Reimagining In/Visibility, Archival Practice and the Emergence of AI Cinema: An Exploration through Refik Anadol's Artworks

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Abstract

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This thesis explores the characteristics of "AI Cinema" through an analysis of Refik Anadol's works. Integrating Artificial Intelligence (AI) in moving image art challenges the existing film theory and aesthetics and redefines the conventional boundaries of archival use in visual art. Drawing from an interdisciplinary approach, this study analyzes two installations, "Data Tunnel" and "Machine Memoirs v.2" from Anadol's *Machine Memoirs: Space* exhibition, to illustrate the transformative role of AI in reimagining cinematic aesthetics and expression. The first chapter concentrates on the artwork "Data Tunnel," delves into how AI facilitates new ways of seeing and challenges traditional concepts of visibility and invisibility in art. The second chapter extends analysis from "Data Tunnel" to "Machine Memoirs v.2" and focuses on the reconstitution of archives, highlighting AI's role in redefining archival content from mere narrative support to foundational material for artistic creation. The concluding segment synthesizes the insights from the earlier chapters to articulate the emergence of AI cinema as a new cinematic form. It identifies the departure from traditional cinematic storytelling and aesthetics, fostering a dynamic, algorithm-driven cinematic experience. Through this exploration, the thesis aims to contribute to the broader understanding of cinema's evolution in the digital age, particularly focusing on the role of AI in forging new forms of narrative and aesthetic expression. By focusing on AI cinema, the study adds to the limited but growing academic discourse in this area, providing a clear analysis of its unique characteristics and importance in the modern cinematic landscape.

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Introduction

Over the past few decades, the integration of new media art with emerging technologies, particularly artificial intelligence (AI), has significantly influenced the evolution of cinema. In his 2002 essay, John Belton states that from production to post-production, filmmaking had become increasingly relied on digital technology.[1] While film itself still exists, the process of filmmaking and the form of the cinema have evolved from traditional analog methods to a mostly digitized approach.[2] While celluloid cinema had its own form of high-quality visuals and sophistication, the changes introduced by digital production encompass both technical advancements and aesthetic transformations. Advanced digital technology, including AI, has markedly enhanced the accessibility, flexibility, and creative possibilities in film production and post-production which have encouraged more experimentation among filmmakers. The film industry's reliance on technologies changed from camera to computer vision systems such as CGI and then artificial intelligence applications.[3] This shift has brought profound aesthetic changes in cinema, from the enhanced realism and dynamic visual styles enabled by CGI to the abstract forms and innovative uses of colour and shapes introduced by AI. There are several factors for this shift, including the enhancement of creativity, cost-effective production and the influence of global trends and audience demands.[4]

Belton discusses a possible future in which non-film technologies could affect the evolution of film and transform its final form.[5] Artificial intelligence as a non-film technology has been used

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[1] John Belton, "Digital Cinema: A False Revolution," *October* 100 (2002): 98–114, doi:10.1162/016228702320218411, 103.
[2] 1. Steven Shaviro, *Post Cinematic Affect* (John Hunt Publishing, 2010): 8.
[3] Shane Denson, *Discorrelated Images* (Durham: Duke University Press, 2020): 68.
[4] Ibid.
[5] Belton, "Digital Cinema," 114.

for various purposes, from generating visual effects and animations to contributing to scriptwriting and editing in cinema. And today, new media artists create a new form of cinema through this evolving technology. According to Joanna Zylinska, AI art is characterized by the creative process being informed or dictated by algorithms typically associated with machine learning or neural networks.[6] Artificial neural networks are computer systems that imitate the way the human brain learns, connecting dots of information to recognize patterns, much like we do when we learn new things.[7] Zylinska, drawing on Jacek Dukaj's observations, notes that AI's involvement in the creation of contemporary cultural artifacts is significant. She points out that, for instance, Hollywood blockbusters are often edited using advanced computers equipped with AI-based software, providing extensive creative flexibility in post-production.[8]

AI cinema, a term that I encountered in the work of new media artist Refik Anadol, refers to the combination of two concepts, "artificial intelligence" and "cinema".[9] Anadol is a renowned new media artist and is recognized for creatively integrating artificial intelligence into visual art. The utilization of AI is not just about the application of technology in Anadol's AI cinema; it is also about how this technology expands the traditional boundaries of cinema and reimagines it. AI cinema is different from traditional blockbuster Hollywood films, which use AI for special effects and narrative enhancement. Anadol's work is deeply experimental, focusing on visualizing the invisible through AI, thus creating a new form of cinema.

AI's emergence in the artistic sphere has brought critical questions to the forefront of art and technology in this new era. For instance, Zylinska's question, "What will art 'after' AI look

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[6] Joanna Zylinska, *AI Art: Machine Visions and Warped Dreams* (London: Open Humanities Press, 2020): 15.
[7] Christiane Paul, Digital Art, 3rd ed., World of Art (London: Thames & Hudson, 2016): 164.
[8] Zylinska, *AI Art,* 68.
[9] Refik Anadol, "Machine Memoirs: Space," *RefikAnadol,* accessed December 13, 2022, https://refikanadol.com/works/machine-memoirs-space/.

like?"[10] encapsulates a major shift in the art world. The evolution of generative media has been progressing for more than two decades.[11]

Figure 1. "Nightmare beast," digital image created by Alexander Mordvintsev using DeepDream, 2015. Accessed October, 2023. https://thereader.mitpress.mit.edu/deepdream-how-alexander-mordvintsev-excavated-the-computers-hidden-layers/ (Left Image).

Figure 2. Untitled, digital image created by Zhang Haijun using Midjourney, 2023, Accessed October 2023. https://www.technologyreview.com/2023/03/29/1070432/china-ai-retro-photo-midjourney/ (Right Image).

Over the last decade, the scope of AI-generated art has extended from the abstract to works that are identical to ones created by humans. Moreover, computers have gained the capability to generate images in the styles of various renowned artists.[12] AI generators such as DeepDream, Canva,

[10] Zylinska, *AI Art,* 14.
[11] Lev Manovich, "Seven Arguments about AI Images and Generative Media," in *Artificial Aesthetics: A Critical Guide to AI in Art, Media and Design* (2023):2, http://manovich.net/content/04-projects/168-artificial-aesthetics/lev-manovich-ai-aesthetics-chapter-5.pdf.
[12] Wolfgang Ertel, *Introduction to Artificial Intelligence,* 2nd ed., trans. Nathanael Black (Cham, Switzerland: Springer, 2017): 7, https://doi.org/10.1007/978-3-319-58487-4.; 2. Manovich, "Seven Arguments about AI Images."

DALL-E, and Midjourney demonstrate the transformative impact of AI on art and design, offering a range of styles that are now a part of our visual and cultural experience.[13] These tools, which are more accessible and known than the advanced technologies used by major studios, illustrate the shift in how art creation extended towards digital.

Artificial intelligence's involvement in filmmaking shows that cinema not only adapts to but also reflects and shapes societal trends and cultural shifts. The question posed by Zylinska, once contemplated by a small number of scholars, has now, through the advent of contemporary AI generators, evolved into a pervasive inquiry embedded within everyday life. The advancements in AI technology and its applications, particularly in visual art, foreshadow the new forms in cinema. Although there is a significant and growing interest from both artists and scholars in AI art and cinema — with notable contributions from Joanna Zylinska, Lev Manovich, and Harry Lehmann— the discipline is still in its early stages of development. Our understanding, along with attempts to categorize AI cinema and connect it to the broader historical development of film, continues to evolve alongside the technology itself.

