

**BABES-BOLYAI" UNIVERSITY CLUJ NAPOCA**

**FACULTY OF THEATRE AND FILM**

**DOCTORAL SCHOOL OF THEATRE AND FILM**

**Cinematography and Media Department**

# **DOCTORAL THESIS**

**AUGMENTED REALITY IN ART:**

**A LAYERED STUDY OF PERCEPTION, SPACE, AND TECHNOLOGICAL  
PERMANENCE**

**Summary**

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**2025**

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## SUMMARY

**Key Words:** Augmented Reality (AR), Intermedia Experience, Artistic Sustainability, Perception, Space, Art-based Research, Practice-based Research, AR Content Analysis, AR Taxonomy, Aesthetic Theory, User Engagement, Digital Art, Archival Challenges, Interdisciplinary Collaboration

### Introduction

"Augmented Reality in Art: A Layered Study of Perception, Space, and Technological Permanence" is a doctoral research that embarks on a vast exploration of Augmented Reality (AR) within the artistic domain. By viewing AR as a main medium, I explore how these practices offer a lasting or evolving direction different from visual art of the past. First, the thesis suggests an original contribution by conceiving of AR as an "Intermedia Experience within the Art-Field Paradigm," thus drawing attention to new possibilities for intermedia art and aesthetics from an artist's perspective.

There are three main objectives guiding this study:

1. Framing the artistic AR world: What is its context, in terms of theory and technology in the 2020-2023?
2. Identifying prominent AR artists and their works: In-depth reviews are conducted.
3. Investigating the author's personal practice in relation to research findings: Formulating my own AR works through this lens, examining all aspects of it against the work of others.

A multi-method approach is used by the researcher. This research experience is built on a complex dual-methodology foundation consisting of art-based research and practice-based research as the primary means. These are in turn supplemented by rigorous case studies and content analysis (both theoretical and practical), in addition to extensive interviews. More than 20 interviews with AR artists from all over the world and representing various tribes of art (including prominent figures like Ines Alpha, John Craig Freeman, ORLAN, and Manuel Rossner) as well as students, audiences, and researchers were held. The general findings of this were that it is possible to find plenty of first-hand material which shows the development and present condition of content on display.

This thesis consists of seven chapters, ordered in a logical way and capturing the main themes: foundational concepts of AR technologies, theoretical paradigms in aesthetic experience, perception and space, categories of art, practical strategies and finally, results. Key paradigms explored include AR as a hybrid space, the nature of active and embodied perception in AR, AR's role as a tool for socio-political narratives, ethical considerations surrounding its use, the democratization of art through AR, and a chronological categorization of AR's evolution within the art field. During the study, I conducted many AR projects. These practical experiments incorporated both research achievements and creative works, serving as a further development for my artistic creations to enter the AR world. They consist of "Above and Beyond", "Arcul Limbii Romane", "Pineapple Express- Lurre", "Treat it like you eat it", "Les films de Saint Orlan" and "Anamorphic Reality (AR)". As an artist-researcher, I make a comprehensive inquiry into AR in every direction, from a theoretical discussion backed up by practical demonstration to the national and international levels, a new research direction and indeed introducing a categorization for established artists, a taxonomy. The work is carried out from an artistic viewpoint, integrating concepts of perception and aesthetics without pursuing the intellectual.

## **Chapter 1: Methodology**

The research methodology itself is a synthesis of qualitative approaches and art-based research stages, designed in order to achieve a comprehensive understanding of AR in art. This strategy makes use of the strengths of different paradigms, so that all phases of research methods are supported. Art-based research and practice research stand as the principal paradigms, using art as their essential characteristic and based in practical artistic projects and theoretical foundations. An important element in the strategy, autoethnography utilizes my, the researcher's personal experience as data. I compared my artistic practice with various audiences and situations (Romania, Germany, Austria and Portugal): a deeply subjective treatment in alignment with qualitative principles.

Case study and content analysis methods are artistically integrated into the whole research process, content analysis of unique research topics, case studies of individual works of art and artists gives deep insights whilst observing materials systematically attests to their communicative qualities. For the observational approaches and interviews, I sought out firsthand artists as data sources: their experiences and thoughts helped gain further insights into



what we often think of as "common sense ideas." During exhibitions, I assumed the role of "observer as participant" in order to collect information on audience behavior. In-depth interviews with well known AR artists and their studios provided useful insights as well as access to private material, aiming to understand their orientation to AR. To maintain trustworthiness, different data sources are triangulated with each other. Ethical concerns are strictly observed: the rights of the subjects (informed consent and anonymity, confidentiality of data) are guaranteed. Intrinsic to the method's mixed nature is a diversified exploration of AR, perception and space theory in art, a combining of methodologies in the field of diverse media.

