Breaking through the Screen-Window Metaphor

Suspended disbelief in Mixed-Reality Media at Hatsune Miku's Hologram Concerts

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Summary

This thesis revolves around methods to bring the virtual and actual together in one shared space. It opposes the screen-window metaphor prevalent in traditional thinking about screen media. The screen-window metaphor, popularized by Anne Friedberg, states that the screen functions as a barrier between virtual and non-virtual environments: Audiences located in the non-virtual environment can look at a screened virtual environment, but cannot be placed inside it. Friedberg also states that the screen forms an ontological cut between the actual 'here' and the virtual 'there'.

Mixed-Reality media have found more and more place within our contemporary media landscape through technological developments. This category includes many types of media that do not adhere to the screen-window metaphor. Hologram concerts are taken as example of introducing virtual elements into a non-virtual space. This thesis explores how the audiovisual design of hologram concerts merges virtual and actual space.

In order to do so, suspended disbelief is addressed and broken apart into two relevant concepts: Presence (reduced awareness of mediation) and liveness (interpreting a performance as created in the moment). Markers for both concepts are listed and then compared to an extensive analysis of Hatsune Miku's hologram concerts.

Foreword

Starting the Screen Cultures program, Anne Friedberg's introduction chapter of *The Virtual Window* was one of the first readings for the very first course. It was basically the introduction to discourse within the field of screen theories. Friedberg's comparison between the screen and the window, and her notion of an 'ontological cut' between screened content and the physical world made quite an impression on me, personally. Moving forward through the courses the Screen Cultures program offered, Friedberg's way of thinking seemed to be echoed by various other writers, either implicitly or explicitly.

At first, my general thinking was much in line with this way of thinking. It fitted in with my interest in immersion in entertainment media. At some point, though, I started focusing more on media examples that *didn't* fit in with Friedberg's narrative. AR-apps like geocaching or VR-based video games. My personal favorite example was an event I attended in Tokyo in 2016: Miku Expo, a hologram concert by virtual pop-star Hatsune Miku.

Before then, I did not know much about hologram concerts or Miku herself. I mostly went because I was curious about the phenomenon and the technology. During the concert, however, I was struck by the overall audiences' reaction to the hologram and also by the fact that I found it easy to forget about the screen. It was an enjoyable but also somewhat puzzling experience.

At the time I did not know that this experience would ultimately become the topic of my thesis. I'm happy that it did, because relating my own personal interest to the theories and discourse of this academic field proved to be a challenging, insightful and fun experience. My supervisor, Gunnar Liestøl, has guided me well throughout the process. I would like to thank him for sharing his thoughts and advise on my writing, despite my delayed fulfillment of this project. In addition, I would also like to thank my brother, Herre, for his help proofreading and his support as someone who has already delivered an impressive Master thesis.

Introduction

Every august for almost ten years now, Osaka and Tokyo turn into hubs for Hatsune Miku fans. For up to six days, crowds get the rare opportunity to attend a concert by this Japanese idol. Visitor numbers reach up towards 10.000 for each of the twice-daily shows. The events resemble typical pop-concerts, with crowds of fans cheering, waving and singing along to their favorite songs. These concerts, however, show one major difference to most other pop-concerts: the singer the fans came to see has no physical body.

Hatsune Miku is a virtual celebrity: her voice is constructed through a computer program and her appearance resembles an anime-style cartoon. There is no person behind the character, she is simply the name and face that belong to the constructed voice. As such, the only way for her to appear on stage is as a holographic projection. Hologram concerts form an upcoming trend in the entertainment industry. Tupac and the Gorillaz made headlines worldwide after appearing on stage this way. Other artists, too, have been featured in successful hologram tours, drawing plenty of enthusiastic fans to attend the events.

Hologram concerts have not only proven to be commercially viable or even successful, attending fans' reactions have been surprisingly similar to those visiting traditional pop-concerts. The portions of the audience willing to play along are large enough to make these events resemble other concerts. This playing along can also be described as adopting a state of suspended disbelief: visitors know that they are watching a virtual projection but choose to ignore this knowledge and interpret the hologram as a live performer. At that point, audiences may interpret the holographic performer as 1) three-dimensional, not limited to the properties of a screen and 2) able to perform their act in the moment, rather than being pre-recorded. Thus, the virtual perceptually merges with the physical, creating a space in which both coexist and the line between the two is blurred.

Such a merged space contrasts with traditional thinking in screen theories. For a long time, the screen has been widely interpreted as a border between the realm of the virtual and the physical world. These two were often considered strictly separated. Relatively recently, however, technological developments have introduced forms of media in which

this separation becomes much less obvious. This thesis considers hologram concerts as exemplary for group entertainment within this category.

However, suspended disbelief is important to merging virtual elements into a physical setting and suspended disbelief is not a guaranteed to take place. It is important, then, that creators of hologram concerts offer the right kind of setting to help bring about suspended disbelief among audiences. Certain factors in the audiovisual design of the concerts can help encouraging visitors to interpret the virtual performer as merged with the physical venue.

Taking a series of Hatsune Miku's concerts as example, this thesis intends to find out what factors can be considered relevant to presenting these events as concerts and encourage audiences to interpret them as such. The research question is:

How does the audiovisual design of Hatsune Miku's hologram concerts encourage a state of suspended disbelief among its audiences?

Answering this question will shed light on the ways on-screen audiovisual design can challenge the screen-window metaphor. The answer to this question will be found through a case study: The footage of a series of selected hologram concerts will be analyzed to see what kind of recurring or prominent design concerts can be related to suspended disbelief. First, however, the concept of suspended disbelief at hologram concerts will be accounted to two other concepts: the sense of presence and the sense of liveness.

A sense of presence indicates that an audience experiences a reduced awareness of an event's mediated nature. This is what helps audiences interpret the performer as three-dimensional. A sense of liveness denotes audiences' interpretation of an event as being created in the moment. This relates to a reduced awareness of the pre-recorded state of the concert. Together, these factors can be said to form the state of suspended disbelief.

By finding out what kind of factors help suspend disbelief, we can see how to encourage audiences to accept the virtual as merged with physical surroundings. This could help gain insight in new ways of thinking about screen media, opposing the view of the screen as a barrier. It could also form some guidelines in designing media that aims to present virtual elements and place them in our physical world.

This thesis is structured in two parts: the first one will lay out a theoretical framework, while the second part focuses on the case study and the analysis of the selected concerts.

The first part will start off with placing the concept of hologram concerts in a context. As will be elaborated upon, the projections used are not true holograms but screen projections. They have been given the name due to their resemblance to holograms as found in popular media, but even the very word 'hologram' can mean a variety of things.

The second chapter will relate the concept of hologram concerts to modern screen media. Here, popular screen theories that consider the screen as barrier will be explained further. It will also explain how hologram concerts fit in with a new wave of media technology that counters this view: Mixed-reality media.

Chapter three will discuss the concepts of presence and liveness. What makes these relevant here and how are they commonly explained? There will also be an overview of markers often associated with fostering proper conditions for a sense of presence and liveness to come about.

Chapter four will introduce Hatsune Miku and provide the tools to understanding her status as a virtual pop-star. It will also elaborate on why Miku was chosen as the topic of the case study and introduce the concert series that were used for analysis.

Chapter six through nine will present the findings of the analysis focused on four different areas: the information provided to prospective audiences beforehand; the physical elements present at the venue during the concerts; the audiovisual design of the content presented on various screens during the concerts; and the way Miku moves and acts on stage.

Part 1:

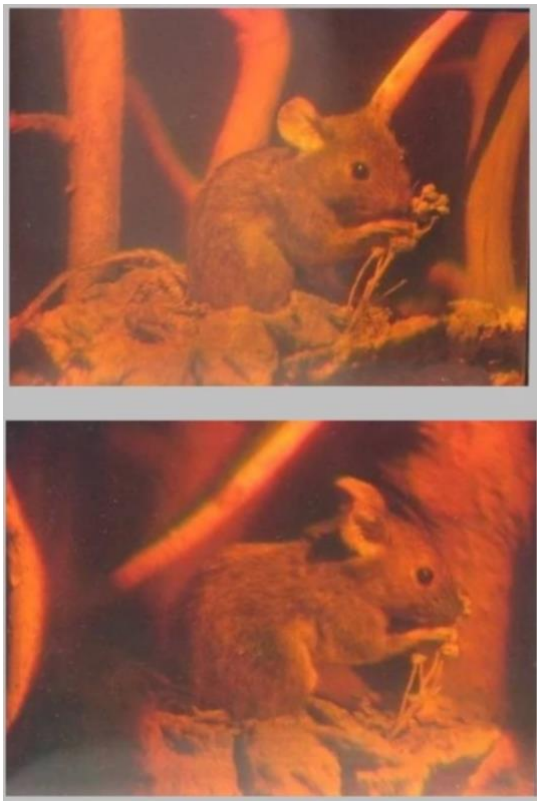
Theoretical Framework

1. What is a hologram?

1.1 Actual Holograms

This thesis focuses on hologram concerts. The first question that comes to mind, then, is: *What is a hologram?* The answer to this question shows that the projections used at events generally referred to as hologram concerts, are actually not holograms at all.

Holography is a means of recording and replicated the way light scatters off an object. Using a laser beam split in two, one half directed at the object and scattering off of it, and one half directed at a recording medium via a mirror, the two halves create a pattern that can be stored and reproduced as an image. (Workman, 2013) Simply put: Whereas a photograph only records the brightness of light reflecting off an object, a hologram also records the reflected light's direction. (Kahn, 2015) This results in an image on a flat-surface medium (such as a print or a screen) that appears three dimensional when observed from different angles. The word 'hologram' is derived from the Greek words 'holos' (meaning 'whole') and 'gramma' (meaning 'message').



A holographic image of a mouse: two pictures taken of the same flat-surface print, showing a different view from two different angles. (Svitlyk, 2022)

This technique of recording light was invented by Hungarian engineer Dennis Gabor in 1947, who received a Nobel Prize for his work on hologram theory in 1971. Though Gabor, at the time, theorized this technique could be used to create three dimensional images, he did not have the technology to make it work in practice. (Johnston, 2008) It was only with the invention of the laser in 1960 that big advances in hologram research could be made. (Kahn, 2015) In 1963, Emmett Leith and Juris Upatnieks, at the University of Michigan's Willow Run Laboratories, created a hologram of a toy train which was seen as a breakthrough in hologram research due to its quality. (Smithsonian, 1963) The American Institute of Physics promoted their work publicly, sparking a wider interest in holography around the world. (Johnston, 2008)

The general public, who did not understand the technique that created holograms, were puzzled by these images. Even scientists and engineers, aware of the technology behind holograms, struggled getting used to the sight. Many observers of holograms were reported to try and reach inside the image, having a difficult time believing it was printed on a flat surface. (Johnson, 2017)

As holograms started getting exposed to an increasingly wide audience, through, for example, displays at art exhibitions, being used as magazine covers or holographic advertisements (Johnston, 2008), they also made their way into popular culture. From here on, the word 'hologram' slowly started to diversify in meaning. At the time, laser-technology was seen as a symbol for technological advancement. Since the creation of holograms used lasers, holograms, too, were associated with futurism. Holograms strongly influenced the genre of science-fiction from the mid-1970's onward. Authors and screenwriters often took some creative liberty here, straying away from real-life holograms printed on a flat surface. Instead, they depicted them as specter-like three-dimensional images projected without the need for a screen. Especially the *Star Wars* movies, the first one being released in 1977, had a great impact on marking this interpretation of holographic images onto public memory. (Johnston, 2017). As a result, the word 'hologram' can no longer only be defined in a way that only refers to Gabor's invention. 'Hologram' now also commonly refers to imagined techniques of three-dimensional projections displayed onto thin air.

Nowadays, holograph techniques are less commonly used to produce images and more for other purposes. An example of holograms used in everyday life is as security measure on bank notes or credit cards, generally appearing as a shining seal that changes

appearance when viewed from different angles. Other areas where holography is applied include microscopy, data storage and interferometry. (Harihan, 1996)

Alongside these kinds of 'true' holographs, the fantasized holograms of science-fiction, too, persist. Research on how to make these kinds of holograms a reality is ongoing, arguably with limited success. So far, screenless floating projections are still a project of the future. However, technological advancement has allowed the creation (and popularization) of media that create the illusion of a floating projection. These technologies use a screen and/or lack a three-dimensional aspect but are still often referred to as holographic.

1.2 Hologram Concert Techniques

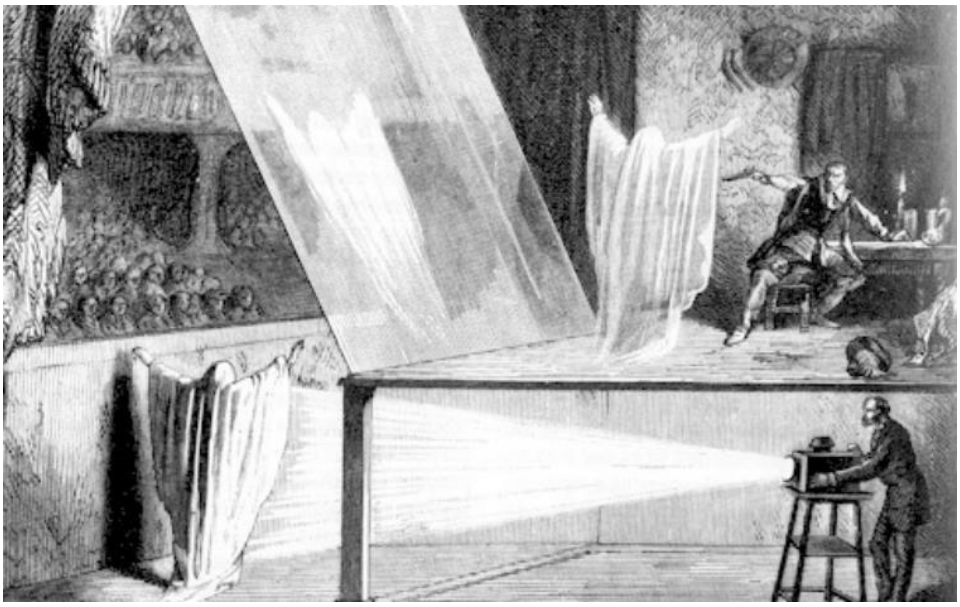
The projections used at hologram concerts fall under this category. They use a screen, though attempts are made to make it seem like they don't. The projection of the performer is flat, but creates the illusion of being three-dimensional. Due to the depth seen behind the projection, the eyes are tricked into interpreting the projection as having depth as well. (Geng, 2013) Due to the apparent three-dimensional image and the lack of screen, these events have earned the name 'holographic'. To make the images appear as holograms, hologram concerts generally use one of two types of techniques: Pepper's Ghost illusion or a translucent screen projection.

1.3 Pepper's Ghost Illusion

While holograms have long been seen as a symbol of futurism and technological progress, a popular way of emulating holograms nowadays actually stems from the 19th century. Pepper's Ghost Illusion was already used as an optical trick in theatres as early as 1862 as a means to project ghost-like images onto the stage. Based on a suggestion by Henry Dircks, the technique was invented by English scientist John Henry Pepper in 1862 and soon after appeared in many theaters around the world. (Burdekin, 2015)

The illusion made use of a compartment below the stage, within which an actor would be positioned with a bright spotlight aimed at them. Above the compartment, on the stage itself, a glass screen would be placed, tilted at an angle. The image of the actor below stage would be reflected through the screen. Due to the angle of the screen, the reflection then created and image that looked like it appeared directly on the stage itself to the audience. (Burdekin, 2015) Especially when used in relatively dark settings (such as theaters

or concerts), the screen is difficult to see from the audiences' point of view, strengthening the illusion that the image appears in thin air.



A stage set-up for the use of Pepper's Ghost Illusion: The actor dressed as a ghost is placed underneath the stage, he is reflected through the angled screen above him. The audience sees his reflection on stage, next to the other actor who is actually positioned there. (Illustration of Pepper's Ghost, n.d.)

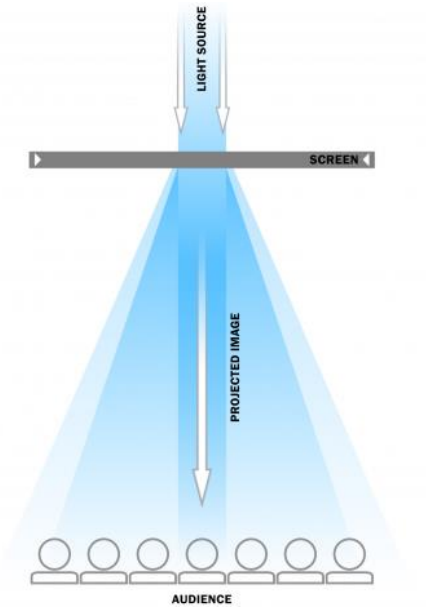
Despite being invented over 150 years ago, Pepper's Ghost Illusion is still used in a variety of settings today. A famous example is the Haunted Mansion ride at various Walt Disney Parks around the world, where it is used to project ghosts into a series of scenes. Several other theme parks around the world also use the illusion in atmospheric rides. Pepper's Ghost Illusion can also be found in art, political campaigns and even in car displays. When talking about hologram concerts, the technique was used at, for example, the performance of the virtual band Gorillaz at the MTV Europe Music Awards in 2005, the resurrection of deceased artist Tupac at Coachella in 2012 and Michael Jackson's performance at the Billboard Music Awards in 2014, 5 years after his death.

In its contemporary uses, Pepper's Ghost Illusion is often implemented in a modernized shape. Rather than using a compartment below the stage, it makes use of a projector displaying an image on a reflective surface on the floor or roof. It is this image, rather than a live actor, that is reflected through the tilted screen. In addition, the glass screen is usually replaced with a thin, reflective foil, which is less visible to the audience due to the material and angle.

Pepper's Ghost Illusion is a technique that enables high resolution images and low screen visibility. However, it also has some practical drawbacks. The audience must be placed in a position where the original image (on the floor or roof) cannot be seen, limiting the number of venues where hologram concerts using this technique can take place. Another limitation is the fact that, due to the angle of the screen, Pepper's Ghost Illusion takes up a relatively large amount of space. Additionally, the material used in the set-up of the illusion is expensive, delicate and time-costly to put up, making it less suitable for concert touring. (Ownbey , 2020)

1.4 Translucent Screen Projections

Whereas the Pepper's Ghost Illusion shows its audience a reflection of a projected image, this technique involves an image projected directly onto a screen. This set up generally uses a projector that can emit concentrated light beams to form a projection, so that only a part of the screen will be projected upon. The screen can be made of frosted glass or can be a translucent mesh fabric, treated to be highly reflective. The screen is often referred to as a hologram screen or hologram gauze (Ownbey, 2020) Using such materials as a screen causes a clearly visible image when projected onto it, while the visibility of the screen is limited, especially in settings with dimmed light conditions such as concert halls.



An illustration of rear-projection onto a translucent screen. The projected light is concentrated, caught on the screen and visible to the audience. Depending on the materiality of the screen and its surroundings, the projection shows clearly while the screen is more difficult to discern. (Stage Depot, n.d.)

This technique has gained popularity within the advertising business over the last few years. Used as an eye-catching way of displaying items or persons, there is now a wide variety of companies that specialize in offering translucent screen projection displays for trade fairs, store fronts and on-street promotions. Translucent screen projections also find uses in other fields. For example, it was used at a 2015 'holographic' protest in Spain against an upcoming law that would severely restrict citizens' right to protest. Using recorded footage of protestors projected onto a translucent screen rather than physically present protestors, the organization of the protest aimed to sketch a futuristic scene in which Spanish citizens would only be able to protest in holographic form if the law would be passed. (Lopez, 2016) In terms of more personal use, translucent screen projection can be found, for example, in the form of a 'holographic' virtual assistant created by the Japan-based company Gatebox in 2016. Having similar functions to Amazon's Alexa or Apple's Siri and promoted as a personal assistant as well as a virtual companion, the Gatebox character comes in a small-sized device which uses a translucent screen to create a visual appearance to go with the AI voice system.

When it comes to hologram concerts, this technique was used, for example, at the 'Roy Orbison – In Dreams: Hologram Tour' in 2018 (30 years after his death), 'The Bizarre World Of Frank Zappa' tour in 2019 (26 years after Frank Zappa passed away) as well as several hologram concerts featuring virtual characters, mostly in Asia, such as Hatsune Miku (since 2009), Kizuna AI (2018) and Nintendo's Splatoon (2019).

Compared to Pepper's Ghost Illusion, a projection onto a translucent screen arguably provides a lower quality experience. Due to the material of the screen and its angle in relation to the projector, it is more likely to reflect other light sources in addition to the projection, increasing its visibility to the audience. However, the screens used in this technique are more durable and less expensive than the foil screen used for Pepper's Ghost Illusion. Additionally, the screen is less time-consuming to put up and needs a smaller stage area. (Ownbey, 2020) This makes the translucent screen projection a popular alternative to Pepper's Ghost Illusion for hologram concert tours along several places and stages.

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2. Hologram concerts and Mixed Reality Media

2.1 The screen-window metaphor

A common way of thinking about screens within media studies, at least until relatively recently, is to interpret them as a border in between our physical reality and the digital realm which the screen enables us to look at. Be it a movie, a videogame or a Zoom call, the environment we physically inhabit is often seen as separated from the virtual environment of the screen: A physical 'here' and a virtual 'there', separated from each other by a screen.

