, etc.), even if the music itself faithfully reproduced the studio recording (p.346).

However, while many prefer live concerts over mediated ones for the previous stated reasons, Auslander (2008a) disproves the idea that being present at a live performance automatically provides a better experience. People standing at the very back of the concert hall see the performers as miniatures, for example. Furthermore, not all concert halls offer equally good acoustics, which can have a major impact on the experience (cf. 1.2 An evolution in concert spaces). Therefore, Auslander (2008) says, it is better

to interpret the ‘experience’ of concertgoing as the socio-cultural value attributed to one’s attendance at a unique live event rather than a purely aesthetic and qualitative interpretation. People derive status and prestige when they can brag about the fact they have seen that particular artist live or were part of that amazing performance everyone’s talking about. Attending a live concert has become a status symbol (Charron, 2017; Earl, 2001; Melamed, 2018; Kulczynski et al., 2016; Mulder & Hitters, 2021), for example translated in attendees taking videos and photos of the concert so they can prove to the outside world that they were among the lucky few who were present (Melamed, 2018). Thus, attendance at a concert becomes symbolic capital, and sometimes has no relation anymore to the quality (Auslander, 2008a).

Engagement

The experience of a live concert is mostly accompanied by a social dimension as well. This social dimension of live concerts is put forward in literature as one of the most important motivations to attend a concert (Dearn & Price, 2016; Earl, 2001; Mulder & Hitters, 2021; Pitts, 2014; Tarumi et al., 2017), confirmed by the findings of Brown & Knox (2017) who nominate *engagement* as second most important motivational category of attendance, based on their study results. Engagement refers the connection that a concertgoer experiences with other people present at the concert. People mostly define this as ‘a shared experience’ (Brown & Knox, 2017; Holt, 2010); on the one hand with the artists, and on the other hand with the people in the audience. Also, this sense of engagement will generally be used as a measure of the quality and appreciation of a concert (Radbourne et al., 2014).

Engagement with the artist. People consider live concerts not only as a financial support to the artist (e.g., buying admission tickets), but also as an emotional and cultural support (Earl, 2001; Pitts, 2014). Through loud applause, singing along with and dancing to the music, they express their fanhood and worship. Live concerts are crucial moments to shape and experience the fan-artist relationship (Brown & Knox, 2017). This is fueled by the artists' speeches directly addressed to their audience; they give an insight into their personality, their reflections on music or how certain songs came about. As a result, the audience experiences a certain familiarity, a trusting and intimate bond with the artist (Pitts, 2014). Again, Auslander (2008a) brings us an interesting nuance as concerns the urge to experience an engagement with performers during live concerts. In contrast to the assumptions and desires of many concertgoers, sharing a space with performers does not guarantee a greater intimacy or connection with them, since there will always a gap between performer and audience:

The more you approach a performer, the more you inhibit the very performance you are there to see. No matter how much a performer gives, no matter how intensively you attend to her, the gap remains between performers and spectators (Cubitt, 1994 as cited in Auslander, 2008a, p.65).

Engagement with the audience. This includes the feeling of sharing the live experience with like-minded people that share the same musical values (Brown & Knox, 2017; Charron, 2017; Kulczynski et al., 2016; Melamed, 2018; Pitts, 2014). At first, we think of friends or family members you go to concerts with, but even when you attend a concert alone, you always end up in a larger social whole (Pitts, 2014). You may generally assume that everyone present at the concert shares the same preferences in terms of music and is a fan of the artist. This creates a bond between the audience members, stimulating interactions with each other and enhancing a sense of belonging (Earl, 2001). As Pitts (2014) describes it, people are brought together by the music, so the experience of concerts often evokes a sense of cohesion. The connection of the audience is also expressed literally and physically when people are crammed together like sardines in a can, indicated as an essential contribution to the concert experience by many people (Kronenburg, 2014). Also the dancing, cheering and reacting as one audience sharpens the feeling of unity (Tarumi et al, 2017).

Dearn and Price (2016) conducted a research on the experience of classical music concerts, with complementary findings to the other studies. Unlike pop music, the social significance of classical music is often overlooked since there is not really a fan culture. Nevertheless, a “listening community” is created at classical concerts; people from different backgrounds unite around the same passion they share, namely (classical) music, creating social relationships (Dearn & Price, 2016, p.12). Spectators discuss what they just heard and share their musical knowledge with each other (Earl, 2001). As one of the participants in Dearn and Price's study (2016) put it:

Such a community is very important. It adds to the experience, as you can share and be stimulated and challenged by other people's views (p.10).

Novelty

Thirdly, the concert experience is shaped by the desire to discover novelties and be surprised. Brown and Knox (2017) distinguish "acoustics and variation in sound" and "unprecedented elements" (p.241) in this category.

Acoustics and variation in sound. The hall or venue where the concert takes place plays a particularly important role in the experience, as demonstrated earlier in the section on the evolution in concert spaces. Some concertgoers are specifically attached to one concert house, visiting multiple concerts in that venue (Dearn & Price, 2016; Kronenburg, 2014 ; Pitts, 2020). Besides, when artists put on a show in exceptional locations, this can be a direct motivator for people to go through such a new and unique experience (Kronenburg, 2014). However, the venue can also produce the opposite effect; people who are knowledgeable about acoustics may refrain from going to a concert if they think the venue does not have optimal acoustic properties (Kronenburg, 2014). Next to these aspects connected with the concert venue, many wish to attend a concert to experience the music live because it is labeled

as different and more unique than the recorded versions (Melamed, 2018). "To hear the music without all the production that occurs on studio tracks," as quoted by one of the respondents in the study of Brown and Knox (2017, p.241), expresses this reasoning.

Unprecedented elements. These refer to the opportunity to hear new music from the artists in first person at the concert (Brown & Knox, 2017; Earl, 2001; Kulczynski et al., 2016; Mulder & Hitters, 2021). The experience becomes much more special when the audience is spoiled with music that no one outside the concert venue has heard before. Also, existing songs that are revamped, for example a subdued and acoustic version of a rock song, contribute to the aspect of novelty. Improvisations, covers, and reworking existing music demonstrates creativity and musicality, and can bring additional appreciation from the audience. Besides, Brown and Knox's (2017) participants indicated an interest in unknown bands or artists who provide the support act, a practice that is especially common at pop concerts. This, however, is contradicted by Charron (2017) who states that the motivation to discover new artists at concerts is irrelevant these days, since everyone can do some research on the Internet and on digital streaming platforms, for example, before attending a concert.

Practical

To conclude, there are also some practical considerations why people want or do not want to attend a concert. These include ticket prices, possibility of parking, distance etc. Especially merchandise is an important element; Frith (2007) explains that the sale of merchandise should not be seen solely as an economic factor, since fans also use it to express their fanhood and personality. For them, attending a concert also means purchasing a t-shirt, totebag ... of the artist; as financial support, lasting memory and perpetuation of their identity as a fan.

Early research on concert attendance was mostly conducted from economic and marketing motivations and focused primarily on this practical component (Earl, 2001; Pitts, 2014). Current research confirms that such practical issues play a role into the decision of the potential spectator (Brown & Knox, 2017; Frith, 2007; Mulder & Hitters, 2021; Pitts, 2014), however a broader view is needed. By including the other themes - experience, engagement, novelty - it should become clear that audience motivation and experience is much more complex than just economic and practical considerations. The "musical, social and personal experience" may cause people to happily pay a little extra or travel extra miles to still attend the concert (Pitts, 2014, p. 28).

2. OBJECTIVES

COVID-19 has profoundly changed the way we live and has set in motion new trends and developments, with VR concerts as an example of this. Up to now, research has mostly focused on either VR as a medium or the audience experience of concerts in physical venues, but the audience experience of VR concerts is almost uncharted territory. However, such concerts will most likely become increasingly prevalent in the coming years, so a better understanding is required. The ability of VR to unite the music scene around the world and appeal to new audiences can break down boundaries for both audience and artist. Yet, in order to handle this medium properly and to make the best use of it, it is important that musicians and organizers know what their audiences value.

The primary goal of this research is thus to gain a better understanding how VR concerts are experienced by the audience, with additional insights and comments of a VR developer. Therefore, two research methods are applied: [1] a survey study on the audience experience, referred to as Study I, and [2] a semi-structured interview with a developer of VR concerts, referred to as Study II.

2.1 Study I: survey on the audience experience of VR concerts

<p><i>Note.</i> In this study, a broad definition of VR is applied, including low immersive (i.e., desktop screens) and immersive VR (i.e., head-mounted displays) as explained in section 1.1 Virtual Reality.</p>

Study I is the heart of this dissertation; it provides us with information on the experience of VR concerts, answering the central research question: “How does the audience experience VR concerts?”. Since the research goal is rather broad and abstract, this study is based on four sub-research questions (sRQ) which allows for a more concrete and complete approach of the topic. By eventually combining these four questions, a comprehensive answer to the central goal (i.e., audience experience of VR concerts) can be offered, and recommendations could be formulated for musicians, organizers and developers. An overview of the sub-research questions with their accompanying hypotheses can be found on the following page.

sRQ1. Do motivations to attend VR concerts differ from those to attend physical concerts (cf. Brown & Knox, 2017)?

Hypotheses sRQ1. It is expected that

- the categories of experience and engagement will be the main motivators to attend VR concerts, as with physical concerts;
- the category of practical will gain importance as motivator for VR concerts, compared to physical concerts.

sRQ2. What are the (dis)advantages of VR concerts compared to physical concerts?

Hypotheses sRQ2. It is expected that

- the advantages of VR concerts will be assigned to practical aspects such as location and price;
- the disadvantages of VR concerts will especially include the lack of direct social contact.

sRQ3. To what extent are sense of presence and virtual togetherness experienced in VR concerts?

Hypothesis sRQ3. It is expected that

- these experiences will strongly depend on the technology used by the audience to watch VR concerts.

sRQ4. What are the estimations on the future of VR concerts?

Hypotheses sRQ4. It is expected that

- VR concerts will be deemed an integral part of the future music scene;
- although the increasing popularity of VR concerts, people will still choose physical concerts over virtual ones.

sRQ1. A great deal can be found in the literature about the audience experience of concerts with physical presence, including the research of Brown and Knox (2017), explained in a previous paragraph (cf. 1.4 Motivations to attend concerts). Their findings were incorporated into the survey study (i.e., Study I) to check to what extent there are similarities and differences in the motivations to go to physical concerts compared to VR concerts. The first hypothesis for sRQ1, as concerns experience, is based on the idea that VR can evoke impossible experiences and that artists are the main reason to attend a concert. As concerns engagement, this hypothesis is based on the idea that people look for alternative ways to

have social contacts in these covid-times. The second hypothesis for sRQ1 ensues from the elimination of travel to concert halls since VR concerts can be watched at home.

sRQ2. The study also explores what advantages and disadvantages people attribute to VR concerts compared to physical concerts. The lack of travel requirements and less expenditure (e.g., no expensive food/drinks, cheaper ticket prices, no travel expenditures etc.) are expected to be the main advantages of VR as concert space. As concerns the disadvantages, it is hypothesized that social feelings will dominate, taking into account the restrictions due to the pandemic.

sRQ3. A research question that specifically focuses on VR as medium. Extensive writing has already been accomplished on this subject from a variety of scientific fields, but a focus on VR concerts is still missing. The hypothesis for sRQ3 are based on the importance of immersion to evoke sense of presence and virtual togetherness, as described in section 1.1 Virtual Reality.

sRQ4. The last main theme involves the estimations on the future of VR concerts. Although VR concerts are gaining more traction, the public is not yet familiar with them. This unawareness can possibly create barriers for VR as new concert space.

Furthermore, as second-order analysis of the survey data, three factors with possible influence on the answers are taken into account. We examine if:

- [1] there are any differences in the experience of VR concerts caused by technology; do people who use *immersive VR* technology (i.e., head-mounted displays) have another experience than people who watch VR concerts using *low immersive VR* (i.e., desktop screens) ;
- [2] people who frequently attended physical concerts before COVID-19 experience VR concerts in a different way than people who (almost) never attended physical concerts ;
- [3] the feeling of missing physical concerts has an influence on the experience of VR concerts.

2.2 Study II: a semi-structured interview with a developer of VR concerts

Study II is conceived as an extra voice added to the observations of Study I . An interview was conducted with *Soundstorm*, a Belgian developer of virtual worlds for in-game concerts. This study departed from three main questions:

- Q1.** What is the artistic vision of the developer?
- Q2.** How does the company try to enhance the audience experience?
- Q3.** What are the estimations on the future of its discipline?

3. STUDY I: METHODS

3.1 Data collection

A survey study was conducted to gain insight in the audience experience of VR concerts. This way, qualitative as well as quantitative data on this topic could be collected. The Ethics Committee of the Faculty of Arts and Philosophy, Ghent University, gave their approval for implementation. The survey, administered in Microsoft Forms, was distributed online from January 26th until March 14th.

People who already attended a concert in VR were encouraged to participate in this study through different online channels. Specific VR communities were targeted through social media channels as Facebook and Reddit, websites of VR developers, and platforms such as Twitch and Discord. Respondents could fill out the form in Dutch or English. The survey was anonymous and voluntary, respondents could quit at any time, and no financial compensation was given for participating in this study. Before completing the survey, respondents had to sign an Informed Consent Form, stating they give permission to use, process and report their responses. At the end of the survey, respondents were given the opportunity to leave comments before submitting the form. Only completed forms of respondents older than 18 years were processed.

3.2 Measures

The survey consisted of 57 questions (cf. Appendix II), containing open-ended questions and closed-ended questions. The closed-ended questions included multiple-choice and 7-point Likert scales with incrementing ranks referring to increasing importance of the tested item (e.g., 1 = ‘not important at all/not real at all/no concentration at all/...’ and 7 = ‘very important/completely real/total concentration/...’) or to increasing agreement with a certain statement (e.g., 1 = ‘strongly disagree’ and 7 = ‘strongly agree’).

Most questions of the survey were prepared based on existing literature on VR as medium (cf. 1.1 Virtual Reality) and the audience experience of physical concerts (cf. 1.4 Motivations to attend concerts). Some questions were borrowed or adapted from the Igroup Presence Questionnaire (IPQ), a self-report questionnaire initially developed by Schubert et al. (2001). In its original version, the IPQ aims to measure the three components of sense of presence: spatial presence, involvement, and experienced realness in virtual environments.

Questions were categorized in three main sections:

1. **General information** (q. 1-10). In this part, questions on general demographics were asked. Additionally, questions were asked regarding their musical education, music listening activities,

and their concert attendance before the COVID-19 restrictions. Concert attendance in this case means regular concerts taking place in physical venues (i.e., physical concerts). This information provides us an overall profile of the respondents, demographically as well as musically.

2. *Used technology for VR concerts* (q. 11-16). Because technology has a big influence on the experience of VR content, the participants were asked about the type of screen, audio and platform, and their viewing perspective on the VR concert. Multiple answers were possible. Next to this, the survey queried whether the participants were affiliated with a VR community.
3. *Experience of VR concerts* (q. 17-57). This section may be called the heart of the survey. To ascertain the VR concert experience of the participants, the questions were divided in six subthemes:
 - i. general information on the attended VR concerts (acquaintance, quantity and music genres);
 - ii. motivations to attend VR concerts;
 - iii. sense of presence experienced during VR concerts (in accordance with the questions used in the previously mentioned IPQ);
 - iv. virtual togetherness experienced during VR concerts (i.e., social presence);
 - v. comparison of VR concerts with the regular, physical concerts; and
 - vi. perspectives on the future of VR concerts.

3.3 Data analysis

Data from the Dutch and English survey were merged, processed and coded in Microsoft Excel. For the data analysis and visualization, R version 4.0.3 was used. Open questions were processed qualitatively, using thematic coding, Likert-scales and multiple choice questions were processed quantitatively.

Besides the main research questions (cf. Chapter 2 Objectives), various statistical tests were applied as second-order analysis to test factors that could possibly influence the way respondents filled out the survey; [1] Wilcoxon Ranked Sum Test to check potential differences between respondents who used VR headsets to watch VR concerts and those who did not; [2] Kruskal Wallis test and Wilcoxon Ranked Sum Test (with Bonferroni adjusted alpha level of .005) to check potential differences between respondents according to their frequency of attending physical concerts before the COVID-19 pandemic; [3] Spearman's Rank Correlation Coefficient to check potential correlations between the feeling of missing physical concerts and the experience of VR concerts.

4. STUDY I: RESULTS

4.1 Respondents

A total of 78 responses were collected; three respondents were minors and the form of one respondent was declared invalid, leaving 74 valid responses. Of all respondents, 19% were female and 81% male. Age ranged from 18 to 72 years ($M = 34.730$, $SD = 11.361$). Most respondents indicated the USA (26%) as country of residence, followed by Belgium (23%), United Kingdom (18%), Germany (11%) and The Netherlands (5%). The remaining 17% lived in various countries, such as Canada, Italy, Ireland, Australia, Russia, South Africa, Jersey, Greece, Brazil, Portugal and Switzerland.

Musical profile

When asked about the musical background, years of musical experience ranged from 0-40 years ($M = 10.108$, $SD = 12.332$). Most of the respondents pointed out that they did not follow any kind of musical education, others received various types of musical training, as can be seen in Figure 1 below. Respondents could indicate multiple answers.

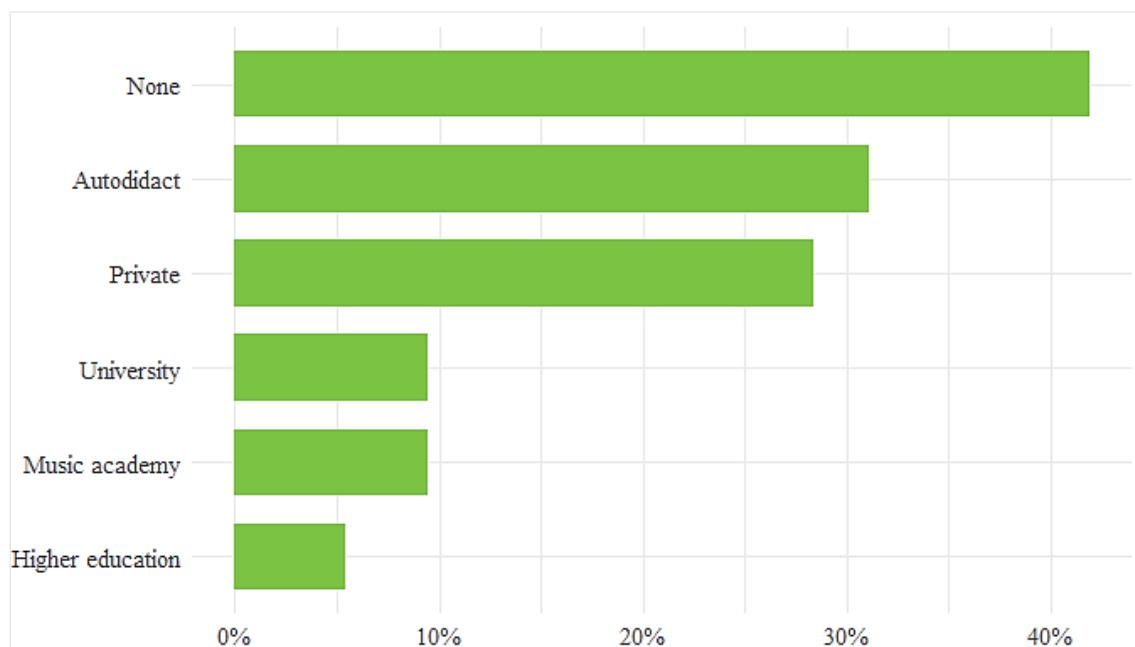


Figure 1. Overview of the types of musical education followed by respondents, expressed in relative frequencies ($N=74$).

