Augmenting Materialities

A Case Study of MASCHINENKLANGWERK

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INTRODUCTION

Augmented reality can be understood as an integration of the virtual into the real or augmentation thereof. This places augmented reality on the 'reality' side of the mixed reality continuum,[1] meaning that virtual elements usually exist as foreign bodies in a real space. While there are many possible applications for augmented reality, its potential for application in site-specific installations is undeniable. Augmented reality's proclivity for spatial immersion and interactivity makes it a natural fit with installation art, and digital games. The existence of augmented reality in the real and in the virtual situates it as an enticing point of inquiry for the study of materialities.

We recently created an innovative augmented reality installation that treads just such a line between augmented reality game and site-specific art installation: MASCHINENKLANGWERK. The objective of this paper, then, is twofold: analyze MASCHINENKLANGWERK as a media artifact and in so doing, examine the distinct materiality and mediality of augmented reality and discern its characteristics. To begin, we will introduce our project, MASCHI-NENKLANGWERK, an interactive sound and light installation which was exhibited at the Dropforge Hendrichs in Solingen, Germany, from March 12 to 19, 2022. We will discuss its inception and dive into some design concepts behind it, especially characterizing the installation as a 'ludification.' Next, we will re-approach the subject from an angle of aesthetic

1 See Milgram, Paul et al.: "Augmented Reality: A Class of Displays on the Reality-Virtuality Continuum," in: *Telemanipulator and Telepresence Technologies 2351,* December 21, 1995 for the concept of the mixed reality continuum.

theory and dissect its material makeup while also discussing the medium of mixed and augmented reality and its materiality in more general terms. Finally, we will broaden the definition of augmented reality as a medial augmentation of the real by examining MASCHINENKLANGWERK from a media studies perspective, thus also expanding upon the unique materiality of the project and augmented reality as a medium. It is our intention and hope to set new precedents for augmented reality both as a technology and as an artistic medium; to reinvigorate and expand its scholarly discussion, and to inspire innovation in the creation of augmented reality artifacts.

LUDIFYING MATERIALITIES

In late May 2021, our team participated in a game jam for the Dropforge Hendrichs museum in Solingen as part of the FUTUR21 festival. The goal was to create an AR gaming experience that addressed topics of energy, power consumption, and the future, as well as to capture the essence of the museum that thematically explores work during the industrialization in Germany. Going into the project, we already had a preset notion about many AR applications as gimmicky and redundant, so we definitely did not want to create the next typical gamified AR experience as we see a lot of issues with current approaches to AR applications—which we will elaborate on over the course of this paper.

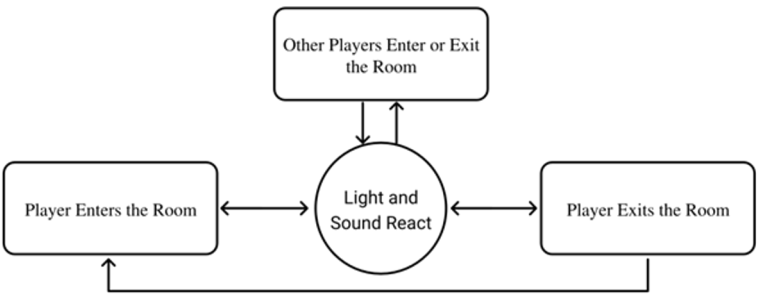
As an industrial heritage site, the museum is already very captivating in its own right, so there was no need to overshadow the beautiful machines and the grime of the industrialization that is still sitting within its walls. To quickly set the scene: MASCHINENKLANGWERK was an interactive audiovisual installation that used the former factory's space to investigate the connection between man, machine, and energy. While exploring the installation, participants encountered an ever-changing sound- and lightscape depending on the number of participants in the museum and in each individual room. This very basic interaction invited participants to stay, explore and play around in the gritty past of industrialization and the possible future that is still to be negotiated.

For us, the most important part was to not put a layer on top of what was already there but rather to enhance the museal space, as Janet Murray said in a 2019 article:

"Expanding human expressivity into new formats and genres is culturally valuable but difficult work. We are collectively engaged in making necessary mistakes, creating examples of what works and what doesn't work for one another to build on."[2]

Camera-based tracking would force participants to absorb their surroundings through their smartphone screens constantly. Instead, to track participants, we used the technology of Bluetooth beacons, which give off a Bluetooth signal at regular intervals. Based on the signal strength, smartphones can identify the relative distance to the nearest beacons and map them accordingly in a digital space. This digital space then opened up the opportunity to create an interactive sound- and light-scape that responded to the number of players within any given room of the exhibition space. The soundscape was individual to each visitor and was played back on their smartphones via headphones, while the lightscape was shared and physically integrated into the museum space using stage lights in key locations.