Anadol's artworks embody a particular aesthetic expression that blurs the lines between abstraction and realism, capturing elements that evoke the familiar while still retaining a sense of the surreal (figure 3), all through the key thematic elements of artificial intelligence, such as in/visibility, new ways of seeing, and innovative uses of archives. Curators Paola Antonelli and Michelle Kuo highlight the machine learning model's unique approach to data interpretation when they talk about Anadol's work *Unsupervised*, which draws from MoMA's collection. Kuo remarks the model forms a complex map of MoMA's archive, grouping data to create a galaxy with vast empty spaces. In these spaces, the AI, together with Anadol's team, speculates on the unknown,

[13] Ibid.

venturing into a kind of dreaming where it imagines what could exist in these empty spaces, beyond the current archive.[14] My research is driven by a fascination with the unique outcomes of AI's involvement with archives as exemplified by Anadol's work.

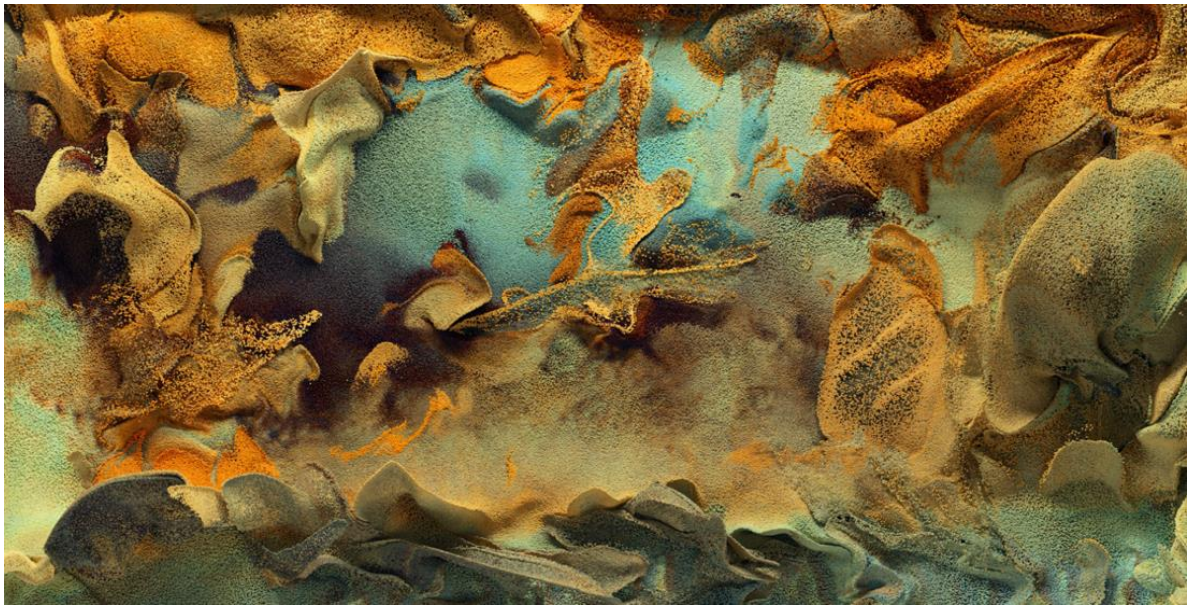

Figure 3. Digital image captured from an original audiovisual installation of Refik Anadol's *Machine Memoirs: Space,* 2021. Accessed October 2023. https://refikanadol.com/works/machine-memoirs-space/

Anadol mentions that "every single data point in the archive will have its own context and discourse. They are not similar, and they are uniquely valuable".[15] This approach, focusing on the "in/visible" aspects of data and using AI to fill gaps with imaginative content as Kuo mentions, heralds a new era for visual art, and it becomes the condition for the emergence of AI-generated cinema. This process implies a shift towards more personalized, data-driven aesthetics, an expansion of creative possibilities beyond traditional filmmaking techniques, and potentially new

[14] The Museum of Modern Art, "How Refik Anadol Uses AI to Sculpt with Data," *YouTube* video, 3:27, March 5, 2021, https://www.youtube.com/watch?v=G2XdZIC3AM8.
[15] Refik Anadol, Casey Reas, Michelle Kuo, and Paola Antonelli, "Modern Dream: How Refik Anadol Is Using Machine Learning and NFTs to Interpret MoMA's Collection," *MoMA*, 2021, accessed December 13, 2022, https://www.moma.org/magazine/articles/658.

forms of viewer interaction with archives, reflecting a broader evolution in the art of cinematic storytelling. This thesis investigates the emergence of "AI cinema" as a distinct form and challenges existing film theory and aesthetics. It explores how the integration of Artificial Intelligence in art, as exemplified by Anadol's works, redefines traditional concepts of in/visibility and the use of archival materials, thereby contributing to the creation of distinctly AI-driven cinema. In this context, examining Anadol's artworks opens a dialogue on broader discussions surrounding how Anadol's approach both diverges from and interacts with established cinematic traditions and how this interaction challenges the role and perception of technology in contemporary filmmaking.

Exploring the Artist and the Artworks in Question

Refik Anadol, a prominent artist based in Los Angeles, is renowned for integrating moving image art with artificial intelligence. He leads Refik Anadol Studio, which is known for its pioneering works in AI-driven art. The studio's research and development section, RAS LAB, serves as a center where Anadol and his team develop their creative projects. As a UCLA alumnus and faculty member, Anadol advocates for an artistic exploration of the "'human' in the non-human" and highlights the intricate complexities of artificial intelligence through art.[16] He stands out as a pioneering figure in AI and data aesthetics within the field of new media art and the "first to use artificial intelligence in a public immersive artwork".[17] Anadol's innovative approach situates him at the intersection of art and technology, offering new perspectives on invisible aspects

[16] Mike Fricano and Erica Palomares Smith, "Digital Prometheus: Artist Refik Anadol imbues artificial intelligence with creativity," *UCLA Newsroom,* April 18, 2022, https://newsroom.ucla.edu/stories/digital-prometheus-artist-refik-anadol-imbues-artificial-intelligence-with-creativity-2724911.
[17] Refik Anadol, "Keynote: Biographical Sketch," *ACM Spatial User Interaction 2022*, accessed December 13, 2022, https://sui.acm.org/2022/keynote-2.

of AI-generated artwork, such as identifying and generating patterns within complex, high-dimensional data spaces. Thus, AI not only delves into the visible and known aspects of archives, but it also actively generates new possibilities and insights, and essentially constructs what could additionally be perceived and understood about them.

Furthermore, Anadol's engagement with data is deeply humanistic, rooted in a desire to uncover the hidden narratives and aesthetics within digital archives and to reimagine the possibilities of human-machine collaboration. By employing advanced algorithms to vast troves of information—from the intricate patterns of neural networks and the urban pulse of metropolises to the hidden rhythms of nature—Anadol crafts visual symphonies that speak to the interconnectedness of all things. His work traverses a wide spectrum of data sources, including the oceanic depths charted by marine research, the historical archives of cultural institutions, and the real-time data streams of environmental sensors, showcasing a profound exploration of both the macrocosm of space and the microcosm of human experience. This process is not just about the aesthetic transformation of data but a philosophical quest to explore the boundaries of memory, perception, and reality itself. Anadol's work, thus, becomes a testament to the potential of technology to enhance our understanding of the human condition, offering a visionary lens through which we might behold our world anew. In this light, data is not simply a subject of Anadol's art; it is a driving force for a deeper exploration of what it means to be human and what art could be in an increasingly digitized landscape.