As shown in Figure 2 on the next page, most of the respondents spent 1-2 hours per day listening to music as main activity or as background (41%), followed by 3-4 hours and 5-8 hours.

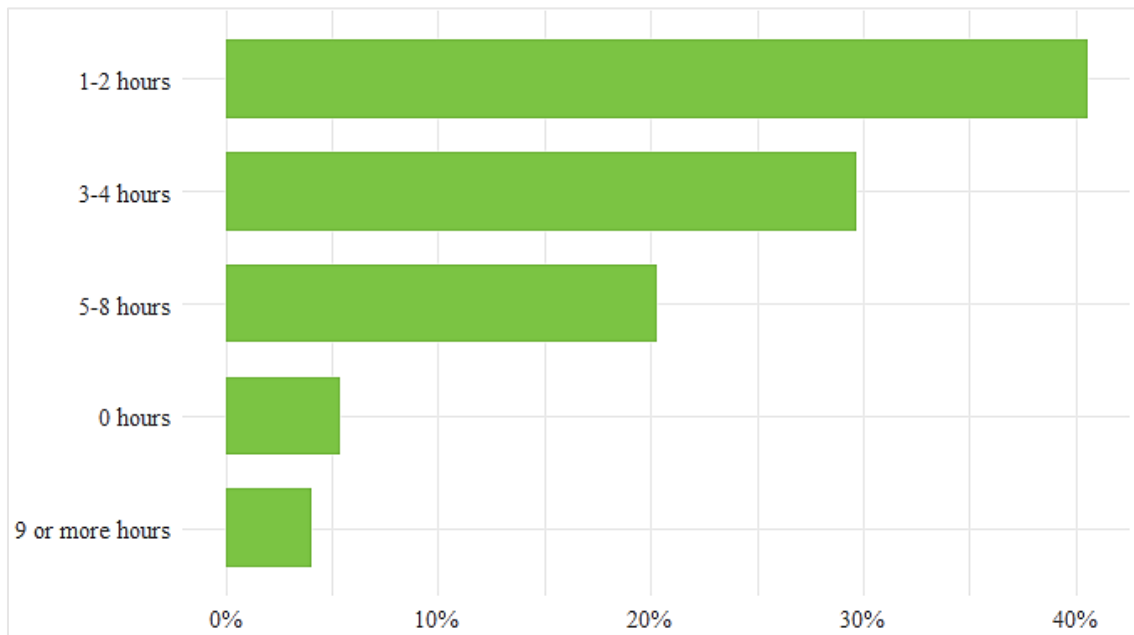


Figure 2. Hours per day respondents spent on listening to music, expressed in relative frequencies ($N = 74$).

Responses on the frequency of attending physical concerts before the corona pandemic showed following tendencies:

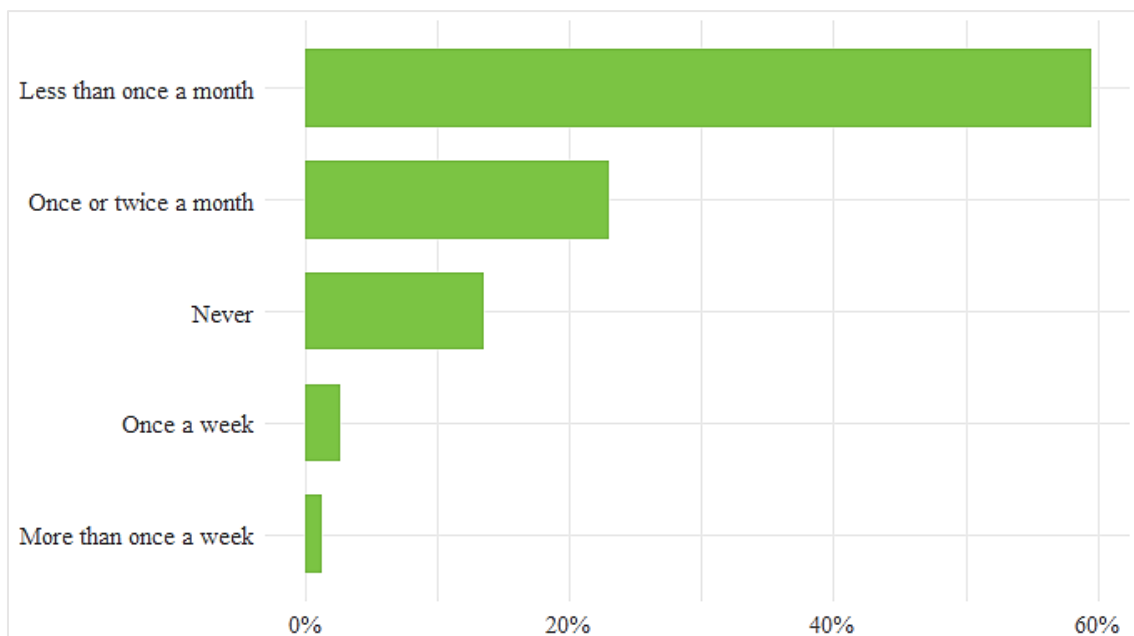


Figure 3. Overview of the frequency of attending physical concerts before COVID-19, expressed in relative frequencies ($N = 74$).

34% of the respondents were affiliated with at least one VR community. *AltSpaceVR* (24%), *VRChat* (24%) and *Oculus* (20%) were the most popular ones.

4.2 Used technology

Screens and audio

Table 1. Overview of used technology for VR concerts.

<u>Screens</u>		<u>Audio</u> (*self-assessed quality)	
		<u>Speakers</u>	
(Big) TV screen	32%	Basic quality*	15%
Laptop screen	26%	High quality*	9%
Desktop screen	26%	Stereo	22%
Phone screen	19%	Surround	14%
Large projection	8%	<u>Headphones</u>	
VR headset	59%	Basic quality*	24%
		High quality*	53%
		Noise cancelling	15%
<u>Other</u>		<u>Other</u>	
iPad	3%	Build-in headset speakers	3%

Note. Results are expressed in relative frequencies ($N = 74$), multiple answers could be indicated.

As can be seen in Table 1, a VR headset was mostly used to watch concerts in VR. The most common headset brand was *Oculus* (70%), followed by *HTC* (11%), *Sony* (9%), *Valve* (7%), and *Samsung* (5%). As regards audio, most of the respondents used high quality headphones.

Platform

VR concerts are organized on different types of platforms, such as games or specific VR apps. 70 respondents completed the question on the platform they have used to watch the VR concert. Results are displayed in Table 2 on the next page.

Table 2. *The top five platforms used to watch VR concerts.*

<u>VR apps</u>	
VR Chat	16%
Oculus Venues	11%
Melody VR	11%
Wave VR	7%
<u>Social media platforms</u>	
YouTube	21%
<u>Other</u>	
	49%

Note. Results are expressed in relative frequencies ($N = 70$).

As can be seen in Table 2, the top five consists mostly out of specific VR apps, but YouTube was used most frequently overall. 49% of the responses were composed of various other platforms such as *Fortnite*, *AltSpace VR*, *Minecraft*, *Soundstorm* and *Steam VR*.

Perspective

When asking about their viewing perspective on VR concerts, the participants could choose a first-person perspective ('through the eyes of my own character/avatar') and/or third-person perspective ('behind/above my character/avatar'). Results can be read in Figure 4 below.

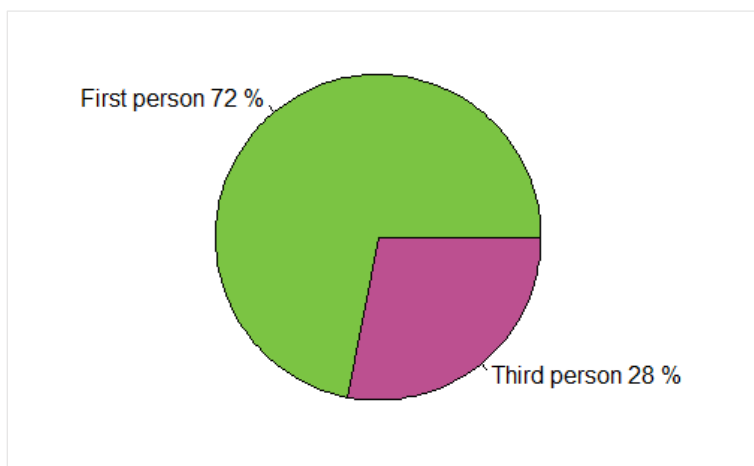


Figure 4. *Applied perspectives by the respondents on VR concerts, expressed in relative frequencies ($N = 74$).*

4.3 General information on the attended VR concerts

Respondents were asked about the frequency of VR concert attendance, how they discovered the concerts, and which music genres were played.

The number of VR concerts attended by the respondents ranges from 1-100 ($Mdn = 3.00$, $SD = 12.355$). Most of the respondents discovered them via social media (59%), friends and family (24%) or while gaming (15%). Other channels (26%) that helped respondents discover the existence of such concerts were VR websites, apps, newsletters, advertisements, etc.

Figure 5 shows the ranking of the most common music genres of attended VR concerts. Again, multiple answers were allowed. ‘Other’ refers to various genres such as punk, metal, lo-fi, alternative etc.

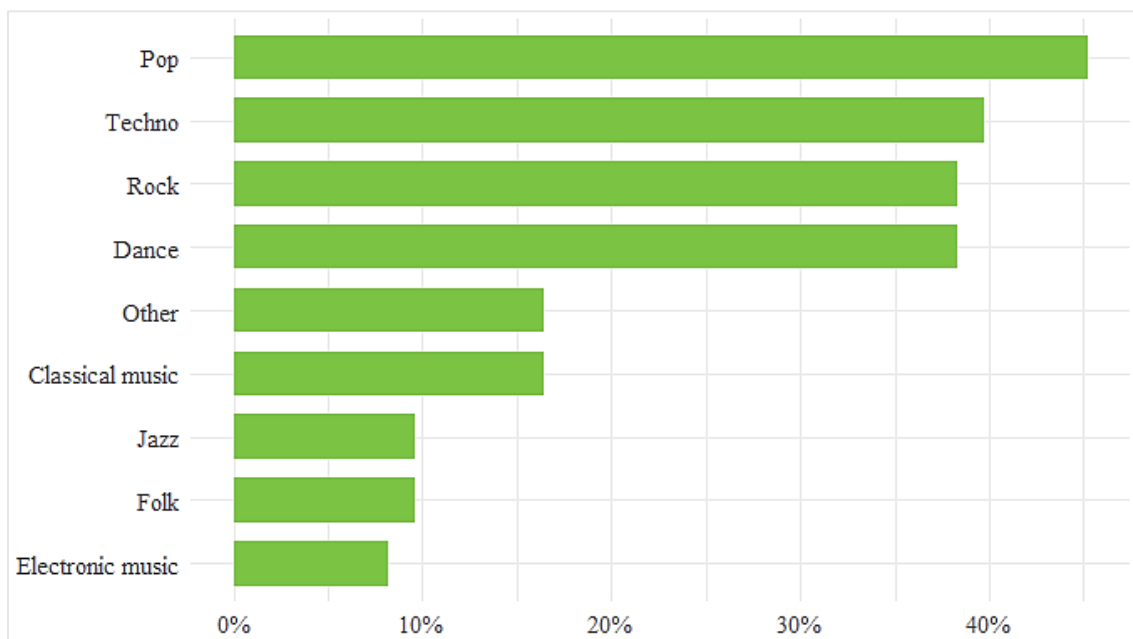


Figure 5. Overview of the genres of attended VR concerts, expressed in relative frequencies ($N=73$).

4.4 Motivations to attend VR concerts

Based on the categories defined by Brown and Knox (2017), who studied the motivations to attend physical concerts, respondents were presented 15 aspects (see Table 3 below) of which they had to assess their motivational qualities for VR concert attendance; ranging from ‘not a reason for attendance at all’ (score 1) to ‘very much a reason for attendance’ (score 7). Next to the four categories of Brown and Knox, a new category was added with specific aspects possible due to the VR environment.

Table 3. Applied categorization of motivators in the survey.

<u>Category</u>	<u>Motivation</u>	<u>Used abbreviation</u>
<u>Experience</u>	Visual effects	Visual effects
	The artist(s)	Artists
	The possibility to be part of something unique	Unique experience
<u>Engagement</u>	Sharing the experience with other people in the audience	Sharing experience
	Feeling a togetherness with other people in the audience	Togetherness audience
	Meet people from all over the world	Meet people worldwide
	Feeling a togetherness with the artists	Togetherness artist
<u>Novelty</u>	Discovering new music	Discover new music
<u>Practical</u>	You can stay at home	Stay home
	Concert tickets are cheap or for free	Price
<u>VR related</u>	Possible to (re)watch the concert at a moment of your choice	(Re)watch at moment of choice
	A better view	Better view
	Don't have to be quiet for others during the concert	Don't be quiet
	The ability to stop watching at any time	Stop watching at any time
	Possible to change places during the concert	Change places

Figure 6 on the next page contains an overview of the scores on all motivational aspects individually, from most important (i.e., top) to least important (i.e., bottom), without considering the overarching categories of experience, engagement, novelty, practical, and VR related.

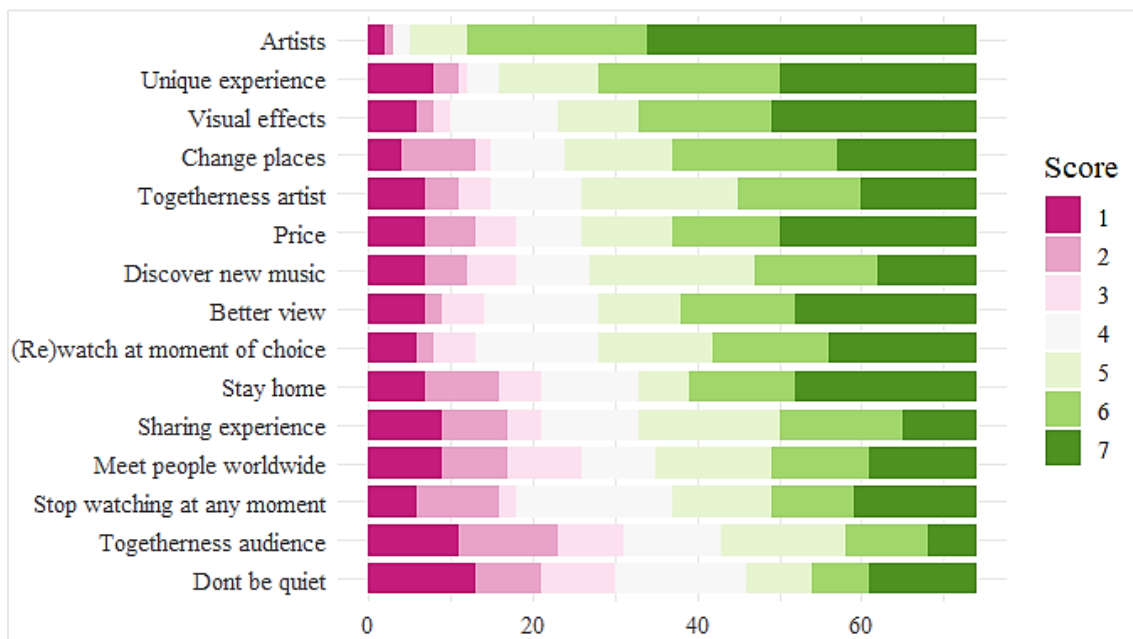


Figure 6. Scores on all possible motivations (7-point Likert scale, ranging from 1 = 'not at all' to 7 = 'very much'). Horizontal axis expresses the total responses in absolute frequencies ($N = 74$).

Next, a ranking is given from most important to least important category, following the manner of reporting by Brown and Knox (2017). This ranking was drawn up according to one overall score per category, obtained by calculating the means of the individual motivator's scores belonging to the respective category. Since the mean is not the most appropriate center size to gain insight into the results of Likert-scales, medians are also provided per individual motivator. Results are expressed in percentages instead of absolute frequencies to facilitate a better interpretation.

Experience

The category of 'experience' got the highest overall score as motivator to go to a VR concert. As can be seen in Table 4 on the following page, almost every respondent indicated artists as very important (score 5-7), with more than half of the respondents (54%) who thought this was a crucial motivator (score 7).

As one of the participants stated:

I'd watch all my favourite artists live in concert on any platform. It's all about the artists pull to watch them live, physically or virtually (participant 33).

Also 'unique experience' and 'visual effects' as motivators gained high scores. When asked if there were any other reasons to attend a VR concert, 27% of the answers ($N=49$) fitted the category of experience. Some examples:

I enjoy seeing the stage sets and lighting. I also really like being able to watch the musicians play their instruments up close (participant 28).

To experience it on a deeper more intimate level (participant 56).

Table 4. Scores on the motivations included in the category of experience.

<i>Experience (M = 5.590, SD = 1.754)</i>			
<i>Motivation</i>	<i>Median (Mdn)</i>	<i>Not important (score 1-3)</i>	<i>Very important (score 5-7)</i>
Artists	7	4%	93%
Unique experience	6	16%	78%
Visual effects	6	14%	69%

Note. Mean, medians and relative frequencies ($N=74$) of the individual scores (7-point Likert scales) per motivator are given. The neutral scores (4) are excluded from the overview.

Additional tests:

A Wilcoxon Ranked Sum Test revealed there were no significant differences between the scores given to the three motivations of the category of experience by respondents who used a VR headset compared to those who did not.

Although, a Kruskal-Wallis test showed that depending on their frequency of going to physical concerts before COVID-19, respondents had significantly different scores on them motivation of ‘unique experience’, $H(4) = 10.86$, $p = .028$. Subsequently, a Wilcoxon Rank Sum Test with a Bonferroni-adjusted alpha level of .005 was performed, however, no significant results were found that drive this effect.

No significant correlation was detected by a Spearman correlation test between these three motivations and the feeling of missing physical concerts.

Practical

The category of ‘practical’ takes a second place. Results can be found in Table 5 on the next page.

Table 5. Scores on the motivations included in the category of practical.

<i>Practical (M = 4.845, SD = 2.063)</i>			
<u>Motivation</u>	<u>Median (Mdn)</u>	<u>Not important (score 1-3)</u>	<u>Very important (score 5-7)</u>
Price	5	24%	65%
Stay home	5	28%	55%

Note. Mean, medians and relative frequencies ($N=74$) of the individual scores (7-point Likert scales) per motivator are given. The neutral scores (4) are excluded from the overview.