Figure 1: MASCHINENKLANGWERK's Experience Loop



Source: Figure by David Wildemann

Both were controlled by a central server and laid out within the digital version of the space. While at first, the soundscape imitated the machines in the museum quite literally, it slowly developed into musique-concrète-esque compositions—a machine sound apparatus (Maschinenklangwerk)—that brought the machines back to life in new and interesting ways.

2 Janet H. Murray: "Not a Film and Not an Empathy Machine, by Janet H. Murray," *Immerse*, March 27, 2019, https://immerse.news/not-a-film-and-not-an-empathy-machine-48b63b0eda93#.wh-k64qepp

Figure 2 and 3: Views of MASCHINENKLANGWERK

Source: Photographs by David Wildemann and Isabel Grünberg

When participants reached a certain threshold, the soundscape changed to reveal a related future version of each room that was not only negotiable but also constantly changing. So, on their way back, participants rediscovered previously explored rooms and gained a glimpse into the future while the sound- and light-scape playfully invited experimentation. Playfully inviting was exactly the thing we strived for. We believe that a good AR application does not force the participants to become players through gamification but rather invites them with smart uses of a ludified space. In this article, we would also like to make a more general case for the use of ludification instead of gamification.

"Gamification, I suggested, is primarily a practice of marketers and consultants who seek to construct and then exploit an opportunity for benefit. The opportunity in question is games, which remain a terrifying yet appealing medium for businesses. Terrifying because traditional organizations don't understand games and therefore fear them: for example, why do people spend so much time in such concentrated attention when playing video games, while they are so distracted or easily disengaged from other media? And appealing because there is some possibility that power can be harnessed for corporate benefit."[3]

Gamification is, per se, not an inherently bad thing, but it keeps us from developing the real potential of AR applications, and just like AR, gamification often feels redundant and unimaginative. The purpose of gamification is to make a boring or tedious task seem more fun and inviting by using gaming elements. Unfortunately, that doesn't translate that well into AR. AR is and can be fun on its own—there is no need to use the stereotypical mechanics (e.g., leaderboards and reward systems) of digital games for interactions when you can also create a reactive real world and develop new mechanics and approaches to AR. With that gamification often forces people to play, e.g., by collecting certain things and creating extrinsic motivations.

"Thus, one could say that a gamified structure and object are non-game structures and objects endowed with components and traits from the gaming regime; while ludified structures and objects are non-game story-structures and story-objects endowed with similar game components and traits whose focus, however, is not so much motivation, feedback, and

3 Bogost, Ian: "Gamification is Bullshit," in: Walz, Steffen P./Deterding, Sebastian (eds.), *The Gameful World: Approaches, Issues, Applications,* Cambridge, Mass.: The MIT Press 2014, p. 65.

reward but, rather, ways of 'designing' and 'telling' stories in new and exciting, i.e. 'ludified' fashions."[4]

Ludification opens the room for play and playful interactivity but doesn't demand it in the way that gamification does.

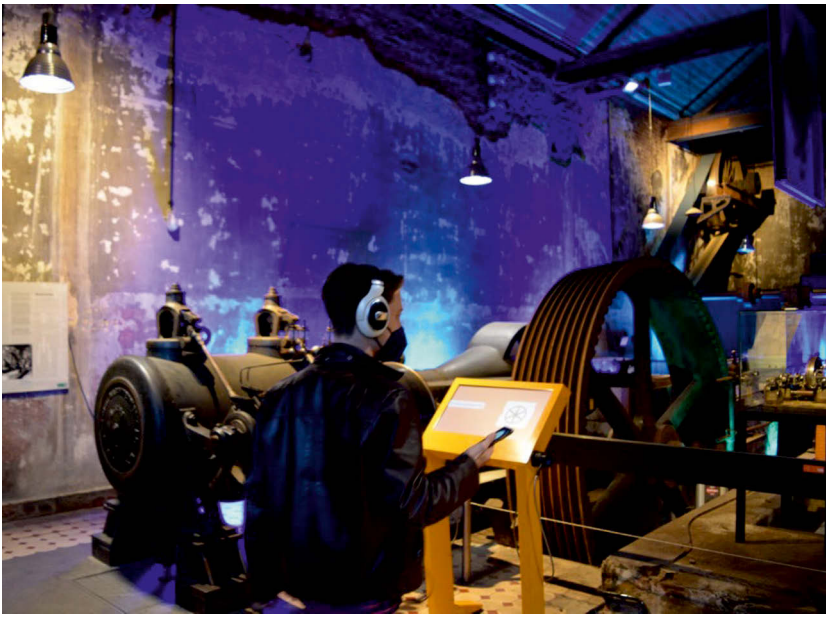
Furthermore, augmented reality opened the opportunity to see the unbelievable or revive what is long gone. One of the key pieces of information we wanted to transport is that the museum is—contrary to what one would believe at first glance—not just an industrial museum of machines but also a museum about the people who worked those machines and were the undeniable motor of industrialization. The workers have left the museal space, but the machines still linger in the halls. With our approach of ludifying the space, we wanted the participants to become symbolic workers that bring back life to the factory and its dormant, grubby machines. Additionally, we wanted to create new context between industrialization and the always present climate crisis, repurposing the rooms and giving them new meaning.