Anadol's work is a profound exploration of the interplay between human creativity and machine intelligence, central to the evolving field of AI cinema. In his artwork, the human element is not overshadowed by the technological; instead, it is amplified, with Anadol's creative process exemplifying how human thought and emotion can be intricately woven into the fabric of digital art. His process begins with the selection of data—a choice deeply intertwined with his artistic

vision, where Anadol and his team curate vast datasets that range from astronomical images to urban landscapes. This initial selection is crucial, as it sets the thematic and aesthetic direction for the AI to follow. Equally important is the development of custom software, a task undertaken by Anadol and his collaborators. This software is designed with specific artistic intentions in mind, directing the AI's learning process and determining how it interprets and transforms the selected data into art. Anadol's role does not end with software design; he is intimately involved in guiding the machine learning algorithms, deciding not just which data the AI should learn from but also influencing how this data is algorithmically processed to achieve the desired artistic outcome. His art embodies the continuous interaction between the artist's creative vision and the machine's capabilities.

Anadol's artistic practice, characterized by its unique integration of data —frequently drawn from artistic, historical, and scientific sources —as a primary medium and his collaboration with artificial intelligence, has significantly influenced contemporary visual art and cinema. This perspective positions data not just as a collection of numbers or facts but as the very fabric of contemporary consciousness, which reflects our complex interactions, emotions, and narratives. Anadol transforms these datasets into immersive, sensory experiences that invite introspection and wonder. He challenges us to consider the profound implications of living in an era where every moment is digitized, yet the human desire for connection and understanding remains timeless. This unconventional approach is exemplified in his outstanding exhibitions. For instance, *Archive Dreaming* at SALT Galata in Istanbul utilized AI to transform archival data into an immersive, interactive art piece. It demonstrates the transformative potential of archives when merged with advanced technologies. This exhibition, which was my first encounter with Anadol's work, revealed an intricate interplay between human perception and archival data. It allowed visitors to perceive complex aspects of archives that are typically imperceptible, offered new perspectives on

realism in moving images and visual art, and invited the audience to immerse themselves within the artwork.

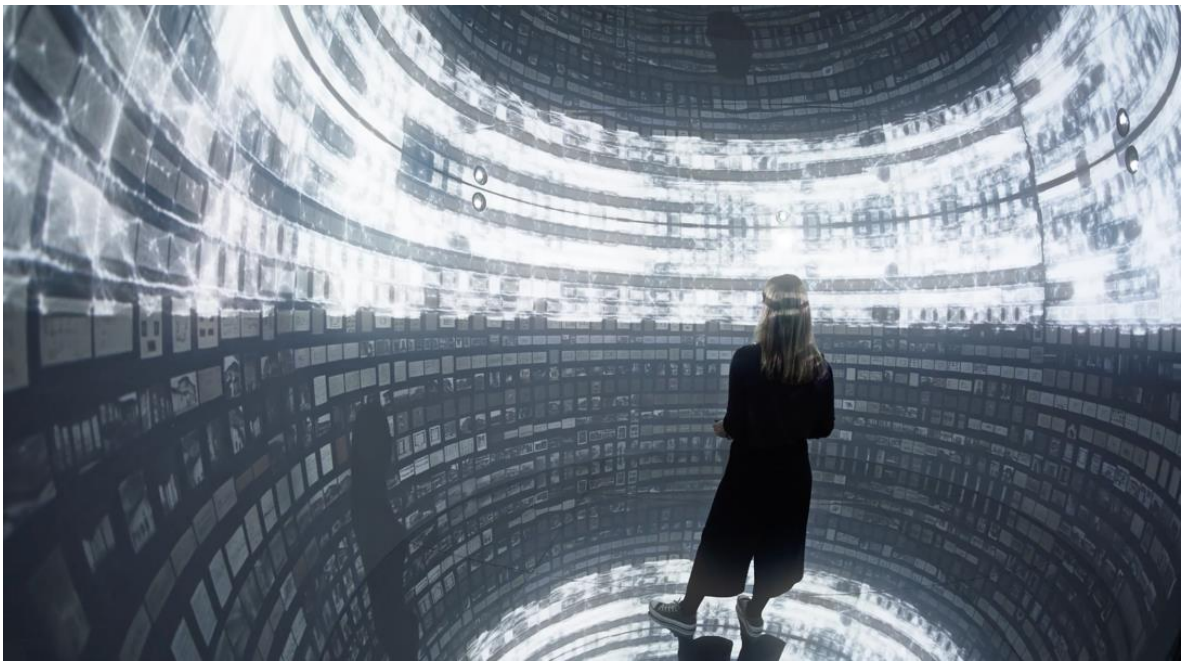

Figure 4. Refik Anadol's audiovisual installation *Archive Dreaming*, 2017. Accessed October 2023. https://refikanadol.com/works/archive-dreaming/

The evolution of visual art's screening and reception culminates in his most recent exhibition, *Machine Hallucinations — Sphere* at The Sphere in Las Vegas. Here, Anadol employs grand-scale projections to transform the space into a limitless cinematic environment. This exhibition exemplifies how the cinematic experience can evolve beyond traditional movie theatre screens, inviting a reevaluation of what constitutes cinema in the digital age. This artwork is characterized by its immersive quality, where viewers are surrounded by visual content without relying on traditional XR devices. This creates a sensory experience akin to being inside a film, rather than merely watching it.

Figure 5. Refik Anadol's audiovisual installation *Machine Hallucinations – Sphere,* 2023 - Ongoing. Accessed November 2023. https://refikanadol.com/works/machine-hallucinations-sphere/

This use of space and technology that blurs the boundary between the viewer and the content challenges the traditional film viewership. These exhibitions collectively underscore Anadol's important role in the burgeoning field of AI cinema. His works are notable for the way they utilize machine learning algorithms and large datasets to create visually stunning environments without relying on traditional XR devices. Furthermore, "AI Cinema," as an innovative approach places Anadol at the forefront of a new wave of digital art that blends data, science, machine learning, archives and visual arts in ground-breaking ways.

A significant portion of Anadol's works is distinguished by its emphasis on scientific data and elements, which has remained a key theme in his artistic work. Anadol, among a growing body of artists, integrates art and science, drawing upon disciplines such as cybernetics, astronomy, quantum computation, neuroscience, and meteorology to inform and enhance their creative output. For example, *Machine Memoirs: Space*, displayed in 2021 at Pilevneli Gallery in Istanbul, Turkey,

features immersive installations that use artificial intelligence to interpret vast sets of space exploration data. The exhibition has been Istanbul's most visited and comprehensive solo exhibition to date.[18]

Anadol's works, created in collaboration with a multidisciplinary team, are placed in the dynamic intersection of varied academic fields, including cultural and media studies, computer science, neuroscience, and philosophy.[19] In this context, Anadol's role as a new media artist is particularly significant, embodying the interdisciplinarity that Oliver Grau deems critical for the evolution of media art.[20] It is evident that the depth of Anadol's artwork—manifest in the intricate layers, aesthetic sophistication, and technical virtuosity—is achieved through this fusion of multiple academic disciplines. Further, Anadol pushes the traditional confines and conceptualizations of visual art and extends beyond conventional materials and presentations, instigating a profound re-evaluation of the very essence of image, narrative, and artistic representation. In 2016, Anadol and his team embarked on a transformative journey into the world of artificial intelligence by joining Google's Artists and Machine Intelligence team, an initiative aimed to acquaint artists with the intricacies of AI.[21] While he had prior experience with visual technologies, this program allowed him and his team to delve into the utilization and application of artificial intelligence in art, deepening their involvement with algorithmic art and expanding their creative horizons.