Anne Friedberg describes this separation as an 'ontological cut' marked by the frame of the screen. Here, our view onto virtual space ends and physical space begins, each with their own materiality and temporality. As such, she compares the screen to a window: it shows us a view of a space that is separated from the space which we are located in. This idea plays an important role in Friedberg's *The Virtual Window*, in which she uses Leon Battista Alberti's comparison between paintings and windows of 1435 as a basis to approach modern screen theory. (Friedberg, 2006)

Friedberg is by far not the only one to stress the separation between virtual and physical space, or even to describe the screen as a window or barrier. In her own text, Friedberg gives a few examples, but others, too, can be found. Fransesco Casetti traces the screen-window metaphor back to 1908, when it was first used by Tullio Panteo in an essay on cinema's social influence. (Casetti, 2017) According to Casetti, the metaphor gained in popularity around the 1960's, when, among others, André Bazin used it in his writings on cinema. Though Casetti acknowledges that the growth in variety of form and function of screens in recent times challenges the metaphor, he still interprets the digital and physical as two strictly separated spheres. (Casetti, 2013).

Two years before Friedberg's publication, Erkki Huhtamo uses the exact same phrase, a 'virtual window', to describe screens. He stresses how the fact that screens, much like windows, are framed and argues that this is what makes the metaphor intuitive. Huhtamo also opposes the screen space, which he refers to as the mediated realm, to physical reality. (Huhtamo, 2004) Stanley Cavell called the screen a barrier between the non-existent 'projected world' and reality, again portraying virtual space as strictly separated from

physical space. (Cavell, 1979) Lev Manovich, too, talks about 'screen space' or 'virtual space' as a world separated from ours by the screen when sketching an extended history of screen practices. (Manovich, 1995) These examples illustrate how the idea of the screen serving as a border between the virtual and the physical has been persistent within screen studies for quite some time.

2.2 Challenging the metaphor

However, throughout the history of media, these two have not always been presented as a binary. There are several instances where the two were presented as merged. To understand this, it is important to keep in mind that 'virtual' is not necessarily the same as 'digital'. Friedberg defines the virtual as something that "*appears functionally or effectively, but not formally, of the same materiality as what it represents".* (Friedberg, 2006) Friedberg's definition allows the word 'virtual' to also be used to refer to, for example, painting, photography or even language (she uses metaphors as an example here). Keeping this definition in mind, it can be said that people have employed various methods to blur the line between the virtual and non-virtual in media since a long time before screen media even emerged.

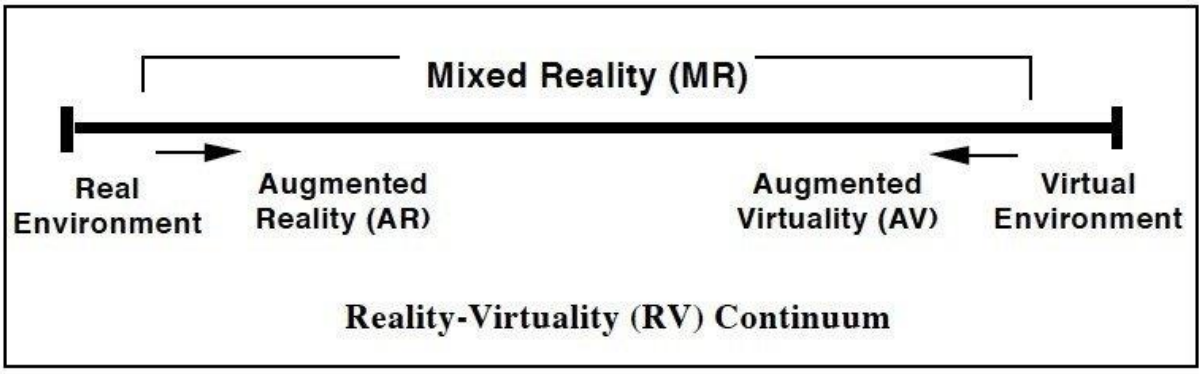
Already during the 19th century, various attractions that blurred the line between virtual images and physical reality gathered attention of large amounts of visitors. The Pepper's Ghost Illusion described in the last chapter is one example. Another one is panorama paintings: Large, circular rooms in which a large painting depicting a landscape spanned the entirety of the walls. Visitors would stand on a platform in the middle of the room, having a 360 degree view of the scenery. Since the platform restricted them from seeing the painting from up close and the lighting in the room made it difficult to see the upper and lower edges of the image, the illusion was created that visitors were looking out onto an actual skyline. (Crary, 2002) The distinction between physical reality and the flat, virtual depiction of the scenery was made deliberately ambiguous. Another example are phantasmagoria shows in which a magic lantern was used to project images onto smoke. Usually presented as ghosts, this technique was used to make it seem like images of people floated in the air. (Castle, 1988)

With the invention and popularization of photography, too, came ways of blurring the lines between the virtual and the physical, such as with the stereoscope. This invention

consisted of a glasses-like set-up with two lenses, one for each eye, behind each of which was placed a photograph of the same scene, from two slightly different angles. Looking through it created a 3D image to the observer. Furthermore, since the device was shaped to hide any other surroundings from the viewer, it aimed at creating the illusion that they found themselves within the picture's scene. (Zone, 2007)

All of these examples share the characteristic of aiming to diminish the boundary between the virtual and the non-virtual. In recent times, as technology advances, this trait is becoming more popular among screen media as well. In a way, Augmented Reality and Virtual Reality screen devices can be seen as successors of the 19th century entertainment described above.

In 1994, Paul Milgram and Fumio Kishino coined the term Mixed Reality, defining it as situations where virtual elements and non-virtual elements are presented "*within the same visual display environment*". (Milgram and Kishino, 1994) They propose reality (in the sense of anything non-virtual) and virtuality are two far ends of a so-called 'reality-virtuality continuum'.



The reality-virtuality continuum as proposed by Milgram and Kishino. (1994)

A completely real environment, according to Milgram and Kishino, consists of only 'real' elements, which they define as having an objective existence. Such environments entail our physical surrounding as well as digitally displayed recordings of those physical surroundings. Completely virtual environments, then, are environments made up entirely out of elements that are virtual (existing essentially and/or effectively, but not formally or objectively). These can only be viewed when simulated. Any environment in which elements of both categories are present can be described as Mixed Reality. (Milgram and Kishino, 1994)

When screens are involved in Mixed Reality, situations may occur that challenge the notion of the screen-window metaphors and the idea that the screen acts as the border or barrier between virtual and physical space. An example that has become popular in recent times is Audmented Reality, which Milgram and Kishino place on the centre-left of the Reality-Virtuality Continuum. Augmented Reality is often described as situations where our audiovisual experience of our physical surroundings is overlaid with virtual elements, creating an environment that is neither only physical nor only virtual. Some scholars, such as Nathan Jurgenson, take the definition of Augmented Reality even further, rejecting its reference to technology and instead arguing it should signify a point of view that contrasts interpreting the physical and the virtual as opposites. (Jurgenson, 2012)

In defining Augmented Reality, Jay David Bolter et al. point out two kinds of techniques mainly used. The first, Augmented Reality through video-mix, is when recordings of real environments are overlaid with virtual elements. (Bolter et al., 2021) This happens, for example, in movies such as *Who Framed Roger Rabbit?* (1988) or *Space Jam* (1996) where cartoon characters are depicted alongside human actors. Another example is smartphone apps that use the phone's camera to display real-time recordings of real environments and overlay these images with virtual elements, such as *Pokémon Go* or Ikea Place. In the case of video-mix, real environments are reproduced on screen and augmented there.

Bolter et al. describe a second type of Augmented Reality that uses see-through optics. Here, a translucent or transparent surface functions as a screen to project virtual elements on. This means that there is no need to reproduce an image of the real environment, as the screen does not obscure the observer's view. As such, virtual elements can overlay the real environment directly. (Bolter et al., 2021) Google glasses and similar devices are an example of this type of Augmented Reality, allowing their wearer to see both their physical surroundings as well as digitally displayed information.

This latter technique of creating Augmented Reality falls under a category of screen media that Jenna Ng calls the post-screen. Ng sees a necessity of defining this new type of screen due to a rising trend in screen devices that are "*seeking to eliminate the presence of the screen and the visibility of its boundaries*". (Ng, 2021) When, through its see-through nature, the screen's materiality becomes more difficult to perceive than the image or information it displays, it serves as a means of blending virtual and physical space rather

than acting as a barrier between the two. As such, the post-screen strongly undermines the idea of an ontological cut that Friedberg sees as inherent to screen devices. (Ng, 2021)

Hologram concerts introduce virtual elements in a non-virtual environment and attempt to diminish the visibility of the screen. They create an environment that merges the virtual and non-virtual. As such, they fall into the category of Mixed Reality Media as well as the post-screen. Hologram concerts can be seen as a recent development in a range of media entertainment that challenge the concept of the virtual window. When the concert is successful at instilling a sense of suspended disbelief among its audiences, the separation or barrier that is prevalent in popular discourse is eliminated. Instead of looking out onto a virtual environment, audiences find themselves inside a merged environment. As such, hologram concerts form an interesting example to gain insight into the ways mixed reality media can challenge the screen-window metaphor.

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3. Presence, liveness, and their relevance to suspended disbelief

3.1 Why presence and liveness?

Encouraging audiences to adopt a state of suspended disbelief is key to audiences' enjoyment of hologram concerts, state Chang and Shin after extensive fieldwork at K-Live. K-Live was a Seoul-located music hall which exclusively hosted hologram concerts between 2015 and 2019 in response to the booming popularity of K-pop. Chang and Shin state that suspended disbelief allows audiences to accept the concerts as virtually real, which in turn grants the concerts "*existential power [similar to] a live concert*" (Chang and Shin, 2019). In short, without suspended disbelief, hologram concerts would not be experienced as concerts by their audiences. Kenny Forbes, who has done a similar field study among visitors of various hologram concerts, echoes the idea that suspended disbelief impacts audiences' experiences positively. He stresses that this is a subjective experience. Even among visitors of the same concert, not everyone reaches the same stage of suspended disbelief. However, the findings of his study imply a correlation between visitors adopting a state of suspended disbelief and their enjoyment of hologram concerts (Forbes, 2021).

Chang and Shin furthermore point out the concepts of presence and liveness as important factors when it comes to allowing audience members to adopt a state of suspended disbelief. However, they do not delve deeply in how we can relate presence and liveness to hologram concerts, or mixed-reality media in general. Their description of the concepts is compact and the rest of their study focuses mainly on audience reactions to hologram performances. However, tying presence and liveness as relevant concepts to mixed- and virtual reality media raises some interesting points and questions.

Both concepts have been used in academic research for several decades. Presence is mostly discussed within the realm of media studies and denotes a state where audience members experience a reduced awareness of mediation. Liveness is more prominent in studies related to performance, live television and (more recently) social media and internet communication. It refers to audience members' interpretation of something as being created or taking place in the present rather than being pre-recorded.

When considering a hologram concert, a reduced awareness of its mediation and of its pre-recorded nature may explain how audiences would be able to accept it as a concert

experience. After all, the norm at concert events is the appearance of an unmediated and live performer. As such, the concepts of presence and liveness tie strongly into audiences' state of suspended disbelief.

In the case of both concepts, they are generally talked about in contexts that assume a clear cut between virtual, mediated content and physical, non-mediated environments. So what happens when we relate presence and liveness to situations where the boundaries between the mediated and the non-mediated are blurred?

Literature that discusses these concepts in such contexts is not abundant. This could be due to the fact that mixed- and augmented reality media have only relatively recently become more and more accessible to the general public. In a 2013 study, Bolter et al. state that contemporary theory is generally difficult to apply to new and upcoming forms of media such as social media, augmented reality and virtual reality. They also mention presence and liveness in this assessment. (Bolter et al., 2013) Since 2013, studies relating to presence or liveness in mixed- or augmented reality situations have been published, but it can still be said to be an underexposed topic that leaves many questions unanswered.

Before going further into depth about this issue, the following section of this thesis aims to give some more insight into the concepts of presence and liveness and the role they have played in academic literature before the rise of mixed reality media. They will also provide a list of markers that are considered important to fostering a sense of presence or liveness among audiences. These markers will provide the tools to relate the analysis of the case study to suspended disbelief.

3.2 Theory on Presence

The concept of presence has been explained and discussed in a wide variety of ways by different scholars, making it a somewhat tricky concept to work with.It does not have a clear-cut definition that is universally used. At its core, however, most researchers seem to agree that the definition of presence involves some variation of the following statement:

Presence is a state of mind in which the user, viewer or player is unaware of (or experiences a reduced awareness of) the mediated nature of an experience. The user, viewer or player tends to respond (to more or lesser extent) to a mediated object, person or environment as though it was unmediated. (See for example Lombard and Ditton, 1997; Lee, 2004; Sacau et al., 2008)

This is also the definition this thesis will use when referring to the concept of presence.

Examples of situations when people experience a sense of presence include feeling scared while watching a horror movie or experiencing vertigo when riding a virtual roller coaster in a VR-environment. In both cases, the viewer or user rationally knows the experience is mediated and that they are merely watching a screen. Still, they respond in a similar way as they would have if the experience had been actual. As such, the concept of presence is often related to feelings of immersion and suspension of disbelief. Presence is often also related to audience's enjoyment of mediated content. In contemporary technology and media, aiming for a sense of presence among audiences seems to be increasingly common, to the point it might be considered the norm. (Marto and Concalves, 2022)

Various texts on the topic of presence propose to divide the concept into several categories or types. The two categories of presence most commonly discussed in academic writings are *spatial presence* and *social presence*. The former relates to a sense of presence through a reduced attention to one's physical surroundings combined with a heightened awareness of a virtual or on-screen environment. The latter relates to perceiving a 'togetherness' with someone and being able to interact with them as if they were in relatively close proximity.

3.2.1 Spatial Presence

Spatial presence (also sometimes referred to as telepresence) seems to be seen as the 'default' category of presence by various academic writers. Due to the prevalent screen-window metaphor, it is not uncommon for texts to equal the reduced awareness of mediation to a sense of being absorbed into a virtual environment. Spatial prescence is often described as a user's or viewer's sense of being cognitively present in a virtual world rather

than their physical surroundings. (See for example: Held and Durlach, 1992; Steuer, 1992; Slater and Usoh, 1993) A temporarily significantly reduced awareness of the world outside of the screen also means a reduced awareness of Friedberg's ontological cut between the virtual and the actual. As such, users or viewers may become temporarily unaware (or less aware) of the mediated nature of their experience, and thus experience a sense of presence.

Spatial presence is most evidently relevant when discussing film or video games, as these often depict a rich environment through audiovisual means (though, of course, it can also arise when interacting with other forms or media). Though drawing audiences into the screened world is a common aspiration of contemporary entertainment media, this has not always been that way.

When film started to become a common form of entertainment, it was often displayed in contexts where the screened and the physical environment played equal parts in the movie experience. A good example are the lavishly decorated movie palaces that were mainly popular during the 1920's. The venue's design and atmosphere were seen as just as much a reason to visit a movie as the screening itself. (Szczepaniak-Gillece, 2018)

In the 1930's we can see a start of a trend towards inducing presence through film with the introduction of the black box cinema: movie screenings in dark rooms without non-essential and distracting ornaments or other elements in sight of the audience. (Szczepaniak-Gillece, 2018) Later introductions to cinema such as wide-screen, surround sound and even 4D elements can also be seen as a trend towards presence, as these aim to make it easier for audiences to feel immersed in the film's virtual environment. (Recuber, 2007) Taking this another step further is VR, which completely replaces audiences' vision of physical surroundings with a virtual environment.

Though spatial presence is a subjective phenomenon (different users or viewers may attain different levels of a sense of presence from the same experience) research has pointed out various factors that can increase the likelihood of inducing a sense of spatial presence. The following is a list of factors often mentioned in academic writing (see for example: Held and Durlach, 1992; Steuer, 1992; Slater and Usoh, 1993; Slater and Wilbur, 1997; Goethe, 2019):

- Hiding any reminders of the medium's technology and its physical existence (or making them less obvious at least). For example, obvious lights or buttons placed next to the screen of a television as well as too much textual

information displayed in a video game's interface can both serve as reminders that you are watching something confined to a screen.

- The number of sensory modalities that are addressed by the medium as well as the resolution of the elements that make up the virtual environment. By creating a mediated experience that addresses more sensory modalities the experience becomes more cognitively demanding. As such, there is less room for awareness of the mediated nature of the experience.
- Similar to the point above, an interactive experience, too, makes for a more cognitively demanding one. Interactivity strongly draws attention to the virtual image over the non-virtual surroundings that are not interacted with during the experience.

3.2.2 Social Presence

The other form of presence, social presence, relates to a feeling of being in the presence of another social being, even if that being is not physically there. (Sacau et al., 2008) Examples of situations which may induce a sense of social presence include texting with a friend over a text-based chat, listening to a newsreader facing the camera, or even interacting with an AI-system that presents itself as a person. The social being does not necessarily have to be a human or a sentient being in order for social presence to come about, as long as the viewer or user interprets the social other as such. (Oh et al., 2018)

Though the phrase social presence (sometimes also called co-presence) has been around for quite some time, it has seen a surge of academic interest with the rise of social media. As technological advancements have made it easier and easier to observe or even interact with others over long distances, social presence has become more relevant to our society.

Just like spatial presence, various academics have done research to what factors play a role in encouraging a sense of social presence among audiences. Oh et al. have done an extensive literature review on a large number of resources that seek to establish the most important factors for social presence to come about. Following is a list of relevant factors resulting from Oh et al.'s research (2008):

- Visual realism, mainly of the behavioral type. Though photographic realism may be a helpful element, too, behavioral realism is pointed out as an

important factor to social presence. This refers to a realistic way of moving (such as blinking, breathing, repositioning etc.) as well as realistic ways of responding to surroundings and others.

- Interactivity. This point ties in with behavioral realism to some extent, as realistic feedback between the audience and the mediated social being can add greatly to a sense of social presence. Even just showing an awareness (or an apparent awareness at least) of the audience's presence can form an important factor to social presence. It should be noted, however, that interactivity is not strictly necessary for social presence, as it can also occur in one-way modes of communicating. (Lee, 2004)
- The number of sensory modalities addressed. Oh et al. found that several resources mentioned a greater sense of social presence when interacting with media that address more senses, such as a combination of sound in sight over just using one of those.
- Being able to witness other users, players or audience members reacting to the mediated social being. Research has shown that in such situations, seeing others react positively and socially increases the chances of social presence to play a role.

In short, there is a variety of factors to look at when analyzing media that may bring about a sense of presence. There is some overlap between the factors marked relevant to spatial and social presence: Interactivity, medium richness and quality (or resolution). In addition, it is helpful to look at the extent a medium's physical and technical properties are noticeable and visual realism. Seeing or hearing other audience members react to the medium can also play a part and although this is not something the medium can control completely, it can prove useful to analyze whether audience members can witness each other and if (and how) they are encouraged to show their reactions to the medium.

The case study presented later in this thesis will keep all above-mentioned factors in mind when analyzing hologram concerts, including the ones for spatial presence even if hologram concerts display virtual elements rather than a complete environment. When talking about mixed-reality media, space can be a tricky concept. When a medium seeks to present an image as something present within physical space rather than something

confined to a screen, it can be hard to say exactly where the physical space ends and the virtual space begins. It can even be said that physical environment temporarily becomes part of a virtual environment: the physical environment can be seen as a space where the virtual person or object does not exist; The virtual environment is a space that may closely resemble the physical one, but differs in the fact that the virtual element(s) does exist in this space. For that reason, even the concept of spatial presence will be considered relevant to hologram concerts in the remainder of this thesis.

3.3 Theory on liveness

Within the realm of performance studies as well as screen studies (and even other fields), the concept of liveness has been defined in a variety of ways, but it is safe to say that these definitions generally refer to liveness as related to something happening 'in the moment' in one way or another. Within performance studies, liveness is often defined in opposition of the mediatized and/or recorded. (Kim, 2017)

In a world where media technology is rapidly evolving, elements such as voice amplification, synthesized sounds or projected images are becoming more commonplace on stage, challenging what the notion of 'live performance' means. Within this line of thought, Paul Sanden defines liveness as:

"*a sense of human production that is different from that found in mediated music or that is, at the very least, resistant to the transformative powers of mediatization*". (Sanden, 2013)

Through this definition, Sanden links the bodily creation of sounds and other forms of expression to liveness. He relates the concept of liveness to words such as 'natural' and 'human' in contrast to their binary opposites, 'artificial' and 'machine', which are more closely related to the mediated. (Sanden, 2013)

This binary that is often used when defining liveness has not always existed. Before technology made it possible to implement mediated, pre-recorded elements into staged performances , stage performances could only be created in the moment through human bodily action. It made no sense to call a performance 'live', since the category of non-live performance did not yet exist.