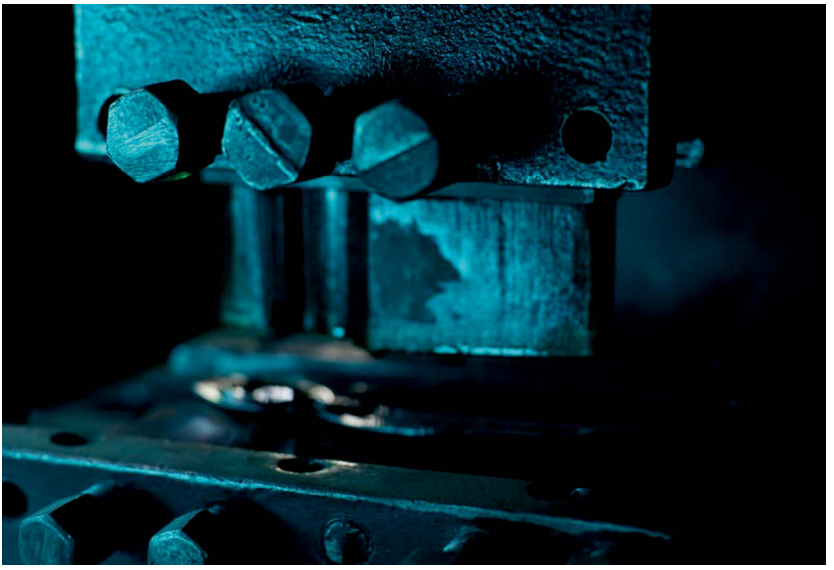
When participants walked into the first room, which used to be a coal oven, they were greeted by a fiery lightscape with the sounds of a person shoveling coal into the oven. The more people joined the room, the faster and more intense the shoveling became and the louder the flames would crackle in the oven until finally, the sound- and lightscape escalated into a ferocious wildfire. If the participants caught a glimpse of their phone, they could read the Haiku "Es brodelt im Tief; Flammen Licht der Dunkelheit; Zurück bleibt die Leere" which roughly translates to: "It seethes in the deep; Flaming light of darkness; Emptiness remains." This haiku adds an additional, albeit optional, textual layer of interpretive reality to the installation as it recontextualizes the room to further imply that these natural catastrophes that are happening all around the globe are a direct response to not only the industrialization but also the mass production and exploitation of earth's natural resources. With these Haikus, we invite introspection and reflection. When returning to the same room in the future soundscape, the lights remained the same as in the past, but the sound recontextualized the room in a very different light. Now the participants are greeted with the serene sound of waves crashing on the beach. It's a peaceful but quiet place that opened the question of the survival of the human species. Together with the new Haiku: "Langer Reise Ziel; Anbruch eines neuen Tags; Meer der Vision" ("Long journey destination; Dawn of a new day; sea of

4 Walther, Bo Kampmann/Larsen, Lasse Juel: "Gamification and Beyond: The Case of Ludification," in: *Lecture Notes in Computer Science,* 2020, p. 125.

vision"), the room invites the participants to reflect on their journey through the installation but also the journey of humanity towards the future.

Figure 3 & 4: Views of MASCHINENKLANGWERK





Source: Photographs by Isabel Grünberg

All these elements were chosen to intensify the space and subliminally break its boundaries to contextualize it with the world in the here and now as well as the potential future and the past. We aimed to highlight the systems that have shaped the room and its materiality that are still at work today.

We did not want to deal in absolutes or show our explicit thoughts while designing but rather leave room for discussion and interpretation—to inspire people to think, share opinions and possibly even act on them. Another important element for us—the interpersonal interactions—originated in a desire to bring people together. While designing our installation, we were still in the middle of a pandemic where social isolation was the norm for many people, so we focused also on creating interaction between humans on a very basic level: simply existing in the same room. It was about becoming aware of oneself in the room, as well as the position of others not just in the real space but also in the abstracted virtual world and their position of impact on it. With that, we aspired to create a sense of community and belonging that would encourage participants to share their visions, hopes, and dreams for the future.

We strived to not only invite play with the material of the installation but also to encourage interaction with the other participants. Our way of interpreting and ludifying the space played into the materiality and history of the space, expanding it and making it more visible and experiential again. This is an extraordinary power that (especially) digital augmented reality holds, and this approach stands in contrast with more narrow gamifications. In ludifying the space using augmented reality, an entirely new materiality emerged. Next, we will discuss this distinct materiality of augmented reality and MASCHINENKLANGWERK in greater detail.