## **Chapter 2: Definitions and Delimitations of Augmented Reality in Art**

After this, the thesis defines and limits Augmented Reality in Art, exploring its initial development and origin. AR was defined as real-time, site-specific, and interactive technologies that overlay virtual information onto physical reality in real time all over a given area. The distinction between Augmented Reality (AR) and Virtual Reality (VR) is significant, but AR emphasizes transferring virtual elements into the natural environment. Through AR public space is now possible to achieve freedom as never before for public art, wherever artists want to place their works around the world. The early pioneers were people like Ivan Sutherland and Morton Heiling who laid the groundwork for immersive technologies.

AR can be divided into markerless AR (depending on device features such as GPS) and marker-based AR (relying on a visible indicator). Both its ease of access and delivery are different, with markerless generally having higher stability. AR is situated on the continuum between physical and virtual worlds, being nearest to our reality. As things get closer to perfection, tasks begin to involve marketing of computer vision technology: making things track. We have the problem that objects overlap, block light, and otherwise break up images when trying for photo-realistic rendering. User surveys are essential for measuring AR's effectiveness, and continued application development together with tracking and display technology are keystones in this effort. For its part, AR's activism side is showing increasingly. "AR Art Manifesto" by the "Manifest Augmented Reality" collective in 2011, is providing a new perspective for social movements. This comprehensive survey highlights AR's historical background, modern applications and its further role as a specific form of artistic activism, especially after becoming available globally due to the smartphones.

### **Chapter 3: Content Analysis from Theoretical and Technological Perspectives**

It is only with a broad content analysis from the dual perspectives of theory and technology that I begin to understand what forms AR art can take. From a theoretical standpoint, this study borrows ideas from Aesthetics, especially Nathan Knobler's "Visual Dialogue" that explains how aesthetic experience emerges from the dialogue between art and audience. In Mikel Dufrenne's "The Phenomenology of Aesthetic Experience," the emphasis is on the viewer's involvement with an artwork as distinct from its existence in itself and as a transcendence of artistic object into something else yet to be determined by viewers. Katja Kwastek's "Aesthetics of Interaction in Digital Art" concentrates upon interaction in new media art. Her work clearly evokes a hybrid character. Steve Dixon's "Digital Performances" sees technology as an enhancer. In theories of perception, particularly Rudolf Arnheim's "Art and Visual Perception," perception is depicted an active process. Wilhelm Worringer's "Art and Problems of Perception" argues that reality is never like reality, but that it can be understood through art by experiencing a similar human behavior the world over. E.H. Gombrich's "Art and Illusion" provides a foundation where AR works can keep their value, noting that art interprets the world for us in spatial images. The combination of the ideas from Knobler, Kwastek, Dufrenne, and Wilson is the experiential, subjective, immersive, interactive features of AR where emotional response and reality understanding cross the boundary between ideas. Oliver Bimber's "Spatial Augmented Reality" creates a matrix with which to understand how AR art acts on space, and emphasizes the role of physical environment in shaping spatial perception. In site-specific AR artworks: physical space is integrated. This selection of theories helped me understand the essence, the base of what I am constructing physically, and moreover gave a direction to look for when networking with other artists in the future development of this research.

In terms of technology, the thesis formulates a system of classification for AR artworks and AR artists based on the way they take applications with technology. Markersless AR relies on GPS & device sensors. John Craig Freeman's "Border Memorial: Frontera de los Muertos" (socio-political commentary) and "EEG augmented reality: Things we have lost" (connecting thoughts to AR)." Other examples: augmented reality sculptures (Manuel Rossler's 3D architecture), generative AR markers as graphic planes pushing into our realm. In AR Marker-Based Works, where one needs a visible indicator for continued use during playback, there are mixed media by Adrien M and Claire B ("Faune" - AR posters, "Acqua Alta" - pop-up AR book), augmented

reality portraits (Mandy Sobo), illustrations (Susi Vetter), sculptures, graffiti. AR, AR of people, AR and the human body (Ines Alpha's 3D makeup in particular and Jeremy Bailey's body interactions most recently). The dynamic development of AR driven by hardware and software achieves a happy integration with AI and machine learning. Such AR platforms as Artivive, Adobe Aero, Spark Studio and Unity are outlined. The rapid development of AR hardware has led to lenses that are shaped like glasses and could one day overpower Apple's leading position in AR. For several years the significant increase in the AR market has been driven almost entirely by companies such as Apple, Google, and Microsoft. Future AR glasses can then be applied throughout a wide range of industries, and AR applications are likely to become mainstream. Chronologically categorized and counted thus are 99 AR Artists that I came across during the years of my research. The growth and popularity of AR can be observed around 2017, but remaining stable afterwards.