On the open question on other reasons why respondents attended a VR concert, 25% of the answers ($N = 49$) fitted the category of practical reasons; no travel needed, no additional costs etc. The fact that VR concerts were more accessible for people with physical, social or mental disabilities because you can stay at home, was mentioned a couple of times. As demonstrated by following quote:

I can do it from my room, in my house. I suffer from severe social anxiety and ptsd [sic], so i [sic] cannot attend concerts live. I can barely leave my house, actually. So that is (a) way for me to have a kind of comfortable concert experience..." (participant 46).

Additional tests:

A Wilcoxon Ranked Sum Test demonstrated that the category of practical was scored differently by the respondents who used a VR headset compared to those who did not. Table 6 displays the results of the test.

Table 6. Effects of using a VR headset on practical motivations.

<u>Motivation</u>	<u>No headset: Mdn, SD</u>	<u>Headset: Mdn, SD</u>	<u>Wilcoxon W</u>
Price	Mdn = 4.5, SD = 2.070	Mdn = 6, SD = 1.909	W = 447.5 (p = .017)
Stay home	Mdn = 3.5, SD = 1.996	Mdn = 6, SD = 1.731	W = 1038 (p = < .001)

Note. Median scores (7-point Likert scales) and standard deviation of both groups, and results of Wilcoxon Ranked Sum Test are provided.

A Kruskal-Wallis test was conducted to check potential differences between participants based on their frequency of attending concerts before the pandemic and the scores they gave to the practical motivations. As concerns 'price', a trend towards a significant difference was revealed, $H(4) = 9.36$, $p = .053$. For 'stay home', Kruskal-Wallis test showed a statistically significant difference between participants based on their frequency of attending concerts before the pandemic, $H(4) = 21.67$, $p = .001$. Subsequently, a Wilcoxon Rank Sum Test with a Bonferroni-adjusted alpha level of .005 was conducted

for this motivation of ‘stay home’. It showed that people who never went to physical concerts before the COVID-19 pandemic scored significantly higher on the motivation of staying home ($Mdn = 7$, $SD = 1.317$) than those who went once or twice a month to a concert ($Mdn = 4$, $SD = 1.772$), $W = 150.5$, $p < .001$.

Furthermore, a Spearman correlation test revealed that the motivation of ‘stay home’ was negatively correlated to feelings of missing physical concerts, $r_s = -.50$, $p < .001$. No significant correlation was found between ‘price’ and the feeling of missing concerts, $r_s = -.20$, $p = .092$.

VR related

The VR related category finishes as third most important. The overview of the scores can be found in Table 7 below.

Table 7. Scores on the motivations included in the category of VR related.

<u>Motivation</u>	<u>VR related ($M = 4.673$, $SD = 1.938$)</u>		
	<u>Median (Mdn)</u>	<u>Not important (score 1-3)</u>	<u>Very important (score 5-7)</u>
Change places	5.5	20%	68%
(Re)watch at moment of choice	5	18%	62%
Better view	5	19%	62%
Stop watching at any moment	4.5	24%	50%
Don't be quiet for others	4	41%	38%

Note. Mean, medians and relative frequencies ($N=74$) of the individual scores (7-point Likert scales) per motivator are given. The neutral scores (4) are excluded from the overview.

Considering other motivations given by the respondents in the open question, only two answers ($N=49$) belonged to VR related aspects. These were:

Fixed camera position. Traditional live streams have many camera cuts (participant 9).

[...] timing! Nyc shows used to be so so late at night (participant 51).

Additional tests:

A Wilcoxon Ranked Sum Test demonstrated that within the category of VR related motivations, four motivations were scored differently by the respondents who used a VR headset compared to those who did not. Table 8 below displays the results of the test.

No significant differences between the respondents based on their frequency of attending concerts before the pandemic was found by the Kruskal-Wallis test, nor a significant correlation between these motivations and missing physical concerts was disclosed by a Spearman correlation test.

Table 8. Effects of using a VR headset on VR related motivations.

<u>Motivation</u>	<u>No headset: Mdn, SD</u>	<u>Headset: Mdn, SD</u>	<u>Wilcoxon W</u>
Change places	Mdn = 4.5 SD = 2.012	Mdn = 6 SD = 1.562	W = 424 (p = .010)
(Re)watch at moment of choice	-	-	W = 650 (p = .915)
Better view	Mdn = 5 SD = 1.850	Mdn = 6 SD = 1.859	W = 434.5 (p = .011)
Stop watching at any moment	Mdn = 4 SD = 2.040	Mdn = 5 SD = 1.709	W = 477.5 (p = .041)
Don't be quiet for others	-	-	W = 511.5 (p = .099)

Note. Median scores (7-point Likert scales) and standard deviation of both groups, and results of Wilcoxon Ranked Sum Test are provided.

Novelty

Statistically, the category of novelty has the second lowest overall score, as shown in Table 9. However, the difference with the VR related category is very small.

Table 9. Scores on the motivations included in the category of novelty.

<u>Novelty (M = 4.662, SD = 1.830)</u>			
<u>Motivation</u>	<u>Median (Mdn)</u>	<u>Not important (score 1-3)</u>	<u>Very important (score 5-7)</u>
Discover new music	5	24%	64%

Note. Mean, medians and relative frequencies (N=74) of the individual scores (7-point Likert scales) per motivator are given. The neutral scores (4) are excluded from the overview.

14% of the answers ($N = 49$) on the open question if there were other reasons for attending a VR concert connected with the category of novelty. Most of them expressed the possibility to experience something new, as demonstrated by following quote:

Experimentation. VR offers possibilities not possible elsewhere (participant 49).

Additional tests:

A Wilcoxon Ranked Sum Test revealed there is no significant difference between the score given to the motivation of discovering new music by respondents who used a VR headset compared to those who did not, $W = 581.5$, $p = .382$.

Although, a Kruskal-Wallis test showed that depending on their frequency of going to physical concerts before the COVID-19 pandemic, respondents had significantly different scores on this motivation, $H(4) = 14.519$, $p = .010$. Subsequently, a Wilcoxon Rank Sum Test with a Bonferroni-adjusted alpha level of .005 was performed, however, no significant results were found that drive this effect.

No significant correlation was detected by a Spearman correlation test between the motivation to discover new music and the feeling of missing physical concerts, $r_s = .18$, $p = .120$.

Engagement

The category of engagement ends last with the lowest overall score of all categories, shown in Table 10.

Table 10. Scores on the motivations included in the category of engagement.

<u>Engagement ($M = 4.331$, $SD = 1.927$)</u>			
<u>Motivation</u>	<u>Median (Mdn)</u>	<u>Not important (score 1-3)</u>	<u>Very important (score 5-7)</u>
Togetherness artist	5	20%	65%
Sharing experience	5	28%	55%
Meet people worldwide	5	35%	53%
Togetherness audience	4	42%	42%

Note. Mean, medians and relative frequencies ($N=74$) of the individual scores (7-point Likert scales) per motivator are given. The neutral scores (4) are excluded from the overview.

Feeling a togetherness with the artist was for 65% of the respondents an important reason why they attended the VR concert. This is in strong contrast with the motivation of ‘feeling a togetherness with the audience’, that only convinced 42% of the respondents.

On the open question about more reasons to attend a VR concert, 20% of the answers ($N=49$) fitted the category of engagement: sharing the experience with (long distance) friends, supporting the performer, and other emotional and psychological arguments. Two examples:

Occasionally creating shared experiences with IRL friends who leave abroad (participant 40).

Improve Mental Health”(participant 58).

Additional tests:

Only for the motivation of ‘sharing experience’, a Wilcoxon Ranked Sum Test demonstrated that respondents who used a VR headset scored significantly higher ($Mdn = 5$, $SD = 1.872$) than those who did not ($Mdn = 4$, $SD = 1.859$), $W = 468$, $p = .032$.

For none of the engagement motivators, a significant difference between respondents based on their frequency of attending physical concerts before the pandemic was detected by a Kruskal-Wallis test, nor a significant correlation by a Spearman correlation test between the engagement motivations and the feeling of missing physical concerts was shown.

COVID-19 related

Although this wasn’t included in the survey, 16% of the answers ($N = 49$) on the open question regarding additional motivations why respondents attended VR concerts correlated to the current situation due to COVID-19 restrictions. These respondents indicated that the most important reason they attended a VR concert was the fact that it is no longer possible to attend them in person. Some quotes to illustrate this:

To compensate the lack of physical concerts (participant 66).

The only possibilities are online now. Otherwise I wouldn’t participate, but I want to support the artists (participant 72).

4.5 (Dis)advantages of VR concerts

The survey contained questions presenting the respondents a comparison between VR concerts and physical concerts. Seven questions were close-ended, using a 7-point Likert scale, four questions were open-ended. All questions were asked from the perspective of VR concerts (e.g., “Are VR concerts more or less accessible than physical concerts?”). Figure 7 shows the results of the Likert scale scores.

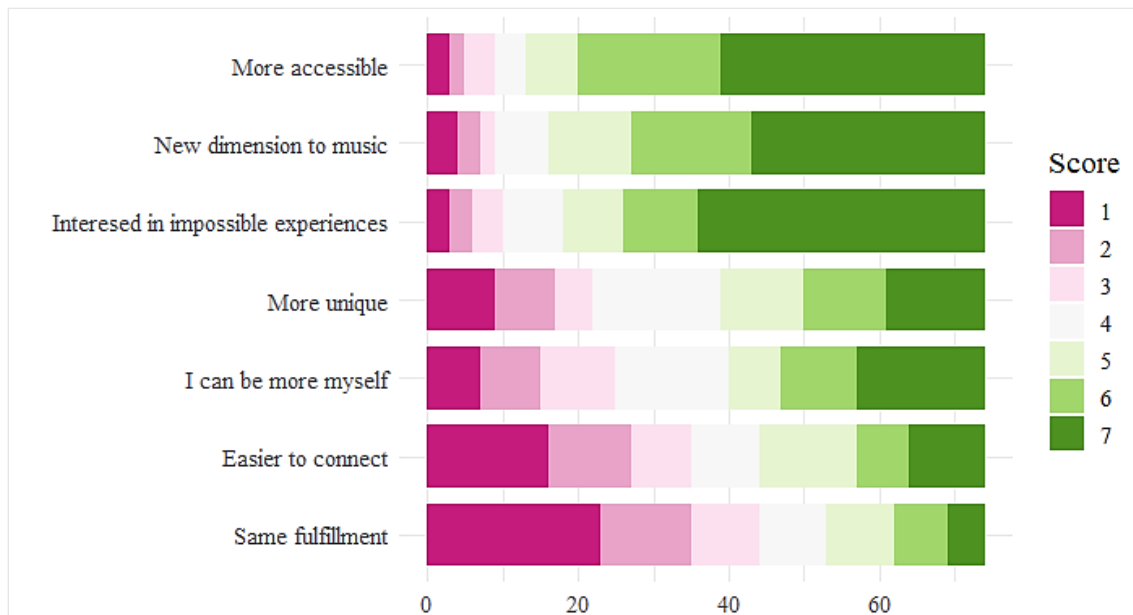


Figure 7. Scores on possible advantages of VR concerts compared to physical concerts (7-point Likert scale, ranging from 1 = ‘strongly disagree’ to 7 = ‘strongly agree’). Horizontal axis expresses the total responses in absolute frequencies ($N = 74$).

The following part focuses on the separate questions. For each one of them, a table is given containing the median score and relative frequencies to facilitate a clear overview of the results.

Accessibility

A big part of the respondents thought VR concerts were more accessible than physical concerts, as can be seen in Table 11 below. 47% even cited VR concerts as far more accessible (score 7).

Table 11. Scores on the accessibility of VR concerts compared to physical concerts

<u>Median (Mdn)</u>	<u>Less accessible (score 1-3)</u>	<u>More accessible (score 5-7)</u>
6	12%	82%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Aspects that facilitate this accessibility were clarified in an open question ($N=69$). The most recurring themes in these answers were inclusivity as regards location (45%) (e.g., no geographical boundaries, staying home) and people with disabilities (13%), the convenient usage and access (30%), and price (25%). Respondents who thought VR concerts were less accessible than physical concerts dedicated this mostly to the required technology (15%).

New dimension to music

VR concerts can display exquisite visual effects that physical concerts cannot realize. Most of the respondents agreed that visual spectacles add a new dimension to the music, with 42% strongly agreeing (score 7) with this statement. Results are shown in Table 12.

Table 12. Scores on the new dimension to music because of visual effects in VR concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
6	12%	78%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Interested in impossible experiences

Overall, most respondents agreed with the fact that they were interested in VR concerts precisely because of the impossible experiences it enhanced (see Table 13). Of all questions asked about the possible advantages of VR concerts, the interest in impossible experience was scored most frequently with a 7 (= ‘strongly agree’), more specifically by 51% of the respondents.

Table 13. Scores on the interest in impossible experiences facilitated by VR.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
7	12%	76%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Uniqueness

Table 14 on the next page shows us that less than half of the respondents indicated VR concerts as more unique than physical concerts. 23% being undecided on this matter (score 4 = ‘neutral’).

Table 14. Scores on the uniqueness of VR concerts compared to physical concerts.

<u>Median (Mdn)</u>	<u>Less unique (score 1-3)</u>	<u>More unique (score 5-7)</u>
4	30%	47%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

In an open question, respondents ($N=70$) were given the opportunity to explain their assessment. Reasons why they think VR concerts are more unique mostly correlated to the spectacle of VR concerts (16%), their convenience (12%) and the view (5%). As regards the opinion that VR concerts are less unique than physical concerts, the lack of interaction (10%) and a different atmosphere (8%) were answered most frequently. Two examples of other, various reasons (46%) why VR concerts were thought of more or less unique:

Access to normally inaccessible areas of the stage. Being able to concentrate on a different aspect of the concert each time. I've watched some concerts eg Awolnation 50+ times and I am guaranteed to see new things with each viewing (participant 24).

You can attend at your own leisure [*sic*] vs the whole standing in line for tickets and being excited for weeks before. You're not getting dressed up or missing out on stuff during bathroom breaks. (participant 62).

16% of the respondents explained they did not have a clear answer ready because they thought of both concert forms as incomparable, as this participant expresses:

Every experience is unique - physically or virtually. One is enjoying from different angles and as long as these services exist and have the opportunity pandemic or not that's what counts (participant 33).

Be more myself

Because no one can see you, we wanted to know if the participants thought they could be more themselves during VR concerts compared to physical concerts. Results can be found in Table 15.

Table 15. Scores on being more yourself during VR concerts compared to physical concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
4	47%	32%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Easier to connect

Is it easier to connect with other people in the audience at VR concerts compared to physical concerts? Based on their experiences, almost half of the respondents disagreed with the idea that one could connect easier with other attendants at VR concerts (see Table 16).

Table 16. Scores on easier connection with others during VR concerts compared to physical concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
4	47%	27%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Same fulfilment

On the question if VR concerts give the same fulfilment as physical concerts, more than half of the respondents answered they did not derive the same fulfilment from VR concerts (Table 17). 31% indicated that VR concerts did not give the same fulfilment at all (score 1).

Table 17. Scores on VR concerts giving the same fulfilment as physical concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
3	59%	28%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Added value and aspects being missed

This survey topic closed with two open questions probing what the participants missed at VR concerts compared to physical concerts ($N = 74$), and what added values VR concerts have according to them ($N = 72$). A top five for each question was made; Table 18 shows the missed elements and Table 19 the added value. Both can be found on the next page.

Table 18. Top five themes that were missed at VR concerts compared to physical concerts.

<u>Themes</u>	<u>Examples</u>
Social experience (50%)	Interaction, seeing other people and artists in real life, singing with the crowd
Physical experience (41%)	Sensory stimuli (e.g., smell, sweating, too loud music), feeling other people
Atmosphere (16%)	Shared tension with the audience, energy of the crowd, overall atmosphere
Facilities (15%)	Food and drinks, merchandise
Technical aspects (14%)	Proper technological quality

Note. Expressed in relative frequencies ($N = 74$), with accompanying examples given by the respondents.

Table 19. Top five added values of VR concerts compared to physical concerts.

<u>Themes</u>	<u>Examples</u>
Accessibility (32%)	No geographical limits, on-demand
View (24%)	More intimate view, multiple angles, close-ups
Convenience (21%)	Comfortable, no pushing crowds, no travel needed
Price (19%)	Cheaper ticket price, no travel costs, no expensive drinks or foods
Spectacle (15%)	Visual effects, impossible actions and environments

Note. Expressed in relative frequencies ($N = 74$), with accompanying examples given by the respondents.

Additional tests on the (dis)advantages of VR concerts

For most of these questions concerning the (dis)advantages of VR concerts, a Wilcoxon Ranked Sum Test revealed a significant difference between respondents who used VR headsets compared to respondents who did not use VR headsets, as shown in Table 20 on the following page.

A Kruskal-Wallis test was performed to detect potential differences between the respondents based on their frequency of attending physical concerts before the COVID-19 pandemic. However there was some significance, when applying a post-hoc analysis using Wilcoxon Ranked Sum Test with Bonferroni adjusted alpha level of .005, no significant results were found that drive this effect.

A Spearman correlation test was conducted for each question on the (dis)advantages of VR concerts, with results shown in Table 21 (next page). Except for accessibility and the idea that visual effects add a new dimension to music, all scores are negatively correlated with the feeling of missing physical concerts.

Table 20. Effects of using a VR headset on the scores on (dis)advantages of VR concerts.

	<u>No headset: Mdn, SD</u>	<u>Headset: Mdn, SD</u>	<u>Wilcoxon W</u>
More accessible	-	-	$W = 725.5 (p = .445)$
New dimension	$Mdn = 5.5$ $SD = 2.097$	$Mdn = 7$ $SD = 1.275$	$W = 885 (p = .001)$
Impossible experiences	$Mdn = 5$ $SD = 2.047$	$Mdn = 7$ $SD = 1.322$	$W = 930.5 (p = .001)$
More unique	$Mdn = 4$ $SD = 1.754$	$Mdn = 5$ $SD = 1.867$	$W = 963.5 (p = < .001)$
Be more myself	$Mdn = 4$ $SD = 1.868$	$Mdn = 5$ $SD = 1.911$	$W = 918 (p = .004)$
Easier connection	$Mdn = 2.5$ $SD = 1.768$	$Mdn = 4.5$ $SD = 2.139$	$W = 907.5 (p = .006)$
Same fulfillment	$Mdn = 1$ $SD = 1.752$	$Mdn = 3$ $SD = 1.999$	$W = 923 (p = .003)$

Note. Median scores (7-point Likert scales) and standard deviation of both groups, and results of Wilcoxon Ranked Sum Test are provided.

Table 21. Correlation between missing physical concerts and the scores on (dis)advantages of VR concerts.

	<u>Missing physical concerts</u> <u>(Spearman's Rho)</u>
More accessible	$r_s = -.10 (p = .413)$
New dimension added to the music by visual effects	$r_s = -.17 (p = .145)$
Interested because of impossible experiences	$r_s = -.37 (p = .001)$
More unique	$r_s = -.30 (p = .008)$
Be more myself	$r_s = -.50 (p = < .001)$
Easier to connect with others	$r_s = -.40 (p = < .001)$
Same fulfillment	$r_s = -.39 (p = < .001)$

Note. Results of the Spearman correlation test are provided.