MERGING MATERIALITIES

In 1994, Paul Milgram et al. laid the groundwork for categorizing kinds of mixed reality and understanding mixed reality as a reality-virtuality continuum.[5] When we consider a continuum of realms, of the virtual and the real, we must then also consider a continuum of converging materialities. This, of course, presupposes that virtuality brings with it its own distinct sense of materiality. While there are many avenues to take in understanding the virtual as material, from structural[6] to

5 P. Milgram et al.: "Augmented Reality."

6 Allen-Robertson, James: "The Materiality of Digital Media: The Hard Disk Drive, Phonograph, Magnetic Tape and Optical Media in Technical Close-Up," in: *New Media & Society,* Vol. 19, Issue 3, 2017.

functional[7] approaches, it is most relevant for our work on MASCHINENKLANGWERK to think of virtual materiality as an aesthetic quality. While we can usually not touch or smell the virtual, its material properties can be evoked by the synesthetic effect of the other senses, the visual and the auditory. Through this, we each form our unique understanding of what the virtual feels like, what it is made of and how it will behave, its texture, viscosity, and weight, if you will. It is this synesthetic interpretability of the virtual that creates its distinct materiality.

Through this convergence of distinct realms and materialities, a new materiality emerges; somehow real and physical, and somehow virtual and ephemeral. It is this intersection that becomes a fascinating point of scholarly inquiry and an exciting space of possibility for art. Of the greatest interest are the tensions that exist at this intersection and between realms. While they are exciting indeed, they also bring many technical and creative challenges that are only reflected too well in the state of mixed reality as a medium. Let us examine then this intersection of materialities and these tensions. What happens when we merge the virtual with the real? How do their distinct materialities converge, entangle, and affect one another? And from a practical perspective: When integrating virtuality into a real place, how is that place's material character altered? What can be lost, and what can be gained? It seems clear that these questions cannot be universally answered but must be answered specifically for the purposes of this text, based primarily on our interactive installation, MASCHINENKLANGWERK.

On the virtuality-reality continuum, Milgram et al. place augmented reality close to the reality-end and augmented virtuality on the virtuality-end. When we talk about augmented reality, then, we should expect a merging of reality and virtuality in a way where the virtual elements are integrated into reality. Interestingly, Milgram et al. focus their efforts exclusively on screen-based applications of mixed reality. Here, they distinguish between see-through and opaque camera-based screens. In today's terms, we have see-through screens in Microsoft's HoloLens and Google Glasses. However, the use of opaque screens and camera-based mixed reality is much more abundant as it can be achieved with almost any smartphone or tablet. In fact, this singular focus on screen-based mixed reality betrays an alarming trend in the discussion surrounding it—the reduction of an infinitely variable medium to a single technology.[8] But what about other forms of

7 For a functional approach, see, e.g., Leonardi, Paul M.: "Digital Materiality? How Artifacts Without Matter, Matter," in: *First Monday,* 15(6), 2010, and cf. Chalmers, David J.: "The Virtual and the Real," in: *Disputatio*, April 16, 2017.

8 Cf. MacIntyre, Blair et al.: "Augmented Reality as a New Media Experience," in: *Proceedings IEEE and ACM International Symposium on Augmented Reality,*

mixed reality that do not make use of a screen as the primary motor? Might other forms of mixed reality offer solutions to the problems facing the emerging medium, as criticized by Janet Murray, for example?[9]

When we want to create immersive experiences, the classical form of screen-based augmented reality can become a problem because there is a layer of glass separating you from what is supposed to immerse you. Two possible solutions come to mind: create an experience that truly works with the format and makes the intersection of realms its immersive focus or create an experience that circumvents the layer of glass entirely.

For MASCHINENKLANGWERK, the solution was a combination of both. We circumvented the screen by focusing on sound as a primary vehicle for the experience and focused especially on the tensions between the virtual soundscape and the real space. We deliberately created and resolved these tensions for dramatic effect. Sometimes the soundscape matches the real space, amplifying its existing materiality by restoring the sound of long silent machines. Sometimes the soundscape deviates from the real space by introducing new elements: sounds of nature as well as more explicitly musical elements. This juxtaposition created new and unexpected material experiences and a sense of wonder and enchantment. Janet Murray uses this term, enchantment, to describe the transformative quality of augmented reality. According to Murray, we desperately want to be enchanted by the magic of augmented reality, but this is also a double-edged sword. Relying purely on the novelty of this enchanting quality will surely hold back augmented reality as a medium. The way forward is through experiences that actively work with the format.[10] With MASCHINENKLANGWERK we worked to weave this enchantment into the core of the experience, also, again, by circumventing the traditional augmented reality screen and the disappointments that come with poorly integrated visual elements. When MASCHINENKLANGWERK transitions from literal sonic depictions of the real machines to a fantastically and musically altered version of the same soundscape, the machines do not disappear or are overshadowed. They shine in a new light—their being transformed into something not quite real and not quite virtual, but all the more magical.

When we merge materialities, we can create enchantment by enchanting one materiality with the other. In this way, we create new materialities that are distinctly

October 2001, and Yeon, Jung Ma/Choi, Jong Soo: "The Virtuality and Reality of Augmented Reality," in: *Journal of Multimedia* 2, No. 1, February 1, 2007.