Liveness, then, has only been a concept of debate since relatively recent history. It started becoming relevant when television broadcasting started to switch from live to recorded programs, which happened during the 1950's. (White, 2006) Before then, the live and immediate qualities of television were generally seen as essential to the medium. The new trend towards pre-recording and rebroadcasting sparked academic debates about liveness. (Auslander, 2008: Live Performance in a Mediatized Culture)

For some time, the binary opposition between live and recorded was mostly strict and obvious. Concerts were live, performed by singers and musicians creating sound through body movements (such as singing or strumming a guitar). Records were not live, their sound was produced through electronic devices playing back a recording of something that was produced in the past. Live performance was strongly associated with sharing the same spatial and/or temporal space as the performer, spontaneity and acoustic sounds, as opposed to non-live performance. (Sanden, 2019)

With the advancement over time of technology capable of replaying and even producing sound and image through electrical means, the once clear binary has become blurred. Starting with the popularity of synthesized sounds during the 1960's and 70's, a grey area appeared, containing performance elements which could not easily be categorized as live or recorded. Nowadays, the use of synthesizers, autotune, sampling, mixing and other elements is not uncommon during live performance. These are often accepted by the audience as part of a live show despite not being created purely by bodily performance. For example, during a DJ performance where the performer uses a computer or other electric devices on stage, audiences may not be able to tell what actions by the DJ trigger which sounds. They may not even be able to tell whether the music is produced in the moment or not. Still, these types of events are generally considered a live performance.

As Inger Helseth and Anne Danielsen argue, since such non-acoustic sound sources have become common in modern live performance, audiences cannot always see or otherwise determine the source that creates the sound. Even when a performance is produced live, there is no guarantee that audiences experience it as such. (Danielsen and Helseth, 2016) Much in line with the concept of suspended disbelief, Kimi Kärki states that a sense of liveness among audiences can help blur the line between the simulated and the real. (Kärki, 2022)

3.3.1 Liveness during the event

Like presence, liveness is not an objective concept. One audience member may interpret a performance as being created in the moment while another audience member of the same performance could interpret it as a recording or mediated show. That being said, a sense of liveness among audience members is generally regarded as positive and desirable outcome for a 'good' performance as it may also generate or strengthen a sense of authenticity. (Auslander, 2008: Introduction) Performers may employ (audio)visual techniques to try and convince their audiences to interpret their performance as live, even if it contains recorded elements. (van Es, 2016: Social TV; Danielsen and Helseth 2016)

Academic research and writing on liveness takes a wide range of different approaches since it is a subjective concept and can apply to a wide variety of media. Within performance studies, Anderton and Pisfil point out a switch in focus from live elements to mediated elements. (Anderton and Pisfil, 2021)

In looking at liveness in live concerts as well as recorded music, Sanden summarizes a series of 'types of liveness' which are particularly useful to this thesis as they can be interpreted as various different factors that can stimulate a sense of liveness among the audience. (Sanden, 2013) Sanden distinguishes 7 categories of liveness which can take place separately as well as simultaneously:

- *Temporal liveness*: When audiences feel they are witnessing a performance at the time it takes place.
- *Spatial liveness*: When audiences feel they are in the physical presence of the performers.

(It should be noted that one of these two can happen without the other, though it can be said that when occurring together they may reinforce each other. Watching a livestream on a smartphone, for example, will likely not trigger a sense of spatial liveness but can very well trigger a sense of temporal liveness)

- *Liveness of fidelity:* When the sounds produced by the performers' voices or instruments are (or seem) unaltered by electronic means.
- *Liveness of spontaneity:* When a performance is or seems (partly) improvised and/or when it is obvious to the audience that there is a genuine possibility the performer could make a mistake. It creates the sense that each

performance is unique, that visiting the same show on another light could provide a different experience.

- *Corporeal liveness*: Relates to creating a visual link between bodily movements and audible sound, such as the visibility of a performer strumming a guitar at the same guitar music is audible to the audience.
- *Interactive liveness*: When interaction takes place between the performers and the audience. This can, for example, be when performers single out an audience member for conversation as well as inviting the entirety of the audience to sing or clap along.
- *Virtual liveness*: Arguably Sanden's most complex category. To define virtual, Sanden takes the same approach as Friedberg as described earlier in this thesis: something that is *'real but not actual*'. Virtual liveness does not occur by itself, but as virtual versions of the other categories. This means that the factors for other categories of liveness are not there, but the audience may still interpret them to be. (Sanden, 2019) For example, lip-sync, when a performer pretends to sing but the audible vocals are actually a pre-recorded track, can still trigger the illusion of corporeal liveness.

3.3.2 Liveness through metatexts

While Sanden's approach focuses more on audiovisual factors of performance that may instill a sense of liveness among audiences, Karen van Es researches how to analyze to what degree audiences experience a sense of liveness. Though this approach differs from this thesis (which will analyze concerts rather than audiences), van Es raises an important point of analysis that is not mentioned by Sanden: the metatext. She describes this term as 'a platform's paratext' and urges researchers to take a good look at information that surrounds an event (such as a website, advertisements, interviews and other promotional materials) and see how this could influence audience members' interpretation of an event. (van Es, 2016: Constellations of Liveness) After all, an audience member who is told beforehand that they are about a live concert may interpret a performance differently from an audience member who has been told they are about to witness, for example, a media art show.

In this thesis' approach to analyzing techniques hologram concerts may use to encourage a state of suspended disbelief through a sense of liveness, both Sanden's and van Es' texts are valuable tools. The analysis of this thesis will mainly focus on the temporality, spatiality, corporeality and interactivity displayed during the analyzed concerts. In addition, the metatext surrounding the concerts will be discussed.

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Part 2:

The Case Study

4. A note on names, stylization, and translations

This thesis attempts to explain suspended disbelief through presence and liveness in the context of hologram concerts through a case study. The case study consists of a series of hologram concerts by Japanese singer and vocal synthesizing program Hatsune Miku. Since Hatsune Miku is a mostly online Japanese phenomenon in origin, the following chapters will include several mentions of Japanese names, software product names, usernames, and song titles. These may differ from common naming traditions in other parts of the world and other languages. Therefore, it needs to be prefaced with a short clarification.

In Japan, the way of addressing a person by their full name mentions the family name first, followed by the given name (as opposed to many western societies that start with a person's given name, followed by their family name). For the sake of this writing, since these chapters include names of people from various parts of the world, all names will be written out in European tradition: Given name, then family name.

When talking about Hatsune Miku (as well as other vocal synthesizing characters), it is not entirely correct to say the name belongs to a person. In fact, when looking at English websites that relate to Miku, these often include a small section introducing her, prefaced by the phrase "*What is Hatsune Miku?*" rather than *"Who is Hatsune Miku?*". In essence, Hatsune Miku is the name of a software product, presented as a character. The software is designed and named in Japan. Hatsune would be the family name, while Miku would be the given name. This thesis will not switch these names around to resemble European naming tradition. This because even on English versions of officially licensed websites, the character is referred to as 'Hatsune Miku' rather than 'Miku Hatsune'. Often, she is also simply referred to as 'Miku'. In the case of other vocal synthesizing products, too, names will be written out and stylized as on the official product's website. In some cases, this means that names will be displayed in all capital letters or include no capital letters at all.

In addition, as will be described later, the phenomenon of Hatsune Miku is deeply rooted in social media. Many creators who upload songs made using vocal synthesizing software use a chosen username rather than their own name to publish their songs. When referring to songs in this thesis, they will be displayed in the same way they are registered on

social media. Again, this may mean that the use of capital letters may deviate from common European tradition.

This thesis occasionally refers to songs to use as examples. The song titles (which are often Japanese in origin) will be written out in the same way they are displayed in the English version of officially licensed media (such as CD's, video games or websites). In some cases, these will be English, in other cases Japanese. When titles are in Japanese, an English translation will be added in the footnotes. When mentioning English titles or translated quotes, the original Japanese text can also be found in the footnotes.

5. Subject of case study: Hatsune Miku

5.1 Why Hatsune Miku?

Japanese pop star Hatsune Miku's concerts have sparked the interest of news outlets around the world as an emblem of Japanese pop-culture: crowds gathering at music venues not to see a singer of flesh and blood but rather a projection of a girl with exaggerated, anime-like features, green hair, and a futuristic school uniform. Even in Japan, the appeal is not universal but it's enough to make touring around the world a lucrative venture. But who is Hatsune Miku? Or rather, as is written on all of the concerts' information web pages, *what* is Hatsune Miku?

At its core, Miku can be described as a plug-in product for a voice-synthesizing computer program. To date, various of such programs exist. Miku was originally created for Yamaha's Vocaloid program (hence she is often referred to by fans as a Vocaloid). Vocaloid allows users to transform text-based lyrics into audible vocals that can be used to create songs, substituting a human singer. Users can select phonemes (the smallest distinctive units of spoken sound) and string these together to create words and sentences. Users can purchase a variety of digital voices (referred to as voice banks) to sing their lyrics. Each voice bank consists of a library of phonemes pronounced by the purchased voice. To date, Miku is the most popular voice bank for purchase.

For marketing purposes, Miku's product packaging at the time of her release featured the image of an anime-style girl. The combination of this image and the voice have since been embraced by fans as the character 'Hatsune Miku', featured in fan creations as well as commercial productions. Miku does not only star in music, but also in video games, comic books, advertisements and more. Her appearance in a variety of media has allowed Miku's popularity to spread widely, mainly in Japan but also in various other regions around the world. This popularity has also made it possible and lucrative for Miku to be featured in a range of live concerts as a holographic projection.

Hatsune Miku's original character illustration by KEI. (Crypton Future Media, 2007)

Hatsune Miku's live concerts will function as the topic of the case study for this thesis. This particular singer's concerts have been chosen for a number of reasons. First of all, compared to other holographic performers Miku has a long history and varied repertoire when it comes to hologram concerts. First appearing as a guest performer during a concert at Animelo Summer Live 2009, in Saitama, Japan, she has appeared in her own concert tours regularly since.

Many other holographic performers feature only in incidental events. For example, Tupac's famous appearance at Coachella in 2012 lasted only for three songs and was a one-time occasion. Roy Orbison, Frank Zappa, Whitney Houston and others have had their holographic double perform on tours consisting of several concerts but have never been featured in more than one tour, making their number of concerts limited. Hatsune Miku, due to her long history of consistent touring, not only has been featured in a large amount of hologram concerts but also in a wide variety of differently programmed concerts as each tour has different setlists, costumes and MC. Miku's abundant and varied history of hologram concerts makes her performances an interesting topic for this thesis.

Secondly, most of Hatsune Miku's concerts are well documented. Most of the tours are professionally recorded by cameras from different angles and have later been distributed on DVD or Blu-Ray. Since the scope of this thesis focuses not so much on

audience reception but rather on the audiovisual presentation of the holographic performer, this provides many useful examples to analyze. Fan recordings and descriptions of many of the concerts are also available online and can be used as additional reference.

Lastly, Miku is an explicitly virtual being, more so than the majority of other holographic performers. Holographic concerts featuring projections of real humans may induce a state of suspended disbelief among audience members to a greater extent through high quality equipment and high-resolution projections. This would result in a holographic performer that audience members can familiarize with. However, Miku does not look human (nor is she meant to). Her holographic image would not either, even with the use of life-like quality projections. This may mean that in programming her concerts, the makers need to go through greater length to encourage suspended disbelief through other elements than just visual quality.

All things considered, Hatsune Miku's concert make a suitable topic for a case study on hologram performances. Before presenting concert analysis, this thesis will first provide an overview of Miku's history as a vocal synthesizing program as well as her popularity as a character.

5.2 What is Hatsune Miku?

The first vocal synthesizer program to be released was Vocaloid 1, produced by Yamaha. The program had been created at Pompeu Fabra University, Spain, in 2000 and was made available to the public in 2004. In order to create vocals using the program, users must also purchase a so-called voice bank: a library of recorded sounds by a human voice provider. The library consists of a large amount of spoken phonemes. The vocal synthesizing program can convert written lyrics into audible language using the phonemes stored in the voice bank, in a variety of pitches chosen by the user, thus creating virtual vocal lines. Later versions of vocal synthesizing programs also added options to make the vocals sound more lifelike, for example through breathing sounds and whispers.

Though there are currently many voice banks users can choose from, Vocaloid 1 only had five voices available: LEO, LOLA, MIRIAM (all three developed by Zero-G Limited, aimed at the English-speaking market), MEIKO and KAITO (both developed by Crypton Future Media Inc., aimed at the Japanese market). Promoted as a music-making tool for

professionals, Vocaloid received much criticism for sounding too robotic and unnatural. Still, sale numbers were high enough to warrant continued development of the program.

In 2007, Vocaloid 2 was released with improvements to the program's interface and sound output. Hatsune Miku was one of the voice banks available for this version of Vocaloid. It was partially due to Miku's unexpected popularity that this version of Vocaloid became much more successful than its predecessor. Miku, developed by Crypton Future Media Inc. (hereafter referred to as Crypton), was the third voice bank available for Vocaloid 2. When her visual image featured in various memes across the internet, she quickly started gaining fame, particularly in Japan.

The Miku memes raised public awareness of the existence of Vocaloid, causing the userbase to spread not only among professionals but also among amateurs and hobbyists. Particularly among these latter categories of users, it became common practice to share songs created with the Vocaloid software through social media. Mainly Niconico Douga, a Japanese video-sharing website launched in 2006, became a hub where Vocaloid fans came together to share and listen to creations.

The success of Vocaloid has persisted through the years, with Vocaloid 6 currently being the latest installment, released in October 2022. Other companies have produced their own vocal synthesizing programs, such as CeVIO, Synthesizer V and Piapro Studio. Voice banks, too, are available in large numbers, most of which with corresponding character visualizations. Popular vocal synthesizing characters include GUMI, IA, flower and Kafu. Despite such variety in programs and voice banks to choose from, Hatsune Miku is still the most popular character to date and is generally seen as the face of the vocal synthesizing phenomenon.

When Crypton released Hatsune Miku, it was only a small company focused on distributing music software based in Sapporo, Japan. Most of their products until then were instrumental synthesizers. Considering MEIKO's and KAITO's limited success, the company never expected Miku to become so widespread. (Leavitt et al., 2016) Currently, the company licenses six voice banks and their characters: Hatsune Miku, Kagamine Rin, Kagamine Len, Megurine Luka, MEIKO and KAITO (hereafter referred to as 'Piapro characters'). Their characters are well recognized and popular among Vocaloid fans and creators, making Crypton one of the leading voice bank producers. The sale of voice banks are Crypton's main

source of revenue in regards to vocal synthesizing products, but the company also manages to monetize the characters in a variety of other ways.

Soon after Miku's release in 2007, Crypton also released a platform called Piapro (an abbreviation for the Japanese pronunciation of 'Peer Productions'). With growing amounts of professionals as well as amateurs producing creative content featuring Miku's voice and image, the company soon found themselves in need of establishing a means to manage a balance between their corporate, commercial ownership of the character versus creative fan productions. The most common way for producers of Miku's music to deliver their works to listeners is through social media. Thich poses very little financial limitations for either party as both sharing and listening is free. For Crypton, the social media circulation of their product gains them no revenue.

Rather than enforcing a strict copyright and control over production to fight this mode of sharing among fans, Crypton decided to take on an administrative stance towards such circulation of their product. (Leavitt et al., 2016) This is made possible due to the Creative Commons License that is applicable to any content involving any of Crypton's original characters. It is a creative copyright license which Crypton adheres to that allows anyone to create and share content involving the characters as long as it is for non-commercial purposes. Once creators aim to monetize their content they should reach out to Crypton to set up an agreement, making Crypton one of the benefactor of the commercial product.

Crypton also created their own music label, KARENT, allowing content creators relatively easy access to opportunities to monetize their songs. The Piapro Character License makes sure Crypton maintains ownership of their characters and the potential to use them for commercial purposes while also making it possible for fans to create and distribute art and music using the characters with very few limitations.

Crypton does not only allow fans' content creation and circulation, they also encourage it. Crypton CEO Hiroyuki Itoh considers it Crypton's job to foster safe and suitable environment for fans to create and share. (Melissa, 2016) In order to do so, Crypton created the Piapro platform. The website serves as a meeting place where creators can share and coordinate production. A popular way of presenting songs made with vocal synthesizing software among fans is by embedding the music into a video alongside lyrics and artworks (ranging from still images to animated videos). This means that a wide skillset may be

needed, depending on the ambitions of the music producer. The Piapro platform offers vocal synthesizing programmers, musicians, video editors and visual artists a virtual space to reach out to each other and work together on producing creative content. Crypton does not only benefit from these creators potentially taking the step towards monetizing their creations at some point, but also from fans creating and spreading content non-commercially. The circulation of their product online raises public knowledge about their products. Effectively, the non-profit circulation of fan-created content that uses any of the Piapro characters' image or voice functions as advertising content that commercially benefits few others than Crypton and their partners. (Hahn and Klein, 2019)

Besides the sale of the voicebanks and receiving royalties from for-profit content that features those voicebanks, Crypton also gains revenue through partnerships with other companies. Examples include the Project Diva videogame series by SEGA, figurines as well as race car related sponsor materials from Good Smile Company, recurring goods and advertisements from Family Mart and many other companies producing articles or advertisements featuring Piapro characters in collaboration with Crypton, mainly in Japan. Similarly to the circulation of fan created content, the goods and advertisements resulting from such partnerships help spread an awareness of Crypton's products among a wider audience. In addition, the company benefits from market sales.

It should be noted that even when collaborating with other commercial companies, Crypton expresses valuing fan creativity and content creation. Itoh explains that, in selecting possible partners and projects, the company greatly prefers partnerships which allow for content creators to be involved. (Leavitt et al., 2016) As a result, the vast majority of music and images featured in the products of such partnerships also involve a collaboration with song writers and/or illustrators (whom are often already involved in the Vocaloid online communities) that are commissioned or have won a contest designed for a specific project.

Lastly, as a continued source of revenue, Crypton launched their own vocal synthesizing software in 2013: Piapro Studio. Substituting the Vocaloid software, Piapro Studio only works with the Piapro character voice banks. This way, Crypton ensures providing their products as a contained system rather than selling plug-ins to be used with third-party software. Since Crypton's vocal synthesizing software and their voice banks can exclusively be used with each other, the purchase of either encourages also buying the other.

5.3 Fan reception

Though she was not the first voice bank released by Crypton, Hatsune Miku's voice and image are responsible for the majority of Crypton's success as a business compared to their other characters. Even among the wide variety of voice banks available today by other companies as well, Miku is often pointed out as the most well-known and popular vocal synthesizing character. After the relatively limited commercial success of the first series of voice banks, it was Miku who paved the way to bringing the vocal synthesizing phenomenon to a wider audience.

Her voice derived from that of Japanese voice actor Saki Fujita and her image resembling manga-style illustration created by KEI, Miku as a character fits in well with Japanese popular culture. Even so, her sales figures during the first period after release were much higher than even Crypton had anticipated, especially since their marketing strategies did not deviate much from those for MEIKO and KAITO. (Okata, 2007) Still, Miku's voicebank reached a decently sized group of users who were eager to create and share content.

During the first period after the launch of Hatsune Miku's voice bank, users mainly used the software to create covers of pre-existing songs by other singers, mainly within the J-pop scene in Japan. After a while, she also started to be featured more and more in songs that were composed by the users themselves. Among these early original compositions written for Miku to sing, the genre of 'Chara Sons' (short for character songs) became particularly popular with users of the software. Songs within this genre use the character that sings it as the subject of the song text. Since Crypton had not assigned personality traits to Miku (she was only described as a 16-year-old girl who loves to sing), fans were free to decide for themselves what kind of person she was to them. In the lyrics of many of these songs, Miku describes herself and her place in our world, often with an emphasis on her role as a singer and her virtual nature.

After a boom of this type of songs being spread around through social media, songs created with Miku's voice bank started more and more to resemble common Japanese pop music, both in lyrics and musical style. The song *Melt* (by ryo, 2007) is often described as a turning point, since it did not place Miku herself as the central topic of the lyrics and since the song was able to reach a wide audience. (Knight, 2013) Though Chara Sons are still a somewhat common theme among Miku's songs, creations that fit into other, more common, music genres were uploaded more frequently after this.

Other popular songs that are written in a style resembling popular music, such as *World is Mine* (by ryo, 2008, reaching number 7 on the charts after its release on iTunes in the US) and *Tell your World* (by kz, 2011, used for a Google Chrome advertisement that generated more views on Youtube than equivalents of the advertisement starring Lady Gaga and Justin Bieber) have helped Miku to establish a name for herself in the Japanese music scene.

Since the release of Miku's voice bank in 2007, users have created and uploaded massive amounts of songs that feature her voice. Lacking mental, physical, or spatial limitations that generally apply to human singers, new songs featuring Miku are uploaded every day to Youtube as well as Japanese video sharing website Nico Nico Douga. Part of Miku's popularity is often said to be due to her grassroots nature. Though she is created and distributed by Crypton, users are free (even encouraged) to express Miku's looks and personality in their own way. As stated before, Crypton has not established any personality traits for Miku, apart from her love for music, allowing fans to fill in this blank themselves. In fact, Crypton has carefully steered clear of producing media that show Miku expressing herself to large extent (although word of an upcoming animated series featuring Miku might indicate Crypton will stray from this path in the future. (PRNewswire, 2021)) Miku gives no interviews, speaks only brief phrases during commercials, and does not speak at all in the Project Diva videogame series.