4.6 Sense of presence and virtual togetherness

4.6.1 Sense of presence

As explained in the introduction (cf. 1.1 Virtual Reality), sense of presence is determined by various aspects such as concentration, realness, sense of acting, involvement etc. Most of the questions concerning sense of presence are based on the iGroup Presence Questionnaire. Figure 8 gives the overview of the scores on the Likert-scale questions concerning sense of presence.

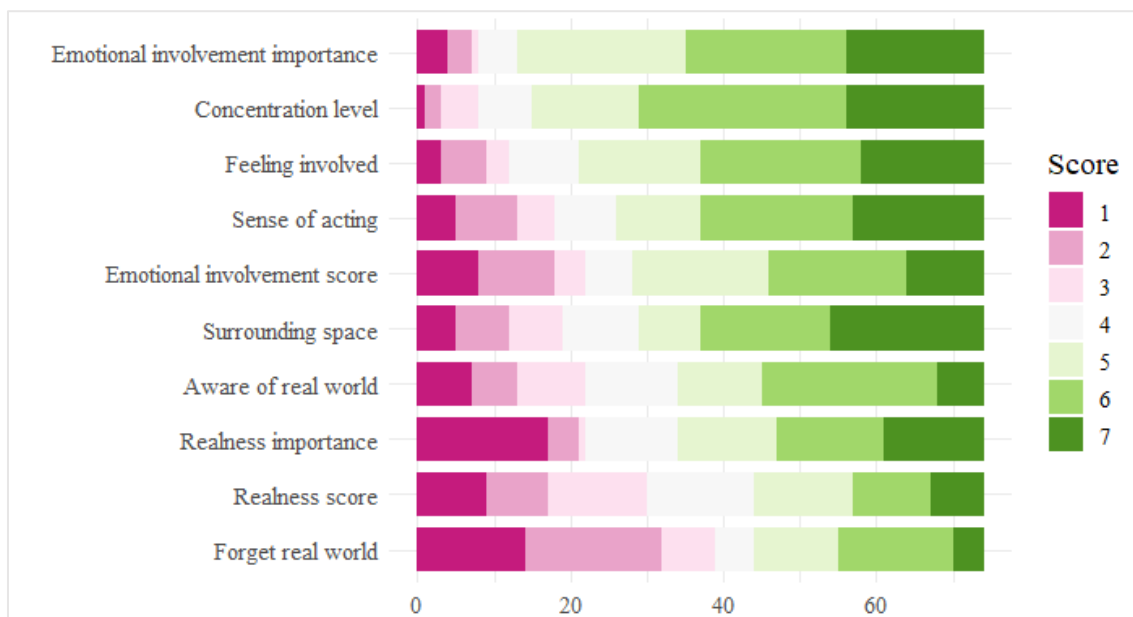


Figure 8. Scores on experienced sense of presence (7-point Likert scale, ranging from 1 = 'strongly disagree/not at all/...' to 7 = 'strongly agree/ very much/...'). Horizontal axis expresses the total responses in absolute frequencies ($N = 74$).

As with the reporting of the (dis)advantages of VR concerts compared to physical concerts, every topic will be illuminated separately.

Emotional involvement: importance and score

How important is the feeling of being emotionally involved during a VR concert (Table 22, next page), and how many times did the respondents actually experience this feeling (i.e., score) (Table 23, next page)?

Table 22. Scores on importance of emotional involvement during VR concerts.

<u>Median (Mdn)</u>	<u>Not important (score 1-3)</u>	<u>Very important (score 5-7)</u>
6	11%	82%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Table 23. Scores on experienced emotional involvement during VR concerts.

<u>Median (Mdn)</u>	<u>Never (score 1-3)</u>	<u>Always (score 5-7)</u>
5	30%	62%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Based on the responses ($N=66$) on the open question asking how emotional involvement did or did not express itself, the feeling was mostly facilitated by the music (24%) and disturbed by the idea that VR concerts aren't real (11%). As one of the participants stated how he/she experienced emotional involvement:

When the music touches you and you are closed off from the outside world for a moment, you feel emotionally involved (participant 68).

Concentration level

We asked the participants how concentrated they were during the VR concert(s) they attended (see Table 24). Some respondents ($N=70$) clarified in an open-ended question that good technical quality (30%), the music (19%) and interaction with the audience and artists (16%) had the greatest, positive influence on their concentration level.

Table 24. Scores on concentration level during VR concerts.

<u>Median (Mdn)</u>	<u>Not concentrated (score 1-3)</u>	<u>Very concentrated (score 5-7)</u>
6	11%	80%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Feeling involved

Feeling involved contributes to the feeling of being present. Based on their experiences, a large part of the respondents agreed with the statement that they felt involved during the attended VR concerts (see Table 25, next page).

Table 25. Scores on feeling involved during VR concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
5.5	16%	72%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Sense of acting

According to Table 26 below, most of the participants experienced a sense of acting during the VR concerts they attended.

Table 26. Scores on having a sense of acting during VR concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
5.5	24%	65%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Surrounding space

Also the feeling of the concert space surrounding the attendants during VR concerts was confirmed by more than half of the respondents, as shown in Table 27.

Table 27. Scores on the feeling of a surrounding concert space during VR concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
5.5	26%	61%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Aware of real world

On the question how aware of the real world the participants were while watching the VR concert, just over half of the respondents indicated not being aware of their real environment (see Table 28, next page). Some respondents ($N=71$) clarified which factors in the real world kept attracting their attention; these were mostly other people in the room (34%), auditory stimuli (25%) (e.g., noises), and tactile stimuli (16%) (e.g., VR headset and controllers).

Table 28. Scores on awareness of the real world during VR concerts.

<u>Median (Mdn)</u>	<u>Still aware (score 1-3)</u>	<u>Not aware (score 5-7)</u>
5	30%	54%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Realness: importance and score

The survey contained two questions on realness; how important it is for the participants (Table 29), and how realistic the VR concerts they attended were (Table 30). For more than half of the respondents it is important that the concerts seem real. However, looking at the scores given to the realness of the attended VR concerts by the respondents, the percentages are evenly distributed.

Table 29. Scores on the importance of VR concerts seeming real.

<u>Median (Mdn)</u>	<u>Not important (score 1-3)</u>	<u>Very important (score 5-7)</u>
5	30%	54%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Table 30. Scores on the experienced realness of VR concerts.

<u>Median (Mdn)</u>	<u>Not real (score 1-3)</u>	<u>Very real (score 5-7)</u>
4	41%	41%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Some respondents ($N=73$) clarified which aspects they experienced as real and which as unreal. The performing artists were indicated as most realistic (29%), the VR environments as least realistic (33%). As regards audio quality and visual effects, 26% think these were realistic, whereas 16% indicated them as unrealistic.

Forget real world

Table 31 on the next page shows the results of participants forgetting the real world during the attended VR concerts.

Table 31. Scores on forgetting the real world during VR concerts.

<u>Median (Mdn)</u>	<u>Don't forget (score 1-3)</u>	<u>Totally forget (score 5-7)</u>
3	35%	41%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Additional tests on sense of presence

For most of these questions on sense of presence, Wilcoxon Ranked Sum Test revealed a significant difference in experienced sense of presence between respondents who used VR headsets compared to respondents who did not use VR headsets. Results are displayed in Table 32.

Table 32. Effect of using a VR headset on experienced sense of presence during VR concerts.

	<u>No headset: Mdn, SD</u>	<u>Headset: Mdn, SD</u>	<u>Wilcoxon W</u>
Emotional involvement: importance	-	-	$W = 645.5 (p = .873)$
Emotional involvement: score	$Mdn = 4.5$ $SD = 1.954$	$Mdn = 5$ $SD = 1.870$	$W = 859 (p = .026)$
Concentration level	$Mdn = 5$ $SD = 1.406$	$Mdn = 6$ $SD = 1.171$	$W = 1006.5 (p = < .001)$
Feeling involved	$Mdn = 5$ $SD = 1.676$	$Mdn = 6$ $SD = 1.577$	$W = 907.5 (p = .005)$
Sense of acting	$Mdn = 4$ $SD = 1.930$	$Mdn = 6$ $SD = 1.664$	$W = 963 (p = < .001)$
Surrounding space	$Mdn = 4$ $SD = 1.771$	$Mdn = 6$ $SD = 1.572$	$W = 1075.5 (p = < .001)$
Awareness real world	-	-	$W = 801.5 (p = .113)$
Realness: importance	-	-	$W = 575.5 (p = .347)$
Realness: score	$Mdn = 3$ $SD = 1.695$	$Mdn = 4.5$ $SD = 1.829$	$W = 850.5 (p = .034)$
Forget real world	$Mdn = 2$ $SD = 1.826$	$Mdn = 4.5$ $SD = 2.040$	$W = 873 (p = .017)$

Note. Median scores (7-point Likert scales) and standard deviation of both groups, and results of Wilcoxon Ranked Sum Test are provided.

A Kruskal-Wallis test revealed a significant difference between respondents based on their frequency of attending concerts before the COVID-19 pandemic as concerns ‘sense of acting’, $H(4) = 11.66$, $p = .020$; and ‘surrounding space’, $H(4) = 10.75$, $p = .030$. Although, when conducting a subsequently Wilcoxon Ranked Sum Test with Bonferroni adjusted alpha level of .005, no significant results were found.

Furthermore, a Spearman correlation test showed that the feeling of a surrounding concert space is negatively correlated with the feeling of missing physical concerts, $r_s = -.16$, $p = .020$.

4.6.2 Virtual togetherness

A second important goal of VR developers is facilitating a feeling of virtual togetherness. Therefore, we have included some questions concerning this aspect in the survey. Below, Figure 9 displays the scores given to the different interrogated topics.

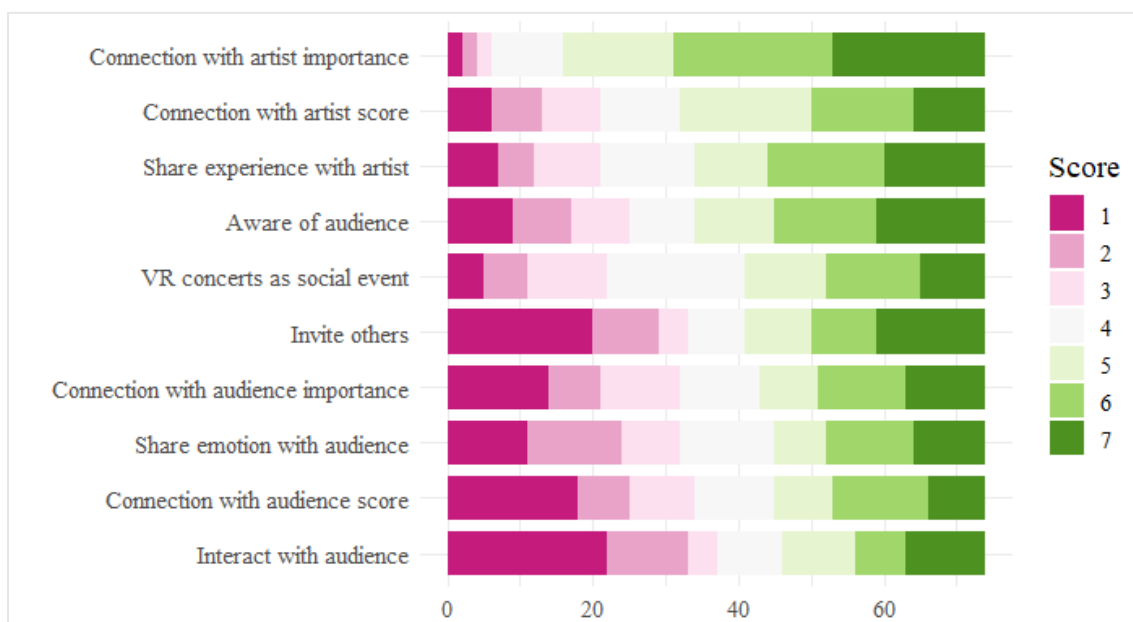


Figure 9. Scores on experienced virtual togetherness (7-point Likert scale, ranging from 1 = ‘strongly disagree/not at all/...’ to 7 = ‘strongly agree/very much/...’). Horizontal axis expresses the total responses in absolute frequencies ($N = 74$).

Following are the results reported per question.

Connection with artists: importance and score

The connection with artists gained the highest scores. Table 33 presents the scores on the importance of it, Table 34 the scores on how many times respondents actually experienced this feeling. 66 responses on an open-ended question clarified how this connection came to expression during the VR concert; mostly through interaction (36%) and the performance of the artist (17%). Two quotes illustrated this:

It's elusive; I somehow need to know that the artist is constantly reacting to our mood and queues and that this is truly coming alive in the present, and not something that could had been prerecorded (participant 40).

The artist playing to the camera which feels like they are just performing for you (participant 32).

Table 33. Scores on importance of a connection with the artists during VR concerts.

<u>Median (Mdn)</u>	<u>Not important (score 1-3)</u>	<u>Very important (score 5-7)</u>
6	8%	78%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Table 34. Scores on experienced connection with the artists during VR concerts.

<u>Median (Mdn)</u>	<u>Never (score 1-3)</u>	<u>Always (score 5-7)</u>
5	28%	57%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Sharing experience with artists

In line with the question on feeling connected with the artists, respondents were asked to score the statement they felt like sharing the experience with the artists during the VR concerts they attended (see Table 35).

Table 35. Scores on the feeling of sharing the experience with the artists during VR concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
5	28%	54%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Aware of audience

We asked if the participants were aware of the other people in the audience attending the same VR concerts. Results are demonstrated in Table 36 below.

Table 36. Scores on the awareness of the audience during VR concerts.

<u>Median (Mdn)</u>	<u>Not aware (score 1-3)</u>	<u>Very aware (score 5-7)</u>
5	34%	54%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

VR concerts as social events

When asked if respondents thought of VR concerts as rather a lonely (i.e., solitary) or social event, less than half indicated them as social (see Table 37).

Table 37. Scores on VR concerts as rather lonely or social events.

<u>Median (Mdn)</u>	<u>Rather lonely (score 1-3)</u>	<u>Rather social (score 5-7)</u>
5	30%	45%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

In the open question, 67 respondents clarified their answer why they think VR concerts are social or lonely. Those who indicated they thought of the concerts as very social mostly did so because the people in the audience are real (18%) and you can interact with them (10%). Those who indicated VR concerts as lonely, did so because there was no interaction needed or possible (15%) or because of the simple fact one was attending the event alone (10%). Some examples, the first as testimony for VR concerts as social events, the second for VR concerts as lonely events:

Other people are there live (participant 41).

You'll still be watching alone (participant 66).

Invite others

Respondents were asked if they invited other people to watch the VR concert together. This could be online as well as in 'real' life. Table 38 on the next page displays an equally divided score of people who never invited others and those who always invited others.

Table 38. Scores on inviting others to watch VR concerts together.

<u>Median (Mdn)</u>	<u>Never (score 1-3)</u>	<u>Always (score 5-7)</u>
4	45%	45%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

58 respondents clarified why they did or did not invite others. Reasons to invite others were mostly sharing the experience (22%) and because it was more fun (10%). Other people not owning the right equipment such as VR headsets (18%) and respondents who had no need for inviting others (18%) were the most frequently given reasons to not invite others.

Connection with audience: importance and experience

As with the artists, respondents were also asked about the connection with the audience during the VR concerts they attended (importance and times experienced). Table 39 shows that the scores on the importance are close to each other. However, more respondents never experienced a connection with the audience during the concerts than those who always experienced one, as shown in Table 40.

Table 39. Scores on importance of a connection with the audience during VR concerts.

<u>Median (Mdn)</u>	<u>Not important (score 1-3)</u>	<u>Very important (score 5-7)</u>
4	43%	42%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Table 40. Scores on experienced connection with the audience during VR concerts.

<u>Median (Mdn)</u>	<u>Never (score 1-3)</u>	<u>Always (score 5-7)</u>
4	46%	39%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

According to the given responses ($N=57$) on the open-ended question, this connection expressed itself mostly in talking (39%) and dancing (26%) with other people in the audience. Next quote explains such an experienced connection:

You can jump with others and dance. I know it's not real life but it brings me joy to see it. There's is a certain humor to it as well (participant 22)

Sharing emotions with the audience

Table 41 displays the extent to which respondents agreed with the statement they had a feeling of sharing emotions with the audience during the VR concerts they attended.

Table 41. Scores on sharing emotions with the audience during VR concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
4	43%	39%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Interaction with audience

As regards interaction with other people, half of the respondents stated they never interacted with the audience during a VR concert (see Table 42). 30% of them even explicitly stated they never did so (score 1).

Table 42. Scores on committed interaction with the audience during VR concerts.

<u>Median (Mdn)</u>	<u>Never (score 1-3)</u>	<u>Always (score 5-7)</u>
4	50%	38%

Note. Median and relative frequencies ($N=74$) of the scores (7-point Likert scales) are given. The neutral scores (4) are excluded from the overview.

Most of the respondents ($N=72$) explained why they did or did not interact with others during a concert. Those who interacted, did it mostly because it was more fun (15%) and to share the experience (13%). Those who did not interact said they had no need for it (14%) or they thought the music was more important than interaction (18%). Following are two quotes that illustrate both sides. The first one comes from a participant that likes to interact, the second one from a participant that doesn't interact:

Because the fact that a concert is more than just music, otherwise I just listen to a recording (participant 64).

It takes me out of my concentration. At a live concert, I enjoy myself in the moment without a phone or internet. I try to do that at home too (participant 68).

Additional tests on virtual togetherness

A Wilcoxon Ranked Sum Test was conducted to check potential differences between respondents who used a VR headset and those who did not (see Table 43 below).

Table 43. Effect of using a VR headset on experienced virtual togetherness.

	<u>No headset: Mdn, SD</u>	<u>Headset: Mdn, SD</u>	<u>Wilcoxon W</u>
Awareness of the audience	-	-	W = 801 (p = .117)
Invite others	-	-	W = 591.5 (p = .446)
Interact with audience	-	-	W = 783.5 (p = .167)
VR concerts as social event	Mdn = 4 SD = 1.592	Mdn = 5 SD = 1.736	W = 846 (p = .038)
Connection audience: importance	-	-	W = 698.5 (p = .672)
Connection audience: experienced	-	-	W = 795.5 (p = .132)
Connection artists: importance	-	-	W = 660 (p = 1)
Connection artists: experienced	Mdn = 4 SD = 1.884	Mdn = 5 SD = 1.670	W = 839.5 (p = .045)
Share emotions with the audience	Mdn = 3 SD = 1.882	Mdn = 4.5 SD = 2.066	W = 841 (p = .044)
Share experience with artists	Mdn = 4 SD = 1.938	Mdn = 6 SD = 1.785	W = 868 (p = .021)

Note. Median scores (7-point likert scales) and standard deviation of both groups, and results of Wilcoxon Ranked Sum Test are provided.