9 Murray rightly criticizes the current state of AR for its reliance on novelty in her 2017 talk: "Thresholds of Reality: Creating Coherent Enchantment in AR."

10 Ibid.

other. We can also enhance an already existing materiality by restoring aspects of its material character that have been lost or are not present. So instead of altering its character, we can enhance it. These seem to be the primary aesthetic possibilities of mixed reality: *alter* and *enhance*. But sound is not the only mode in which this is done in MASCHINENKLANGWERK. The light installation that accompanied the soundscape behaved similarly, only that it was fully integrated into the real space. Yet, its counterparts exist also in the same virtual space as the soundscape, where the lights are dynamically animated. This puts them in an interesting spot on the reality-virtuality continuum, existing fully in reality but also fully in virtuality. They are an augmentation of physical reality using physical means that are digitally controlled; they exist in a *superposition*.

Naturally, we must consider a third element in this—the digital game. While mixed reality allows for an audiovisual collage of the virtual and the real, it is often also a ludification of the real. With ludification come the aesthetic pleasures of interactivity or agency.[11] The impression that we can magically affect the real and virtual world through our ludic interaction with mixed reality is certainly intoxicating. Not only that, it also fundamentally changes our material experience of mixed reality. From a functionalist perspective, the ability to interact, to poke and prod at its substance, makes the experience all the more visceral. MASCHINENKLANGWERK, too, is a ludification of reality, albeit not an outright game. Through movement in the real space, one also traverses the virtual space of the installation, which is not visible but audible. Not just an exploration of spaces, though, the soundscape also adapts to one's presence and to the presence of others: it increases and decreases in intensity, it shifts and transforms. This creates a sort of invisible substance that one can experiment with by moving through it; entering and exiting certain rooms; going back and forth to explore how the substance reacts. The material is not static but pliable.

MASCHINENKLANGWERK is also a shared experience by all participants, yet each participant traverses their individual virtual space. The participants are connected by network code, and their virtual worlds are interdependent, but they are still separate, simply in that they exist on each individual device. This seems to be a key aspect of the materiality of this kind of augmented reality—its existence in a shared real space but individual virtual worlds that are somehow enmeshed. In fact, we make use of this specific point of tension in MASCHINENKLANGWERK. As participants traverse the installation and soundscape, they become transported into

11 See Murray, Janet H.: *Hamlet on the Holodeck, Updated Edition: The Future of Narrative in Cyberspace*, Cambridge, Mass.: The MIT Press 2017, p. 123 on agency as an aesthetic pleasure in digital artifacts.

a futuristic version of the same soundscape that is entirely different. As they go back through the installation, they encounter participants that are still in the old soundscape—they become time travelers encountering their past selves.

This means that MASCHINENKLANGWERK is a participatory and procedural art piece—it cannot not exist without its participants, and its specifics are always different. In this sense, it defies traditional conceptions of sound installations and installation art. Drawing on Adorno, Juliane Rebentisch supposes:

> "In sound installation, there is usually no musical construction that could be 'composed along to while listening' because there is neither a composition nor a performance nor even the reproduction of one: there is only sound in space."[12]

But this is exactly what the transmediality of augmented reality allows for—and ludification and participatory culture call for: the open work of art as Eco understood it.[13] MASCHINENKLANGWERK's musical compositions were designed systematically and produced procedurally, as a digital game would be. The dynamic movement and necessary dramaturgy of the composition are suggested in its systems but are ultimately performed by the participants and at their discretion. The work is open both in its production and its reception. From the specific to the general then: mixed reality allows for the procedural production of its artistic material, as digital games do. This makes the material variable and pliable as opposed to fixed and thus never graspable as a single whole: as would be demanded by an objectivist view of art. This seems little revelatory in the context of digital games but is all the more so when these material characteristics of the digital game become merged with reality.

In examining MASCHINENKLANGWERK, we were able to discern some key characteristics of its materiality and the materiality of augmented and mixed reality in general: its enchanting quality to either enhance or alter; its pliability and variability resulting from its procedural and interactive nature; its otherness and superposition of existing simultaneously in virtual and real space. We have also discussed the medium of augmented reality in broader terms, its opportunities and challenges, especially when it comes to tensions created between realms and materialities. In the following chapter, we will continue this thought by examining mixed reality not just as an integration of the virtual into the real, or

12 Rebentisch, Juliane: *Aesthetics of Installation Art*, Berlin: Sternberg Press 2012, p. 211.

13 See Eco, Umberto: *The Open Work*, Cambridge: Harvard University Press 1989 (1962), e.g., p. 1, p. 4.

vice versa, but by going into greater depth on its transmedial character and by positioning it also as an integration of different media into the real.