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[18] 1. Pilevneli, "Refik Anadol, Machine Memoirs: Space," *Pilevneli*, accessed December 13, 2022, https://www.pilevneli.com/exhibitions/38-refik-anadol-machine-memoirs-space-pilevneli-dolapdere/press_release_text/.
[19] Daria Kravchuk, "Refik Anadol: Creating Narratives Where Art, Science and Technology Collide," *ART*, accessed November 2023, https://art.art/blog/refik-anadol-creating-narratives-where-art-science-and-technology-collide.
[20] Oliver Grau, *Virtual Art: From Illusion to Immersion* (London: MIT Press, 2007): 5.
[21] Pena, "'Hala En İyi Hayallerimi Ülkeme Geri Getiriyorum' Refik Anadol Buyrun Benim'de," *YouTube*, March 30, 2021, interview, https://www.youtube.com/watch?v=BeYvLUlcayE.

Each piece in the *Machine Memoirs: Space* exhibition represents the collaboration that began in 2018 between Refik Anadol Studio and NASA's Jet Propulsion Laboratory (JPL). The partnership's initial project involved the visualization and transformation of NASA JPL's 60-year public archives into a data sculpture for the organization's headquarters (Anadol, 2022). This initial collaboration ignited Anadol's further exploration of space themes, leading to the conceptualization of this exhibition. Anadol's work challenges conventional cinematic norms through the lens of AI cinema, with the AI's role in data interpretation which leads to spontaneous, less predictable and evolving visuals. By transforming NASA's archival data into art, Anadol is paying homage to humanity's drive to explore the unknown and our quest for knowledge. By transforming scientific data into an artistic form and concept, Anadol not only makes this content/information more approachable and accessible for a broader audience but also underscores the potential of art and cinema to reinterpret and revitalize archival material, offering new perspectives on existing information.

Machine Memoirs: Space exhibition consists of over 4 million datasets obtained from NASA's open archives. It primarily utilizes data from three distinct space missions: the International Space Station (ISS), the Hubble space telescope, and the HiRISE (High Resolution Imaging Science Experiment) telescope on the Mars Reconnaissance Orbiter (MRO) (Anadol, 2022). The project is divided into three chapters based on the machine's source and called ISS Dream, MRO Dreams, and Hubble Dreams, respectively. The ISS contributes a unique perspective of Earth from space and various space phenomena and is based on 1.2 million datasets. The HiRISE camera on the MRO, known for its high-resolution images of the Martian surface, provides detailed Martian landscapes and geological features. It is based on over 1.5 million datasets. Lastly, the Hubble Space Telescope, renowned for its deep space images, offers a wealth of cosmic imagery and based on it, offers more than 1.5 million sets of data (NASA 2022). The exhibition consists of

audiovisual installations, custom software, custom media servers, 3D CNC Milled data sculptures, AI data paintings and AI Cinema entitled: “Data Tunnel,” “AI Data Sculpture: ISS, Hubble, MRO,” “Machine Memoirs: v.2,” “Machine Hallucinations: Synthetic Landscapes,” and “Machine Hallucinations: Hubble Dreams/ISS Dreams/MRO Dreams”.[22]

In order to explore AI cinema within the new media landscape, this thesis focuses on “Data Tunnel” and “Machine Memoirs v.2” from the exhibition. “Data Tunnel” provides crucial insight into the initial stages of AI art creation, where complex datasets are transformed into initial visual forms. This artwork redefines the concept of in/visibility, introduces new ways of seeing and archival practices, and sets the stage for AI cinema. On the other hand, “Machine Memoirs v.2” stands as a distinct embodiment of AI cinema, where the algorithmic process is dynamically ongoing, continuously generating new visual narratives. This work exemplifies the potential of AI in aesthetics and cinematic creation, showing a new form of cinema where the artwork is a dynamic, evolving material. The juxtaposition of these two works enables a layered understanding of AI cinema processes – from initial data processing in “Data Tunnel” to the complex, ever-evolving cinematic landscapes in “Machine Memoirs v.2.” This thesis focuses the process of AI cinema creation, where AI generates hyperconnections during archive processing, and how this process is essential for understanding shifts in cinematic practice both technologically and artistically. This deliberate selection of artworks aligns with the thesis’ aim to dissect and comprehend the technological intricacies, aesthetic evolution, archival utilizations, and socio-cultural impacts of AI cinema, thereby contributing a nuanced perspective to the field.

[22] Anadol, “Machine Memoirs: Space.”; Berna Kılıçoğlu and Mehmet Emin Kahraman, “Sanat ve İzleyici Deneyimi Üzerine Bir Araştırma: ‘Makine Hatıraları: Uzay’ Sergisi Örneği,” Idil 93 (May 2022): 745–759, doi: 10.7816/idil-11-93-09.

Situating AI Cinema in New Media Art and Cinema

The history of cinema has been marked by a series of transformative changes, each driven by technological innovations that redefined the way of producing, processing, and projecting a film. Lev Manovich states that "most discussions of cinema in the digital age have focused on the possibilities of interactive narrative".[23] In the contemporary discourse surrounding cinema in the age of artificial intelligence, there remains a predominant focus on narrative structures. However, this research expands the dialogue and equally recognizes and explores the transformative impact of AI on cinematic form and aesthetics. Since digital technologies such as artificial intelligence offer new ways of seeing and will challenge human perception through machine vision, Manovich argues that digital technologies have transformed cinema's defining characteristics,[24] such as capturing physical reality and/or the role of the camera and replacing them with 3D computer animation and, in general CGI. Thus, computers have started to generate images instead of cameras and transcended the physical limitations of shooting locations and sets.[25]

Each milestone, from early films, Louis Le Prince's *Roundhay Garden Scene*, to the contemporary digital cinema, James Cameron's *Avatar: The Way of Water,* reflects an evolving interaction between technology and film. These films, marking different eras in cinema, showcase how advancements in technology have continually reshaped filmmaking — from the earliest moving images captured on film to the sophisticated CGI and 3D technology that brought *Avatar* to life. Stephen Prince gives the release of *Star Trek II: The Wrath of Khan* and *Tron* in 1982 as an example to demonstrate the significant impact of digital imaging on storytelling and film

[23] Lev Manovich, "What is Digital Cinema?" in *Post-Cinema: Theorizing 21st-Century Film*, ed. Shane Denson and Julia Leyda (Falmer: REFRAME Books, 2016): 21, https://reframe.sussex.ac.uk/post-cinema/.
[24] Ibid., 20-42.
[25] Ibid.

production.[26] According to Prince, as digital imaging tools became integral to every stage of the filmmaking process, film's expressive potential rapidly evolved.[27] Since 1982, cinema has significantly advanced in this area. Particularly, the involvement of machine vision in filmmaking has uncovered previously unseen expressive possibilities, which will be explored in detail later in this thesis.

The distinction between AI art and other forms of digital art lies in the methods and technologies employed. As Christiane Paul notes, digital art is primarily defined as digitally born and computable art, utilizing the inherent capabilities of digital technologies for creation, storage, and distribution.[28] Digital cinema traditionally indicates the use of digital cameras for shooting films as opposed to film cameras and digital projectors for their projection, replacing conventional film projectors.[29] This term gained prominence during the late 1990s and early 2000s, marking the film industry's shift from analog (film-based) methods to digital technologies.