Project Sekai, a mobile game by Crypton and Colorful Palette featuring the Piapro characters, can be said to be an exception to this rule. In this game, players can unlock chapters of a series of visual novels by playing rhythm games. Miku appears as a character in these visual novels and has more lines of text here than in any other Crypton licensed media she appears in so far. However, even here, she only appears as a support character despite the game being advertised as a Hatsune Miku game.

Her character is presented by Crypton without too much depth, her personality largely revolves around wanting to help others through music. Her appearance in this game expresses Crypton's intent to allow fans to be in charge of her personality quite strongly. Other (human) characters in the game comment frequently on how Miku's versatility. Moreover, her looks and personality differ depending on which character she's interacting with. For example, to Minori, an aspiring pop idol, Miku appears as an energetic show girl who is well versed in entertaining crowds. To Kohane, a shy teenager who recently joined a

group of street musicians, Miku is a down-to-earth café worker who she can turn to for advice. Perhaps most extremely, to Mafuyu, an ace student suffering from depression, Miku appears drained of color and emotion who offers her silent companionship. Displaying Miku with such a wide variety of character traits can be seen as a way in which Crypton informs users that Miku is theirs to shape and interpret.

Encouraging users to find 'their' Miku and allowing them to depict and share Miku how they wish, puts the concept of participatory culture at the center of Crypton's vision for Miku. As such, Miku fits in well within Japanese doujin culture, which could be another explanation of her popularity, at least in Japan.

Doujin culture refers to a phenomenon within Japanese pop-culture where fans can be described as active interactors of media rather than passive consumers. They create, distribute, and sometimes even monetize derivatives of licensed productions (often animations, comics or video games). These activities are well-embedded within Japanese popular culture. The resulting fan-made productions are generally accepted as works that add meaning to the original rather than seen as rip-offs of an original. (Le, 2015; Leavitt and Horbinski, 2013)

Crypton's strategy in presenting their vocal synthesizer characters can be seen as a way to optimally invite consumers to engage with their product in the spirit of doujin culture. Allowing fans to construct Miku beyond her looks, voice and occupation, she can be seen as a community-made pop icon.

Some go as far as to say that her popularity might be partially because her user-generated nature can be seen as a countermovement against Japanese pop idol culture. Within the Japanese popular music industry, it is fairly common practice that popular singers' lives and personalities are strictly regulated by the companies that license and distribute their music, both publicly and privately. On stage and during other public appearances, these singers act out personalities that have been carefully constructed for them. This goes as far as companies dictating aspects of their private lives, too, such as if and who they are allowed to date. The companies also decide what kind of productions and media appearances the singers will be involved in, as well as exerting great influence over the course of the singers' career paths. All in all, it is not uncommon for the singers to perform under a lot of stress due to filled up daily work schedules and lack of influence over when and how they perform. (Marx, 2012)

The system receives a lot of criticism, especially since many singers in the Japanese pop-music scene are being scouted into the business as teenagers. In 2013, Minami Minegichi, 20-year-old member of Tokyo-based pop band AKB48, made headlines in various news outlets worldwide after shaving her head in an online video as an apology to her fans. This was after photos of her and her boyfriend had leaked out to the media. The company producing the band's music strictly forbade the members to date, a condition Minegichi broke through the relationship with her boyfriend. Feeling threatened to lose her contract as a singer, Minegichi felt forced to express amendments to her fans in an extreme way. The online video, which sparked a lot of criticism both in and outside of Japan, was posted by Minegichi herself partly as a means to ask the production company to allow her to continue her career. (BBC News, 2013)

Some see the popularity of the phenomenon of virtual singers, such as Hatsune Miku, as firm criticism of this strict top-down management culture prevalent within Japanese pop-music. Miku's virtual nature means that she cannot be overworked, harmed, or taken advantage of by the industry. The participatory culture inherent to the vocal synthesizer business model sketches a stark contrast with companies exerting tight control over singer's public images and lives.

Though it is public knowledge that many Japanese pop icons put up an act during public appearances rather than show their real personalities, audiences generally accept this and play along. It seems that there are fans among the vocal synthesizer scene drawn to Miku because they disagree with this mode of entertainment and interpret Miku as bringing in a refreshing 'realness': Miku is unable to act out a fake personality since there is no 'real' underlying personality to diverge from. (Zaborowski, 2016) Wataru Sasaki, who originally pitched the idea of Hatsune Miku to Crypton, suspects that her popularity is in great part thanks to the fact that she is not bound to accepted social frameworks. As a result, she is universally easy to relate to. (Performing Arts of Japan, 2016) Additionally, in a country like Japan, with a culture in which communal values are often portrayed as more desirable than self-expression (at least compared to many western countries), tools like Miku may help people to publicly voice their thoughts and feelings anonymously.

In short, Crypton's business model, which leans heavily on fan participation, can be seen as a reason for Miku's popularity in Japan. It fits in well with certain aspects of pop-culture already present (doujin culture) and it brings an alternative to heavily criticized

corporate models present in the Japanese music industry. In addition, it is likely that another source of Miku's popularity lies in her virtual, futuristic, presentation.

Japan has a long history of being isolated from the rest of the world. Before 1868, the government made a deliberate decision to limit international trade and other foreign influences as much as possible. This strategy was abruptly abandoned during the Meiji restoration in 1868. Through contact with many countries beyond its borders, it quickly became clear that Japan's technological development was far behind that of the western world. National policy stated that strong effort must be put into industrial development to catch up. This influenced a cultural focus, too, on technology.

This focus was strengthened further after Japan's defeat in the Second World War. During the occupation by the United States between 1945 and 1952, many political, economic and social reforms were implemented. One of these involved the demilitarization of the country and expressing a peaceful national character instead. Through these many reforms, Japan came to reconsider its national identity and cultural essence. During this time, the Japanese government promoted a techno-nationalistic cultural focus: by celebrating new technological achievements as inherent to Japanese culture, Japan gradually became to be associated more and more with advanced technology. (Sone, 2016)

The introduction of popular media such as television, cinema and videogames proved to provide very suitable formats to express techno-nationalism and spread it among a wide audience. *Astroboy* (1963), *Doraemon* (1973), *Mobile Suit Gundam* (1979) and plenty of other examples focus strongly on imaginative futuristic technologies, such as robots, space travel and other inventions. (Gilson, 1998) Even now, futurism and technology are common topics among contemporary Japanese popular media. In many ways, Hatsune Miku fits right into this tradition.

Crypton commissioned Miku's original character image from illustrator KEI. The commission details dictated that Miku was an android character, which, in most illustration, is evident in the ribbons used to tie up her hair. (P-Tina, 2008) In addition, her name, too, connects to the theme: Written with the characters for 'first' or 'beginning' (*hatsu*) and 'sound' (*ne*) while Miku can be interpreted as '*future*', the name Hatsune Miku is often translated to English as 'the first sound of the future'.

Throughout the years after her release, Miku became known as a virtual celebrity with no physical existence, only to be found within the realm of cyber space. It is not

uncommon for her songs to express her awareness of what it means to be a virtual being in our world. In fact, Crypton adapts relatively high numbers of such songs in their productions. For example, in *The Intense Voice of Hatsune Miku*[1] (by cosMo@Busjou-P, 2010), Miku ponders her existence as an 'imitation of humanity', eventually realizing what comfort her words can bring listeners. In *Hibikase*[2] (by Giga-P and Reol, 2014), Miku eagerly waits to make music with the person on the other side of the screen, as this is the only way she can engage with the person she loves due to her virtual nature. In *ODDS&ENDS* (by ryo, 2012), Miku invites the song writer to use her mechanical voice to express their emotions and hardships. These and several other songs with similar themes have been selected by Crypton to be featured in various titles of the Project Diva video game series, concerts, and the mobile game Project Sekai.

Moreover, references to Miku's virtuality is a recurring motif in the theme songs to concert installments commissioned by Crypton, too. *Bless Your Breath* (WADATAKEAKI, 2019) can be interpreted as a letter from the song writer to Miku, looking back on how Miku was only a lifeless tool to them at first but gradually became her own person through the words the song writer wrote for her to sing. In *39Music!* (by MikitoP, 2016) Miku expresses her hopes to connect all of Japan through her appearances in uploads on her Youtube channel and Niconico Douga. In *Because You're Here*[3] (by Pinocchio-P, 2020) Miku thanks her fans and song writers for their interaction with her, as it is only through that interaction that she can continue to exist.

In the mobile game Project Sekai, too, Miku is presented as explicitly and exclusively virtual. She and the other Piapro characters reside in alternate dimensions, called 'Sekai'. The game also features several other, human, characters who take the central stage in the majority of the game's story. The human characters live in Shibuya,Tokyo and can be seen interacting with each other in front of major landmarks, such as Shibuya's scramble crossing. In doing so, the game ties the game's human characters explicitly to the real world and puts emphasis on them being of human origin as opposed to virtual (despite these characters, too, belonging to the virtual world of a virtual game).

[1] Original Japanese: *Hatsune Miku no Gekishou*
[2] English translation: *Resonate*
[3] Original Japanese: *Aisarenakutemo kimi ga iru* (Literal English: *Even when I'm not loved, you're here*)

This is in stark contrast with the way the Piapro characters are presented in the game. The human characters can travel freely between Shibuya and the Sekai dimensions by playing an audio file on their computer or phone (implying that the Sekai dimensions, too, are virtual in nature to some extent). They have a physical presence in both and can freely interact with the environment, items, and people in either world. Miku and her fellow virtual singers, however, are strictly bound to the Sekai dimensions. They are referred to as Virtual Singers and mostly rely on the human characters visiting them in order to interact with them. On occasion, they may catch a glimpse of the non-virtual world by appearing as small holograms. Their hologram versions are projected from the cell phones of the human characters in the game and strongly resemble stereotypical depictions of holograms in popular media, slightly pale and translucent, emitting light. Though Miku does not seem to mind her virtual nature and the limitations it imposes on her, she is clearly aware of the difference between herself and her human friends.

In short, although Crypton has taken active steps in encouraging fans to construct Miku's personality, their choices in presenting her in officially licensed media content express that her awareness of her virtual nature is an integral part of her character. In a similar way, Crypton also presents her as someone who loves music and singing.

Crypton emphasizes this trait in Project Sekai: Miku appears in a variety of ways, depending on which characters she's interacting with. Despite the various versions of Miku's differing in character and appearance, they all convey a love for singing and performing. Miku frequently suggests performing together with other characters as a means of cheering them up, helping them decipher their feelings, connecting with friends etc. In addition, a large portion of the video's accompanying songs in the Project Diva video game series also show Miku performing on stages, not uncommonly in front of large audiences.

5.4 Miku's Concerts

It can be said, then, Crypton's ambition to allow Miku to perform outside of the virtual realm and in the setting of real-life concerts is in accordance with their strategy of conceptualizing Miku. To Crypton, as well as fans of Miku, concerts are seen as a rare chance of physical engagement with the character, who is otherwise always separated from her audience by a screen. (Lam, 2016 and Leavitt et al., 2016) Originally pitched by SEGA to promote sales of the Project Diva games, Crypton saw benefit in hosting concerts as a means

of introducing and explaining Miku in a traditional and familiar setting. (Performing Arts of Japan, 2018; Leavitt et al., 2016).

Miku's first concert performance occurred just under two years after the release of her voice bank, on August 22, 2009, at *Animelo Summer Live* (Tokyo). She appeared as a guest star for two songs, projected alongside a blue-white backdrop resembling a stage onto a cinematic screen mounted against the back wall of the concert venue.

Later that same month, she appeared in concert on a semi-transparent screen as a holographic projection for the first time. This was at *MikuFES'09*, an event hosted in celebration of the two-year anniversary of the release of her software. The majority of the concert consisted of performances by artists who had produced music using her voice bank, but Miku also appeared on the screen for several songs.

In March 2010, Miku featured for the first time in a holographic solo concert at *Miku no Hi Kansashai 39's Giving Day*[4] (Note that in Japanese, 39 could be pronounced as 'san-kyuu',resembling the Japanese pronunciation of the English phrase 'thank you', as well as 'mi-ku'). This concert differed from Miku's earlier 'live' appearances in the fact that the entire setlist featured songs performed by Miku as a holographic projection (along with some guest appearances by the other Piapro characters), a live band providing background instrumentals being the only human elements on stage. Since then, Crypton has hosted many musical events with this format throughout the years, both within Japan as well as worldwide: some concerts consisting of one-time events and some as yearly recurring concert tours.

This means that right now, almost 14 years after Miku's first 'live' concert experience, there exists a large number of documented shows that are labeled as 'concert' or 'live experience' featuring Hatsune Miku. For the scope of this thesis' case study, only a selected portion of concerts are analyzed. several factors have been taken into consideration for this selection: the materiality of the screen, the visual presentation of the projected content, the setting in which the event takes place, and the accessibility of content through a visual medium.

When looking at the materiality of the screen, it is important that the screen is transparent or translucent, but not opaque. The idea that visitors could interpret the screen

[4] English translation: *Miku's Thanksgiving Day*

as absent is fundamental to hologram concerts, so the materiality of the screen should possess at least some properties that could reasonably be argued to hide its presence. In the case of Miku's *Animelo Summer Live* appearance, in which a white screen mounted to the back wall of the stage was used, this was not the case. The *Miku Symphony* concert series (2016-present), use a screen mounted above the Tokyo Philharmonic Orchestra. As the screen was clearly visible due to its opaque properties, it offers no reasonable indication to an intent to hide it from visitors.

The visual presentation of the projected content is important, too. Even when using a transparent or translucent screen, visual design choices can still impact whether the projection would reasonably allow audiences to interpret them as holograms of performers. For the sake of this thesis, it will be assumed that hologram concerts intend to invite audiences interpret the hologram as an actual person. As such, the performer should be projected human-sized and in standing position. This is not always the case. For example, Keiichiro Shibuya's rock opera *The End* (2013) used a series of see-through mesh fabric to project Miku, but often displayed Miku's body at the size of the entire height of the stage, at various angles floating in and out of sight.

Another assumption for the sake of this thesis is that, in order to invite audiences to adopt a state of suspended disbelief, hologram concerts should avoid using projections in a cinematic manner: in this context understood as using cinematic effects such as switching camera angles and close-ups, as well as projecting backgrounds along with the performers. After all, they would try to convince audiences that the performer is present in the same area as the audiences. Events such as *NicoNico Cho Party* (2012-present) have used a translucent screen in some editions, but these are largely used in a fashion that puts Miku in an animated background.

The setting in which the event occurs is also important. Hologram concerts could be argued not to be concerts at all, often criticized for the lack of the physical presence of a performer. Still, they present themselves as concerts: projecting a performer on a stage in a setting that resembles a traditional concert. In contrast, *Hatsune Miku Galaxy* (2020-present) is described by Crypton as a live concert, audiences are even required to buy a ticket. But the event can be accessed from audience's own homes through a VR device, not requiring viewers to attend a concert hall at all.

Finally, in order to study a concert and relate it to liveness and presence, footage and information regarding it must be available online or on DVD. Due to the covid-19 pandemic, an in-person experience was not possible within the timeframe of writing this thesis. As such, it relies on the availability of audiovisual documentation. For many concerts that took place during the earlier years of Miku's existence, access to footage is difficult. Language barriers, too, may limit access to information and footage of concerts, as is the case with, for example, the *Miku With You* concert series (2018-present) taking place in various Chinese cities.

Keeping all these criteria in mind, this thesis' case study will mostly focus on two concert series that check all the boxes: *Magical Mirai* (2013-present) and *Miku Expo* (2014-present).

Magical Mirai is a yearly recurring concert tour in various cities in Japan, organized by Crypton and Tokyo MX. The locations have switched between several cities in the past, but have consistently been in Chiba, Tokyo since 2016. A leg was added in Osaka since 2018 and another one in Sapporo since 2022. The concerts take place in large-size event halls at convention centers. The events are accompanied by an art exhibition featuring the Piapro characters as well as workshops and contests. These concerts happen yearly around the time of Miku's anniversary. The theme songs mostly center around celebrating Miku and her music.

Miku Expo visits a different part of the world each year, offering concerts in various countries. Most of the venues visited are smaller than the *Magical Mirai* ones, though it depends on its location. Side-events such as painting workshops and DJ shows using Crypton's voice banks are offered separately alongside the concerts in many cases. The theme songs of these concerts often revolve around bringing people across the world together through music. Note that the concerts from 2021 onward have been exclusively online in the form of livestreams and will not be considered for this thesis.

A list of analyzed concert showings can be found in appendix A. Appendix B provides a set of links to Youtube videos featuring concert footage for reference.

When analyzing the contents of the concerts, this will be done in relation to the factors pinpointed as most relevant to presence and liveness in the previous chapter. In the case of presence, this will mean a focus on interactivity, medium richness and resolution. In

the case of liveness, emphasis will be on temporality, spatiality, corporeality and interactivity. There will also be an analysis of metatexts audiences would likely engage with before visiting the concert.

The analysis for the case study will be divided into four separate parts: Metatexts (websites and other promotional materials that could influence audiences' interpretation of the events), the materiality of the stage (considering all the physical elements present in the concert hall), the visual design of the projected content (what is shown on the screen and in what manner?) and the behavior of the holographic performer (focusing on Miku herself and her actions).

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6. Metatexts

The vast majority of fans who attend a Hatsune Miku concert have most likely encountered some form of information about her prior to the event. As Karen van Es points out, such prior knowledge poses a relevant factor to audiences' experience of an event, as it raises certain expectations and influences interpretations. (van Es, 2016) Of course, Crypton cannot control what kind of information each fan will or will not consume (especially since they allow anyone to spread their definition of Miku freely online), but the company can present and spread their own curated content regarding the concerts and hope to guide fans' interpretation in that way.

This chapter looks at the official information on Hatsune Miku's concerts as provided by Crypton and the way the company encourages fans to interpret the concerts through this information. Two channels will be analyzed: Firstly, the official websites of individual concerts. Not only do these websites provide information on the concerts, they are also the place for fans to buy tickets. Therefore, it is very likely that visitors of the concerts have encountered these websites before attending. Secondly, the Piapro official blog (also described as Hatsune Miku's official blog). The blog functions as Crypton's channel to announce any news about Miku and other Piapro characters, including the concerts. Miku's official social media accounts (such as Twitter and Facebook) are highly commercial in nature, most posts consisting of merchandise advertisement, but whenever these accounts mention any information regarding concerts they refer and link to the Piapro blog. In addition, when relevant, other official media that may relate to the concerts will also be discussed.

When analyzing these sources, there will be a focus on three aspects: the way Crypton describes the events, the way Miku is presented and the way the technology used to facilitate the concerts is referred to.

6.1 Concert descriptions

Through its official channels, Crypton uses both text and image to tell audiences what to expect of their concerts. Upon visiting an official concert website, visitors will first be shown the website's main page, generally consisting of an image of Miku in a themed outfit,

a short text introduction of the event, a list of dates and locations, and some information about Miku herself. A top menu on the web page can send visitors to more information on the venues, surrounding events (such as exhibitions and workshops), ticketing, visiting guidelines, merchandise and surrounding media (such as commissioned art, outfits, theme songs and advertisement videos for the events). Once the tour is completed, an after-report is uploaded, consisting of a series of professional photographs of the contert showings as well as the exhibitions.

Depending on the year and the type of event, there is some variation in what information is posted on the websites. For example, the *Magical Mirai* websites generally have more information and more menu options than the *Miku Expo* ones. This might be because the former is catered to larger number of visitors and often includes more concert showings and surrounding events. In addition, information on older websites is somewhat more limited compared to more recent ones. In all cases, as more information is added to the website in the time leading up to the event itself, such additions are announced on the Piapro bog. In addition, after every concert, the Piapro blog dedicates one or more posts to an 'after-report' which looks back on the event in text and image.

One thing that stands out when looking at the writing on both the websites and the blog, is the way the concerts are referred to. When looking at *Magical Mirai*, which is mostly catered to Japanese audiences, the websites of the 2013 and 2014 events in Japanese writing use the word *'konsaato*' (the Japanese pronunciation of the English word 'concert'). From 2015 onward, the events are referred to as '*raibu'* (the Japanese pronunciation of the English word 'live'), a somewhat more fashionable word used for live concerts in a pop-music context. The Piapro blog (only available in Japanese) adopts the same fashion of describing events. The 2015 website and onward also offer English versions of the web pages. Here, the events are referred to as 'concert', 'live concert', 'live show' or even simply 'live', often using a variety of these terms per website.

By using terminology that resembles common descriptions of more conventional pop-concerts, Crypton encourages audiences to adopt a similar interpretation and state of mind when attending Hatsune Miku concerts as when they would be visiting any other artist, virtual or physical. Furthermore, the terminology used focuses heavily on the 'live' aspect of the events. With a few exceptions (which will be explained later), all of Miku's actions have been programmed beforehand, but this is not mentioned on any of the concert websites or

the blog. There is no mention of the live band (consisting of physical human musicians) accompanying Miku on stage on any of the concert websites, with a single exception for the *Miku Expo Indonesia* (2014) advertisement video during which the words "*With live band!*" appear for a brief moment. (Hatsune Miku Channel, 2014) Any writing published by Crypton on Hatsune Miku's concerts does not reflect any pre-recorded nature of the projection. Additionally, by discerning no difference between Miku's projection and objectively live elements (such as the band members) Crypton strongly promotes expectations and interpretations of a concert performance that is created 'in the moment'.