DESIGNING MATERIALITIES

MASCHINENKLANGWERK is an augmented reality installation. A half-digital half-game, enchanting a very particular industrial heritage site. It is an installation fully concerned with and resulting from its host's materiality and its consequences. It shines a light on the material characteristics of the industrial site; it embeds its real players into a causal relation to the machine remains and each other, and it is overwhelmingly concerned with extrapolating the very real material consequences of humanity's machine-media-augmentations. As an AR play space juxtaposed with the backdrop of a late industrial age factory, it embraced the material realities of the museum through its own materialities. It could itself not escape the history and consequences of humanity's augmentations of the real. Is not the factory itself a relic of humanity's golden age of augmenting reality? Are not present and future generations faced with the anthropogenic consequences of this medial all-augmentation?

Now, Art, Media, the Real, and the Virtual are all terms that have been, and luckily will be, subject to a variety of different interpretations and extrapolations. This multitude of definitions makes it easy to create a viewpoint but impossible and undesirable to draw up a definitive conclusion on any term associated with it, including, of course, the term AR; augmented reality. For ease of discussion, reality will be considered as physical material reality throughout this chapter, while a different interpretation of the fundamental concept of the Real could lead to different insights into the topic. A supposition of two viewpoints on media might be fruitful in trying to re-approach the term AR, aside from its current interpretation as "[overlaying] digital content and information onto the physical world—as if they're actually there with you, in your own space."[14]

The McLuhanian school of thought would teach us to use the terms media and technology interchangeably, for media to McLuhan are technological extensions of the self and humanity; their true meaning being their acceleration of scale or pace or pattern of human affairs.[15] Thus, to McLuhan, all media is augmentative: augmentative of the individual, society, and our very senses, our perception and

14 Google, "Google AR & VR," 2020, https://arvr.google.com/ar/

15 McLuhan, Marshall: *Understanding Media: The Extensions of Man,* London/New York: Routledge 2010 (1964), p. 7-9.

reality itself.[16] This view might be contrasted with a communication sciences approach, where we find Gadamer,[17] Eco,[18] and others,[19] seeing media and art as the encryption and transmission of meaning, shared narratives, and ideas, that are then decrypted by their recipient. Following the communication sciences strain of thought, we see a separation between what Gadamer calls the material "Kunstgebilde" and its transmitted effects.[20] As such, media and art exist in physical reality and a subjective sensual reality, resulting from the human interpretation of any media artifact.[21] Thus, any media artifact exists in mixed realities to begin with, its material merely being the anchor for a much more important ethereal reality it's often amorphous, subjective interpretation. However, that all media and art exist in mixed realities does not explain the need for a particular definition of augmented realities. What is special about augmented reality through medial means is the desire to integrate media within 'ordinary' reality, and 'ordinary' reality within media. This is a unique medial process, wherein an existing reality is integrated consciously into a transmedial work, albeit not in a particularly new process.

A great quotidian example shows both the ubiquity and importance of this medial practice and existing analog medial augmentations of reality: street and road signs. They embed a spatially contextualized layer of information into physical reality. While this information is transmitted via a physical form, road signs convey specific and critically important encoded messages. These messages are not only inherent to the signs' physical properties, but through an interpretative act by a reader within the social norms, rules, and laws that they reference. In short, street signs integrate references to a transcendent societal reality into material reality. Their message is incomprehensible to those not privy to the meaning and rules behind these signs. Physical reality is and continues to be augmented medially. The result of this integrative process, medializing reality's materiality, is a transmutation of the medial properties and materialities of its constituent 'real' and extra-real medial parts.

16 Ibid, p. 48-52.

17 Cf. Gadamer, Hans-Georg: *Die Aktualität des Schönen,* Stuttgart: Reclam 2012 (1977).

18 Cf. U. Eco: *The Open Work.*

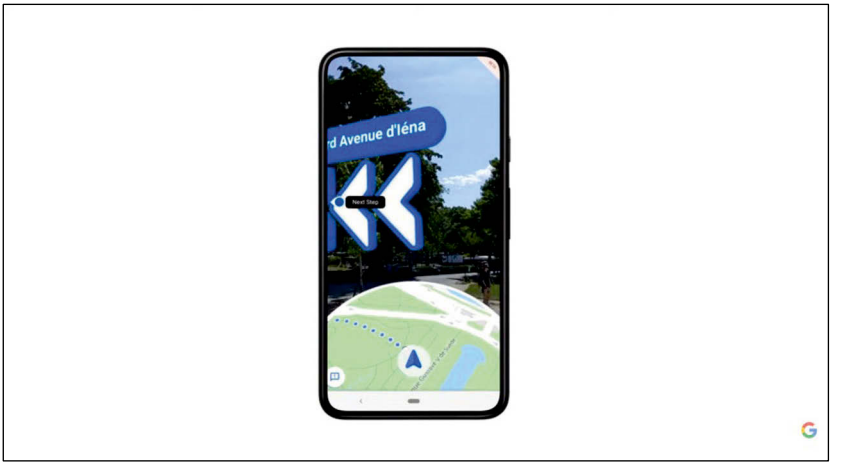
19 See for example Pross, Harry: *Medienforschung: Film, Funk, Presse, Fernsehen,* Darmstadt: Carl Habel Verlagsbuchhandlung 1972, p. 127-129.