#### **Chapter 4: Interviews and Analysis of Artists' AR Work**

After this, the dissertation presents a qualitative content analysis and functionalities of art works made by some AR artists selected: like John Craig Freeman, Adrien M and Claire B, Ines Alpha or Jeremy Bailey within the seeming framework of perception, aesthetics and space. John Craig Freeman's "The Border Memorial: Frontera de los Muertos" makes use of markerless AR to construct a virtual memorial for migrants, blending technology, cultural symbols and social action. His "EEG augmented reality: Things we have lost" researches ways of linking thoughts to AR by means of brainwave sensors. Adrien M and Claire B has launched "Faune - An augmented reality Urban Cartography," which adopts marker-based AR posters to give the user an experience of city life from within a networked environment., While "Acqua Alta - Crossing the Mirror 2020" is a pop-up AR book for storytelling," showing lines of unfinished letters and arbitrary color schemes that fade a sheet in and out into itself every so often. Ines Alpha did her "3D Makeup" with augmented beauty products produced based on AR filters, overturning traditional beauty standards. Jeremy Bailey's essay on 'Augmented reality Sculpture and the Lucid Body' explores the relationship between human form and self-made AR software, questioning issues such as identity and space. What I have gathered and applied from Bailey is the fact that he presents a deconstructed idea of AR, that helped me better understand the principles and the technologies behind. These analyses show situations

when these artists use AR for social commentary, to tell innovative tales, when they turn all of our senses upside down and to express society's most pressing issues.

## **Chapter 5: User Acceptance and Experience**

In this segment, user acceptance and enthusiasm for AR is closely looked at and thoroughly analyzed. Strengths, weaknesses and challenges are all viewed from the perspective both of the user and the artist. In the case of users, AR gives dramatic experiences such as those found in "Pokémon Go" and used in retail via fitted out shopping carts. The scale and growth of AR are tied up with the widespread availability of smartphones. Yet, the limitations of existing equipment cut down participants' immersion such that they are never entirely entered into nor experienced interly; also real-time monitoring in an era where an economy is ran by data alone is perceived as "virtual stealing". The market is also very fragmented. Other challenges include : hardware restrictions (expensive equipment, short battery life), content production difficulties (the need for talented engineers and lack of open platforms), substantial data protection worries, cultural challenges, network connectivity requirements, high power consumption. From the artist's point of view, the task is to make AR apps more real, more immersive and more sensory with interactive content and real-time rendering. Cloud-based AR allows multiple users to have a shared experience. It fosters International collaboration and shared art movements. It opens art up to more affordability and accessibility, beyond traditional spaces. For artists, challenges include acquiring technical proficiency and protecting their intellectual property rights. For me, user feedback and constant experiment as well uncover new artistic possibilities. I believe that user acceptance and satisfaction are critical factors for the successful development of AR. Consequently, relevant apps should be intuitive and have rigorous privacy laws. AR is capable of transforming cultural experiences, but can also result in addiction. Such risks must be managed proactively through cooperation between disciplines and due attention to context.

## **Chapter 6: Practice as Research: Personal Artworks**

This thesis then changes tact, switching to an auto-ethnographic approach. It discovers my own artistic practice in AR, blending academic reviews with personal thoughts at once. With roots in fine arts my art career evolved to incorporate digital innovations, and lived experience and artistic creation act as consistent data for the research. The purpose is to study how AR brings