When looking at images and videos chosen by Crypton to give visitors of the websites and blog an impression of Hatsune Miku concerts, it stands out that visual material focuses on two things: Miku and her audiences. Many (if not most) of the concert websites prominently feature photos and/or videos of earlier concert showings on the upper part of the main page, ensuring visitors will see it immediately when entering the website. There is also a mention of how many people visited the event the previous year and a link to the previous year's *Magical Mirai* website where they can find a series of pictures of the concerts. These images also feature in the Piapro blog's 'After-Report' entries. Advertisement videos for concerts are also shown on the websites and include footage of previous concerts.

The vast majority of the visual material offered either zooms in on Miku's projection, with little to no view of other elements present inside the venue, or gives a view from further back (away from the stage) hovering over the audience, Miku still visible beyond them. It should be noted that individual audience members are generally not discernible, but the presence of the crowd is clearly visible due to the Japanese tradition of carrying and waving brightly colored glow sticks during pop-concerts. Images of Miku in a variety of sceneries on the internet are widespread, but the addition of a visible audience makes the context of visual material on the websites clear at first glance: this resembles a concert event. Crypton's choice to feature such images and videos prominently on their channels when writing about Hatsune Miku concerts can be seen as another encouragement to interpret the events similarly to conventional concerts.

Additionally, the visual material used to promote the concerts arguably ties a link between these events and fans' prior knowledge of Miku. In other media, especially the mobile- and videogames, Miku is often depicted as giving live concerts. In Project Sekai, the

mobile rhythm game, players can attend so-called ‘virtual lives’ (in Japanese) or ‘virtual shows’ (in English). During these shows, the player can experience a short concert-like segment on their phone screen during which they adopt a first-person perspective of an avatar standing in front of a stage where Miku and other characters can be seen singing and dancing. They can move their character around within the boundaries of the audience area, wave their glowsticks in chosen patterns, and see and chat with other players who are using the feature at the same time. Besides resembling a concert audiovisually, these shows are only accessible during limited, pre-scheduled timeframes, sharing starting times for all players. Some shows even require players to buy tickets to gain access. Through doing so, it can be said that Crypton normalizes fan engagement with Miku in a concert context.

In Project Diva, too, Miku is often depicted as a concert performer. In the games appearing in the series, players play stages of a rhythm game while an animated music video plays in the background. Some of these music videos resemble those commonly found in pop-music, displaying a loose storyline or simply showing Miku singing in a variety of sceneries. Other music videos resemble recordings of concert showings, displaying Miku on a stage, sometimes also including audiences. Some of the music videos in the latter category strongly resemble footage of actual Hatsune Miku concerts. In Project Diva F (2012) and Project Fiva F 2nd (2014), players even have access to a game mode called ‘Live Studio’, in which music videos that recreate the concert showings of *DAIBA de DIVA* (2012) and *Magical Mirai 2013* can be accessed.

Top: A photo taken at Magical Mirai 2018 (Crypton, 2018)

Bottom: A screenshot of the SPiCa (Toku-P, 2009) music video as featured in Project Diva Extend (2011) and later installments in the series. Screenshot taken from Project Diva Future Tone (SEGA, 2016)

Both images show a very similar setting, including the stage, spotlights, audience etc.

As seen in the images above, the Project Diva series includes stages that resemble actual Hatsune Miku concerts to great extent. The titles in the series are widely accessible since they are available on a variety of gaming platforms and most can be purchased either in physical format or downloaded through a platform's digital store. This means that fans of Hatsune Miku also have easy access to familiarizing themselves with Miku in a concert context through the Project Diva games. The same can be said of Project Sekai, which is free to download on either iOS or Android operating systems. Fans who have interacted with one

or more of these games before visiting the concert websites may instantly recognize it as a concert setting and feel invited to relive their virtual experiences in a large, physical setting.

6.2 Presenting Hatsune Miku

Unsurprisingly, Miku is a central element on the websites and Piapro blog. On all channels, her image is prominently displayed on top of the web pages, ensuring users will see her immediately upon their visit. Her image can also be found in various other parts of the websites. When looking at textual information, the ways Miku is mentioned are strikingly twofold: As a passive phenomenon on one hand, and as an active social actor on the other.

When talking about the events as a whole (which includes the concerts, but almost always also one or more side activities such as exhibitions, workshops, DJ performances, merchandise sales etc.), Miku is described as a phenomenon or cultural element that brings people together and which fans can engage with in a variety of ways. This puts audiences, rather than Miku herself, in an active role. For example, the *Magical Mirai 2014* website introduces the event as "*an event which distributes the 'now' of the creative culture surrounding 'Hatsune Miku'."*[5] (Crypton Future Media, 2014) Note that the name 'Hatsune Miku' is occasionally, but not always, put between quotation marks, especially in information published on earlier events. Though Crypton does not explain this choice, it seems that the marks are mostly used when referring to Miku as a software program or a cultural element as opposed to a character or virtual person.

The mentioning of Miku as a phenomenon which facilitates creative culture is recurring, especially on the *Magical Mirai* websites compared to the *Miku Expo* ones (though this could be explained by the fact that the latter has fewer surrounding activities). Until 2020, *Magical Mirai* websites use descriptions which are variations on the one mentioned above, after 2020 the following statement becomes a central line in introducing the events: "*By making Hatsune Miku and her friends a creative hub, we are hoping to make space for people to gather and have fun tied together with the keyword 'creativity'."* (*Magical Mirai 2020, 2020*) Here, too, Miku is posed as a passive element which facilitates engagement rather than engages herself.

[5] Original Japanese.: *'Hatsune Miku' wo torimaku sousakabunka no 'ima' wo hasshinsuru ibento desu.*

When looking more closely at statements made specifically in regard to the concert showings rather than the event as a whole, Crypton seems to take a different approach to mentioning Miku. This is mostly the case on the *Miku Expo* websites (where side events have less priority), under the 'concert' submenu at the *Magical Mirai* websites and at the concert after-reports on the Piapro Blog. Here, Miku is described in a much more active role.

For example, the commercial video created for *Hatsune Miku Indonesia* (2014) states that *"Miku is coming soon!!".* (Hatsune Miku Channel, 2014) The *Miku Expo 2018 USA and Mexico* website opens with the text "*Hatsune Miku returns to the USA and Mexico in summer 2018!*". (Crypton Future Media, 2018) "*Miku goes on her second European tour in January 2020"* is displayed on the website for *Miku Expo 2020 Europe*. (Crypton Future Media, 2020) In the case of *Magical Mirai*, the 2014 website states that *"'Hatsune Miku' sings songs from various creators, creating a performance together with the audience*".[6] Later websites advertise the concert with the text "*Live show with virtual singers' performances*!". (Crypton Future Media, 2014)

In these cases, Miku is presented as a being who independently performs certain actions ('goes', 'sings', 'returns', etc.). As a software program, Miku can only exist and function depending on input commands. However, by using such phrases as the examples above, Crypton assigns a certain level of apparent agency to Miku. The feigned presence of this humanizing trait in Miku makes her concerts easier to compare to conventional live shows, where an artist's agency over their own actions is generally unquestioned.

This illusion of agency is driven further by making it appear as though Miku continues to act behind the scenes. In Project Sekai, for example, Miku and the other Piapro characters are depicted as talking to each other or expressing thoughts to themselves even when there are no humans around to witness them. Another example is a feature in the Japanese app smash, which allowed fans to take a peek into Miku's dressing room and watch rehearsal footage. (Piapro Blog, 2020) This content was available for a limited time to promote Magical Mirai 2020. In doing so, Crypton presented Miku as someone who needed a dressing room and someone who needed to rehearse her performances. As a pre-programmed virtual projection, of course Miku needs neither. Her virtual nature means that she only exists when

[6] Original Japanese: *Taiyo una kurieitaatachi ga sousakushita gakkyou wo 'Hatsune Miku' ga utai, kankyaku to ittaitonatte suteeji wo tsukuriagete ikimasu*

observed on a screen. Still, it creates the sense that Miku is able to think, move and act outside of human interaction.

6.3 Mentions of technology

Though technically not involving actual hologram technology, news and other media outlets were quick to use the name 'hologram concerts' in reference to musical events involving performers being projected on translucent screens. Many artists and/or their management have promoted their productions by this name, too. Posthumous tours of Frank Zappa, Ray Orbison and Whitney Houston have all included '*the Hologram Tour*' as part of their name. Abba, though not following this same trend, advertises their *Voyage* concert series as one where they will not appear themselves, but using cutting-edge technology to let their digital avatars (or *Abbatars*) perform for the crowds. In these cases, the technology employed to create the shows is used as promotional element. Compared to these examples, mentions of technology on the channels of Hatsune Miku's concerts are surprisingly scarce.

As mentioned before, Crypton's websites call the events a concert, but the word 'hologram' is not mentioned at all. The *Hatsune Miku* websites of 2014 (Indonesia, Los Angeles and New York) call the concerts "*a fabulous live show of Hatsune Miku using cutting-edge projection technology*", but this statement does not reappear anywhere else after. The *Magical Mirai* websites do not mention any involvement of technological equipment or projections until 2020 and after, when they state that "*'Magical Mirai' is combined event of 3DCG live concert of virtual singers such as Hatsune Miku, and an exhibition where you will be able to experience the creative culture surrounding Hatsune Miku."*. They keyword here is '3DCG', which is short for '3D computer graphics' and implies that the concerts involve digital animations of some sort. The means and extent of involving such animations is not elaborated upon. There are, however, a few mentions of Miku's 3D model on the Piapro blog. Starting in 2017, there have been some cases of using a so-called R3 model (developed by Crypton) in the projections, as opposed to the much more commonly used model created by SEGA.

Apart from these references, no other mentions on technology and projection can be found. There is no explanation of how a virtual person like Miku could perform in a physical setting. Website FAQ's (when available) do not include questions about this topic.

Promotional pictures on both the websites and the Piapro blog do not focus on the technological equipment. Instead, most of the uploaded photos taken at the events are taken from angles and distances from which the screen and projectors are hard to discern. Crypton prefers not to draw attention to the equipment on stage.

It seems like there are only two cases when Crypton has openly acknowledged the use of a screen and projectors to make Miku appear. First, there was an incident in 2014 when a company called Hologram USA, Inc. sent a letter to Crypton demanding them to cancel *Miku Expo* in Los Angeles and New York that same year as well as Miku's planned appearance on *The Late Show with David Letterman*. The letter asked Crypton's confirmation of cancellation within four days, claiming their concert infringed patents on holographic projections belonging to Hologram USA, Inc.

Crypton's reaction to these demands was to allow Hologram USA, Inc. to come and inspect the technological equipment and their use on stage to show that there was no case of copyright infringement, but in addition Crypton also sued the US-based company based on the claim that the incident stirred up controversy and in fear of receiving similar demands in the future. During the court case, Crypton was asked to elaborate on their projection technology in order to allow the jury to make a fair judgment. (Crypton Future Media, Inc. v. Hologram U.S., Inc., 2015) Though Crypton does not promote the information, the court proceedings are openly accessible, making it a rare case of Crypton providing details about their concert equipment.

The second case of Crypton publicly acknowledging the technology used at concerts can be found in Project Diva Future Tone (2016) and later titles in the series. Specifically, the music video of the song *39* (sasakure.UK and DECO*27, 2012) is relevant here. *39* is a song originally uploaded in celebration of Miku's fifth birthday and is featured in several video games, concerts and CDs. In the 2016 game title, it featured alongside a music video which depicts Miku performing on a stage in front of an audience. Though this is the case for several music videos in the series, what stands out here is the presence of the holographic screen as well as the projectors used at Hatsune Miku concerts.

A still from the music video of the song 39 as featured in Project Diva Future Tone (2016) and later installments. It shows the screen and projectors used at Hatunse Miku concerts on stage behind Miku herself. Screenshot taken from Project Diva Future Tone. (SEGA, 2016)

The projectors can be seen behind the screen, implying the screen is translucent or transparent. The screen itself is depicted as displaying the same reflective properties as the ones used at physical concert showings. The only difference between this setting and that of Miku's concerts is that the video shows Miku standing in front of the screen rather than being projected onto it.

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7. Venue and stage

The physical setting of an event such as a hologram concert may have a big impact on audiences' ability to suspend disbelief. After all, it is a very different experience to watch and listen to a musician on a screen at a cinema screening compared to doing so at a concert hall. The very fact that the event takes place at a concert venue and requires visitors to purchase a concert ticket in itself can be seen as a piece of metatext that informs audiences how to interpret the experience. Once inside the venue, visitors are presented with the organizers' choices in technological equipment, staff, audience size and position, elements of decoration and other factors. This chapter will look at these physically present components of the analyzed Hatsune Miku concerts to determine how these may encourage feelings of presence and liveness among the audience.

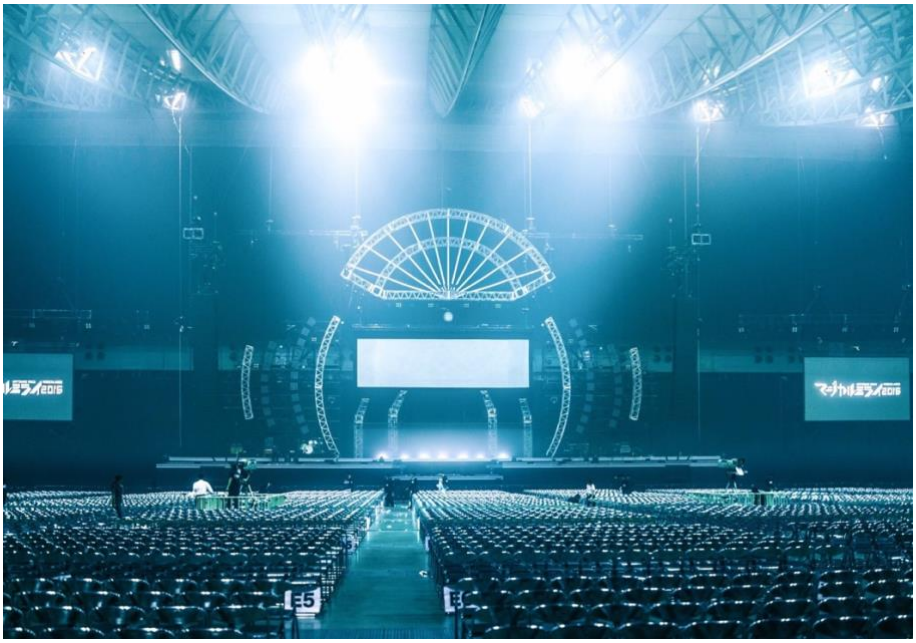
7.1 Overview of recurring elements at the venue

In the case of Magical Mirai, most of the concerts throughout the years present a similar set-up on stage with some variations in decorations. The majority of these events have taken place at Makuhari Messe Tokyo and Intex Osaka (as well as some similar event centers in other cities for the earlier concerts), which are Japan's first and third largest convention centers respectively. The event started in 2013 with two concert showings and expanded in the following years to 4-5 concert showings per venue per year. As ticket demand usually exceeds ticket availability, fans must enter in a lottery system in order to be able to buy a concert access. Winners of the raffle will automatically be charged the entry fee and provided with a ticket for their chosen concert showing. This means that the concert halls at Magical Mirai are generally packed full (with exception of concerts held during the Covid-19 pandemic, where audiences were seated with sufficient space in between them). Crypton does not provide specific information on how many tickets go up for sale per concert, but the Makuhari Messe website states to be able to host up to 9,000 visitors, giving an indication of audience size.

Recurring elements on the stage are the translucent screen (in many cases spanning almost the entire width of the stage) and several projectors, as well as a live band consisting of 4-5 musicians. The band members are placed to the sides of the central screen near the

edges of the stage (with exception of Magical Mirai 2013, where the band members were positioned on a balcony above the screen). There is also an opaque screen positioned on the back wall, high above the other elements, and two more opaque screens attached to the back wall on quite a distance from the stage itself. Other decorative elements differ per year and include metal constructions, curtains, spotlights, LED-lights, smaller screens, etc.

A concert showing at Magical Mirai 2013, Yokohama Arena, bird-eye view of the venue showing the audience position as well as the stage. (Piapro Blog, 2013)



The stage set-up for Magical Mirai 2016, Makuhari Messe, photograph taken before the concert takes place. (Yako_FLPR3, 2016)

While the Magical Mirai concerts take place in a very similar setting each year, the Miku Expo events show a bit more variety. This can be explained by the fact that the concert showings are spread among a larger number of locations and venues, meaning that there is a larger variety of stage shapes and sizes as well as equipment available. In addition, the set-up on stage needs to be built up and taken down more often as most locations offer only one concert viewing before the staff and band moves on to the next city.

Audience size, too, is much dependent on the venue and its capacity. With exception for the concert at Axiata Arena in Kuala Lumpur, Miku Expo takes place at locations of a smaller scale than Magical Mirai. For example, previously used concert halls include the Balai Sidang Convention Center, Jakarta (capacity of 2,000); the Hammerstein Ballroom, New York (capacity of 3,500); Zepp Sapporo (capacity of 2,009); and Verti Music Hall, Berlin (capacity of 4,500). Tickets are sold on a first-come first-serve basis and whether the venue gets sold-out depends on the location.

Like at Magical Mirai, the band, the screen and the projectors are present on stage at every performance. While the band members are always the same musicians who also appear at Magical Mirai, the screen and projectors are rented on-site and therefore varying in material and size (Crypton Future Media, Inc. v. Hologram U.S., Inc., 2015). In the majority of cases, the screen is more narrow than the one used at Magical Mirai. Some venues provide decoration on stage locally and in addition for some of the tours (but not all) the organizers' own décor is taken along from location to location. Whether additional screens are present is mostly dependent on whether they are provided at the venue.

The stage at Miku Expo Japan 2016, Tokyo, the set-up includes a décor but no additional screens (Crypton Future Media, 2016).

7.2 Technological equipment

An earlier chapter of this thesis explained two methods currently used during hologram concerts: Pepper's Ghost Illusion and a direct projection onto a translucent screen. For both Magical Mirai and Miku Expo, Crypton uses the latter: A series of projectors create an image on a screen which stands in front of them. Crypton refers to this as 'rear-projection technology'. (Crypton Future Media, Inc. v. Hologram U.S., Inc., 2015) As this type of technology generally uses a screen that is more easily discernable by audiences compared to screens used for Pepper's Ghost Illusion, it can be argued that it results a lower quality hologram. Crypton has made no public statements on why they opted for this technology, but it is plausible that concerns for money and time-management were of influence.

Several staff members of Crypton have expressed the company's desire to be able to make Hatsune Miku's concerts an accessible event to a wide public, which would ideally mean organizing the events at a larger variety of locations and points in time. This sentiment is expressed at various occasions, for example by Crypton CEO Hiroyuki Itoh (Browne, 2012) and Wataru Sasaki, the driving force behind creating Hatsune Miku (Performing Arts of Japan, 2018). In both cases, this statement is followed by an explanation of how Crypton's current funds are not able to make this a reality. Compared to rear-projection technology, the materials used for Pepper's Ghost Illusion are costly and fragile. While large and well-

known companies such as Coachella and MTV may be able to afford this, Crypton is a relatively small and local company despite Miku's popularity. It may be that the cheaper option is chosen as a compromise to retain more funds to help ensuring Miku concerts can take place at a wider variety of dates and locations.

Additionally, Pepper's Ghost Illusion takes a longer time to prepare, and its fragility also means that touring with it can pose a risk. Crypton have commented on several occasions how the rear-projection technology used takes a long time to set up, limiting options to visit many places within the time frame of a tour. Kanae Muraki, global marketing director at Crypton, states that the company considers it important to ensure a high-quality projection which takes up a significant amount of preparation time for each showing. (jrharbort, 2014) Production manager Masaki Suda explains that the long set-up time is mostly due to a challenging process of adjusting the projection and the lightning at each location. (Hatsune Miku Channel, 2014) According to a staff member at Miku Expo Los Angeles 2014, the process of setting up the stage can take several days. (Kai, 2014) Despite the long set-up time, which Crypton appears to consider a disadvantage, their chosen technology is probably the option that takes up the least time.

In short, the rear-projection technology used by Crypton offers some valuable advantages in terms of finances and time-management. The screens used at the concerts are about two meters in height, the width varies depending on the location and sometimes consist of several sections placed next to each other. Information about the exact material used is not published, but it appears to be acrylic or glass in nature. During earlier Magical Mirai concerts the screens were supported by a metal framework that matched the stage décor, while at Miku Expo the screens were in most cases held upright with wires hanging from the ceiling. In later concert showings, both solutions appear to be omitted and the mechanism keeping the screen in place is not visible. Earlier concerts used somewhat large projector devices, but throughout the years the projectors have become more hidden by using smaller ones that can project from floor-height.

The main benefit of the materials used lies in the screen's translucent qualities. When considering presence and liveness, the advantage of this quality is due to two factors: it hides the presence of the medium to some extent, and it creates a sense of depth on the stage.

As stated in an earlier chapter of this thesis, a feeling of presence can come about when viewers have a lowered awareness of the mediated nature of an experience. In some media, this low awareness can be caused in a cognitive sense, but in this case, it is encouraged through quite literal means. The screen's translucent material allows a projected image to be visible on its surface, while also retaining low visibility, especially in certain settings. Through this contrast (the clear visibility of the projection and the lower visibility of the screen's material) it may create the illusion of not being present at all. This can be interpreted as an encouragement to (temporarily) forget or at least ignore the medium.