A Kruskal-Wallis test only demonstrated a significant difference between respondents based on their frequency of attending concerts before the COVID-19 pandemic as regards the importance of feeling connected with the artists, $H(4) = 12.426, p = .014$. However, when performing post-hoc analysis using Wilcoxon Ranked Sum Test with Bonferroni adjusted alpha value of .005, no significant results were found that drive this effect.

A Spearman correlation test discloses that the importance attached to feeling a connection with the artist(s) is positively correlated to the feeling of missing physical concerts, $r_s = .26, p = .027$.

4.7 The future of VR concerts

The survey concluded with four questions probing the prospects for VR concerts. Figure 10 displays the scores given for every question.

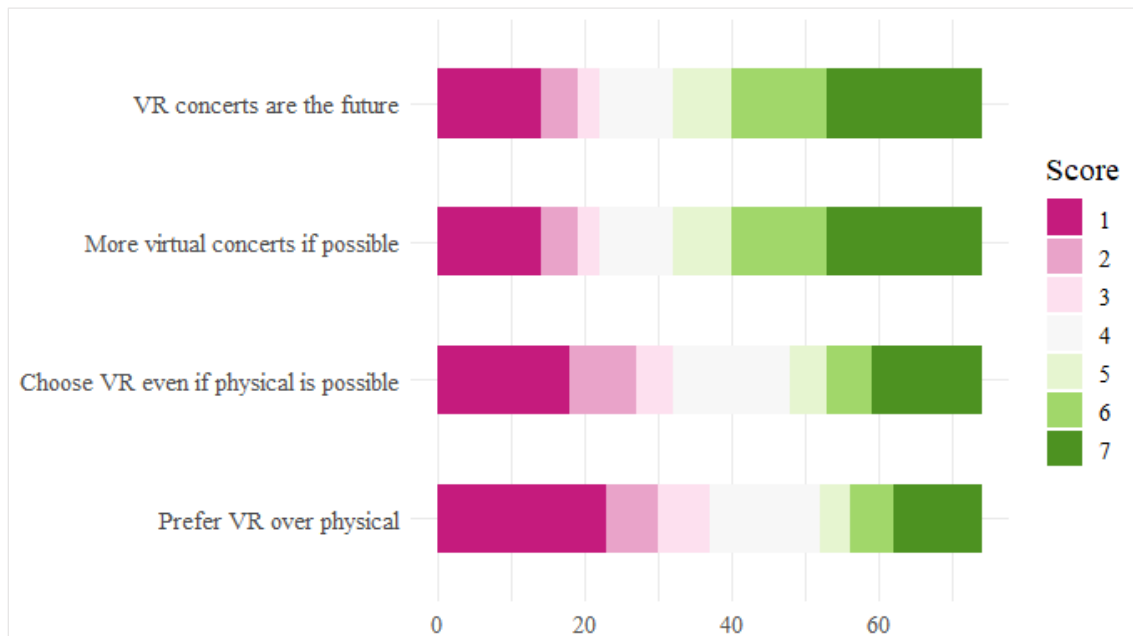


Figure 10. Scores on the future of VR concerts (7-point Likert scale, ranging from 1 = 'strongly disagree/not at all/...' to 7 = 'strongly agree/very much/...'). Horizontal axis expresses the total responses in absolute frequencies ($N = 74$).

VR concerts are the future

The statement "VR concerts are the future of the music scene" was agreed upon by 70% of the respondents (see Table 44 below). 37% of them even strongly agreed (score 7).

Table 44. Scores on VR concerts as future of the music scene.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
6	22%	70%

Note. Median and relative frequencies ($N=74$) of the scores (7-point likert scales) are given. The neutral scores (4) are excluded from the overview.

More VR concerts if possible

Because VR concerts are still very rare, we asked the participants if they would attend more VR concerts if possible. More than half of the respondents indicated they would attend more VR concerts, with 28% who totally agreed with this statement (score 7). Results can be found in Table 45 on the next page.

Table 45. Scores on attending more VR concerts if possible.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
5	22%	57%

Note. Median and relative frequencies ($N=74$) of the scores (7-point likert scales) are given. The neutral scores (4) are excluded from the overview.

Choose VR concerts even if physical concerts are possible

Table 46 tells that when an artist would give a VR concert as well as physical concerts, 43% of the respondents would not chose the VR concert over the physical one, with 24% of them who would totally not (score 1). Of the respondents who would chose VR concerts over physical ones (35%), 20% of them strongly agreed with this statement (score 7).

Table 46. Scores on choosing VR concerts even if physical concerts are possible.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
4	43%	35%

Note. Median and relative frequencies ($N=74$) of the scores (7-point likert scales) are given. The neutral scores (4) are excluded from the overview.

Prefer VR concerts

On the question if they preferred VR concerts over physical concerts (see Table 47), half of the respondents does not, with 31% who totally doesn't (score 1).

Table 47. Scores on preference of VR concerts over physical concerts.

<u>Median (Mdn)</u>	<u>Disagree (score 1-3)</u>	<u>Agree (score 5-7)</u>
3.5	50%	31%

Note. Median and relative frequencies ($N=74$) of the scores (7-point likert scales) are given. The neutral scores (4) are excluded from the overview.

Additional tests on the estimation of the future of VR concerts

Wilcoxon Ranked Sum Test was used to explore potential differences between respondents who used VR headsets to watch the VR concerts and those who did not (see Table 48, next page).

Table 48. *Effects of using a VR headset on estimations about the future of VR concerts.*

	<u>No headset: Mdn, SD</u>	<u>Headset: Mdn, SD</u>	<u>Wilcoxon W</u>
Attend more VR concerts if possible	Mdn = 2.5 SD = 2.135	Mdn = 6 SD = 1.823	W = 1050.5 (p = < .001)
Prefer VR concerts over physical concerts	Mdn = 1 SD = 1.906	Mdn = 4 SD = 2.011	W = 1037.5 (p = < .001)
Choose VR concerts even if physical concerts are possible	Mdn = 1 SD = 1.868	Mdn = 4.5 SD = 1.954	W = 1067 (p = < .001)
VR is the future of the music scene	-	-	W = 825.5 (p = .060)

Note. Median scores (7-point likert scales) and standard deviation of both groups, and results of Wilcoxon Ranked Sum Test are provided.

Additionally, we checked for differences between respondents based on the frequency of attending physical concerts before the COVID-19 pandemic, using Kruskal Wallis test. A significant effect was revealed for every question (see Table 49 below). Subsequently, a Wilcoxon Ranked Sum Test with Bonferroni adjusted alpha level of .005 was performed, revealing the results driving this effect (Table 50, next page).

Table 49. *Effects of frequency of physical concert attendance on estimations about the future of VR concerts (Kruskal Wallis).*

	<u>Effect of frequency of attending physical concerts before covid (Kruskal H)</u>
Attend more VR concerts if possible	H(4) = 19.648 (p = < .001)
Prefer VR over physical concerts	H(4) = 18.39 (p = .001)
Choose VR concerts if both is possible	H(4) = 16.14 (p = .003)
VR concerts are the future	H(4) = 23.032 (p = < .001)

Note. Median scores (7-point likert scales) and standard deviation of both groups, and results of Kruskal Wallis test are provided.

Table 50. Effects of frequency of physical concert attendance on estimations about the future of VR concerts (Wilcoxon Ranked Sum Test).

<u>Effect of frequency of attending physical concerts before covid</u> <u>(Wilcoxon W)</u>	
Attend more VR concerts if possible	Those who never went to physical concerts before the pandemic scored significantly higher ($Mdn = 6.5$, $SD = 1.247$) than those who went once or twice a month ($Mdn = 3$, $SD = 2.015$), $W = 149$, $p = .001$.
Prefer VR over physical concerts	Those who never went to physical concerts before the pandemic scored significantly higher ($Mdn = 5$, $SD = 1.506$) than those who went once or twice a month ($Mdn = 2$, $SD = 1.458$), $W = 159.5$, $p < .001$.
Choose VR concerts if both is possible	Those who never went to physical concerts before the pandemic scored significantly higher ($Mdn = 4.5$, $SD = 1.700$) than those who went once or twice a month ($Mdn = 2$, $SD = 1.841$), $W = 145$, $p = .002$.
VR concerts are the future	Those who went less than once a month to physical concerts before the pandemic scored significantly higher ($Mdn = 7$, $SD = 1.733$) than those who went once or twice a month ($Mdn = 4$, $SD = 2.00$), $W = 616$, $p < .001$.

Note. Median scores (7-point likert scales) and standard deviation of both groups, and results of Wilcoxon Ranked Sum Test with Bonferri adjusted alpha level of .005 test are provided.

Lastly, Spearman correlation test was applied to check for possible correlations between the estimations on the future of VR and the feeling of missing physical concerts. Results can be found in Table 51 below.

Table 51. Correlation between missing physical concerts and estimations about the future of VR concerts.

<u>Missing physical concerts (Spearman's Rho)</u>	
Attend more VR concerts if possible	$r_s = -.577$ ($p < .001$)
Prefer VR over physical concerts	$r_s = -.676$ ($p < .001$)
Choose VR concerts if both is possible	$r_s = -.598$ ($p < .001$)
VR concerts are the future	$r_s = -.241$ ($p = .039$)

Note. Median scores (7-point likert scales) and standard deviation of both groups, and results of the Spearman correlation test are provided.

5. STUDY I: DISCUSSION

The main aim of Study I was to gain insight in how VR concerts are experienced by the audience. This knowledge should help organizers and developers to enhance the experience of this rapidly emerging virtual concert space. An online survey was distributed, with questions concerning four themes: motivations to attend VR concerts, the (dis)advantages of VR concerts, experienced sense of presence and virtual togetherness, and estimations on the future of VR as concert space. Because this study is one of the first that focusses on different experiential aspects and future visions on VR concerts, it can provide new findings in research on both VR and concert experience. An encouragement for further research on the experience of VR concerts is also aimed.

The following section provides a deeper understanding, contextualization and interpretation of the most striking results. Furthermore, hypotheses stated in Chapter 2 (Objectives) are reviewed. To keep a good overview, the same structure as used in the reporting of the results is maintained. The discussion concludes with the benefits and limitations of this study, and implications for future research.

5.1 The audience experience of VR concerts

5.1.1 *Motivations to attend VR concerts*

sRQ1. Hypothesis 1. The categories of experience and engagement will be the main motivators to attend VR concerts, as with physical concerts.

Although the motivational categories used by Brown and Knox (2017) were adapted to a virtual context for this study, respondents still attached the most importance to experiential aspects of (virtual) concert-going. Thus, these findings partially confirm our first hypothesis.

Almost every respondent indicated the artists as main reason to attend a VR concert, confirming Swarbrick et al., (2021) that ‘liking the artist’ is an important attendance motivation and, consequently, predictor of ticket purchase. It also correlates to the concept of *hero worship* (Breese, 2020; Earl, 2001; Kulczynski et al., 2016; Mulder & Hitters, 2021) that motivates to attend music concerts. Even though concertgoers in VR cannot see the artists in real life or touch them, the desire to attend a performance of them instead of just listening to records is still prevalent. This finding also correlates to the opinion that fandom is an active process, not a passive one (Derbaix & Korchia, 2019). The motivation to be part of something unique was recognized by a large part of the respondents; a tendency already suggested by Charron (2017), who stated that uniqueness is a central component to “the experiential nature of concert-going” (p.3), regardless of whether the concert is live or mediated. As for the visual

effects, one would assume that these are deemed more important as motivator for people who own immersive VR headsets, since they display virtual worlds more vividly (Gandolfi, 2018; Kahani & Beadle, 1997; Steuer, 1992; Zhao et al., 2020). However, no significant difference with people using low immersive VR (i.e., 2D displays) was found. This may reflect that all attendants, regardless of the technology they use, expect or desire visual spectacle during the VR concert. Referring to the study of Verhagen et al. (2012), this desire can be explained by attractive visuals in the virtual world attributing to the entertainment of its users.

Surprisingly, the category of engagement finishes last, with a striking distinction between engagement with the artists and engagement with the audience. All motivations of togetherness or sharing an experience referring to the audience scored significantly lower than those referring to the artists. This result not only contradicts our first hypothesis, based on the idea that people would reach out for every possibility to meet other people in these covid-times. It is also in strong contrast to studies on motivations for physical concert attendance that illuminate social motives as one of the most important reasons to go to concerts (Brown & Knox; Charron, 2017; Dearn & Price, 2016; Earl, 2001; Mulder & Hitters, 2021; Pitts, 2014; Tarumi et al., 2017). Even studies on motivations to participate in virtual worlds in general (Albuquerque & Velho, 2002; Eisenbeiss et al., 2012; Hassouneh & Brengman, 2014; Zhou et al., 2011) come to this conclusion. Consequently, this finding in our research cannot be directly explained by previous studies on both concert attendance and VR.

Clearly, the motive of meeting like-minded people (Brown & Knox, 2017; Charron, 2017; Kulczynski et al., 2016; Pitts, 2014) and bonding with them fades at VR concerts. The lack of motivation to feel a togetherness with the audience could potentially be explained by the remoteness of VR concerts that may cause the impression that it is simply not possible to experience a satisfying social engagement with others you cannot see or hear (Vandenberg et al., 2021). Another possible explanation is given by the survey data of this research itself; when asked if respondents interacted with other people in the audience during the concert, half of them stated they never did. This creates the impression that attendants of VR concerts do not feel or have the same social desires as physical concert audiences, providing some interesting insights that require further investigation. Nevertheless, it was demonstrated that people using immersive VR technology thought of 'sharing the experience with others' as more important motivator than people using regular desktop or TV screens. This could hint that a higher degree of immersion enhances a greater social experience. However, the significance of this effect needs to be interpreted with caution since it's rather weak ($p = .032$).

sRQ1. Hypothesis 2. The category of practical will gain importance as motivator for VR concerts, compared to physical concerts.

Results support the second hypothesis considering the category of practical motivators (i.e., stay home and price) that was indicated as second most important. It may be very tempting and welcoming that VR concerts can be watched from home. Long travel times and additional costs are no longer needed; some of the main disadvantages of physical concert attendance described by Earl (2001).

Staying home as motivator specifically caused big differences between respondents based on their frequency of attending physical concerts before the corona pandemic. Those who never went to physical concerts found it more important that they could stay at home. Possible reasons why respondents never attended concerts can be a shortage of time, living in remote places, or maybe just not enough interest in music to make big efforts. Whatever reason, in most of the cases it can easily be solved by the fact one can stay home to watch the concert. On the opposite, results insinuate that frequent concertgoers (i.e., once or twice a month) before the pandemic already had the habit to attend physical concerts and do not mind traveling to concert venues. This is echoed in the study of Brown and Knox (2017) where practical reasons were the least prominent of all motivations to attend physical concerts. Some respondents also admitted they only attended VR concerts because physical concerts were not possible. In other words, they did not actively choose to stay at their houses. This, in turn, may be a possible explanation why people who really miss physical concerts do not value the ‘stay home motivation’ that much.

As concerns ticket price, an overall increase for physical concerts tickets during the last decades is noted, creating possible barriers for some people (Holt, 2010; Pitts, 2014). Considering VR concerts with generally cheaper tickets, the decision whether or not to attend the concert is possibly made easier for people with limited financial resources. Also people using VR headsets are more motivated by cheaper ticket prices, although the significance of this effect is not very high ($p = .017$). A possible explanation for this is that these respondents already made a big financial commitment by purchasing the VR equipment and therefore attach more importance to lower ticket prices than people who just use their computer or TV. Moreover, Swarbrick et al. (2021) report in their study that people who attended more physical concerts before the corona pandemic found it less of a problem to pay for tickets for virtual concerts. In our study, a similar trend was detected, however, no significance ($p = .053$) was obtained.

Generally, the facts that you can stay home and that concerts are financially more accessible, may facilitate impulsive purchases on the one hand. Even five minutes before the concerts starts, you can buy tickets, so to speak. On the other hand, financial and emotional risks of concert attendance (Pitts,

2014) are diminished; disappointment caused by expensive tickets, bad acoustics of the concert venue, or uncomfortable seats is eliminated in the virtual world. So, a “clear decision-making strategy” that considers possible risks and aspects such as time and travel costs is no longer needed if one wants to attend a concert in VR; the exact opposite of what Brown and Knox (2017) write about physical concert attendance (p.242).

5.1.2 (Dis)advantages of VR concerts

sRQ2. Hypothesis 1. The advantages of VR concerts will be assigned to practical aspects such as location and price.

Current study reveals the accessibility of VR concerts as greatest advantage of the virtual concert space, confirming the first hypothesis of our second sub-research question. The lack of geographical and temporal boundaries, lower ticket prices and unlimited tickets expands the opportunities to appeal new target audiences that would not be able to participate otherwise (Decesare & Wang, n.d.; Vergauwen, 2021; Mileva, 2019). Notable comments were given concerning accessibility in relation to people with disabilities. VR allows people with physical or mental disabilities to attend concerts in full comfort and confidence. Definitely, VR contributes to the inclusiveness of concerts. The use of VR in the context of disabilities was already noticed by other studies who illuminated its suitability for social skills training (Parsons et al., 2006), its facilitated inclusivity (Cassidy, 2008), and its access to activities that are impossible in real life for people with disabilities (Stendal et al., 2011). However, as for accessibility, the main threshold remains the technology. With prices starting from €300 (c. \$255), VR headsets are not extremely expensive but still not appealing to the wider public. Technology must be user-friendly also; possible actions and controls need to be clearly explained by developers and/or organizers, so every person can handle it properly and perform all desired actions.

Another main advantage of VR concerts over physical concerts is the view. It is often the case with physical concerts that the view is disturbed by other attendants (Auslander, 2008a; Earl, 2001), something that completely disappears in VR. Moreover, when organizing a concert in VR, multiple camera angles can be applied (e.g., from the stage next to the artist, from backstage), giving the audience the opportunity for new experiences (Sing, 2020). One may also choose to display the artists in close-up, enhancing the feeling of standing front-row and the artists singing and speaking directly to the attendant. This camera feature could make the experience more intimate in different ways: [1] spatially by evoking closeness to the audience, [2] temporally by evoking immediacy, [3] and socially by the impression that artists are directly addressing to the audience (Berryman & Kavka, 2017).

Furthermore, additional analyses illustrate two influencing factors on the assessment of VR concerts' advantages: technology and the feeling of missing physical concerts. First, evidence is found that the more people miss attending physical concerts, the more they think negatively about possible advantages of the new concert space. Second, respondents who used immersive VR technology are more convinced about the possibilities and advantages of virtual worlds than people who experienced the virtual world through a desktop screen. However, VR headsets do not ensure that VR concerts give the same fulfilment as physical concerts. An explanation for this is not asked at our respondents, but could definitely be interesting for further research.

sRQ2. Hypothesis 2. The disadvantages of VR concerts will especially include the lack of direct social contact.