20 H. Gadamer: *Die Aktualität des Schönen*, p. 54-57.

21 Ibid.

While this transmutation might be conducted through physical or digital artifacts, the digital computer medium offers unprecedented affordances, unattainable using analog means. Understandably, then, the new wave of medial augmentations utilizes these technological features to create artifacts of unprecedented material characteristics. Interestingly enough, in a step parallel to the first adaptation of board games, particularly Chess, to the computer medium,[22] the previously mentioned road signs and navigation systems have become an early application for Personal Display-based augmented reality applications such as *Maps AR* by Google.[23]

Figure 5: Maps AR by Google



Source: From the Google I/O 2021 Conference Maps Live View Presentation, 56:06

By comparing the two technological foundations for medial augmentations of reality—the road sign and its virtual counterpart—their different medial affordances and thus materialities become readily apparent. Where the street sign is ubiquitous and physical, the augmented reality navigation app is temporary and only accessible via specialized hardware. The street sign exists in a shared physical reality, whereas the augmented reality navigation app is an individualized virtual overlay. While the street sign is static and indifferent to its reader's destination, the

22 Donovan, Tristan: *Replay: The History of Video Games,* East Sussex: Yellow Ant 2010, p. 3-7.

23 https://io.google/2021/session/88b34a4e-6170-4f18-a321-4260fb559e60?lng=en at 56:06.

augmented reality app can overlay encyclopedic real-time information relevant only to an individual user at any given time. Both, however, act to augment reality through medial means. As this small comparative example shows, the digital transmedium the computer behind digital AR experiences adds a unique set of medial affordances, which might explain the radical exclusion of analog media in contemporary discussions of augmented realities.[24] For Janet Murray, these "new" and unique medial affordances of the computerized digital medium are: encyclopedic, spatial, procedural, and participatory.[25] Depending on which medium and technology is used to augment reality, its affordances and resulting properties change, which makes augmented mediality, augmented materiality, a question of source material and the conscious design of the resulting material nature of any augmented reality artifact. The materiality of augmented reality is, therefore, inherently a combination of the medial properties and materialities of its constituent realities and medialities. Augmented reality is, of course, not just street signs or camera-based personal navigation systems but a transmedial practice and transmedium with flexible medial and material properties that can change with and be selected consciously for any given artifact. This new perspective on the transmedium augmented reality might help explain some shortcomings of contemporary digital augmented reality approaches.

In her 2017 *Thresholds of Reality* talk, Janet Murray offers an interesting first critique as to why current augmented reality applications, particularly in the museum space, fall short of their grand initial visions:

"1. Too much focus on the mobile augmented reality screen at the expense of the historical or natural site.
2. Too much distraction from augmented reality experience from liveliness of the actual world.
3. Too literal replication of legacy media formats—audio tours, pamphlet of text – with too little interaction."[26]

In short, augmented reality applications are suffering from a misguided realization of the unique materiality of augmented reality—its opportunities and risks. This misguided materialization of augmented reality applications might, in part, be traced back to the underlying technology used to create most spatialized interactive

24 Cf. B. MacIntyre et al.: "Augmented Reality as a New Media Experience."

25 Murray, Janet H.: *Inventing the Medium: Principles of Interaction Design as a Cultural Practice,* Cambridge, Mass.: The MIT Press 2012, p. 23.

26 J. H. Murray: "Thresholds of Reality."

experiences—augmented reality camera tracking. So much in fact that, as has been discussed in the previous chapter, the technology has, for many researchers, become synonymous with augmented reality itself.[27] While a grand step towards integrating the digital medium into the physical space, this technology presents strict limitations on the possible interactions and interactive responses of the resulting augmented reality experiences. Camera tracking works based on information collected by (usually) a smartphone camera held by the user. That means the window to the digital side of any experience is also the main functional anchor of the experience. Users have to carefully move their smartphone to 'track' the space while also somehow interacting with something on the smartphone screen. The result is an uncomfortable dance between arm movements and finger presses, players looking into the physical space to suspect a response in the digital. It's akin to walking through a museum looking through binoculars while having to press something on one of the lenses from time to time. This kind of materiality is by no means bad, it is just a limited fit for most media artifacts. It can, for instance, in the case of POKÉMON GO, perfectly mesh with the narrative and gameplay of a virtual safari. For different intended experiences, it is therefore sensible to consider alternative foundations for intersecting realities, resulting in different material attributes, in turn allowing different interactions between the users and the media artifact.

MASCHINENKLANGWERK, emerged from a conscious game and media design process, designing for material meanings. As outlined in the preceding chapters, from the desire to augment the industrial heritage site with an artistic intent, arose the very particular combination of media that now constitutes this interactive installation. Stage lights directed by a networked game server let the space itself react to its players while a private soundscape morphs and enchants. Walking through the space becomes impactful to the players and their environment, fostering a playful discussion between players through symbolic play.