The translucent nature of the screen also means that audiences are able to see behind it. As Jason Geng describes, seeing depth behind a holographic projection can trick audiences into interpreting a 2D image as a 3D one. (Geng, 2013) At Miku's earlier concerts, the projectors are easily discernable behind the screen and at several of the later concerts, decorations are placed towards the back of the stage. As Miku's projection moves around in front of these elements, emphasizing distance between different layers of depth on stage, it can be difficult to tell that she is actually a flat image. Considering flat screens generally do not produce 3D images, this arguably works in the favor of the sense of presence as this, too, obscures the means of mediation.

Hatsune Miku projected at Magical Mirai 2013, using rear-projection technology. Note that the projectors can be seen behind the screen. (Crypton Future Media, 2013)

The main downside of the rear-projection technology is that, due to the screen's translucency and its vertical placement, it is also prone to reflect other light sources present at the venue besides the projection of the performer. As at most concerts, spotlights are used in different colors to illuminate the band and generate a certain atmosphere. In addition, at all concerts analyzed for this thesis, large numbers of audience members carry glowsticks during the events. The use of glowsticks (used to wave and dance) is a common practice at pop-concerts in Japan and Miku's performances form no exception. At her international concert showings, too, many fans adopt this custom. They are arguably encouraged by Crypton, as glowsticks are also visually presented in Project Diva and Project Sekai and visitors can buy them at merchandise stands during the events. At some Miku Expo events, low-quality versions were even given away to audiences before the concert's start.

Both the venue's spotlights and the audiences' glowsticks pose an interference with achieving a low visibility of the screen. During the analyzed concert showings, it seemed that the more spotlights aimed at or around the stage, the more visible the screen became as it adopted a hue of the venue's light colors. In addition, bright spotlights aimed at the audience occasionally resulted in a reflection visible on the screen. This was mostly the case at smaller venues with balconies. The glowsticks, too, were in many cases reflected directly on the screen.

It seems that the layout of the elements present at the venue can make a big difference in how much light interference affects the screen. In the case of the Magical Mirai concerts, the screen is placed at a higher point and larger distance from the audience than most of the Miku Expo concerts. For Magical Mirai, this is possible because the concerts take place at large-scale concert halls, but it is also plausible to assume Crypton had more options in adjusting the configuration of the stage as the venue was rented for a longer period of time and took place in a multi-purpose location. The spotlights are placed at several heights in front of the screen and are aimed mostly towards the audience, keeping the screen free from interfering light shades. In contrast, as most of the Miku Expo concerts use the standard spotlight set-up offered at the venue, the screens at these events are often lit up because the stage is illuminated in its entirety.

The larger distance between the screen and the audience at Magical Mirai, too, is beneficial since the light of the glowsticks is less likely to reflect towards the audience. This is

not only because they are positioned further away from the screen, but also because they are positioned at a lower height. At most Miku Expo concerts, front members of the audience are placed up close stage and their glowsticks often reach up the height of the lower half of the screen.

A picture taken at Miku Expo USA & Mexico 2018, New York, showing the reflections of the lights present in the venue. (Kelly, 2018)

Of course, it should be noted that whether the reflection of a light source is visible to an audience member in part also depends on their individual position and the angle they witness the screen from. Footage from various angles of the concerts show that more reflections of audiences' glowsticks can be seen from higher positions, such as balcony views, while visible reflections from lower standing points were much more limited. In two cases, the Shanghai concert showing of the Miku Expo China 2016 and Miku Expo Shanghai 2015 (taking place at two different venues). In both cases, the audience was positioned on a stair-like area in front of the stage, meaning fans were standing at a wide variety of different points of height. This resulted in a large amount of light interference visible from almost all angles.

An exceptional case of screen use can be seen at Magical Mirai 2021. In addition to the screen as used at other concerts, there was a secondary screen which appeared to consist of a mesh material which spanned almost the entire width of the screen as well as the entire height (the top was attached at the ceiling of the venue). This secondary screen was placed at the very front of the stage, overlapping the entirety of the primary screen as well as the pianist and drummer. For the majority of the concert, Miku was projected as at most concerts, on the smaller screen, but during several songs the secondary screen was used to allow Miku to appear on a higher point, standing on a (projected) platform. The location closer to the spotlights at the front of the stage and/or its material however, caused this screen to be very visible during its use compared to the primary screen. This mesh screen was not used again at Magical Mirai 2022 and made no appearances at any of the Miku Expo concert showings.

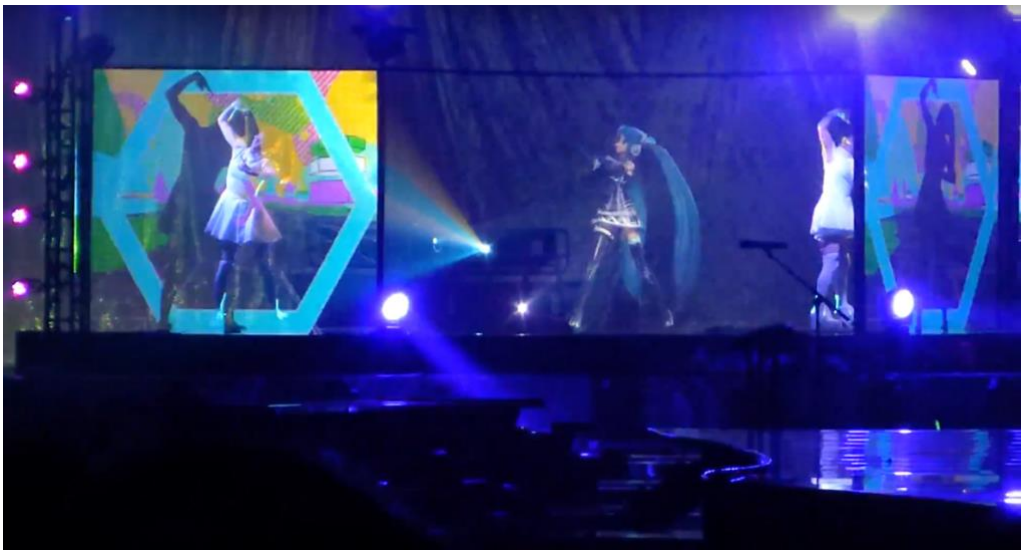
7.3 The band

Joining Miku's projection on stage is a live band consisting of one or two guitarists, a bass player, a drummer, and a pianist. In an interview, Itoh states that the band was originally added to the concerts out of fear that audiences would interpret the event too movie-like if all aspects of the shows were pre-recorded. (NBT and Sizergyia, 2019) Masaru Angelo Teramae, who frequently joins the tours as guitarist, adds that *"There is something special you can only get out of the show when bringing together the raw performance - the human elements - and the digital elements which the characters provide."* (NBT, 2019)

During the shows, the band is split up and located on either side of the translucent screen. At Magical Mirai, they are placed at a larger distance from the screen than at Miku Expo (where space often does not allow for it). With a few exceptions, the band members stay in one place and do not move closer towards Miku. As a result, the stages at the concerts appear to be separated into two different 'zones': One where Miku performs and one where the band members are located. The secondary screen at Magical Mirai 2021 arguably breaks up the separation between these zones, as it overlaps the view of the drummer and the pianist. During the sequences when this screen was used, the screen appeared quite well visible in front of the musicians, enclosing both them and Miku into the same sphere. Despite the secondary screen's disadvantage of higher visibility, this poses an

interesting example of an alternative way in which the lines between virtual and physical space can be blurred.

A similar conclusion can be drawn to Miku's appearance as opening act for Lady Gaga's ARTPOP Ball tour (2014). For this tour, the stage was equipped with three partitions of a translucent screen. Miku appeared on the center partition, while the other two were used to project colors and shapes to match the song's atmosphere. During several songs at these performances, dancers were located between these side partitions and the projectors, casting a shadow version of themselves onto the screen while still also being visible behind it. Like in the case of Magical Mirai 2021, this performance plays with the boundaries between the physical and the virtual as the dancers are both presented in physical and virtual form (the latter being their shadow projection) within the borders of an on-stage screen.



Miku's performance as opening act to Lady Gaga's tour, where dancers joined her on stage. (panthurrr2, 2014)

Through their visible and audible live music performance, the band present at Magical Mirai and Miku Expo strengthens the context of the live concert at these events. In addition, they often encourage the audience to clap or sing along through gestures. Not only does this, too, fit in with common live concert practices among audience and performers, it also creates an element of interaction between the two as it gives audiences an opportunity to answer their act with actions of their own.

The band also occasionally performs acts of apparent interaction with Miku and the other Piapro character as they are projected on stage, such as joining in dance sequences and returning choreographed gestures. Unlike the audience, the musicians know what Miku is programmed to do and thus are able to act in accordance with the projections, which in turn can be programmed to seemingly react to them. This helps in creating the illusion that Miku is able to see her surroundings and base her actions on what happens around her in the moment. When interpreted this way, it may seem that Miku is positioned in the same ontological realm as the band and audience. It also gives the impression that Miku is not programmed beforehand and has agency over her actions during the show. Both of these interpretations are favorable in fostering the sense of presence and liveness.

7.4 The audience

Paul Sanden states that all live musical experience is also social experience. (Sanden, 2013) In a similar trail of thought, Karen van Es describes how audiences sharing a same temporal and spatial bound experience may also experience a sense of a shared community, referring to the concept of imagined communities from Benedict Anderson. (van Es, 2016) Miku fans, who mostly interact with each other online, form an imagined community within virtual space. The concerts offer a rare opportunity for them to move to physical space for a short amount of time and express their sense of community in person.

Many audience members at Miku concerts behave much in the same way as audiences at more traditional concerts: they cheer, wave and shout Miku's name, ignoring the fact that she is only a projection who cannot hear or see them. As mentioned in the chapter on presence, seeing other people express their sense of social presence has a positive effect on one's own sense of presence. As such, audience members reacting to Miku as a social actor can encourage a sense of presence among other spectators as well. If other fans then react to their sense of presence by exhibiting the same behavior, this creates an effect that reinforces itself.

In terms of technological equipment, the position of the audience is beneficial to the Hatsune Miku concerts. The flat surface projection can only obscure its means of mediation when witnessed from a limited range of viewing points. Walking around it would make it overtly clear that a screen is used, the sharper the angle its being viewed at, the more difficult it is to see the projected image. Here, the very fact that these events take place in a

concert setting offers a great advantage. As at most other concerts, the venue is split up in an area for the performers (the stage) and an area for the audience. Audience members crossing this border and setting foot on the stage is not allowed. Fans at Hatsune Miku concerts do not need to be told they cannot get too close to the screen because it is common practice at such events to stay away from the stage.

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8. Audiovisual Content and Design

This chapter will discuss the audiovisual design of the projected content on the holographic screen as well as other screens used at the concerts. The analysis of Miku's behavior itself will be presented in the next chapter, for now there will be a focus on choices made in audiovisual presentation of projections and the way they can be seen as ways to encourage a state of suspended disbelief. In doing so, the analysis will be aimed at the functions of the various screens present at the concerts; holographic and cinematic screen use; and Miku's visual appearance.

8.1 Functions of the different screens

The concerts make use of three different types of screens: The translucent one which is placed on the center of the stage, a screen mounted above it on the back wall of the stage and two more screens positioned on the walls of the venue on either side of the stage. The center screen is present at every of the analyzed concerts with no exceptions. The two other screens are present at all of the Magical Mirai iterations but for Miku Expo it depended on the availability at the venue per concert showing. Each of the screens is used for a different purpose. The center screen is used to project Miku onto, making it the most essential one. The top screen is decorative in nature, its projected contents mostly used to promote a certain atmosphere. The side screens show live footage of the stage and the audience, allowing audience members with a less convenient view of the stage (due to distance, for example) a better look at the performance.

Most of the content projected onto the top screen promote a certain atmosphere during each song by, for example, playing (parts of) videoclips or other graphics. During some of the songs, it is also used to engage the audience by displaying lyrics of the songs performed by Miku. This does not only inform audiences that they are invited to sing along, it also helps them when not familiar with the lyrics of a song.

Another function of the top screen seems to be to draw a connection to Miku's grassroots nature. The exhibitions organized alongside the Magical Mirai events as well as many of the Miku Expos focus greatly on promoting fan created content. For example, Crypton organizes displays featuring fan-made content, walls for visitors to draw on and

workshops in art and programming. In doing so, Crypton expresses their ideal of shaping Miku as a fan-created celebrity. The concert showings themselves, however, are entirely curated by Crypton. There is fan-creation involved since the performed songs are a mix of popular online uploads, commissioned theme songs and contest winners. In addition, the outfits are based on fan-created music videos as well as contest-winning entries. (KKS, 2012) However, Crypton makes the decision on which songs will be included in the concert showings and how the performance is presented to the audience. (Leavitt et al., 2016) Composers and artists are credited by the company in recordings of the concerts when circulated on DVD/Blu-Ray or uploaded online, but audiences in the moment of the concert showings can only tell if they possess the right prior knowledge. It could be that the decision not to reference creators explicitly during the concerts is because it would not fit into the common pop-concert context and would risk breaking audiences' interpretation of the event as such.

It can be said that the top screen gives Crypton a chance to incorporate fan creation to a somewhat larger degree. As mentioned before, this screen is occasionally used to display (parts of) music videos uploaded by creators. It is also used to display artworks created and submitted by fans. In this case, this takes a form similar to a slide-show and includes art in a wide variety of styles and skill levels. The artworks used have been submitted to the Piapro website beforehand. The fact that the slideshow also includes art works that do not resemble the quality of professional illustrators that makes it clear that it is created by fans, even during the concert showings themselves.

In addition, the top screen occasionally shows photos of fans themselves, too. These include photos taken at the exhibition and workshops organized around the concert, showing fans engaging in fan-activities such as drawing, dancing and cosplaying. From 2020 and onwards, the Magical Mirai websites encourage fans to join in a so-called 'live cheering project'. On the dedicated web page for the project, anyone can upload a 4-5 second silent video of themselves waving or dancing, optionally with glow sticks. Crypton chooses a selection of the submitted videos to be played during one or more songs at the Magical Mirai performances.

There is also one instance in which the top screen was used to refer rather explicitly to one specific song creator. The creator, known by the name wowoka, was well known among Hatsune Miku fans and considered an influential artist of Miku's songs since soon

after the release of her voicebank. wowoka passed away due to heart failure in 2019. During the Magical Mirai 2019 concerts, Crypton chose to include a tribute to this artist: after a moment of silence on stage and in absence of both Miku and the Band, the top screen showed a compilation consisting of fragments of wowoka's most well-known songs and graphics in a similar style to his video uploads. It was exceptional since no other composer of Miku songs has been referenced to in such an isolated and extensive manner. Large parts of the audience appeared to immediately recognize what the fragment referred to, which is evident in the fact that a unified chanting of wowoka's name can be heard from the crowd.

Finally, the side screens are used to show a live recording of the concert itself. It alternates between showing the stage from afar, also including parts of the audience within the view, and showing close-ups of Miku as well as occasionally the band members as they perform. Such screen use is not unconventional at large concerts and music festivals and helps emphasizing the setting as a concert performance. It also allows visitors who are located at larger distances from the stage or positioned with difficult viewing of the stage for other reasons a chance to get a better look at the performance. In terms of liveness and presence it also offers some other advantages.

By including footage that show both the audience as well as Miku in a single frame, it presents a space in which both the physical, human visitors as well as the virtual performer are present. Objectively speaking, there is an ontological difference between Miku's virtual realm limited to the confines of the screen and the physical world surrounding it. As much as certain elements of the performance may diminish the border between those two spaces from the audience's point of view, when only looking at the screen itself the effect may have its limits. Showing the audience an alternate viewpoint from which they can see themselves (or at least the crows which they are a part of) and Miku in one space, can be seen as a way of unifying the two spaces and encouraging spectators to decrease their focus on the contrast between the two.

Additionally, showing Miku in the same frame as the audience stresses the presentation of the performance as a live event. People's own agency and being in the moment goes generally unquestioned. Seeing the crowd which one is a part of in a live recording would arguably have the same effect. As such, seeing many live elements within the frame may very well result in Miku being interpreted as a live and conscious being, too.

The Magical Mirai concerts from 2020 onward added one more viewpoint to the side screens: an augmented reality view showing a live recording of the stage and venue with an overlay of a 3D Miku model from the side, top or back (depending on the camera's location). When showing Miku from the back, a camera mounted on stage pointed at the audience provided the footage. For the side views, the view also included the band members. This means that, similar to the long distance footage of the stage, both Miku and the audience or band are shown in a single frame. Even more significantly, the AR view ignores the fact that Miku is a 2D projection on a screen.

From the audiences' point of view, Miku can only be seen from a single side. As discussed previously, this does not seem unnatural due to the concert context of the event. The AR view on the side screens allows the audience to witness the stage from an alternative angle. The footage leaves the center screen out of view and overlays the viewpoint with a model of Miku (or, in later installments, one of the other Piapro characters) performing the same movements as the holographic projection. As such, it draws a visual link between the AR character model and the holographic projection, implying they are one and the same. In doing so, Crypton presents Miku as a 3D being who is not mediated through a flat glass surface. Since the audience is unable to move to the AR cameras' viewpoints themselves, the illusion won't be contradicted during the concert showing. This fits in well with the theory of liveness as a state in which mediation goes unnoticed, as the AR views erase the medium of the translucent screen as well as the fact that Miku is limited to a 2D being as a result of it.

A view of one of the side screens at Magical Mirai 2022, showing a VR view of Kagamine Rin's performance seen from behind, looking out onto the audience. (Crypton Future Media, 2022)

The content of one of the side screens at Magical Mirai 2022, showing a VR view of Hatsune Miku from the side. Note how the band is visible in the back and the angle does not show the translucent screen. (Crypton Future Media, 2022)

8.2 Holographic and cinematic projections

The projections at Hatsune Miku's concerts can be said to be used in two different ways: projections that fill the entire surface of the screen (in this thesis referred to as cinematic) and projections that only include certain elements and leave the surrounding space empty (only used on the translucent screen and in this thesis referred to as

holographic). Miku's appearance uses holographic projections exclusively, but certain other elements of the concert showings are cinematic or fall somewhat in between the two categories.

Two parts of each concert showing are cinematic in every analyzed concert: The opening and the band introduction. The openings of the shows use a variety of visual fragments in which each of the Piapro characters is shortly introduced (often in a relatively abstract form, hinting at them rather than showing them directly) as well as some atmospheric graphics to excite the audience. The band introduction happens sometime midway through the show, displaying visual graphics alongside each band member's name to introduce them to the audience one by one. In both cases, this happens in absence of Miku (with the single exception of Magical Mirai 2013).

The majority of openings and band introductions happen on the opaque top screen rather than the translucent one. In some of the Miku Expo events, however, secondary screens are not present on stage, in which case the holographic screen is used. This can be interpreted as an indication that Crypton prefers not to use the translucent screen for cinematic purposes. The cinematic sequences span the entire surface of the screen. For the translucent screen, this means that it is temporarily clearly visible, regardless of the venue's lightning or the audiences' location. The rear-view projection technology relies on the contrast between the projected character and the emptiness surrounding it to draw focus away from the screen's presence and visibility. However, when projecting onto the whole surface, this contrast is not there, the edges of the screen become clearly visible, and its existence is undeniable. It becomes an element that likely could break audiences' state of suspended disbelief and it seems that Crypton tries to avoid this as much as possible.

There are also occasional cases where special effects are projected alongside Miku. These effects, projected during a few songs at each concert, arguably lie somewhere between holographic and cinematic screen use. The effects are mostly visual graphics or words projected onto the translucent screen. They do not reach the screen's edges, thus not drawing attention to its limits and therefore its presence, but also do not represent physical objects or beings.

A still from Miku Expo Japan 2016 where special effects are projected alongside Miku (Xue, 2020)

In *Reality Principles*, Herbert Blau argues that the concept of liveness is complicated in modern theatre through the use of computerized scenic effects. (Blau, 2011) The effects used at Hatsune Miku concerts may fit in with this way of thinking. Modern stage performances incorporating mediated special effects can, similarly to hologram concerts, be seen as a way to merge physical and digital elements into a single space. For Miku and other hologram performers, audiences' familiarity with such effects may be beneficial. Having seen an unmediated performer on stage alongside digital effects could help audiences at Miku's concerts to interpret these graphics as special effects rather than simply flat projections.

8.3 Miku's visual presentation

One of the factors pointed out by various authors as helpful in encouraging a sense of presence is the resolution or quality of the virtual content. A visual projection that looks flawed or incomplete can form a disruptive factor to the state of disbelief. This does not necessarily mean that the visual needs to look realistic, but rather that it is coherent. The coherency needs to be present both between different elements and parts within the visual itself, as well as between the visual and its surroundings.

The character model that represents Miku is designed and animated in collaboration with SEGA and Marza Animation Planet. It is based on Miku's original voice bank software box art, although Miku often changes to alternate outfits. The model has undergone some

adjustments throughout the years, and in 2017 a second model, created by Crypton itself and introduced under the name R3, was introduced. The R3 model shares many characteristics with the SEGA one but has slightly different proportions and softer features, giving her a somewhat more mature look. The R3 model has been used occasionally in concerts since 2019, for Miku as well as other Piapro characters which received a similar additional model, but the majority of the songs performed still use the SEGA model.