During VR concerts, the audience mostly missed the social experience of concertgoing (i.e., 50% of the answers). This result is in line with our hypothesis and Tarumi et al. (2017) who found that remote audiences of a performance lacked a sense of unity. Moreover, almost half of the respondents stated it was harder to connect with others during VR concerts compared to physical concerts. Audiences express their shared experience and enjoyment through joint activities such as singing, clapping and dancing, which in turn creates a bond (Dearn & Price, 2016; Earl, 2001; Schultze & Brooks, 2019; Tarumi et al., 2017). As already stated, not seeing, hearing or feeling other people in the audience can make it a lot harder to obtain this connection or togetherness (Albuquerque & Velho, 2002; Vandenberg et al., 2021).

However, questions can be asked about the contradicting result that social motivations (i.e., category of engagement) scored the lowest of all motivators but that the respondents missed the social experience nevertheless. In previous paragraphs of this discussion, it was suggested that VR audiences do not feel the same urges to connect with other people as audiences of physical concerts do, since they attach little value to these motivations. Although, the indicated absence of the social experience seems to counter this reasoning. From these results, it is clear that even if it is not a direct reason to attend VR concerts, audiences still value interaction possibilities and the visibility of other people (e.g., through avatars) that both raise social awareness (Scarborough & Bailenson, 2014). Therefore, reasonable efforts should be made by developers to enhance this social experience. It may as well be important that artists interact and connect with their audience as much as possible during the concert, for example by talking to them with their real voice.

Besides the social experience, much attention was paid to the lack of physically experiencing the concert. In contrast to physical concerts, not all senses of the audience are stimulated during VR

concerts. Although one can hear and see the performance, respondents mentioned the absence of other stimuli, e.g., you cannot smell the beer or other people, no one is bumping into you, the heat and excitement does not make you sweat, you cannot feel the bass vibrating in your body etc. Specifically the lack of smelling the experience was already noted in another study about the missed aspects in the virtual concert experience (Linder, 2017). Furthermore, all these earlier mentioned things that are missed confirm previous studies that revealed uncomfortable elements in themselves as essential for the concert experience (Earl, 2001; Holt, 2010; Kronenburg, 2014). Of course, it is hard to mimic these stimuli in VR, especially in low immersive VR. However, developers of immersive VR experiences should attempt to include tactile feedback, for example vibrating controllers when an avatar bumps into the user's avatar.

5.1.3 Sense of presence and virtual togetherness

sRQ3. Hypothesis. The experiences of sense of presence and virtual togetherness will strongly depend on the technology used by the audience to watch VR concerts.

Sense of presence

Since more than half of the respondents gave high scores (i.e., 5-7) on almost all questions concerning sense of presence, we may conclude that VR concerts succeed in generating a feeling of being present in the virtual concert space.

Questions with the highest scores relate to involvement, implying that audiences were very concentrated during VR concerts, and that the virtual world and artists could keep their attention. Nevertheless, attendants did not completely forget their real environment even though their concentration level was high. Disturbing factors in the real world, technical issues or consequences of the VR headset (i.e., motion sickness, tactile discomfort) prevented them from being fully present in the virtual world. These elements are already nominated as disruptive by previous studies (Albuquerque & Velho, 2002; Coehlo et al., 2012; Witmer & Singer, 1998). The apparent contradiction between full concentration but not forgetting the real environment can be refined by the finding of Witmer and Singer (1998), who state that involvement in the virtual world doesn't require a "total displacement of attention from the physical locale" (p.227).

The lowest scoring component of sense of presence is judgement of realness, with an interesting gap between the importance attached to VR concerts being realistic and VR concerts experienced as realistic, both in comparison to physical concerts. From the results, we may conclude that many people think it is important that the virtual concert space is realistic, meaning credible and accurate. However,

VR concerts apparently did not always meet these expectations around realness; whereas artists were deemed the most realistic aspect, the environments were least realistic. This suggests that there was less perceptual realism than social realism, as conceptualized by McMahan (2003). Although previous studies determine judgement of realness as an important component of sense of presence (Cummings & Bailenson, 2016; McMahan, 2003; Sherman & Craig, 2019; Schubert et al., 1999), another study on sense of presence in virtual concert spaces (Linder, 2017) stated that a lower level of realness does not have major negative influences on the experienced sense of presence. This may also be the case in this study, since about all other questions on presence were answered positively. As organizer or developer, however, you can try to meet the realness expectations by opting for existing concert venues rebuilt in VR, or paying extra attention to logical consistency that plays a major part in the judgement of realness (Cummings & Bailenson, 2016; Witmer & Singer, 1998).

Overall, results demonstrate that the used technology influences the extent to which respondents feel present in the virtual world. This is in line with our hypothesis. Based on this study, we can say that people who use immersive VR technology generally experienced more spatial presence and involvement. These results correspond to other studies who found that immersive VR generates more sense of presence than low immersive VR, during music performances (Linder, 2017; Onderdijk et al., 2021), as well as in other contexts (Chirico et al., 2017; Oh et al., 2019). Effects of technology on the judgement of realness are proven, however, the significance is not as strong as with spatial presence and involvement ($p = .034$). That virtual concert spaces are not found to be as realistic as physical concert spaces, both by immersive VR users and low immersive VR users, is also noticed by Linder (2017).

Virtual togetherness

Compared to sense of presence, the scores on questions concerning virtual togetherness tell that this feeling was less experienced during VR concerts. Furthermore, there is a great contrast between feelings of virtual togetherness with the artist compared to the audience. That same discrepancy occurred with the findings of social motivations (i.e., engagement) to attend VR concerts.

Taken into account that almost every respondent was motivated by the artists and the feeling of a togetherness with them, it is not surprising that many attached importance to experiencing a connection with artists during the concert. A previous study explained that fans will make big efforts to establish closer relations with their musical idols (Derbaix & Korchia, 2019), and that concerts are crucial to shape such a fan-artist relationship (Brown & Knox, 2017). Thus, it is most likely that audiences obtain greater fulfilment when they get the feeling of being noticed by the artists. Based on this study, we may conclude this same intention for VR concerts as well. Furthermore, it is proven that the more respondents missed physical concert attendance, the more importance they attached to the feeling of being connected

with the artist. This confirms their desire to sustain the fan-artist relation by other means while physical concerts are not possible.

However, as with questions concerning judgement of realness, more respondents expressed the importance of a connection with the artists than those who actually experienced it during VR concerts. This means that developers should provide enough interaction possibilities for audience and artist, even if the VR concert is prerecorded (e.g., artist avatars responding to the audience's feedback). Also artists can enhance this connection by addressing the audience, playing with the camera and activating the audience (e.g., let them perform certain dance moves).

Virtual togetherness with the audience scored surprisingly low. Considerably more respondents never felt like being connected or sharing emotions with others during VR concerts. This is in contrast to other studies showing that shared virtual experiences enhance togetherness (Miller, 2020; Swarbrick et al., 2021; Vandenberg et al., 2021), however these studies were related to livestream concerts instead of concerts in VR. Of course, we need to take into account that for this study, the interaction opportunities of the attended VR concerts are unknown. If attendees could not chat, talk or dance (i.e., joint activities) (Schultze & Brooks, 2019) with each other, it is indeed harder to obtain a feeling of virtual togetherness. Despite most did not experience a feeling of togetherness, respondents were generally aware of the other people sharing the virtual concert space with them. This was most likely due to the use of avatars as virtual representation and embodiment of the users (Schultze & Brooks, 2019).

Maybe more striking is the finding that half of the respondents never interacted with the audience in the virtual concert space. A possible reason can be found in the motivations to attend VR concerts. Respondents showed little interest in a togetherness with the audience as motivator, making it more likely that they made less efforts to obtain this. This reasoning is supported by a recent study that the experience of social connectedness is positively correlated to the motivation and desire of feeling connected with others (Swarbrick et al., 2021). Additionally, a study on different types of fandom in the context of pop music icons reveals that not all fans are interested in interaction with other fans; mostly the artist or music are deemed more important to them (Derbaix & Korchia, 2019). This finding is confirmed by comments of our respondents stating they do not need interaction since the main reason for their attendance was the music. It is possible that attendees want to obtain a fully immersive experience and think that social interactions are disturbing this goal. This thought is already suggested in a recent study on the relation between interaction and immersion (Hudsen et al., 2019), demonstrating that more immersion can be achieved with a lower degree of social interaction, implying that VR users need to choose between a personal, immersive experience or a social experience. However, a striking contradiction with the social importance of physical concert attendance remains. Therefore, a deeper

insight in the social connection and motivations of VR concerts compared to physical concerts provided by further research is needed to explain this salient result.

Unlike sense of presence, the use of VR headsets did not give many beneficial effects on the experience of virtual togetherness. Results suggest that immersive technology enhances the feeling of sharing experiences and emotions with artists and audiences, however, the detected effects are weakly significant ($p = .021 - .045$). It implies that the degree of immersion doesn't contribute that much to the feeling of a virtual togetherness. This finding is in line with previous studies that demonstrated how an increased level of immersion does not affect virtual togetherness (Buru, 2012; Oh et al., 2019). It suggests that technology is not the most important mean to evoke this experience; much depends on the personal motivations and possibilities of social interaction.

5.1.4 The future of VR concerts

sRQ4. Hypothesis 1. VR concerts will be deemed an integral part of the future music scene.

sRQ4. Hypothesis 2. Although the increasing popularity of VR concerts, people will still choose physical concerts over virtual ones.

The majority of respondents were convinced that VR concerts will be an integral part of the future concert scene, and indicated they would attend more VR concerts if that would be possible. Our first hypothesis on this matter is thus confirmed. These results reflect the interest and openness of music fans to the new, virtual concert space. Despite this interest, most still opted convincingly for the familiar way of concertgoing where they can be present in a physical venue. This finding is in line with our second hypothesis. However, additional tests on the possible influencing factors (i.e., technology, concert behavior before corona, missing of concerts) show that both hypotheses, and accompanying results confirming them, need to be interpreted with caution.

Firstly, outcomes of the tests demonstrate that people with a higher frequency of attending physical concerts before the pandemic and who experience the feeling of missing those concerts were less or not convinced about the future potentials and desired attendance of VR concerts. Additionally, respondents who used low immersive VR (e.g., desktop screen) were not motivated to attend more VR concerts if possible. No significant effect of technology on the opinion that 'VR concerts are the future' was found, suggesting that everyone was convinced about the future potentials of the new concert space. However, the p-value ($p = .060$) indicates there's a trend towards immersive VR users being more convinced about this matter.

Secondly, and in the same line with the above paragraph, much depends on the used technology and concert behavior before the pandemic. People who used VR headsets were more in doubt about their preference of physical or virtual concerts, with results suggesting that they are more likely to attend the VR concerts even if the artist would perform ‘physically’ as well. Furthermore, it was demonstrated that people who never went to physical concerts before the pandemic do prefer VR concerts over physical concerts.

Despite the fact that the hypotheses were confirmed by the overall results of the study, the two nuances specified above demonstrate that much depends on additional factors such as technology and regular physical concertgoing. The influence of technology on the estimations about the future and preference of VR concerts is most likely to be explained by the key role of immersion in the experience. As suggested in other studies (Gandolfi, 2018; Kahani & Beadle, 1997; Zhao et al., 2020), higher levels of immersion enhance more intense experiences. People who did not yet experience immersion may have a harder time estimating what it can trigger. The influence of pre-corona concert behavior (i.e., frequency of physical concert attendance) and the feeling of missing physical concerts refer to the liveness debate. Live performances are regarded as more valuable and authentic than mediated performances (Auslander, 2008a,b; Dixon, 2007). As explained in the section on the disadvantages of VR concerts, the social and physical experience cannot be replicated in the virtual concerts space. For many people, this is an inherent part of concertgoing, resulting in the preference for physical concerts, despite all other advantages and possibilities VR concerts have.

5.2 Limitations and future research

The findings of this study have to be seen in light of some limitations.

First and foremost, the survey reached a small amount of respondents. Despite an intensive distribution of the form through various platforms, just 78 people filled it out. This could be due to two things. [1] Because not much is known about the subject of audience experience yet, a rich and comprehensive survey for this research was deemed as best option to collect as much information as possible to start with. The amount of questions may have put people off, resulting in unfinished forms. [2] VR concerts are not very common yet. Moreover, when talking about VR, many think about the immersive VR technology requiring VR headsets and controllers, and automatically exclude the low immersive VR, through regular desktop or TV screens, which more people are familiar with. The possibility exists that people thought they were not suitable respondents for this survey study because they did not use VR headsets. This lower response grade could be countered by future research in different ways; [1] by reducing the amount of questions and choosing specific topics in order to keep the respondents motivated while filling out the form; [2] by focusing on either immersive or low

immersive VR; [3] or by linking the survey to one specific VR concert so all attendees of that concert know they can easily answer the survey.

Second, as for the effects of used technology on the experience of VR concerts, this study only focused on the different types of screens. Audio was left out, on the one hand to somewhere delineate the research focus, and on the other hand because the audio quality was self-assessed by the respondents, which makes it difficult to make generalizations. Previous studies already revealed the influence and importance of audio in virtual reality experiences (Linder, 2017; Melnick, 2020; Narbutt et al., 2018; Yao, 2017) and regular livestream concert experiences (Onderdijk et al., 2021). Additionally, our respondents hinted at the importance of audio for their VR concert experience. So, it could definitely be interesting for future research to focus more on this technical aspect.

Third, the gathered data provides a solid basis for further research, but is still rather broad and unspecific. Respondents could fill out the form based on every VR concert experience they had, meaning we do not know what the conditions of those concerts were (e.g., avatars or not, interaction possibilities or not etc.). It is recommended for future research to revalidate the findings of these study through specific experiments targeting and manipulating the different experiential aspects, especially regarding sense of presence and virtual togetherness. Also physiological reactions (e.g., sweating, heartbeat, eye-tracking) to VR concerts could be taken into account, or even be compared to the physiological reactions of physical concert attendants.

Despite these limitations, this study revealed an interesting result concerning the social motivations and experience (i.e., engagement) of VR concerts attendants. It is strongly recommended for future research to dig deeper into this apparently disinterest to engage with other people in the audience, contradicted by the indicated social experience being missed nevertheless. Possible reasons could be examined, as well as an explanation why this differs so much from the physical concert attendance in which engagement is a very strong element in the concertgoing experience.

Overall we may conclude that this study is a first step into the understanding of the audience experience of VR concerts, providing insights to build further research on.

6. STUDY II: METHOD

6.1 Data collection

An interview with the founder of *Soundstorm*, a Belgian company developing in-game concerts, was conducted to provide the findings of Study I (i.e., audience experience of VR concerts) with an extra voice. This way, similarities or contradictions with, or additions to the opinions of the attendants could be revealed.

The interview was conducted on the 22nd of June, 2021. Because of the corona measures that were still in order at that time, the interview took place via Microsoft Teams. It lasted around one hour and was conducted in Dutch, the mother tongue of both the researcher and interviewee. The conversation was recorded, with the approval of the interviewee. The link to the recording can be found in Appendix III.

6.2 Design

Qualitative data was gathered through a semi-structured interview. This type of interview was deemed the best because it gives the interviewee more freedom, the researcher can go deeper into some topics mentioned by the interviewee, but it is still possible to return to the most important themes that were determined by the researcher before the interview. A list with those determined themes and more specific questions to ask, can be found in Appendix III. This list is partly based on the findings revealed in Study I, for instance by asking the developer's opinion on the comments of the audience, providing a bridge between the two study methods in this research.

The overall goals of the interview can be expressed in three questions, which were also used as starting points for the discussion part. The first goal was independent from Study I and focused completely on the developer's side of VR concerts; the second and third goal were connected to Study II, and withheld opinions about the findings of the survey study and comparisons with the survey study. The three main questions (i.e., goals) were:

- Q1.* What is the artistic vision of the developer?
- Q2.* How does he try to enhance the audience experience?
- Q3.* What is his estimation on the future of his discipline?

6.3 Data analysis

Because of the limited scope of this research, the amount of interviews was limited to just one. The purpose was to add an extra voice to the findings of Study I concerning the audience experience of VR concerts, which still remained the main focus of this research. Results were processed quantitatively, without coding. Since the interview was conducted in Dutch, it was chosen not to fully transcribe and translate the interview to English to avoid mistakes or misinterpretations due to translation.

7. STUDY II: RESULTS

The founding of Soundstorm

Soundstorm brings the live concert experience to your living room. In our slightly crazy concert venues, you can watch the livestream of your favorite artists on a virtual stage (RL Inventive, 2021).

The above quote originates from the front page of the website of *Soundstorm*, a Belgian company developing virtual worlds for in-game concerts and e-sports (i.e., electronic sports, competitive gaming) events. The company was founded in the springtime of 2020 by Reinhart de Lille, our interviewee. He has a background as Chief Technological Officer (CTO) in IT strategy and architecture, and is active as Business Angel (i.e., investor of time and money) in gaming and new media. Besides his professional background, our interviewee is also a great music lover and frequent festival visitor.

With the pandemic outbreak, concerts and festivals were cancelled. The most common alternative in the beginning of the lockdown were livestreams on Facebook and other (social media) platforms. However, these livestreams could not replace the social dimension of concertgoing; there was a lack of togetherness. Our interviewee calls these “one-dimensional experiences”. Therefore, he decided, together with some other people, to create a more interactive music experience inspired by the format of multiplayer games. The combination of his professional and personal interests thus resulted in the founding of *Soundstorm*. The company got off to a flying start; in one year, it hosted more or less thirty in-game concerts.

Virtual concert spaces

Up to now, *Soundstorm* developed five different virtual worlds that organizers and artists can book for their shows. Each world has its own theme; there is *Pluto's Playground* (see Image 4, p.104), a volcanic island that once was the scenery for a legendary battle between gods and humans, or *Polaris Skyprison* (see Image 5, p.105), a prison located on a flying rock. All virtual worlds really capture the users' imagination. The company also offers the opportunity of virtual worlds ‘on demand’; artists can bring up ideas or wished for the virtual world they would like to perform in.

What all virtual worlds have in common is the fact that they are gaming platforms. Our interviewee and his team have consciously chosen this because they are convinced of games being the ‘new’ social media; people meet each other in games as, for instance, *Fortnite*, and built up sustainable

social relations. *Soundstorm* wants to translate this social dimension, central to gaming, to their virtual concerts to compensate the lack of togetherness in regular livestreams.

In-game concerts as social platforms

One of the key aspects of the in-game concerts of *Soundstorm* is thus the social dimension. Attendants are represented by avatars which they can customize before they enter the virtual concert space; “it is like dressing up yourself when you go to a concert or festival, everyone does it and it is an integral part of the experience”, our interviewee said. They can interact with other avatars/attendants by challenging each other for a dance battle or by activating different emotions and gadgets, such as llamas they can ride on. Also a regular chat function is available during the concert. If the attendants want to get to know the persons behind the avatars, they can go to a virtual bar where their cameras are automatically activated when they enter the space. Another feature that is facilitated in the virtual concert spaces is a merchandize booth. As with the virtual bar, webcams are activated when entering, so the attendants can see the seller and merchandize as in real life. It is the aim of *Soundstorm* to develop ‘watch-parties’ in the near future; these would give users the opportunity to attend the virtual concert together with a couple of friends while they can see each other and talk through microphones.