On the other hand, AI art falls under the broader category of digital art, which encompasses all artworks made with digital technology. However, not all digital art is AI art. According to Joanna Zylinska, AI art is characterized by the creative process which is informed or dictated by algorithms typically associated with machine learning or neural networks.[30] Artificial neural networks are computer systems that imitate the way the human brain learns, connecting dots of information to recognize patterns, much like we do when we learn new things.[31] In AI art, artists use these networks as a tool, directing them to process and interpret complex data, which is then transformed

[26] Stephen Prince, *Digital Visual Effects in Cinema: The Seduction of Reality* (Rutgers University Press, 2012): 4.
[27] Ibid.
[28] Paul, Digital Art, 2.
[29] Lev Manovich, *The Language of New Media*, Leonardo (Cambridge, Mass.: MIT Press, 2001): 244-273.
[30] Zylinska, *AI Art,* 15.
[31] Paul, Digital Art, 164.

into artworks. However, as exemplified in Anadol's works, AI is not merely a tool used to analyze and represent data but a participatory agent in art creation.

In *AI Art* (2020), Zylinska explores the intersection between artificial intelligence and art. Moving beyond the traditional question of whether computers can be creative, she incorporates socio-political and aesthetic issues of transformative creativity of AI. She challenges the binary criticisms of current AI discourse, emphasizing a reciprocal relationship between humans and machines in artmaking. This perspective, as opposed to the conventional view of art as an exclusively human endeavour, introduces the concept of nonhuman creativity and intelligence. Zylinska's critique is not a rejection of AI art or AI itself; instead, it calls for a more nuanced understanding of our relationship with technology. She navigates between philosophical, technical, and artistic considerations, situating AI art within a broader cultural and technological context. The author raises critical questions about machine vision, in/visibility, perception, and the ethical dimensions of AI in art, including authorship and originality. Her discussion extends to how AI algorithms not only create art but also open up new possibilities for artistic expression, challenging traditional boundaries. The book addresses broader socio-political issues, highlighting AI art's potential in breaking the circuit of "neurotalitarianism" and enabling different forms of psychopolitics.

Zylinska's argument also engages with the wider debates about AI, ethics, creativity, and the human position in the world, thereby positioning "AI Art" at a cross-disciplinary conjuncture that intersects media theory, technological practice, and social critique. Zylinska's approach, which transcends the analysis of the art object as an isolated entity and offers a relational understanding of art's production, reception, and recognition within specific socio-historical contexts, resonates with exploring Anadol's work in my research. By situating questions of machine vision and AI-driven aesthetics within a broader socio-technological framework, my research aligns with

Zylinska's perspective, particularly in considering how Anadol's use of AI not only challenges traditional artistic paradigms but also fosters the emergence of "AI cinema" as a distinct art form. This parallels Zylinska's discussion on the future states of AI-driven art, providing a relevant and critical backdrop for analyzing Anadol's contributions to the evolving field of AI in cinema.

Redefining cinema's changing identity in the digital age is challenging due to its constant evolution and the advent of new forms like AI cinema. This emerging field, as a relatively new one, has yet to gain widespread discourse in academic and theoretical circles, particularly when compared to more established broader areas like digital cinema or post-cinema. In their book *Post-Cinema: Theorizing 21st-Century Film*, Shane Denson and Julia Leyda address the evolving nature of cinema in the digital age, exploring how contemporary media transcends traditional cinematic frameworks.[32] According to the authors, post-cinema is about understanding how new media forms relate to, interact with, and are informed by traditional cinema. While digital technology plays a significant role in post-cinema, the authors are cautioning against reducing post-cinema to simply being "digital cinema".[33] Instead, they view it as a convergence of various media forms and practices that have evolved in the context of digital technology but are not limited to it.[34] Thus, post-cinema is understood as a part of an ongoing, indeterminate historical transition that reconfigures our relationship with moving-image media, inviting us to consider how these shifts in media affect our perceptions, experiences, and understandings of the world around us.

AI cinema can be seen as part of this broader post-cinematic landscape, characterized by its use of AI technologies in filmmaking. It does not only represent the technological shift but also mirrors societal changes in how we perceive and interact with digital media in an increasingly data-

[32] Shane Denson and Julia Leyda, *Post-cinema: Theorizing 21st-Century Film* (Reframe Books, 2016): 2-7.
[33] Ibid.
[34] Ibid.

driven and algorithmically influenced culture. Post-cinema addresses how digital technologies change narrative structures and aesthetics in film. AI cinema contributes to this transformation as a prime example of this, using algorithms to introduce new aesthetic forms, visual experiences, and storytelling methods. While post-cinema provides a framework for understanding digital media's influence on cinema, it does not specifically focus on AI's role. I aim to fill this gap by examining AI's unique contributions to cinematic evolution.

Shane Denson explores the transformative impact of digital technologies on cinema, leading to what he terms "discorrelation," which signifies a shift where every aspect of audiovisual from generating to presenting images are mediated by computational processes, challenging traditional forms of cinema and perceptions.[35] So "discorrelated images" characterize the shift from a cinematic to post-cinematic media regime".[36] In the conventional form of cinema, images are primarily mediated through photographic processes, which have a "rational ordering of time and space," and they align with how we naturally see the world. In contrast, Denson points out that in digital and post-cinematic media (like AI cinema in this case), this relationship changes. "Our sensory ratios are being reordered, [and] our perceptual faculties are being reformed in accordance with the new speeds and scales of imaging processes".[37] These newer forms of cinematic images are increasingly mediated by computational processes that can abstract, manipulate, or generate new visuals. As a result, an image's physical or rational properties can become indistinction and disappear, so they might no longer directly correspond to real-world visuals or may represent realities in ways that are not immediately intuitive or familiar to human perception.[38] In Denson's terms, discorrelation implies a shift in how reality is mediated, particularly through evolving media

[35] Denson, *Discorrelated Images*, 1.
[36] Ibid, 8.
[37] Ibid., 1-101.
[38] Ibid., 9.

technologies. AI in cinema doesn't just replicate reality but actively participates in creating a new form of it. It demonstrates this fundamental shift that Denson mentions and exemplifies transformative relations between contemporary aesthetics form and spectatorial subjectivity which is influenced by these underlying digital processes.

The concept of discorrelation can be extended to how AI cinema moves beyond human-centric aesthetics and narratives. AI-driven cinema might present perspectives that are not bound by human experiences or perceptions, thereby expanding the boundaries of what cinema can depict and convey. Through his reference to artists like Trevor Paglen, Denson touches upon how AI, as a part of this new media landscape, influences contemporary forms of cinema and its reception.[39] Both Zylinska and Denson, in their respective discourses, navigate away from anthropocentric views, offering critical insights into a new media landscape where human and nonhuman agencies collaborate and intersect. While Denson thoroughly explores digital transformation in cinema, he does not specifically delve into AI-driven aesthetics or AI cinema as a new form. So, while he lays the groundwork for understanding the impact of digital technologies on cinema, my research can specifically highlight how AI is a key factor in this transformation, leading to the emergence of "AI cinema" as a distinct genre. By synthesizing Zylinska's interrogation of A"'s role in art with Denson's analysis of decorrelation, we can better understand AI cinema as a transformative convergence of human and machine intelligence, redefining the boundaries of what cinema can be in the digital age.

When discussing "AI Cinema," Anadol, in one of his interviews, conceptualizes it as a medium that evokes feelings rather than adhering to traditional narrative structures. He aims to evoke a new consciousness through this cinematic experience.[40] He draws inspiration from Gene

[39] Ibid., 68.
[40] Anadol, "Machine Memoirs: Space."