forth emotions and promotes deep immersion. For example: six pieces of personal AR artwork, including "Beyond and Above" (AR on ink illustrations with audio-visual animations), "Arcul Limbii Romane" (AR animation for a public sculpture, reinvigorating cultural heritage), "Pineapple Express- Lurre" (AR for a vinyl music record cover), "Treat it like you eat it" (AR for environmental activism), showing contamination of our local river, "Les films de Saint Orlan" (published AR experience for ORLAN, challenging traditional gender roles), and "Anamorphic Reality (AR)" (interactive AR + AI experience for mental health research). I consider my work is characterized by innovation and a desire to mix traditional illustration with new digital technology. Influences include interactive media pioneers and ideas from philosophy. The development of one's work generally consists of preliminary drawing. Basic self-learning software is needed, while a series of tests refine this into the final product. In a wide range of projects exploring identity, collective memory and socio-political problems, AR functions to place the message in its own context, add to the impact of storytelling and enable viewers with it. By exhibiting AR art internationally I had had different experiences in how AR is perceived as an art form from various cultures, trying to harmonize local voices on global issues. Given at Babes Bolyai University, my AR course was both a solid foundation to learn from and an addition in research. For the future, it is suggested that scholars look at themes such as technological evolution (AI, 5G, wearables), ethical guidelines in production, research on the audience, inter-disciplinary cooperation and some theories for coming AR aesthetics.

## **Chapter 7: Practice as Research: How My Practice as an AR Artist Is Being Shaped by the Research in the Field**

Hence the thesis ends, noting how my artistic practice is shaped by this in-depth research, focusing on AR intermedia dimensions that were developed during the making of "Above and Beyond". I take AR to be able to expand space, release new art forms through a combination of movement and different aspects of aesthetics at work, an environment conducive for entering what I call the "mediation zone." My aim is to create AR works that go beyond simple digital animation, becoming intermedia works of digital, narrative art, joining illustration, animation and sound into narrative journeys that inspire emotional connections. The artworks from the "Above and beyond" series manage to do just so, by introducing firsthand spoken thoughts of the people depicted in portraits for the audience to access.

The research journey also included defining AR and exploring its technology and art-related concepts, and it set out to determine whether AR would be a permanent artistic medium for my future practices. Six major factors shaped the sustainability of my practice. Linking up to Artivive to Adobe Aero, I made technological changes for broader capabilities, pondering designing my own application in future archives. By analogy to theories of active perception and Gestalt principles, I look to heighten immersive experiences while taking account of the active participation of the audience. Highly immersive experiences produce strong awareness, and AR has its own unique storytelling possibilities. In spatial and environmental terms, site-specificity adds to user experiences but restricts audiences; visibility and illumination conditions there are also reflected visually impacting our perception. Socially and culturally speaking, AR's worldwide availability makes it highly accessible. But digital literacy and issues of privacy present problems. I argue that we must protect our own rights. Economically and institutionally, funding models are reviewed and museum integration challenges discussed. AR works are ephemeral and demand new archiving strategies. Corporate influence shapes AR tools, yet there needs to be more interdisciplinarity within the field. Psychologically and cognitively, AR changes perception.

## **Chapter 8: Final conclusions**

In conclusion, this study argues that AR art is both a valid and sustainable direction for action into areas previously neglected by me as an artist-researcher; it extends artists' expression into new media space through expansions of metaphorical/elemental forms as well. I depend largely on my understanding of AR's technology, perception and aesthetics for future developments within my practice. Also significant is knowing the spatial implications as a prerequisite for in-the-moment, live production broadcasting of AR content. I emphasize the importance of content itself, visual elements, and user experience; after this research, my preference is normally monochrome colour schemes with simple animations put together so as to make maximum impact within short timespans. Despite the need to address data privacy issues and find methods of archiving this kind of technology and the fact that new technological alternatives emerge at any point in history AR remains a field capable of continuous progress. As an artist, my suggestion is to keep abreast of the latest technology, invest in archival works (AR data is perishable), and explore AR's ability to enter new dimensions and media. They

could even collaborate with documentary makers in producing art which brings people from diverse industries closer by means of individual, subjective stories presented in AR.

As I mentioned before, I see my practice developing in this direction, in which the people from the illustrated portraits share their stories directly with the viewer, through the augmented reality experience that I am offering. I want my art to work as a platform that facilitates connections between people, in this case, the people that I depict in the portraits and the viewer. In this way, I consider that my artworks reach a level of originality and offer that degree of surprise through emotional dialogue on a perceptual level between the artwork and the audience. The interdisciplinary approach was also presented during research as a contribution to sustainability and supported by the theorists who focus on a positive future for AR. And somehow, the conclusion is that I'm positive about embracing AR as a sustainable direction within my art practice, but with reservations.

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