Close-ups of Miku's R3 model (left) and SEGA model (right) as used at Magical Mirai 2019 (left: Cojika39, 2019; right: Crypton Future Media, 2016)

Both models are projected to be human-like in height (158 centimeters according to Miku's official description on Crypton's website), but their features are cartoonish rather than life-like. This way, Miku's looks at the concert match the style of the original box-art illustration and also stay well clear of uncanny valley. Magical Mirai 10th anniversary in 2022 used an updated R3 model for several songs during the concert showings, with close-ups of its face being shown on the side screens. The majority of comments on a Youtube upload of Miku performing *Vampire* (by DECO*27, 2021) at Magical Mirai 2022 criticize the updated R3 model for being 'creepy' or 'nightmare-fuel'. (Unmotivated, 2022) Judging from this, it seems that Crypton's attempts to make Miku look more realistic are not particularly appreciated by fans.

An important element in Miku's visual presentation as a virtual being in a non-virtual environment is the lightning visible onto her character model. At the concert venues, a variety of spotlights in changing colors flash and move around to illuminate parts of the

stage and the audience. Miku's projection, however, is largely unaffected by these lights. Instead, she is perpetually lit up by a white light which, judging by the shadows cast onto her body, comes from a light source towards her top-left. In addition, as her projection consists of light caught on a screen, she illuminates light herself, too. This may create a visual dissonance between her and her surroundings. While the appearances of the stage, band and audience are affected by the stage lights (adopting the various colors and casting shadows), Miku does not share this characteristic. At concert showings where the band is positioned right next to the screen and spotlights are pointed at the entire stage, which is the case for most of the Miku Expo events, the contrast is the most striking.

A visible contrast between the band members (left) illuminated by a bright spotlight and Kagamine Rin and Len (right), unaffected by the light source at Miku Expo USA & Mexico 2016. Also note how the translucent screen is considerably easier to see on the side closer to the spotlight. (Lee, 2016)

Miku projected close to the drummer at Miku Expo North America & Mexico 2018. Note that the drummer and surroundings are bathed in a red hue due to the lightning of the stage, while Miku remains unaffected. (Crypton Future Media)

At Magical Mirai concerts, Miku and the translucent screen she is projected onto are located at a larger distance from the venue's spotlights as well as other stage elements such as the band. This makes the visual dissonance caused by the lightning less obvious. Still, there are a few occasions in which the band members at Magical Mirai concert showings leave their position and move in front of the translucent screen while Miku's projection is also present. These occasions are very limited, happening only for the song performed immediately after the band's introduction, when audiences' attention is guided to the musicians already. What is striking about these occasions is that the visual dissonance between Miku and the human performers caused by the spotlights is reduced to some extent by only casting white light on the band member at that moment. While the spotlights aimed at the band members' fixed stage positions use a range of different colors throughout the show, at these occasions the only light cast onto the musicians is mimicking the type of light that appears to illuminate Miku.

The guitarist at Magical Mirai 2020 located closely to Miku, a white spotlight cast on him from his top-left, similar to the lightning on Miku's projection. (Crypton Future Media, 2020)

Another method Crypton employs to diminish the dissonance is the use of the R3 model. The R3 model appeared for the first time at the exhibition of Magical Mirai 2017 (it was not yet used for the concert itself at that point) where Crypton presented it as a virtual model that could be manipulated in real-time. This allows the projection to change in appearance under various shades and colors of light similarly to how a physical object would. Looking back on this 2017 event, Crypton explains the benefit of using the R3 technology on their corporate blog and asks *"While on stage, did anyone see how parts of Miku's costume changed under the lightning?*". (Labopton, 2017)

In following years, when Miku's R3 model made occasional appearances on stage of the Magical Mirai concerts, this same technology has increasingly been incorporated, too. On the central, translucent screen, this has been only very subtle or even absent. It is mostly visible on the side screens during the AR views. At Magical Mirai 2020, this viewing mode showed a slight hue on Kagamine Rin's and Len's bodies as the surrounding spotlights colored green. In the following years, the incorporation of the technology has been more obvious, coloring and shading the entire bodies of the character models used (see for example the image of the AR screen included earlier in this chapter).

Another relevant part of Miku's visual presentation is the various ways in which she arrives at and leaves the stage. Where other performers would physically walk to their position, this is obviously not possible for Miku. Projecting her as walking from someplace outside of the screen's range towards her location draws attention to the screen's physical location by clearly showing its edges, which Crypton appears to mostly avoid. Miku leaves and re-enters the stage between nearly every song at the concert showings, presumably because the pre-programmed character model movements are saved as files per song. This means that across the 17 concerts analyzed, each setlist including 24-28 songs (with the exception of Magical Mirai 2020 which was shortened due to the Covid-19 pandemic), Miku enters the stage a great number of times.

Only about a handful of these entrances or exits are done by walking in and out of range of the screen's border. The vast majority of the cases are approached differently. At earlier concerts, Miku often appears to move in and out of range of the spotlights, makes her entrance from the center-bottom of the screen as if standing on a rising platform or even simply blinks in and out of existence. Throughout the years more and more songs also use more elaborate entrances and exits, resembling special effects matching the theme of the song. For example, for the song *Deep-Sea Girl* (by Yuuyu-P, 2010)[7] of which the lyrics contain many underwater-themed metaphors, the projection on the translucent screen shows bubbles floating up from the ground, revealing Miku as they move upwards. For the song *THE END OF HATSUNE MIKU* (by CosMo@BusouP, 2007)[8] in which Miku realizes her software is about to be deleted by the user after which she will not be able to continue singing, the concerts show Miku slowly materializing from a series of 0's and 1's.

Using such methods to make Miku appear on stage, which are presented as special effects, arguably risk breaking audiences' sense of presence and liveness. Miku, despite not looking quite human, is mostly shown as conforming to laws of physics (this will be discussed more thoroughly in the next chapter). These special effects, however, are difficult to explain in other ways than being projected onto a screen. Still, it seems that Crypton considers this a better option than to allow Miku to expose the screen's physical limitations.

[7] Original Japanese: *Shinkai Shoujo*
[8] Original Japanese*: Hatsune Miku no Shoushitsu -DEAD END*

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9. Miku's Behavior

Where the last chapter focused on how the projected content at Hatsune Miku concerts looked, this chapter will zoom in on how she acts. Analyzing how her movements, speech and personality are presented gives an insight into ways Crypton attempts to depict her as a person. A big focus in this chapter will be (feigned) interactive elements, but Miku's movements, personality and interaction with props will also be discussed.

9.1 Physical Movements

As demonstrated in Magical Mirai 2020's behind the scenes special, Miku's movements are based on motion capture technology. A dancer performs the choreography used during the concerts while wearing a motion capture suit while surrounded by motion capture cameras. The movement of every of the dancer's body parts are stored digitally and overlaid with Miku's character model afterwards. (Crypton Future Media, 2020) Some of the choreography used during songs is taken from the Project Diva game series, others are newly created in consultation with the song's producer. (Plaugic, 2016)

The motion capture technology makes sure that all of Miku's movements are realistic and human. Even when striking and holding a pose she seems to be affected by breathing movements and gravity, never becoming a completely still image. Furthermore, facial expressions match the song's mood. She blinks, squints and her mouth moves according to the lyrics of the performed songs. Despite her cartoony looks, Miku's bodily movements offer hardly any reminders of her digitally constructed nature.

During the performances, Miku moves horizontally along the translucent screen. During the vast majority of the songs, she is projected with her feet reaching the very bottom of the screen, directly on top of the stage. On the limited number of occasions when Miku's feet do not reach the ground, she is depicted as needing props to do so. For several songs, amplifiers are projected on floor-level alongside Miku. She uses these to reach a higher point on the screen's surface. During every single occurrence when the amplifiers are projected, they are stepped on by Miku, implying that they are only there for that very purpose. During one song, *The Intense Voice of Hatsune Miku* (by CosMo@BusouP, 2010)[9],

[9] Original Japanese: *Hatsune Miku no Gekishou*

Miku is projected as floating up in the air entirely, but only while she is depicted with a costume that include wings. Towards the end of the song, the wings disappear, and Miku drops back onto the ground immediately. All in all, the implication is that Miku's projection is affected by gravity the same way any physical person is.

Lastly, Crypton appears to make little effort to depict Miku as walking significant distances towards and away from the audience. Occasionally, she seems to walk in place and it is difficult to tell if this is meant to look like she is actually walking forward or backwards across the stage. The only times when it is possible to interpret depth in the movements, is when multiple characters are projected at the same time and cross paths or stand in front of each other.

9.2 Interactivity

An important factor to both the concept of presence and liveness is interactivity. In terms of liveness, interactivity can display an awareness of the performer's surroundings as well as the ability to react in the moment. Regarding social presence, it can make the distance between the mediated subject and its audience seem smaller, both physically and ontologically. Miku's concert performances are pre-programmed, though Crypton CEO Hiroyuki Itoh has expressed an intent to find ways to dictate Miku's actions in the moment. (NBT and Sizergyia, 2019) The human band members on stage add a means to truly interact with the audience, but otherwise there is little true interactivity during the Hatsune Miku concerts. Still, the events incorporate many elements to create the illusion of interactivity between Miku and the audiences.

During the earlier concerts (mainly 2017 and before), these elements of feigned interaction are limited, both in form and frequency. A few times during the shows, Miku waves at the audience, gestures them to clap along to a song or blows a kiss in their direction. Throughout the years, however, these type of actions became more elaborate. Not only did she wave or clap at the audience more often and longer, she also started addressing the audience in speech directly, taking on the role of MC. These were only short moments at first, to welcome the audience and thank them for coming, but also became more elaborate in later concert installments, on some occurrences performing little acts by herself or together with other Piapro characters.

When talking to the audiences, Miku directs her gaze downwards towards her fans, or upwards towards the balconies (often putting a hand above her brow as if peering into the distance). Sometimes she also bends forwards slightly and puts her opened hands next to her face during certain phrases. Such physical gestures makes it clear that she intends to address the audience, they are the ones she is talking to or waving at.

Miku waving at the audience at Miku Expo 2016 Japan just before the end of the concert. (Crypton Future Media, 2016)

Miku also asks the audiences to respond to her, through questions or gestures. The questions are simple ones, such as 'How are you?' or 'Are you ready?', similar to phrases used at many concerts. Miku waits before continuing her act, giving audiences time to response (mostly in the form of cheering). Her waiting is a clear indication that the audience is expected to react. This expectation is emphasized further when occasionally bends towards the audience, turns her head and puts an open hand behind her ear: she expects to hear a reaction. This happens often, for example, when she tells the audience '*good evening*!'[10], after which the audience loudly repeats the phrase.

Other examples of such spoken interaction occurs right after the band introduction of several Magical Mirai concerts. Miku's projection returns to the screen after all band

[10] Original Japanese: *Konbanwa!*

members have been introduced to the audience. She introduces herself by saying '*And on vocals are: one, two…*'[11], gesturing the audience should complete the sentence with her name on the count of three (which they do).

For another example, at Magical Mirai 2019, after telling the audience welcome, Miku first moves towards the fat left side of the stage. Here, she asks '*Everyone over here, how are you doing?*'[12]. After this, she moves to the far right of the stage, asking everyone at the other side of the venue how they are doing. Through this, Miku does not just address the audience, but also specifies which part of the audience she is talking to.

At the same concert, Miku sings a duet with Megurine Luka called *Jump for Joy* (by EasyPop, 2019). During the intro of the song, Miku and Luka teach the audience to sing along to the chorus. They announce they would like to sing the following song together with the audience, sing some phrases and ask the audience to repeat them. They also tell the audience that they did well after repeating this process a few times.

Another way of creating a sense of interactivity is the use of an encore act. At some point during (almost) all of the Hatsune Miku concerts, Miku announces that the next song will be the last one. Afterwards, both she and the band disappear off the stage and the lights at the venue go dark, the concert is seemingly over. The audience stays in place, however, and after some time starts asking for Miku to come back and sing some more, either by shouting her name or by asking for one more song (Japanese audiences chant *"Mou ikkai"* (one more time), perhaps not coincidentally resembling the chorus of a popular song by wowoka). After several minutes of silence and darkness, Miku and the band return to stage to perform a few additional songs. This way, it appears as though Miku has heard the audience ask for her return and decided to honor the request.

The fact that such acts are meant to invite audiences to respond is further emphasized by the difference in approach during the Covid-19 pandemic. Miku Expo events have been taking place online only after January 2020, but the Magical Mirai concerts have continued to take place physically albeit on strict conditions. Visitors were checked for temperature before entry to the venue, wearing a facemask was mandatory throughout the event and there was a seating arrangement that allowed for social distancing. Furthermore, audiences were strictly asked not to cheer, shout, or talk loudly during the concert. To help

[11] Original Japanese: *Soshite, bokaru wa, sei no…*
[12] Original Japanese: *Kochira no minna! Genki?*

the audience adhere to this last rule, Miku's acts that would encourage audiences to cheer were omitted. She did not ask the audience to shout her name when introducing herself, did not ask them how they are doing and left no pauses in between phrases as she had done other years. Shows during the pandemic also included no significant waiting time before the encore act. However, Miku did invite the audience occasionally to interact through the glow sticks. For example, similarly to 2019, she moved to the far left and right of the stage in 2020, asking visitors on each side to wave their glow sticks. This way, elements of feigned interaction did not have to be dropped completely at these events. It also shows very clearly that, despite being mostly implicit, the function of these acts is to incite a back and forth between Miku and the audience.

On occasion, another layer to this back and forth is added when Miku appears to respond to the audience. This happens, for example, when Miku asks the audience to sing to her and compliments their effort, or when Miku invites them to wave their glow sticks and tells them how pretty it looks when they do. Here, a situation arises that is in accordance with Michael Darroch's concept of a feedback loop. This happens when a performer incites a reaction from the audience and lets this reaction affect their performance. (Darroch, 2010) This can affect audiences' interpretation of an event's interactive elements positively (in turn also affecting their sense of presence and/or liveness), even when this feedback loop is only feigned.

Crypton occasionally attempts to move from a situation of feigned interactivity to one of true interactivity through the use of the R3 model. As mentioned in the previous chapter, the R3 model was created to allow for a more in-the-moment performance as it can be manipulated in real time. This also includes the option to adjust Miku's actions during the concert itself. Crypton also sells the R3 technology to third parties and its promotional website explains the benefit of using it over traditional methods. Crypton describes the use of earlier methods (as used with Miku's SEGA model) as predicting audiences' reaction beforehand and programming the virtual performer according to this prediction. This does not allow for any changes in the case of the audiences' reaction differing from the expected. The R3 technology, on the other hand, allows companies to control the performer's voice, movement and timing according to the audience's reaction. (Crypton Future Media, 2016)

After Snow Miku 2018 (Sapporo), which included several performances across two days and introduced the R3 model at a concert tour for the first time, Crypton wrote on their

corporate blog: *"For the MC before the third song, Hatsune Miku witnessed the audience's reaction and changed the content and timing of her chatting across each performance. Did anyone notice?".*[13] (Labopton, 2018)

The question here is how much value true interactivity adds over feigned interactivity. Crypton asks readers if anyone noticed the difference in Miku's act between the different concert showings. However, it is unclear how many, if any, visitors of the Hatsune Miku concerts visit more than one concert showing within the same tour. Buying tickets to more than one show might be difficult or even impossible for parts of the audiences due to both limited ticket availability and ticket prices. Additionally, not all visitors might have time to visit several showings, or even be interested in doing so. It can be assumed that the majority of the visiting audience members would only be present at one of the performances of a tour. As such, they would not be able to tell whether Miku's act is tailored to the audience's reaction in the moment, as they would not have experienced other showings to compare it to.

The events also benefit greatly from the one-to-many style of communication that is prevalent in traditional concert settings. Miku addresses the audience as a single unit rather than singling out individuals. This resembles acts during live performances of human singers, the familiarity makes it an accepted, even expected, communication style at the concerts. Addressing a large number of people necessitates asking questions that have an obvious answer rather than a personal one. For example, asking the audience to shout Miku's name or asking them how they are doing. Answers to such questions can be easily predicted, as the audience is familiar with the concert setting and are likely to play along with its conventions. Furthermore, considering a ticket needs to be bought to gain entry to the venue, it can be expected that they are happy or at least willing to be at the concert. Large portions of the audience reacting lukewarm or averse to Miku's invitations to interaction is an unlikely event.

[13] Original Japanese: *Sankyokumoku no mae no MC demo, Hatsune Miku ga okyakusama no kennou wo minagara kouen gotoni chigau naiyo, taimingu de oshaberi wo shite imashita. Kochira mo ki ga tsuita kata wa irassharu deshouka?*

9.3 Interactivity compared to traditional concert settings

The elements of feigned interaction as described at Miku's concerts (both for the pre-programmed SEGA model and the real-time operated R3 model) resemble acts often found in live performance by human artists. The Miku concerts benefit from this fact: audiences are familiar with the setting and the resemblance to performances where liveness and agency is unquestioned may well these characteristics seem to apply to Miku as well. It also calls into question how much more truly interactive traditional concerts are compared to hologram ones.

In *The Future of Live,* Karin van Es describes the one-to-many mode of communication as prevalent in various types of live entertainment where the performer-audience ratio is out of balance, such as concerts, livestreams, live television broadcasting etc. She argues that in such cases, true interaction becomes a challenge because allowing the audience to respond as individuals would provide too much input for the performer to take in, let alone incorporate into the program. In her case study on a specific live broadcasted talent show which encouraged viewers to interact with the hosts and the performers through social media, van Es describes how the show started out with the ambition of responding on screen to audience input, but ended up interacting mainly with celebrity accounts since the input was too overwhelming to monitor. However, van Es claims that encouraging audiences to interact in such cases can still prove beneficial to a sense of liveness, as long as they get a feeling of making an impact, which van Es calls the illusion of para-social interaction. (van Es, 2016)

At traditional live stage performances, there may be occasions when performers single out audience members by inviting them on stage or addressing visitors near the front row which allows for truly interactive sequences. However, this excludes the majority of the audience of getting a sense of participating in interaction. For the most part, then, the standard mode of performer-audience interaction remains reliant on the one-to-many style of communication which limits possibilities for true interactivity. This is the case both for concerts involving live, human performers and pre-programmed virtual projections.

Similarly, the encore act at Miku's concerts shows little difference from those at traditional concerts. Emma Webster describes how, throughout the years, encore acts at pop-concerts have become more of a ritual than a spontaneous surprise. This ritual is performed between the audience, who know they are expected to cheer for an encore and

are aware the performer will make another appearance, and the performer, who expects to be asked back and has incorporated the encore in their planning and rehearsals. As a ritual, the encore ensures that either party knows how to perform their role while still keeping up an air of spontaneity. One of the functions of the encore act is to create the illusion of audience power. (Webster, 2012) This, too, is arguably no different between concerts featuring humans and holograms.

All in all, it seems that traditional concerts show a similarity in the type of interaction between the performer and the audience compared to Miku's concerts: for the most part, it is feigned. Additionally, similar to the argument presented earlier for Miku's concerts, for traditional concerts the majority of the visitors will also attend only one showing of a tour. They would not be able to tell if a performer makes adjustments in their act in reaction to the audience as they would have no comparable experience.

9.4 Presenting Miku as a conscious being

The elements of feigned interaction during the concerts add greatly to presenting Miku as being conscious of her surroundings. After all, it makes her seem aware of the audience in front of her. Other acts, too, strengthen this illusion. For example, Miku makes encouraging gestures at the band. This mostly happens by directing her gaze to the sides of the screen where the band members are situated. At Magical Mirai 2013, however, the band is located on a balcony behind the translucent screen and Miku at some point turns around completely to wave at them and gesture for them to stretch out the instrumental part they are performing at that moment. At Magical Mirai 2018, too, Miku turns towards the decorative screen mounted on the back wall of the stage as it displays an announcement of next year's event dates. These turns towards the side or back not only present Miku as a 3-dimensional being or projection, they also emphasize the illusion that she has full awareness of her surroundings and the ability to react in the moment.

On a few occasions, Miku and other Piapro characters are depicted as interacting with each other while not on stage. At Magical Mirai 2019, Megurine Luka is the only element projected on the translucent screen as she announces her next song will be a duet with Miku. After calling out Miku's name, Miku appears on stage acting as if she heard the call while backstage. Similarly, at Magical Mirai 2021, Miku announces that KAITO will perform the next song. She holds her hand to her ear as if talking into an earpiece, asks

KAITO whether he is finished preparing and tells the audience KAITO let her know he's ready. These instances depict the characters as existing and acting independently from human programming or interaction (even behind the scenes) and as being bound to the same flow of time as experienced by the human audience. This helps encourage a sense of liveness and also makes them seem conscious and in charge of their own actions.