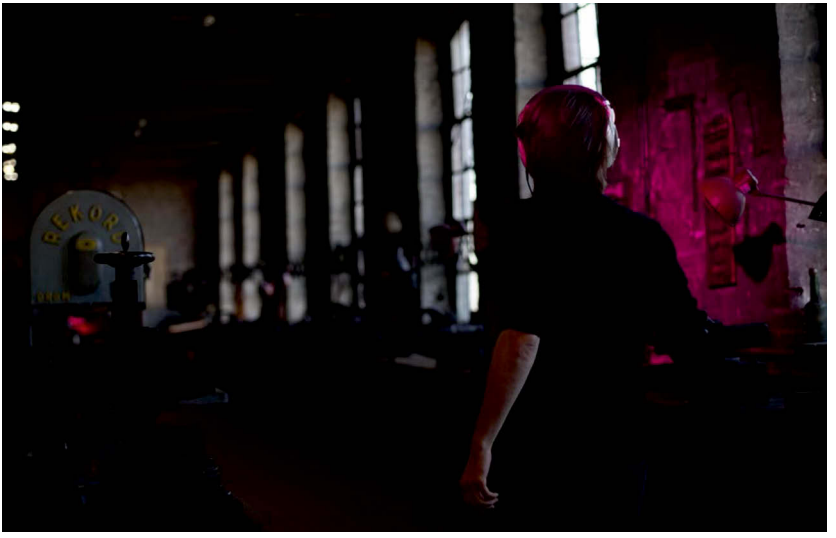
Since none of the digital technologies require active attention, the players are free to forget their smartphones and immerse themselves in the space and their impacts on it. MASCHINENKLANGWERK thus features carefully selected medial properties. Its players were augmented into the exhibition, and for them, their bodies in space became agents of impact; causes of the industrial past, and negotiators of the industrial future.

Creating MASCHINENKLANGWERK in a technology-agnostic way revealed the refreshing flexibility and originality of such an approach and is clearly reflected in the resulting experience. Interpreting augmented reality, not as a singular technology but as a medial practice, offers a beautiful multitude of possible medial

27 See ibid., p. 107.

combinations, which itself constitute each artifact's material nature. This materiality can be purpose fit for each artifact's context, content, and intent, with the unifying goal of augmenting, enhancing, and enchanting reality through media and art. At present, the augmentative medium is reduced to technology-first implementations augmenting through a limited set of methods using the digital transmedium. The increasing standardization of the medium to primarily its camera tracking-based version should be questioned by scholars and practitioners. A single foundational technology—AR Camera Tracking—should not be conflated with the medium itself. For AR's unique potential to develop, technology should be seen as a means toward a core medial desire: altering and enchanting reality through media. To this end, any media might fit perfectly, depending on the specific way in which reality is to be altered.

Figure 6: View of MASCHINENKLANGWERK



Source: Photograph by David Wildemann

CONCLUSION

In this paper, we examined the creative and artistic process and considerations behind our interactive augmented reality installation, MASCHINENKLANGWERK. Through this, we extrapolated insights into the materiality and mediality of augmented reality and discussed its state and potential as a medium. Naturally, we

took different approaches, from reporting and analyzing our process and work to aesthetic theory and media theory.

In wanting to design MASCHINENKLANGWERK as an immersive experience, and dissatisfied with common approaches to augmented reality, we made a case for ludification over gamification—the invitation to play but not the enforcement of it. This allowed us room for ambiguity in its artistic content and narrative, and to play into the strengths of the space's existing materiality and—in turn—the hybrid materiality of augmented reality.

By dissecting the material characteristics of MASCHINENKLANGWERK, we have made a case for understanding augmented reality as possessing a distinct hybrid materiality of the real and the virtual. This hybrid materiality stands out in its enchanting quality to either enhance or alter; its pliability and variability resulting from its procedural and interactive nature that is rooted in digital games; as well as its otherness and superposition of existing simultaneously in virtual and real space. The procedural production of its artistic material makes MASCHINENKLANGWERK open both in its reception and production and allows it to fulfill the desire for a truly open work of art.

Examining the medial nature of augmented reality, we have positioned it not only as an augmentation of the real through the virtual (digital augmented reality) but also as a medial augmentation of the real which can be achieved by analog means as well, e.g., street signs (analog augmented reality). In juxtaposing the two, we discussed the unique medial affordances of digital augmented reality and its underlying and inherently flexible transmedium—the digital computer. We make the case that augmented reality is at its core the practice of augmenting reality medially. This shift in perspective invites the conscious selection of which media and medial combinations should be used to augment reality and by what means. Consequently, we make the case that AR should not be conflated with a single foundational sensory technology, camera tracking and screen overlays. It should ultimately be seen as a means toward the core medial desire of augmented reality: altering and enchanting reality.

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