Youngblood's theory of "Expanded Cinema," where cinema extends beyond technological advancements like computer films or video phosphors.[41] Youngblood explores various forms of cinema that were emerging due to new technologies. He acknowledged the potential of technology to transform cinema, even though the specific digital technologies he discussed might differ from what we have today. According to Youngblood, expanded cinema is a manifestation of expanded consciousness where cinema becomes a dynamic, interactive experience that redefines the meaning through the new image-making technologies and the audience's relationship with these technologies and the image itself.[42] Thus, he offers a conceptual framework that deeply resonates with Anadol's AI cinema, which reshapes not just the aesthetics of film but also its capacity to create expanded consciousness through machine vision. The emergence of expanded consciousness, as explored by Youngblood and exemplified in Anadol's work, is linked to machine vision, which reveals invisible processes of algorithmic operation to our continually evolving perception.

Conceptualizing Invisibility in AI-Generated Art

Anadol's conceptual framework, centred on the theme of in/visibility, challenges traditional storytelling and visual styles, offering an immersive experience that blends artificial intelligence, data visualization, and cinematic aesthetics. Rapidly evolving digital technologies, according to Scott Bukatman, have an impact on discussions surrounding visibility and control because the scale and complexity of technological systems have surpassed our human capacity to fully perceive and

[41] Gene Youngblood, *Expanded Cinema* (New York: E.P. Dutton & Co., 1970).
[42] Ibid., 41.

manage them.[43] In response to this, culture, including art and media, has started to create a visualization to represent and make sense of the invisible sides of technology.[44]

In the context of Anadol's art, the concept of "in/visibility" relates to the complex patterns that AI reveals within large datasets. According to Adrian Mackenzie, traditional statistical methods usually analyze data by looking at a limited number of variables, around ten, with thousands of data points.[45] In contrast, modern data mining and predictive analytics, which are forms of machine learning, can manage a much broader scope.[46] They work with hundreds or even tens of thousands of variables and can process data sets that include millions or billions of data points.[47] The key difference lies in how these approaches manage data. Traditional statistics tend to focus on finding relationships between specific variables, while machine learning is adept at identifying and generating patterns within complex, high-dimensional data spaces.[48] This is possible because machine learning can see and analyze various features simultaneously.[49] These patterns are invisible to human perception due to their complexity and scale. Furthermore, these patterns were not hidden in a traditional sense, but rather, they are new insights and connections that were previously unknown and have become visible through the capabilities of AI.

While Mackenzie's analysis does not directly address cinema, his insights into AI's ability to explore high-dimensional patterns in extensive data sets offer a valuable perspective for understanding the transformative impact of AI in cinematic storytelling, aesthetics, and experience. In machine learning, especially with deep learning models, AI can reveal but also construct new

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[43] Scott Bukatman, *Matters of Gravity: Special Effects and Supermen in the 20th Century* (Duke University Press, 2003): 103.
[44] Ibid.
[45] Adrian Mackenzie, "The Production of Prediction: What Does Machine Learning Want?" European Journal of Cultural Studies 18, no. 4–5 (2015): 434.
[46] Ibid.
[47] Ibid.
[48] Ibid.
[49] Ibid.

patterns by analyzing vast arrays of data. Regarding AI cinema, this can be interpreted as the AI's ability to capture and visualize connections and patterns within data that are essentially "invisible" in conventional terms. Here, "invisibility" refers not just to what is hidden but to what is not inherently apparent or does not exist in a perceivable form until AI algorithms process and reveal it. This offers new ways of seeing and understanding that extend beyond traditional human perspectives. This process transforms traditional concepts of visibility and aesthetics in film, thereby creating not only a new form but a new consciousness.

With each technological advancement, ways of seeing emerged, and the dialectic of in/visibility has shifted, challenging both creators and viewers to navigate this complex concept. The boundaries of the concept of invisibility have been discussed by philosophers, scholars, artists and many more and extended from internal psychological experiences to external, technologically mediated perceptions. Walter Benjamin introduces the camera as a tool that reveals a different dimension of reality - the "optical unconscious".[50] His concept of the "optical unconscious" highlights the capacity of photographic and film technologies to reveal reality's details, usually beyond human awareness.[51] Benjamin introduces the term "optical unconscious" in his 1931 essay "A Short History of Photography." He was influenced by Sigmund Freud's psychoanalytic theories, particularly the concept of the unconscious mind. Benjamin argued that photography, unlike the human eye, can capture minute details and fleeting moments that the conscious mind does not register, such as subtle expressions or background details that we might not notice in real time. This ability to disclose hidden aspects of reality that lie beyond the threshold of human perception is what he termed the "optical unconscious." According to Benjamin, in/visibility is about uncovering

[50] Walter Benjamin, "A Short History of Photography," *Screen* 13, no. 1 (1972): 5-26, doi:10.1093/screen/13.1.5.; Walter Benjamin, *The Work of Art in the Age of Its Technological Reproducibility, and Other Writings on Media* (Harvard University Press, 2008).
[51] Ibid.

layers of reality that are present but not ordinarily seen or acknowledged. If photography, as stated by Benjamin, makes some aspects of reality invisible by the human eye, AI and machine learning technologies take this further by uncovering patterns and connections in data that are imperceptible to human senses, creating a new form of the "optical unconscious" in the digital era. In the context of AI cinema, algorithms do not just reveal hidden patterns; they actively generate invisible patterns in new forms and construct new realities and visual narratives. It challenges traditional notions of what constitutes the visible and invisible in art.

The concept of in/visibility in visual arts, from painting to moving images, presents a multifaceted approach to understanding unseen or abstract elements in art. Different art movements or technological developments bring different forms and narratives of invisibility. Symbolism, for instance, emphasizes emotional and spiritual states that transcend literal representation, using allegorical and symbolic imagery to suggest the unseen rather than directly depicting subjects.[52] In Surrealism, the exploration of in/visibility took a distinct turn, intertwining the realms of dream and reality.[53] Surrealist artists ventured beyond the visible world, tapping into the subconscious and the dream state to portray an alternate, often hidden reality. These nuanced approaches to in/visibility, where meaning is often embedded in layers of emotional states, spiritual dimensions, subliminal storytelling, or subconscious imagery rather than explicit representation, underscore the complexity of invisibility in art.

AI art represents a shift from uncovering the subtext or subconscious to uncovering hidden details that are close to what Benjamin mentions and actively constructing invisible dimensions, enriching our understanding of how art can navigate and reinterpret the concept of in/visibility.

[52] Michelle Facos, *Symbolist Art in Context* (Berkeley: University of California Press, 2009).
[53] David Bate, "Surrealism, Colonialism and Photography," in *Empire and Culture: The French Experience, 1830–1940* (London: Palgrave Macmillan UK, 2004): 57-70.

However, Benjamin's conceptualization of in/visibility is limited in the context of the advanced stage of digital technologies, which expands this notion to hyperconnections and multifaceted reality. Manovich's argument that "we can use a single computer to capture, compare, quantify, and visualize thousands of differences between tens of millions of objects" underscores the transformation of in/visibility.[54] He highlights the significant capabilities of contemporary computing technology and machine vision in the field of data analysis and visualization. Therefore, contemporary thinkers and artists like Hito Steyerl and Trevor Paglen are important figures for understanding the modern interpretation of this concept, particularly through artificial intelligence.