Although the developers provide various options to interact during the in-game concerts, the interviewee revealed that most attendants need an extra boost to actually interact with each other. During the concerts, employees of *Soundstorm* launch challenges and quests which the attendants can fulfill to collect rewards. They also stimulate the audience to perform some actions, such as clapping, ‘we want more’, or their famous llama polonaise. This way, they try to enhance the social interaction and togetherness.

Soundstorm is very proud of its social approach of VR concerts. Our interviewee even indicated he thinks the company excels in it and can separate itself this way from other platforms hosting virtual concerts. By allowing interactions that reach further than a regular chat function, the audience remains captivated during the concert.

Since the company is so committed to the social dimension of concertgoing, the astonishment was great when our interviewee heard that the findings of our survey study indicate a possible disinterest in social motives of the audience. He stated that it could be possible that *Soundstorm* is taking it too far, that the audience might also be happy with just a chat. But it is hard for him to imagine this, because he thinks personalized avatars, dance battles and gadgets make the experience much more fun. Another possible explanation could be the music genre of the concert, the interviewee says. Rougher music genres (e.g., metal, rock) are known for the great interaction between their fans, expressed in walls of death or mosh pits for example. Whenever *Soundstorm* hosted a metal band (e.g., *Psychonaut*), this

audience interaction remained the same as with physical concerts, according to our interviewee. He also noticed that some avatars kept returning to these concerts, creating a more or less regular audience. This is in strong contrast to in-game concerts of singer-songwriters, where the audience is very quiet and introvert. Our interviewee thus believes that the genre of concert may have greater influence on the degree of interaction than we suspect.

Experience the ‘real’ artists

Another key aspect of *Soundstorm*'s in-game concerts is the aim to mimic the feeling that artists are performing for an audience, as with physical concerts. During the virtual concerts, artists can see the avatars of all the attendants on a big screen. Furthermore, *Soundstorm* collaborates with an external platform that offers zero latency streaming, meaning that they are able to reduce the time between the avatars performing actions and the artists seeing these actions on big screen to just half a second. This is in strong contrast to other social media platforms that generally have to deal with a latency of 30 to 60 seconds. Because of the zero latency, both the artists and the audience can immediately react to each other, which enhances the interaction and connection between both parties.

In contrast to the attendants who all have a personalized avatar, the artists are not represented through avatars. Instead, they are livestreamed in the virtual concert space, “ensuring the liveness of the event”, as the interviewee states. When the audience stands in front of the stage, they can see the livestream video of the performing artists. The company only works with fixed cameras, trying to frame the artists in such a way that it looks like they are standing with their feet on the stage. This way, *Soundstorm* wants to offer the audience the same experience as with physical concerts, meaning they can see the artists as they would see them in real life. Artificial camera effects (e.g., zoom, close-up) would disrupt this experience. However, the audience can move their avatars and watch the livestream from different angles and unconventional places (e.g., on stage). This feature provides them with a new experience anyway.

Democratic in-game concerts

Soundstorm wants to provide democratic and open concert experiences. Our interviewee emphasized that every in-game concert should be accessible to every music lover who lacks the feeling of attending concerts during the pandemic, regardless of age or technical knowledge, and without the obligation of purchasing specific equipment. Therefore, the platform of *Soundstorm* is developed in such a way that it can be used even on a “ten-year-old Macbook”, as our interviewee clarifies. By reducing high requirements as concerns computer hardware, the developers want to attract as many attendants as

possible. Moreover, the platform can be downloaded for free. However, the fact that you have to download something still appears to be a high threshold for most people. Unfortunately, *Soundstorm* cannot solve this issue for now because its concept of a multiplayer game as concert venue is not supported in a simple web browser. Furthermore, developers attach great value to the audio quality of the in-game concerts, something that cannot be achieved at the same level in web browsers.

Next to low technical thresholds, the in-game concerts of *Soundstorm* and its partners could be attended without paying entrance fee in the past year. The VR developer chose this to compensate for any technical issues that could occur during the in-game concert; since *Soundstorm* is a new platform, technically, some things still have to be finalized. It also helps to profile yourself as sympathetic, according to our interviewee. However, after the first concert the platform hosted, the developers of *Soundstorm* conducted a survey with the audience, revealing that there was definitely a willingness to pay for the VR concerts. Therefore, the platform currently works with donations that go integrally to Live2020, the charity for the Belgian live music sector. Whether this system can be maintained in the future is still unclear. Our interviewee suspects that funds and sponsors will be needed to further develop the platform.

The future of VR concerts

In order for VR concerts to establish themselves as new concert space in the music scene, there is more awareness needed, according to our interviewee. In Belgium, many artists and organizers are unfamiliar with the possibilities VR concerts have to offer. They think it is a weird concept and do not get the added value of the multiplayer game concept. Our interviewee suspects that Belgian artists are more conservative and that their ambitions do not reach as far as VR, no offense intended. If the artists agreed to perform in one of the virtual worlds of *Soundstorm*, they did not dare to do intensive marketing because they could not estimate the reactions of their fans on this new virtual concert form. Of course, the fact that the corona measures have been in place for more than a year ensures that everyone eagerly looks forward to real concerts in physical venues and interest in virtual substitutes gradually disappears.

Ideally, awareness can be raised, using some artists and important parties in the music scene as ambassadors. Our interviewee refers to *Kiswe*, the platform that made the VR concert of K-pop band *BTS* a big success. These ambassadors can support marketing and promote the experience. But it is a big challenge because there are so many parties in the music scene that need to be convinced about this new concert form: artists, managers, booking agents, concert venues etc.

Soundstorm especially sees future opportunities in the area of festivals. Many people cannot afford the expensive tickets or do not even get the chance to buy tickets since some festivals sell out in less than an hour. For these music fans, *Soundstorm* could bring the solution by streaming the

performances on the festival in their virtual worlds. Festivals already provide many cameramen, so sharing that footage could be relatively easy. The challenge lies in the togetherness and interaction between the artists at the festival and the remote audience in the multiplayer game. However, according to our interviewee, it is a very interesting option to brainstorm about with organizers of festivals and to investigate further.

8. STUDY II: DISCUSSION

Study II withheld a semi-structured interview with a developer of virtual worlds for VR concerts, more specifically in-game concerts. The purpose of this study was to add an extra voice to the audience experience of VR concerts. This is specifically interesting to see to what extent both parties share the same thoughts about the new concert space. As stated in the Method-section of Study II, this discussion starts from the three main questions: the artistic vision and choices of the developer, the efforts to enhance the audience experience, and the estimations on the future of VR concerts.

8.1 Artistic vision about VR concerts

Soundstorm specifically chooses the concept of multiplayer games as virtual concert spaces, creating in-game concerts. Not only the professional background of the founder nurtured this choice, but also his opinion that games need to be perceived as new social media platforms. This vision is also echoed in other blogs and magazines that write about in-game concerts and their potential. Vergauwen (2020), for instance, writes that playing games is more about hanging out with (virtual) friends these days than actually winning the game. Also the founder of *Wave* (i.e., a platform hosting VR concerts) states that people consider multiplayer games more as social spaces where they can interact with others (Ombler, 2020). Therefore, it might be concluded that games are specifically suited to enhance the same social experience that is central to physical concertgoing.

When artists want to give an in-game concert together with *Soundstorm*, they can just pick out one of the already existing virtual worlds they are most attracted to. Moreover, the VR company also provides the option to create virtual concert spaces on demand, giving the artists the opportunity to be co-creators. According to Hu (2021), the customizability and flexibility of the game's interface is a very important feature to make VR concerts more attractive for artists and organizers. If these parties can take part in the creative decisions, they can align the design of the virtual concert space to their own values and identity, and to those of their fan community (Hu, 2021). This not only makes the medium more attractive to the artists, but also to their fans.

8.2 Enhancing the audience experience of VR concerts

The interview revealed several ways in which *Soundstorm* tries to enhance the audience experience of its in-game concerts. They can be summarized in four main themes: the use of customized avatars, the stimulation of social togetherness, evoke the feeling of physical concerts, and optimize accessibility.

Use of customized avatars

Concertgoers experience the virtual worlds of *Soundstorm* through their avatars. Before entering, they can customize and dress up their avatar, just as they would do if they attend a 'real concert in a physical venue, as our interviewee stated. It was proven that the option to change the appearance of avatars and make them physically look like the user are essential to make the virtual world experience more intense (Harvey, 2016; Wrzesien et al., 2015). It is thus recommended that developers of VR concerts foresee in avatars and the option to customize them.

Stimulation of social togetherness

The founding of *Soundstorm* is grounded in the lack of togetherness experienced by our interviewee during regular, 2D livestreams. For its in-game concerts, the platform developed some features that should promote that togetherness and, consequently, optimize virtual concertgoing.

When users enter the bar in the virtual concert space of *Soundstorm*, their webcam is automatically activated. This way, they can meet the persons behind the avatar. Albuquerque and Velho (2002) also experimented with this switch between avatar and webcam in virtual worlds, and its effect on virtual togetherness. Their study revealed that once users started to interact and establish relationships with others, they felt the desire to get to know the "real appearance of each other" (Albuquerque & Velho, 2002, p.5). Seeing other users also on camera, instead of just their avatars, can thus possibly enhance the social experience of concertgoing.

By providing the virtual audience with quests they can fulfill or dance battles they can initiate during the in-game concert, *Soundstorm* hopes to keep the attendants alert. The developers want to avoid the audience being merely passively consuming and perceiving the music, but actively executing actions and tasks instead. Attendants are transformed into performers this way. The idea of the audience as performer is also mentioned in some magazines and blogs about in-game concerts (Hu, 2020; Ombler, 2020). Games as virtual concert space allow the fans not only to consume the music, but also to interact and play with it (Ombler, 2020). This could lead to a more encompassing and unique concert experience.

It has already been mentioned that technical issues such as bad connection and latency disturb the attendants concentration and, consequently, their experience (Albuquerque & Velho, 2002; Coehlo et al., 2012; Witmer & Singer, 1998). These factors were also indicated in our survey study as detrimental. As developer of VR content, *Soundstorm* is of course aware of this. Therefore, one of the main characteristics of their in-game concerts is the zero latency between the livestream video of the artists and the actions of the avatars in the virtual concert space. This makes the interaction between both much more realistic and accurate.

Interesting to take into account is the remark of our interviewee that the amount of interaction and virtual togetherness could be influenced by the music genre performed during the in-game concert. According to him, music genres with strong fan communities (e.g., metal and rock) could result in more interaction and togetherness. At this moment, a possible explanation for this impression cannot be provided. However, in the same trend, a recent study on livestream concerts also revealed the positive influence of the genre of metal on willingness to pay for tickets (Swarbrick et al., 2021). This suggests that it is certainly useful to further investigate the influence of music genres and their fan communities, since it could reveal interesting information regarding the virtual concert experience that is unknown to this very day.

Evoke the feeling of physical concerts

It is notable that *Soundstorm* wants to evoke the feeling of being present at a physical concert with its in-game concerts. This is mostly expressed in the fact that they use livestream videos of the artists instead of working with avatars. Moreover, when told that our survey study indicated that new camera angles and close-ups make the concert experience more intimate, our interviewee did not follow this reasoning because it makes the whole too artificial. For the *Soundstorm* concerts, the artists are filmed as if the audience would perceive them during physical concerts (i.e., with their feet on stage, fixed camera, correct perspective and depth). Although their concerts are virtual, thus mediated, the developer clearly attaches much value to the classic liveness idea, following insights of Phelan (1993): live concerts are more impactful and authentic, the audience needs to get the chance to interact with the artists in real time etc. This way, it distinguished itself from prerecorded in-game concerts like *Fortnite*.

It seems as if *Soundstorm* is really focused on offering a full-fledged but recognizable alternative to music fans for the time that physical concerts are not possible, instead of creating a completely new kind of concert experience. However, we can ask ourselves if this mimicking of the ‘real’ concert experience is necessary. Based on the survey study (i.e., Study I), we might say that most respondents appreciated VR concerts because they are something completely different and allow new experiences. The opportunity to employ technology and create and offer experiences that are not real is also expressed in some blogs about in-game concerts (Music Ally, 2020; Vergauwen, 2020). Moreover, our respondents did not think of VR concerts as an alternative, but more as a complement to physical concerts, excluding the idea that one automatically should replace and/or imitate the other.

Ombler (2020) adds in his article some interesting ideas about these attempts to ‘copy’ features of physical concerts to in-game concerts. According to him, the target group of in-game concerts mostly consists of (young) gamers, which he calls “next-gen fans” (Ombler, 2020). They are already very familiar with virtual experiences, so they do not care about the lack of live interaction or live feeling.

Ombler points out that this target group has already “moved past the live entertainment model”, so trying to evoke this model in virtual concerts does not make any sense because the target group is not waiting for that. Moreover, it is also a very solid reason to invest more in virtual concerts and their unique experiences, since a new generation of music fans is looking forward to this.

Optimize accessibility

Lastly, *Soundstorm* tries to enhance the in-game concert experience by optimizing accessibility for the users. Its platform does not require high-end technology and can even be used on old computers; every fan who wants to enter the virtual concert space should normally be able to do so. This way, the developer counters one of the main remarks from our respondents in Study I, about the technology requirements of some VR concerts that may have negative influence on the accessibility. Furthermore, the in-game concerts hosted by *Soundstorm* were free or worked with donations for charity. We know from Study I what low ticket prices were a great motivator to go to VR concerts. Looking at other big in-game concerts that can be attended for free (e.g., those hosted by *Fortnite*) money can be made from the purchase of costumes and gadgets (Perraudin, 2019). So, if developers and organizers of VR concerts make efforts to think of new ways to make profit in order to keep ticket prices low, this could result in a more successful attendance.

8.3 The future of VR concerts

Surprisingly, our interviewee was in doubt about the future of his discipline, as concerns the music market in Belgium more specifically. The hindering factor for VR concerts to flourish is the current unawareness of the music scene. Artists seem afraid for this new concert form, stopping them from meeting this new challenge or conducting great marketing. Ombler (2020) confirms this restraint; for artists, it is very challenging to convince their fans of this new medium and, subsequently, drag them into new, virtual worlds. Moreover, artists who already seized the opportunity to perform in games such as *Fortnite* or *Minecraft* are huge. This creates the impression that ‘mediocre’ artists do not qualify, artistically and financially, for this new concert experience (Ombler, 2020).

Besides the artists and their managers, there are a lot more parties that need to be convinced about this new medium: promoters, bookers, music venues etc. Hu (2021) notices that game developers often take on all these mediating roles, because great market leaders of the music industry, such as *Live Nation*, missed out on this new virtual concert form. Currently, there is a “verticalization and centralization of operations and opportunities” (Hu, 2021, State of Play). However, if we want VR and

in-game concerts to be vital in the future, this centralization cannot be sustained; the support of the whole music sector will be needed. As our interviewee stated, some ambassadors are needed to not only raise awareness, but also to open up the virtual concert space for every artist who wants to push his musical boundaries.

Despite the fact that our interviewee is quite reserved about the future of VR and in-game concerts, he mostly sees potential in terms of festivals that are relatively expensive and quickly sold out. As a result, many people do not have the opportunity to buy tickets for these events. That VR could offer a solution for this problem is also indicated by Decesare and Wing (n.d.); besides the regular concert tickets, organizers could offer cheaper VR tickets in addition. This would allow fans who could not purchase regular tickets to still experience the concert as if they were standing front row (Decesare & Wing, n.d.).

8.4 Limitations and future research

The main limitations of Study II are the amount of interviews and available literature to base our assumptions and conclusions on.

Firstly, this research only conducted one interview since the developers' side of VR concerts was not conceived as main component but more as interesting addition. Of course, this part has much potential as well and future research could be conducted focusing exclusively on the content development of VR concerts. For this, focus groups could be organized, bringing insights of different VR developers together. Study I about the audience experience could be used as starting point for the discussion. Additionally, an experimental study might elaborate small-scale VR concerts, testing the effects of different features on the audience experience; for example if livestream videos of the artists indeed contribute more to the experience than avatars, as our interviewee is convinced of. Also the slope of music genres influencing the virtual togetherness and/or sense of presence is worth exploring.

Secondly, almost all assumptions and preliminary conclusions made in the discussion of Study II are based on own reasoning and blogs or magazines writing about in-game concerts. Of course, the scientific reliability of this is difficult to verify since it concerns mostly opinions about the virtual concert form. Nevertheless, it demonstrates the lack of literature and studies on in-game concerts. Although this concert form is not completely new (i.e., existing since *Second Life* in 2006), the experience of in-game concert is under-researched. It could be interesting to explore various things in this context: concert experience of people who frequently game in their spare time compared to non-gamers, concert experience of in-game concerts compared to immersive VR concerts in apps such as WaveVR, MelodyVR etc.

9. CONCLUSION

Over the last years, music has gained a new concert space: Virtual Reality. The medium facilitates experiences that are impossible in real life and therefore gives a new dimension to concertgoing. However VR concerts have already been in place for over ten years and boomed during the pandemic because of the social distancing measurements, research about the audience experience of such concerts is currently missing. This research took the first steps towards a better understanding about this subject in order to provide knowledge to improve VR concert experiences. To gain answers on the central research question, “How does the audience experiences concerts in VR?”, this study departed from a international survey questioning four central themes applicated to VR concerts: motivations for concertgoing, their (dis)advantages, experiences of sense of presence and virtual togetherness, and estimations on their future. Additional insights from a developer of virtual worlds for in-game concerts were provided through a semi-structured interview.

The survey research demonstrates the importance of the experiential aspects of concertgoing (i.e., artists, visual effects, event’s uniqueness) as motivators to attend VR concerts, showing an agreement with previous studies on motivations to attend physical concerts. Practical motivators, such as cheaper ticket prices, also generate a higher turnout for VR concerts. Social motives with regard to the audience (i.e., connecting, interacting and sharing the experience with each other), however, are proven to be the least convincing motivations to attend VR concerts. Whereas for physical concert attendance, these social intentions are one of the most important attendance motivators. This research thus proves a discrepancy as concerns the social motivation of concertgoing between both concert forms, providing opportunities for further research to explain this discrepancy.

Compared to physical concerts, VR concerts mostly benefit from their accessibility; everyone, anywhere in the world, can attend concerts of their choice. Another added value is the view of the concert; different perspectives and playing with camera features (e.g., close-up) give VR concerts an edge to physical concerts. Nonetheless, the study indicates that VR concerts generally don’t give the same fulfilment as physical concerts, mostly because of the lack of a social and physical experience. Artists and organizers should keep this in mind and see VR concerts as supplementary rather than substitute for physical concerts. Furthermore, additional tests prove that immersive VR technology ensures that people are more convinced about the advantages of VR concerts compared to physical concerts; whereas the feeling of missing physical concerts causes people to see more disadvantages in VR concerts.