Depicting Miku as such makes her seem more like a person and less like a pre-programmed image. Presenting Miku as a person, however, has been somewhat of a difficult task according to Hiroyuki Itoh. In an interview with Leavitt et al., Itoh states that it was difficult to find a balanced, universal way of presenting Miku. Due to her grassroots nature and Crypton's encouragement towards fans to let Miku be whoever they want to be, Miku's personality is presented in a wide variety of ways across the internet. For the concerts, however, Crypton had to present a single Miku whose personality and actions would need to be acknowledged as fitting by a wide audience. (Leavitt et al., 2016) For a long time, Crypton avoided depicting Miku with strong personality traits in official media. This also reflects in the earlier concert installments, where Miku's MC is limited and her interaction with the audience is superficial.

From 2017 and onwards, however, the Miku projected on stage is arguably imbued with more character and emotion. Magical Mirai 2017 marked the celebration of Miku's ten-year anniversary. The last song of the concert was followed up with a speech from Miku where she expressed her gratefulness for her fans' support and all the songs they wrote for her up until then as well as her wish to continue singing for them. It is an emotional speech, Miku's voice audibly breaks and she wipes away a few tears, which forms a stark contrast with the lack of emotions Miku showed at concerts before. Of course, Miku does not have the ability to feel any of the expressed thoughts: The speech might reflect the feelings of Crypton's staff or may simply be something they thought fans would enjoy hearing. In either way, it presents Miku as an emotional being who is aware of her relation to her fans.

At following concerts, Miku's MC acts become more frequent and longer, also including more emotion and opinion. The speech of 2017 is still exceptional, Miku expresses only shorter thoughts which reflect positive opinions on fans, songs or outfits afterwards. At Magical Mirai 10th Anniversary (2022), the concert ends in another speech, this time broken up between all Piapro characters, which was much more light-hearted in nature. Still, it can

be said that Miku's presentation at the events has more and more towards resembling a feeling and thinking person in this regard.

9.5 The use of props

The previous chapter mentioned the projection of amplifying equipment alongside Miku on the translucent screen to allow her to rise to a higher point of the screen. Various song performances show Miku interacting with other virtual props as well. The most common of these is a microphone which she sings into. The microphones used take on various shapes, depending on Miku's outfit worn during specific songs, and are either mounted on a stand or carried around by Miku. The use of microphones can be seen as a way of emphasizing the illusion that Miku is the source of the vocal sound played during the songs. In reality, vocal parts of the songs are pre-programmed and played from speakers at the venue. Miku's mouth moves according to the lyrics, which is already a means of creating an illusion of the sound source being on stage, the addition of microphones on the screen intensifies this effect. This resembles what Paul Sanden describes as corporeal liveness: seeing the bodily action of a performer while hearing a certain sound creates a link between the two, allowing the audience to interpret the visual as the sound source. It makes it seem like the sound is created in the moment by the performer's physical action. (Sanden, 2013)

In the case of Miku, this does not only help foster conditions for liveness, it also opposes the audiences' knowledge that she is only a flat projection as glass surfaces are generally not associated with creating vocal sounds. The microphone occasionally serves another purpose too: For a few songs across the analyzed concerts, Miku is depicted as aiming the microphone towards the audience. This creates another element of interaction. It is an invitation for the audience to sing along and to make them seem heard (this time not only by Miku but also by virtual technological equipment).

Lastly, Miku is occasionally depicted as playing various instruments, most often a guitar or bass. In these cases, she seems to join the band members. More notably, however, during a few ballads Miku plays a keyboard. The keyboard, like Miku herself and other occasional props, is part of the virtual projection. The songs it is used for do not use any other musical instruments. Striking is that during these songs, the band cannot be seen on stage. In the case of Miku Expo, they leave the stage altogether, while at Magical Mirai, all lights on them are turned off. This way, Miku is the only element visible that shows any

connection to the audible piano sounds. Considering Sanden's concept of corporeal liveness, if both Miku and the band's pianist would be visible playing at the same time during these songs, this would create unclarity about the sound source. However, by illuminating one of the two players (even if it's the one truly accountable for the sound), the player left will be the one most likely interpreted as the live pianist. Hiding the human pianist during these songs indicates that Crypton considers is important that audiences interpret Miku as creating the piano music for these songs.

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Conclusion

This thesis set out to find the ways Hatsune Miku's hologram concerts encourage a state of disbelief among its audiences. Miku's concerts are an example of mixed reality media entertainment that provide large numbers of analyzable events across various years and different settings. As such, they can teach us about exemplary contemporary methods aiming to diminish the barrier between the physical and the virtual in the perception of the audience. Methods used at the Hatsune Miku concerts could also be useful in other hologram concerts as well as other types of entertainment that places virtual elements in our physical surroundings, especially in the context of group consumption.

Though Hatsune Miku might very well be the artist with the most elaborate list of hologram concerts to her name up to date, she is not the only one featured in this type of setting. Hologram concerts are a relatively new and upcoming form of 'live' entertainment, used for performers who have passed away, have no physical body or are not able to be on location. The word 'hologram' in this context should not be taken literally. A true hologram denotes a flat surface which is able to show a three-dimensional image, but in popular media it has come to be closely associated with three-dimensional projected images that need no screen to appear. At Miku's as well as other artist's hologram concerts, the performer is a two-dimensional image projected onto a flat screen. Using a see-through surface for this projection helps creating the illusion of a three-dimensional image, hence the reference to the hologram.

Hologram concerts are not the only form of media that bring the physical and the virtual closer together. The rapid development in technology throughout the last decades has provided possibilities to re-imagine media devices. This has caused the emergence of mixed-reality media: A media form in which the boundary between the virtual and the physical is not quite as clear as in traditional media. A well-known media form that falls under the mixed reality category is augmented reality, which overlays our vision of the physical world with virtual elements. Mixed reality media, however, is a spectrum and contains other (often arguably more experimental) examples too, including the hologram concerts.

The concept of mixed reality media clashes with more traditional ways of thinking about screen theory. For a long time, the screen was seen as a strict border between virtual worlds and the world we live in, which were often considered ontologically separated. We could look at the world projected onto a screen, but we could not be part of it and it could not be part of our physical surroundings. Considering hologram concerts as well as other screen-based mixed reality entertainment, this way of thinking is much less relevant.

To media which present virtual elements as being part of our physical surroundings, it is important to invite the audience to adopt a state of suspended disbelief. In most cases, the observer or interactor of the media will be aware of the fact that they are presented with something virtual, but the medium and/or its content can help make it easier for them to momentarily set this knowledge aside and interpret these two worlds as one and the same. In the case of hologram concerts, this thesis considers two concepts as helpful in encouraging a state of suspended disbelief: Presence and liveness.

The concept of presence is often associated with immersion. It denotes audiences' reduced awareness of the mediated nature of an experience. This can be either cognitively (by taking away the audience's attention off the medium) or in a more literal sense (by hiding markers that signify the medium's presence. The concept of liveness is used often in the context of performance studies. It refers to the audience's interpretation of something happening in the moment rather than being pre-recorded.

A literature study of both the concept of presence and of the concept of liveness shows which factors are considered important for these states of mind to come about. Factors mentioned by several academics were, for example: the features of the technological equipment used; visual realism; a strong link between audible and visual content; interactivity; and audience expectations through previously consumed metatexts. While analyzing Hatsune Miku's concerts, this thesis focused on decisions in audiovisual design of the event that were relevant to these factors.

Crypton Future Media, the company behind Hatsune Miku's creation, is responsible for organizing the concerts that were used for analysis for this thesis. Therefore, the concerts can be interpreted as an expression of the company's intentions on presenting Miku in a physical concert setting. Two things stand out through extensive analysis of a list of Miku's concerts: 1) Crypton attempts to mystify the type of mediation used at the concerts,

and 2) Crypton presents Miku as a conscious person, aware of her surroundings and able to decide her actions in the moment as opposed to a pre-programmed projection. The first observation shows a strong resemblance to the topic of presence, while the second observation ties into liveness. Both play an important part in encouraging the audiences to adopt a state of suspended disbelief.

Presence and mystifying mediation

As mentioned above, the concept of presence is generally explained as a reduced state of awareness regarding an experience's mediated nature. Keeping in mind Miku's cartoony looks and explicitly virtual nature (which is honored during the concerts), it might be fair to say that Crypton may not intend to present Miku as a completely unmediated being but does try to mystify the nature of the mediation. While Miku's projection is in fact two-dimensional, Crypton presents it as a three-dimensional one that is not limited to existing within the dimensions of a flat screen.

This can already be seen in promotional material which Crypton offers prospective visitors of the concerts to inform them about the events. Mentions of the technology used to make Miku appear on stage are scarce. Crypton gives no explanation of how the projection works. Even the pictures of the concerts they share publicly are mostly taken from angles and at settings from which the projectors and screens are difficult to see. Instead, Crypton focuses on their blog and websites on presenting the events as traditional concerts. The word 'concert' is explicitly used and audiences need to buy a ticket just like at other live events. Many pictures and videos shared by Crypton focus on showing the audience, stage and venue, clearly presenting the concert setting. Moreover, fans who also consumed other media featuring Miku, such as the video games, have already been familiarized with seeing Miku in a live concert context. Through the metatexts, Crypton informs the audience that the mediation is not the focus of the concerts and invites them to interpret the events similarly to traditional pop-concerts.

At the concert showings themselves, the choice in technological equipment is vital to obscuring the medium and promoting a sense of presence. Projecting Miku onto an opaque cinema screen would make her mediated nature undeniable throughout the concerts. Instead, a translucent screen is used which clearly shows Miku's projection while leaving any surface area surrounding here see-through. The illusion is not perfect, Crypton's so-called

rear-projection technology uses a screen that is still visible to the audience. Stage set-ups that involve higher quality equipment and thus less screen visibility have appeared in other contexts, but considering Crypton's budget and the tour's time management, this technology may be a good compromise.

The rear-projection technology does not only help hide the screen's presence to some extent, it also can trick audiences' eyes into interpreting the performer as a three-dimensional being. Witnessing the depth of the stage behind the holographic performer creates the illusion that there is also a level of depth in the projection, rather than seeing it as a flat object. This is even more strongly the case at concerts that make use of background decorations. It is beneficial to the sense of presence as a three-dimensional projection is not likely associated with a two-dimensional screen. The illusion of the three-dimensional performer is emphasized further when they are depicted to turn to the side of the back to interact with other parts of the stage. For example, Miku did so when facing the band or the decorative screen behind her.

Analyzing the concert's equipment also shows the benefit of using a custom-built stage as opposed to hologram concerts taking place in a standard music venue. At Magical Mirai events, the screen was much less visible because it was placed away from the spotlights used as well as the audiences' glow sticks. At Miku Expo events, the screen was often clearly visible due to it reflecting various light sources at the venue, somewhat negating the benefit of the screen's translucent qualities.

Additional screens can also form a tool in encouraging the audience to interpret holographic performers as three-dimensional. The AR views that were visible on extra screens at Magical Mirai concerts since 2020 showed Miku from various angles. In general, the audience placement and common viewing practice at hologram concerts is advantageous to mystifying the mediated nature as audiences can't walk around the screen and confirm its flat dimensions. Showing the performer's three-dimensional virtual model overlay a view of the venue, stage and audience can be seen as a way of trying to convince the audience that the model projected on the center of the stage, too, is three-dimensional. In addition, these AR views at Miku's concerts presented a view of Miku without showing the projectors or the screen, completely denying their very existence towards the audience.

Considering the content projected onto the translucent screen itself, it seems important to avoid showing images that are cut off at the screen's edges. This would clearly

show the screen's limits and therefore its presence. This means that letting the holographic performer walk into and out of the screen's reach poses a threat to presence and finding alternative methods to make them appear are worthwhile. In the case of Miku, Crypton has chosen for a wide variety of means, some more elaborate than others as they use playful graphics. In Miku's case, this lies much in line with her cartoony and virtual background.

The chapter on presence pointed out that the resolution and realism of virtual content is important. This does not necessarily mean that Miku's cartoony appearance is a major problem, it refers more to presenting virtual elements that show consistency with their surroundings and their own behavior. Considering the holographic performer is presented as merged into its physical surroundings, it's important that they behave in consistency with the physical world's physics. Miku does so through realistic bodily movements, made possible by motion-capture technology. At later concerts, she is also imbued with personality traits, allowing her to lean towards even more behavioral realism and less towards coming across as a robot.

In terms of catching light, however, she is not convincing. While the physical objects and people around her catch lights from the spotlights at the venue, Miku forms a source of light instead. She is unaffected by the colors of the spotlights, unlike the rest of the venue. Crypton has tried various ways to fight this dissonance between her and her surroundings (again, the custom stage, moved away from light sources, helps to some extent) but still seems to seek improvement in this regard. As such, Miku's concerts show how a holographic performer not behaving in line with its surroundings can pose a disturbing factor to presence.

Lastly, since interactivity is often seen as helpful to presence it should be mentioned here. The reason interactivity helps foster a sense of presence among audiences is that it can create a cognitively demanding experience that draws attention away from the medium. At the Miku concerts, there are elements of interaction, but they are too limited to offer this benefit. It might be that the wider experience, which may include a sense of interactivity among the audience itself could form a distraction from the mediated nature, but Miku herself does not. The one-to-many style of addressing the audience forms something of conflict here as it is the reason the interactive elements can take place, but at the same time means that they can only be too shallow to take up a lot of the audiences' mind space. As described earlier, this is arguably the case for both holographic and non-holographic

concerts, meaning that perhaps a musical performer is not a suitable channel to raise a sense of presence through interactivity to begin with.

Liveness and feigned consciousness

Presenting a holographic performer as being able to witness their surroundings and decide to act in reaction to it is key to giving the audiences a sense of liveness. Again, for Miku this starts already before the event even started, through the information provided beforehand. The websites and blog provided by Crypton explicitly refer to the concerts as live events. Also, the images and texts distributed show great similarities to traditional pop-concerts, where liveness is generally the norm. In doing so, there is a chance visitors will associate the hologram concert with the same kind of liveness. Additionally, there are several cases where Miku is posed as an active participant in the creation of the concerts due to the wording on the websites. She is also depicted as being able to think and act independently from interaction with humans through side media. All in all, the promotional material invites prospective audiences to interpret Miku as a person rather than a constructed character.

The use of a projection on a translucent screen may not be as important to liveness as to presence at hologram concerts. An opaque screen as used for online live streams or live broadcasted television can still incite a feeling of liveness among viewers. However, it should be noted that Sanden described spatial liveness as one of the categories that help induce a sense of liveness. Therefore, once the equipment used at the hologram concert creates the illusion that the performer is not just a screen projection, it forms a helpful condition of liveness. Spatial liveness refers to the sense of being in the direct physical vicinity of the performer themselves. In the case of Miku, whether Crypton intends to make it seem like Miku is physically present is debatable. However, as previously described, she is presented as a three-dimensional performer and, as such, seems to have a physical location on the stage. Therefore, the methods Crypton employs to convince the audience of Miku's three-dimensional appearance can be considered relevant to the concept of liveness as well.

Most of all, the performer's behavior is important to the discussion on liveness. Here, the categories of corporeal liveness and interactive liveness become relevant. It is important that the performer's movements are in line with the sounds played. This can be just making sure that the projection's mouth moves according to the lyrics but can be emphasized more

through the use of props. Microphones and instruments are more easily discernible to visitors towards the back of the audience. They also form a visual cue that emphasizes a feigned relation between the performer and the sound played. As demonstrated by Miku, it also helps to remove the true sound source (in Miku's case the pianist) from the audiences' field of vision to avoid possible confusion of where the sound is created.

Interaction with the audience of hologram concerts helps foster a sense of liveness on two different levels. Firstly, it makes it seem like the projected performer is able to see and hear the physical elements present at the venue. Secondly, it creates the illusion that the performer can react to external cues and decide how to react to these in the moment. The interaction with the audience can show different levels of elaborateness and can include both speech and gestures.

Multiple types of examples can be found in the Hatsune Miku concerts, ranging from simply waving at the audience to asking questions to fans located in different regions of the spectator space. She also shows how physical gestures can emphasize the fact that she addresses the audience directly. Furthermore, by letting Miku react to the audiences' response, a feedback loop is created between the two. This emphasizes the illusion that the hologram can react in the moment to the surroundings. After all, the audience reaction has not been rehearsed. Visitors are likely to feel that their own actions are spontaneous and Miku's reaction to this spontaneity forms a convincing argument for her feigned live nature.

It is important to keep in mind that interaction at hologram concerts should present the audience with cues that elicit an obvious and universal response so the audience can reply in unison. As long as the audience's reaction is predictable, the holographic performer can be pre-programmed to respond to it in a proper and convincing manner. Here, these events benefit from the fact that they take place in a concert setting: the one-to-many mode of communication between the performer and the audience necessitates inviting obvious reactions to allow the audience as a whole to feel included in the interaction. This is arguably the same case in both hologram concerts and traditional pop-concerts. As such, the hologram's inability to truly interact with the audience does not stand out due to the familiarity of the concert context.

Lastly, presenting character traits in the holographic performer's speech and behavior can help presenting them as a conscious person. Throughout the analyzed concert tours, Miku was depicted showing emotions and opinions, arguably making her seem less

robotic. By portraying Miku with such human traits, she is more likely associated with awareness and agency, two qualities helpful to creating a feigned in-the-momentness of a holographic performer.

All in all, analyzing the Hatsune Miku concerts exposed a variety of factors that help foster a sense of presence and liveness at hologram concerts. This has a positive effect on the likelihood of them adopting a state of suspended disbelief, and the way they interpret these events. It should be kept in mind, however, that the conclusions of this thesis are based only on the audiovisual design of Miku's performances. The scope of this essay does not encompass any audience reactions. Further field study and interviews with visitors of such concerts could reveal to what degree Crypton has been successful in encouraging a state of suspended disbelief. This success could also vary from person to person. Individual factors, such as personality, prior experience and cultural background, can affect a person's willingness and ability to suspend disbelief. This thesis also does not represent research into the effect of suspended disbelief to the enjoyment of audiences at hologram concerts.

However, even by looking only at the ways hologram concerts are designed, it can be said that they are exemplary of the ways mixed reality media can diminish the idea of the ontological cut prevalent in traditional screen theories. Once the concert design successfully convinces the audience to suspend disbelief, the audience would interpret virtual elements as merged with the physical surroundings. A holographic performer's appearance unaided by a screen and apparent ability to interact with non-virtual elements helps fighting the ontological cut. There is no longer a perceived difference between the virtual environment and the physical one. As such, there is also no reason to see the screen as a barrier, separating the projected content and its spectators.

The Hatsune Miku concerts show how the audiovisual design of hologram concerts can break through the screen-window metaphor. They represent a part of a wave of media entertainment that necessitates thinking about the screen as a bridge between the virtual and non-virtual, rather than as a barrier between them. It is not unlikely that future developments in technology will pave way to even more types of media that do not fit in with the strict virtual-actual binary. As such, this thesis provides thoughts about ways to express this trend in on-screen audiovisual design as a means of preparation for future developments.

Appendix

Appendix A - List of analyzed concert showings

Magical Mirai:

- Magical Mirai 2013 (Yokohama)
- Magical Mirai 2014 (Osaka)
- Magical Mirai 2015 (Tokyo)
- Magical Mirai 2016 (Tokyo)
- Magical Mirai 2017 (Tokyo)
- Magical Mirai 2018 (Tokyo)
- Magical Mirai 2019 (Tokyo)
- Magical Mirai 2020 (Osaka)
- Magical Mirai 2021 (Tokyo)
- Magical Mirai 10th Anniversary (2022, Tokyo)

Miku Expo:

- Miku Expo Indonesia 2014 (Jakarta)
- Miku Expo Shanghai 2015 (Shanghai)
- Miku Expo Japan 2016 (Tokyo)
- Miku Expo China Tour 2016 (Shanghai)
- Miku Expo Malaysia 2017 (Kuala Lumpur)
- Miku Expo USA & Mexico 2018 (Los Angeles)
- Miku Expo 2018 Europe (London)
- Miku Expo 2020 Europe (London)

(Note that many of the concert tours had minor variations between the setlists per location and date, only one of the showings was taken into consideration for this thesis' analysis)

Appendix B - List of links to exemplary fragments of concert footage

Magical Mirai 2013: *ODDS&ENDS* by ryo. Filmed and uploaded by Crypton:
https://www.youtube.com/watch?v=5kEoYWYnIIw&list=PL-pKPpZ1Q5NZqi-pHqc2zKXk8GG3U2fkW&index=25

Miku Expo Japan 2016: *Ten Thousand Stars* by CircusP. Filmed by Crypton, fragment taken from Miku Expo Rewind 2022 (free online stream), uploaded by Woochop:
https://www.youtube.com/watch?v=K9F4UsyqTs4

Miku Expo North America 2016: *Miku* by Anamanaguchi. Fan upload from Toronto concert by MonokumaTheHeadmaster:
https://www.youtube.com/watch?v=Nu0kC_ZspTo

Miku Expo Europe 2018: *Melt* by ryo. Fan upload from London concert by Captain Lewd:
https://www.youtube.com/watch?v=Zoo1cyOCXUY

Magical Mirai 2019: *Bless Your Breath* by Wadatakeaki. Filmed and uploaded by Crypton:
https://www.youtube.com/watch?v=7EEUU-yIN5c&list=PL-pKPpZ1Q5NZqi-pHqc2zKXk8GG3U2fkW&index=7

Magical Mirai 2021: Compilation of concert highlights. Filmed and uploaded by Crypton:
https://www.youtube.com/watch?v=Ua6Qr9E2qjc