Coming back to the new media landscape, many scholars in the field of AI art, including Zylinska, Manovich, Denson, Steyerl, Paglen, Wendy Chun, Lynn Gamwell and Haschemi Yekani, focus significantly on the socio-political, philosophical, and ethical implications of AI in art. Furthermore, the concept of in/visibility in contemporary literature revolves around the unseen aspect of technology, data, and power structures. According to Manovich, algorithms shape our understanding and perception of the world, revealing hidden patterns in data that were previously invisible.[55] In this context, artificial intelligence could be seen as possessing the capacity to "see" elements beyond human detection and utilizing this information to produce new and unexpected outcomes. Steyerl's perspective resonates with this, as she delves into the complexities of digital invisibility, including unseen signalss and in/visible patterns.[56] The author addresses a shift in how digital technologies change and/or replace our perception and understanding in the digital age. Her critique resonates profoundly in an era where the proliferation of artificial intelligence has catalyzed a reconfiguration of vision. "Data Tunnel" exemplifies this shift, where invisibility

[54] Lev Manovich, *AI Aesthetics* (Moscow: Strelka Press, 2018): 30.
[55] Lev Manovich, "The Algorithms of Our Lives," *The Chronicle of Higher Education* 60, no. 16 (2013).
[56] Hito Steyerl, *Duty Free Art* (New York: Verso, 2017): 31-40.

transcends the absence of visual detection and encompasses the broader domain of cognitive understanding awaiting revelation through computational analysis.

In Anadol's art, human and machine perception converge, defining new ways of seeing, "apophenic vision" and/or "hallucination" that synthesizes both realms' potentials. These terms are used metaphorically to refer to both the AI's process of analyzing vast amounts of data and generating in/visible connections, and the reception of the art. They are essential parts of AI-generated art and correspond to the intertwined machine and human vision. Steyerl also applies these terms to explore how human and machine vision function.[57] Additionally, she emphasizes the shift from human perception (vision) towards machine-like processes. While she highlights the human incapacity to directly discern technical signals, suggesting that unprocessed signals remain beyond our sensory grasp,[58] Anadol's artwork demonstrates how data transform into visual forms that can become accessible and meaningful. The installation thus embodies the essential processing and translation of complex technical signals into a visual that is intelligible, navigating the terrain between raw data and human cognition.

Both Steyerl and Paglen delve into the implications of digital technologies on power dynamics and surveillance. While Steyerl's works emphasize the hidden aspects of digital labour, the covert operation of power structures, and the ways in which people become invisible in the digital age, Paglen focuses on the invisible infrastructures of surveillance and state secrecy.[59] His work, like Benjamin's, might align with the traditional invisibility category, as it can reveal what is hidden from the human eye and uncover hidden infrastructures such as undersea cables, spy satellites, and secret military bases through technological devices. Despite this, Paglen's work often

[57] Steyerl, *Duty Free Art*, 32.
[58] Ibid.
[59] Trevor Paglen, "Invisible Images (Your Pictures Are Looking at You)," *The New Inquiry*, December 8, 2016, https://thenewinquiry.com/invisible-images-your-pictures-are-looking-at-you/.

explores the implications of technological processes, similar to the concerns raised by Steyerl. Paglen discusses the rise of computer vision and AI, and how these technologies transform our ways of seeing and understanding the world. He argues that machines are capable of recalling an infinite number of faces, which is beyond human capability. Thus, particularly in operational images, the primary purpose of image generation is not for human consumption or interpretation, rather, it is for other machines.[60] By demonstrating AI's processing of vast amounts of data, Anadol challenges Paglen's conceptualization of in/visibility and expands both Steyerl and Paglen's discussion of in/visibility through the artistic visualization of these data patterns.

Anadol's artworks provide insights into the often-hidden processes of algorithms and AI. While data and AI are frequently associated with the mechanisms of neoliberal capitalism –often employed for profit, maximization, surveillance, and consumer manipulation – Anadol's art reimagines artificial intelligence as a collaborator for creative and aesthetic exploration. He proposes alternative uses that emphasize artistry, human experience, and the expansion of perceptual boundaries. Therefore, Anadol's work reveals the aesthetic and interpretive dimensions of data, illustrating how AI can uncover and create new forms of in/visibility. This approach not only adds a new layer to the discourse on in/visibility but also bridges the gap between the abstract, often hidden processes of AI and human perception, thereby offering a new perspective on how we understand and interact with the increasingly data-driven world around us. Additionally, Anadol gives open access to his custom software and also shares open data sources and archives like NASA's to encourage people to integrate new technologies with conventional methods and challenge the conventional use of archives in cinema.

[60] Ibid., 2-6.

Human to Machine: Archival Shifts

Anadol's approach to AI not only differs in technique but also in intent. He engages with archival content in innovative ways and enhances the use of the material. Historically, archives were seen as repositories containing documents, records, and various materials held for their value in understanding the past. Yet, the advent of digital technology has broadened the scope of what is recognized as an archive. Specifically, data collections, especially extensive and intricate ones like those maintained by NASA, encapsulate a wealth of data about our planet and the universe at large. Thus, in the digital era, where the boundaries of what constitutes an archive are expanding, data sets embody the characteristics of archives by acting as repositories of information with significant cultural, historical, and scientific value. Digital technologies, Ina Blom says, enable re-examination of archives and challenge our understanding and use of them, particularly in the context of social and cultural memory.[61] In his artworks, Anadol treats data sets as evolving/dynamic archives. Through AI's ability to create in/visible connections, Anadol introduces new perspectives and ways of interaction with archival material.

The role of archives in art and cinema has been historically significant, serving as repositories of culture and memory. Through archives, artists and filmmakers have used them to evoke collective memory and contextualize narratives within broader social and historical frameworks, which have enabled a dialogue between the past and the present. In a traditional sense, archives are often used as supplementary sources to support the narrative, usually in a direct and visible manner, such as historical footage or documents. However, the digital era, as described by Wolfgang Ernst, has transformed how archives are used and perceived, and has become ubiquitous. Archives extend their supportive roles in films, however, Anadol takes this a step further. He views

[61] Ina Blom, "Rethinking Social Memory: Archives, Technology, and the Social," in *Memory in Motion: Archives, Technology, and the Social* (2016): 31.

archives not simply as static repositories of information, historical records, or data. In his perspective, archives are dynamic and living, embodying collective memory and historical narratives. Every piece of information can be seen as a fragment of a larger, interconnected story, reshaping the traditional archive into a new experience of a data library in the age of machine intelligence.[62] Through this lens, Anadol's work invites us to reconsider what an archive can be—a space where the past is not only preserved but also continuously reimagined and re-experienced, considering new technological possibilities. Anadol does not use archives in their conventional visible form. Instead, he employs AI to create what you refer to as "hyperconnections" between datasets within these archives. This method transforms the archives from mere narrative support into the foundational material of his art. In this transformative utilization, the focus is on the invisible aspects of the archives - the data patterns and connections that are not immediately apparent and reveal themselves only through AI's interpretative lens.

Through artificial intelligence, the ubiquity of archives has become inevitable. Archives are digitized; thus, billions of data are in circulation, but they have become more accessible with scanning engines. Catherine Russell focuses on both the collection, reconfiguration, and resignification of archives, but also the practices of contemporary filmmakers who reconstruct and reimagine history through archival images.[63] While both Russell and Ernst van Alphen delve into the implications of digitalization on archives and memory, they do not specifically address the impact of artificial intelligence on archival materials and practices. On the other hand, van Alphen focuses on how contemporary artists utilize and challenge archival principles in their artworks.[64]

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[62] TED. "Art in the Age of Machine Intelligence." *YouTube* video, 6:43. August 19, 2020. https://www.youtube.com/watch?v=UxQDG6WQT5s

[63] Catherine Russell, *Archiveology: Walter Benjamin and Archival Film Practices*, A Camera Obscura Book (Durham: Duke University Press, 2018).