A VR concert generates a sense of presence with its attendants; the technical quality and music keeps them concentrated, and overall, they feel involved and have a sense of acting in the virtual concert space. Although the audience expects that VR concerts feel real, most of them did not experience them

as real, mostly due to unrealistic VR environments and/or quality of audio and visuals. Except for this judgement of realness, more sense of presence is experienced with immersive VR technology. As for virtual togetherness, results of the study show that this is harder to obtain during VR concerts, or at least as concerns a togetherness with the audience. Experiencing a virtual togetherness with the artists seems much more important for attendants, especially when they feel like missing physical concerts. The audience shows greater interest in the music and artists than in the interaction with other people in the virtual concert space. Nonetheless, attendants indicate they miss the social experience of concertgoing during VR concerts. This insists that developers and organizers should support the social dimension anyway by providing enough interaction opportunities that reach beyond the regular chat box, and by actively encouraging the audience to interact during the concert. In contrast to sense of presence, the use of immersive VR technology only has little effect on aspects of virtual togetherness.

Lastly, we can conclude that VR concerts are expected to be an integral part of the music scene in the future. People would generally attend more VR concerts if that would be possible, and a new generation of gaming music fans actively demand a new entertainment model that fits their familiarity with virtual worlds. This is a clear cue to organizers and artists that VR as new concert space is viable. In order to fully establish VR concerts, however, it may be necessary to raise awareness of actors in the music scene. These actors are mostly still focusing exclusively on physical concert forms, powered by the idea that these are more authentic. Additional tests prove that immersive technology strongly effects the estimations on the future of VR in a positive way; whereas a high frequency of attending physical concerts (i.e., at least once or twice a month) before the pandemic and the feeling of missing those physical concerts result in less convincing estimations on the future of VR concerts.

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11. APPENDICES

11.1 Appendix I: Abstract in Dutch

De COVID-19 pandemie heeft de muzieksector hard getroffen. Om een verdere verspreiding van het virus te voorkomen werden maatregelen genomen om sociale afstand te bewaren; muziekevenementen zoals concerten en festivals waren bijgevolg niet langer toegestaan. Het gebrek aan reguliere evenementen maakte plaats voor nieuwe alternatieven, met concerten in Virtual Reality (VR) als een van de snelst opkomende vormen. Met het oog op het optimaliseren van de concertbeleving van zo'n VR concerten, onderzoekt deze studie hoe het publiek de relatief nieuwe concertvorm ervaart. Er werd een enquête gehouden bij 74 personen die allemaal minstens één VR concert hebben bijgewoond, al dan niet met behulp van immersieve VR technologie (bv. VR headsets). In de survey werden vier thema's bevraagd betreft de VR concertervaring: motivaties om naar VR concerten te gaan, de voor- en nadelen van VR concerten, het gevoel van aanwezigheid (*presence*) en virtuele saamhorigheid (*virtual togetherness*) tijdens het concert, en de inschattingen over de toekomst van VR als concertruimte. Mogelijke effecten door de gebruikte technologie tijdens de VR concerten, de frequentie van fysiek concertbezoek voor de pandemie, en het gemis van fysieke concerten werden in rekening gebracht tijdens de data-analyse. Naast de surveystudie werd een semigestructureerd interview afgenomen met een ontwikkelaar van VR concerten. Hierin werd gepeild naar zijn artistieke visie, hoe hij de publiekservaring probeert te verbeteren, en wat zijn inschattingen zijn over de toekomst van zijn discipline. Resultaten van dit onderzoek suggereren dat mensen het meest gemotiveerd worden door de artiesten, de visuele effecten en de uniciteit van de evenementen; en het minst door sociale motieven zoals betrokkenheid. De toegankelijkheid en het zicht worden genoemd als grootste voordelen van concerten in VR; het gebrek aan sociale en fysieke ervaringen als grootste nadelen. Een gevoel van aanwezigheid (*presence*) wordt over het algemeen wel bereikt, maar virtuele saamhorigheid (*virtual togetherness*) lijkt moeilijker te ervaren. Hoewel de respondenten van deze studie verwachten dat VR-concerten een integraal onderdeel van de muziekscene zullen worden, blijft hun voorkeur uitgaan naar concerten in fysiek concertruimtes.

11.2 Appendix II: Survey

Informed consent <standard form of the faculty of Arts and Philosophy, University Ghent>

Q1. Do you agree with the statements above? Yes (1) – No (2)

Q2. Are you 18 years or older? Yes (1) – No (2)

<when indicated 'No' on one or both questions, the survey was terminated>

Section 1: Demographics

Q3. What is your age? <integer input>

Q4. What is your gender?

- Female (1)
- Male (2)
- Prefer not to say (3)
- Other: <free text input> (4)

Q5. What is your country of residence? <free text input>

Q6. What kind of musical education do you follow or have you followed? <multiple answers possible >
<coded as 0 = no, 1 = yes>

- Higher education (e.g., Conservatory)
- University (e.g., Musicology)
- Private courses
- Music academy
- Self-thought (i.e., autodidact)
- None
- Other: <free text input>

Q7. How many years have you been playing music? <integer input>

Q8. On average, how many hours a day do you listen to music? This includes listening to music as main activity as well as background activity.

- 0 hours (1)
- 1-2 hours (2)
- 3-4 hours (3)
- 5-8 hours (4)
- 9 or more (5)

Q9. Before the COVID-19 restrictions, how often did you attend concerts (while being physically present)?

- Never (1)
- Less than once a month (2)
- Once or twice a month (3)
- Once a week (4)
- More than once a week (5)

Q10. How much do you miss attending concerts while being physically present?

<7-point likert scale ranging from 'not at all' (1) to 'very much' (7)>

Section 2: Used technology

Q11. What type of screen did you use to watch concerts in VR? <multiple answers possible >

<coded as 0 = no, 1 = yes>

- (Big) TV screen
- VR headset
- Laptop screen
- Desktop screen
- Large projection
- Phone screen
- Other: <free text input>

Q12. If you used a VR headset, what brand is it? <free text input>

Q13. What type of audio did you use to listen to concerts in VR? <multiple answers possible >

<coded as 0 = no, 1 = yes>

- Headphones: basic
- Headphones: high quality
- Headphones: noise cancelling
- Speakers: basic
- Speakers: high quality
- Speakers: stereo
- Speakers: surround
- Other: <free text input>

Q14. Which platform(s) did you use to watch concerts in VR? <free text input>

Q15. If applicable, which VR community are you a member of? <free text input>

Q16. What the perspective onto to concert did you use? <multiple answers possible >

<coded as 0 = no, 1 = yes>

- First-person perspective: "through the eyes of my own character/avatar"
- Third-person perspective: "behind/above my character/avatar"

Section 3: Concert experience

Q17. How did you find out about VR concerts? <multiple answers possible ><coded as 0 = no, 1 = yes>

- Social media
- Friends or family
- While playing a game
- Other: <free text input>

Q18. How many concerts in VR have you already attended? <integer input>

Q19. Of which music genres have you already attended a concert in VR? <multiple answers possible >
 <coded as 0 = no, 1 = yes>

- Classical music
- Pop
- Rock
- Folk
- Jazz
- Dance
- Techno
- Other: <free text input>

Q20. Please indicate to what extent the following aspects were reasons for you to attend a concert in VR.

	Not at all (1)	Not (2)	Rather not (3)	Neutral (4)	Rather yes (5)	Yes (6)	Very much (7)
Visual effects							
Sharing the experience with other people in the audience							
The artist(s)							
You can stay at home							
Concert tickets are for free or cheap							
Feel a togetherness with other people in the audience							
Discover new music							
Meet people from all over the world							
Feel a togetherness with the artist(s)							
The possibility to be part of something unique							
The possibility to (re)watch the concert at a moment of your choice							
A better view							
Don't have to be quiet for others during the concert							
The ability to stop watching at any time							
The possibility to change places during the concert							

Q21. Were there any more reasons why you attended a concert in VR? <free text input>

Q22. How aware were you of the real world surrounding while watching the VR concert? (e.g., sounds, room temperature, other people, etc.)

<7-point likert scale ranging from 'extremely aware' (1) to 'not aware at all' (7)>

Q23. Please indicate which aspects of your real environment continued to draw your attention during the concert. <free text input>

Q24. Please indicate which aspects of your real environment you no longer paid attention to during the concert. <free text input>

Q25. Do you think it's important that VR concerts are realistic? By realistic, we mean the resemblance to a concert you physically attend.

<7-point likert scale ranging from 'not at all' (1) to 'absolutely' (7)>

Q26. How real did the VR concert you attended seem to you compared to a concert you physically attend?

<7-point likert scale ranging from 'not real at all' (1) to 'completely real' (7)>

Q27. Please clarify which aspects seemed real to you. <free text input>

Q28. Please clarify which aspects didn't seem real to you. <free text input>

Q29. Do you think concerts in VR are a less or more unique experience than concerts you physically attend?

<7-point likert scale ranging from 'far less unique'(1) to 'far more unique' (7)>

Q30. Please explain why you think VR concerts are less or more unique. <free text input>

Q31. Do you think VR concerts are less or more accessible than concerts you physically attend?

<7-point likert scale ranging from 'far less accessible' (1) to 'far more accessible' (7)>

Q32. What do you think makes VR concerts less or more accessible? <free text input>

Q33. Please indicate to what extent you agree or disagree with the following statements regarding your experience of VR concerts.

	Strongly disagree (1)	Disagree (2)	Slightly disagree (3)	Neutral (4)	Slightly agree (5)	Agree (6)	Strongly agree (7)
I felt that the virtual concert space surrounded me.							
I had a sense of acting in the virtual concert space, rather than just perceiving pictures.							
I completely forgot I was in a virtual world and not in a real world.							
I felt involved during the VR concert.							

I am interested in VR precisely because it allows experiences that are not possible in the everyday, physical world.							
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Q34. What was your level of attention during the VR concert?

<7-point likert scale ranging from 'no concentration at all' (1) to 'total concentration' (7)>

Q35. What influenced your level of attention during VR concerts? <free text input>

Q36. How aware were you of other people in the virtual audience attending the same concert as you?

<7-point likert scale ranging from 'not aware at all' (1) to 'completely aware' (7)>

Q37. Do you invite people to watch VR concerts together?

<7-point likert scale ranging from 'never' (1) to 'always' (7)>

Q38. What is the reason you do or do not invite other people? <free text input>

Q39. When attending the VR concert, did you interact with other people in the virtual audience?

<7-point likert scale ranging from 'never' (1) to 'always' (7)>

Q40. Why is interaction with other people during the concert (not) important for you? <free text input>

Q41. How important is it for you to feel connected with other people in the audience during a VR concert?

<7-point likert scale ranging from 'not important at all' (1) to 'very important' (7)>

Q42. Based on all the VR concerts you've seen, how often did you feel connected to others in the audience?

<7-point likert scale ranging from 'never' (1) to 'always' (7)>

Q43. How did this connection with other people in the audience express itself or not? <free text input>

Q44. How important is it for you to feel connected to the artist(s) during a VR concert?

<7-point likert scale ranging from 'not important at all' (1) to 'very important' (7)>

Q45. Based on all the VR concerts you've seen, how often did you feel connected to the artist(s)?

<7-point likert scale ranging from 'never' (1) to 'always' (7)>

Q46. How did this connection with the artist(s) express itself or not? <free text input>

Q47. How important is it for you the feel emotionally involved during a VR concert?

<7-point likert scale ranging from 'not important at all' (1) to 'very important' (7)>

Q48. Based on all the VR concerts you've seen, how often did you feel emotionally involved?

<7-point likert scale ranging from 'never' (1) to 'always' (7)>

Q49. What made you feel (not) emotionally involved during the VR concert? <free text input>

Q50. To what extent do you find VR concerts a lonely or social activity?

<7-point likert scale ranging from 'very lonely' (1) to 'very social' (7)>

Q51. Why do you think VR concerts are lonely or social? <free text input>

Q52. Please indicate to what extent each statement applies to your experience of VR concerts.

	Strongly disagree (1)	Disagree (2)	Slightly disagree (3)	Neutral (4)	Slightly agree (5)	Agree (6)	Strongly agree (7)
I shared emotions with others in the virtual audience during the VR concert.							
I felt like I was sharing the experience with the artists.							
I like attending concerts of artists I don't know yet.							
It's easier to connect with other people in the audience during a VR concerts than a concert you physically attend.							
Compared to physical concerts, I could be more myself at VR concerts because no one could see me.							
The visual spectacle gave the music a new dimension.							

Q53. Compared to concerts where you can be physically present, what do you miss at VR concerts? <free text input>

Q54. Compared to concerts where you can be physically present, what added value do VR concerts have? <free text input>

Q55. Describe the best VR concert you've seen so far. Please mention which concert it was. <free text input>

Q56. Describe the worst VR concert you've seen. Please mention which concert is was. <free text input>

Q57. Lastly, we have some statements of which we would like to know if you agree with them or not.

	Strongly disagree (1)	Disagree (2)	Slightly disagree (3)	Neutral (4)	Slightly agree (5)	Agree (6)	Strongly agree (7)
VR concerts give the same fulfilment as physical concerts.							
I prefer VR concerts over physical concerts.							

If possible, I would attend more VR concerts.							
VR concerts are the future of the music scene.							
When an artist gives a physical concerts as well as a VR concert, I'd still choose the VR concert.							

Q58. Comments. <free text input>

11.3 Appendix III: Interview

Link to the recording

<https://youtu.be/nZ2C4uQVLXY>

Predefined list with topics and questions

Part I: general information *Soundstorm*

- Background interviewee (founder)
- Founding of *Soundstorm*
- Vision and mission
- Target group

Part II: audience experience (partly based on findings Study I)

Technical aspects

- Choice for game as platform
- Virtual worlds: design and possibilities of change
- Avatars: why no avatars for artists but livestream footage?

Motivation for attendance

- Artists: selection
- Social motivations: opinion on apparently disinterest of audience in social connections

(Dis)advantages VR concerts

- In-game concerts = free: reason + future financial plan

- Better view & close-ups as great advantage of VR concerts: applied by Soundstorm as well?
- Ways of enhancing accessibility for the in-game concerts
- Greatest advantage of the Soundstorm in-game concerts ?

Sense of presence & virtual togetherness

- Dealing with technical problems that disturb sense of presence/virtual togetherness
- Facilitation of a togetherness between artist & audience
- Possibilities of interaction for the public

Future of VR concerts

- VR concerts after corona
- General estimations on future VR concerts
- Openness of artists and organizers to virtual concert spaces
- Future of Soundstorm

12. IMAGES



IMAGE 1. Still from *Where Do We Go? The Livestream* by Billie Eilish. Retrieved from <https://3voor12.vpro.nl/artikelen/overzicht/2020/oktober/Billie-eilish-streaming-show.html> on June 1st, 2021.



IMAGE 2. Marshmello performing in the game *Fortnite: Party Royale*. Retrieved from <https://www.rollingstone.com/music/music-features/marshmello-fortnite-show-will-prove-revolutionary-for-the-music-industry-797399/> on June 1st, 2021.



IMAGE 3. Travis Scott performing in the game *Fortnite: Party Royale*. Retrieved from <https://www.campaignlive.co.uk/article/does-fornites-travis-scott-event-reveal-future-entertainment/1681710> on June 1st, 2021.

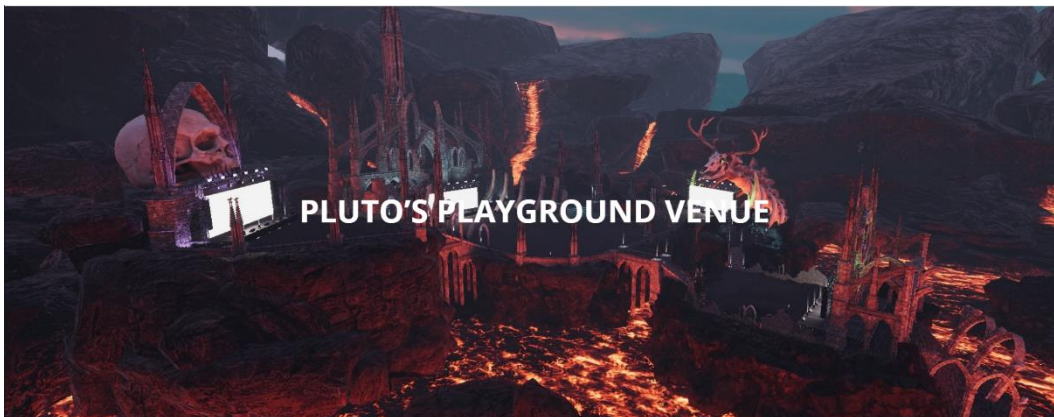


IMAGE 4. *Pluto's Playground*, a virtual concert venue developed by *Soundstorm*. Retrieved from <https://soundstorm.online/plutos-playground-venue/> on July 14th, 2021.

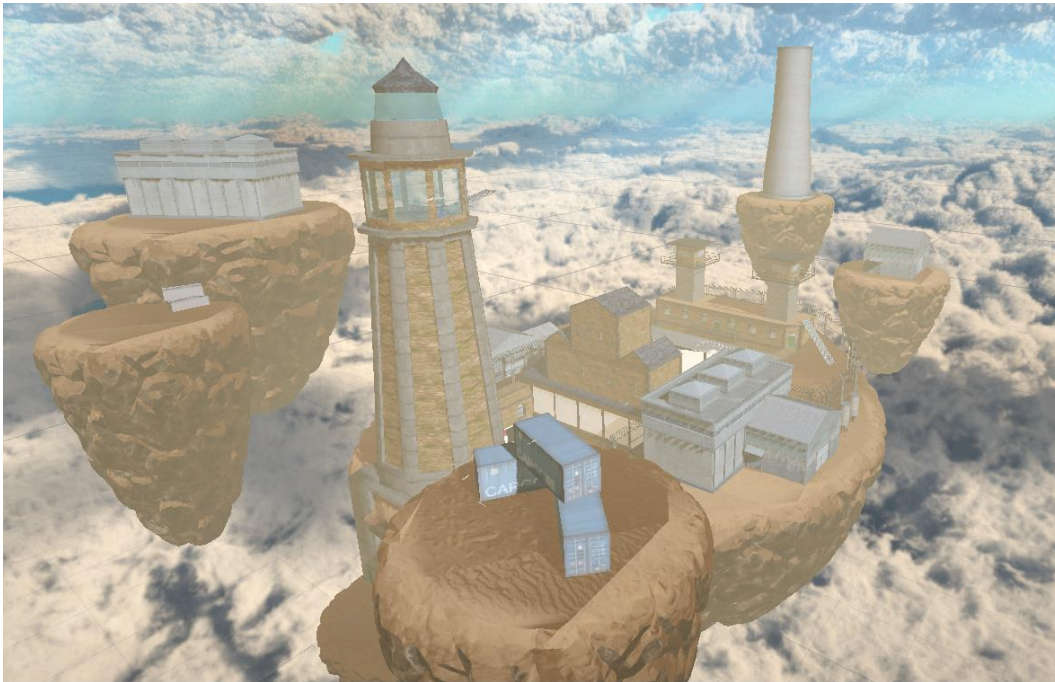


IMAGE 5. *Polaris Skyprison*, a virtual concert venue developed by *Soundstorm*. Retrieved from <https://soundstorm.online/event/explorer-polaris/> on July 14th, 2021.