[64] Ernst van Alphen, *Staging the Archive: Art and Photography in the Age of New Media* (London: Reaktion Books, 2014).

He suggests that artists question what can be archived and redefine the potential of the archive itself, impacting notions of organization, evidence, and documentation in art. Anadol allows for a reinterpretation of archival materials, where AI algorithms not only curate and present but also create new aesthetic forms from archival data through new ways of seeing and in/visible patterns. This approach significantly diverges from traditional uses of archives in art and cinema, highlighting a more profound and exploratory engagement with archival content. van Alphen also does not specifically focus on the technological aspects of archiving in the digital age but more on artistic manipulation. AI and digital techniques take the inherent aesthetic value of archives and amplify, challenge, and expand upon it in ways that prompt viewers to question their relationship with memory and art.

While there is a growing body of literature on the role of AI in art, such as Zylinska or Manovich, the contemporary discourse centers around its socio-political, philosophical, and ethical implications. AI cinema has received comparatively less attention in academic literature compared to other forms of AI art because it is a relatively new and emerging field. Moreover, there is a lack of comprehensive research on the ways AI alters traditional filmmaking, aesthetics, and the reception of this new form through its transformative impact on the concept of in/visibility and archival practices. Particularly, the work of Anadol, which sits at the intersection of AI, cinema, and archival reconfiguration, has not been extensively studied. However, the existing discussions around AI art could be extended into the field of cinema to discuss AI's capabilities under digital cinema, expanded cinema or post-cinema. This thesis seeks to fill the gap by providing a detailed analysis of Anadol's contribution to the field and exploring the broader implications of AI art for the future of cinema.

Methodological Approach

This research adopts an interdisciplinary approach to examine the evolution of cinema in the digital age, focusing on the transformative role of artificial intelligence. Central to this study is an in-depth analysis of two artworks, "Data Tunnel" and "Machine Memoirs v.2," from Refik Anadol's *Machine Memoirs: Space* exhibition. These works have been selected for their exemplary representation of AI's role in creating a new form of cinema and demonstrating this new form, respectively.

The choice of the *Machine Memoirs: Space* exhibition is influenced by its display in Turkey, the shared home country of both the artist and the researcher. This geographical and cultural proximity provides a unique opportunity to understand the presentation, reception, and socio-cultural impact of the exhibition. Anadol's statement about showcasing his best works in his home country further reinforces the significance of this selection.

The methodology involves a critical examination of the selected artworks to understand how AI redefines cinematic boundaries, alters traditional modes of perception, and transforms the use and representation of archival materials. The research acknowledges potential limitations, including the rapidly evolving nature of AI technology and the accessibility of certain digital materials. Terms and definitions within this field are often fluid and subject to change over time, making it difficult to establish sharp distinctions between different works of AI art.

Additionally, the primary case study of this research took place in 2021 in Istanbul during the COVID-19 pandemic. Due to my residence in Montreal, Canada, and travel restrictions related to the pandemic, I was unable to attend the exhibition in person. This is a significant limitation, as experiencing digital art in person can offer unique sensory and spatial insights. To mitigate this limitation, the research heavily relies on secondary sources for data collection. This includes a thorough examination of content from Refik Anadol's website, news articles, interviews, online

videos, and user-generated content on platforms like YouTube. Despite these challenges, this study seeks to make a meaningful impact on the comprehension of AI cinema, situating Anadol's work within broader socio-cultural and technological shifts of the digital age. The approach of this study reflects a commitment to adaptability and resourcefulness in the face of unforeseen global circumstances, and it strives to contribute meaningfully to the discourse on AI cinema within these constraints.

In terms of theoretical framework, the research navigates through a gap in the existing literature, where specific materials focusing on AI cinema are scarce. Therefore, the study will draw upon resources that address the broader evolution of cinema in the digital age and the intersection of AI and art, utilizing works from scholars like Joanna Zylinska and Lev Manovich. This approach aims to construct a theoretical understanding of AI cinema by synthesizing insights from related disciplines such as film studies, algorithmic studies, new media studies, etc.

Thesis Structure and Chapter Overview

The thesis is structured into two distinct yet interconnected chapters, which are then followed by a concluding segment. In the first chapter, "Visions Reimagined: The Alchemy of AI and Perception," the analysis centers on "Data Tunnel." This artwork serves as a case study to examine the transformative impact of machine vision in AI art. This chapter will explore the new ways of seeing and redefining the concept of in/visibility, setting the stage for subsequent discussions. Following this, the second chapter, "AI and the Reconstitution of Archives," continues to focus on "Data Tunnel" while introducing "Machine Memoirs v.2." This chapter bridges the theoretical concepts of the first chapter with practical applications in AI cinema, delving into how AI influences the utilization, interpretation, and presentation of archives materials within cinema. The concluding section, "AI+Cinema: Emergence of AI Cinema," primarily focuses on "Machine

Memoirs v.2." It synthesizes the insights from the previous chapters to present an in-depth analysis of AI cinema as a new cinematic form. This segment will focus on how AI cinema emerges from the interplay of invisible connections and archival content, challenging and transforming traditional cinematic aesthetics and perceptions.

Chapter 1
Visions Reimagined: The Alchemy of AI and Perception

"Art does not reflect what is seen; rather, it makes the hidden visible."[65]

Figure 6. Raw Dataset of MRO. Part of "Machine Hallucinations: Mars" of Refik Anadol's *Machine Memoirs: Space* exhibition. Accessed September 2022. https://refikanadol.com/works/machine-hallucinations-latent-study-mars/

Artificial intelligence plays an increasingly significant role in exploring the "invisible" or unseen aspects of our technologized milieu.[66] The visual representation of raw data[67] above seems chaotic and unintelligible to the untrained human eye, almost as though one is looking at "noise" or random signals. However, there is an inherent meaning hidden within this image. It is embedded

[65] Paul Klee, *Creative Confession and Other Writings*, ed. Matthew Gale (London: Tate Publishing, 2013): 5.
[66] Paglen, "Invisible Images."
[67] Data refers to a set of facts, figures or written information that can be processed by a computer (Turban and Aronson 2001).

with a wealth of intricate connections and hidden patterns and AI's capability to handle it. According to Wolfgang Ertel, AI algorithms, specifically neural networks, are employed to analyze large data sets.[68] These neural networks are engineered to emulate the human brain's structure and functionality, allowing them to process and learn from large quantities of data.[69] As the AI algorithms train on the data, they find or generate new patterns and connections by recognizing underlying structures and relationships within the data. These patterns and connections can be based on various factors such as colours, shapes, textures, or other visual elements present in the data.[70] Adrian Mackenzie argues that modern machine learning algorithms thrive on exploring patterns within high-dimensional spaces. These "high-dimensional patterns" are essentially new configurations of data that are not readily visible or discernible to human observers.[71] They are constructed from the massive data inputs that machine learning algorithms can process.[72] The "in/visibility" I refer to is the intricate and often non-intuitive associations that AI can discern within these large datasets. These are patterns that are not "hidden" in the conventional sense because they were not previously known to exist.

When AI processes massive datasets, it doesn't just reveal pre-existing patterns; it often constructs new ones by finding relationships and correlations between data points across vast, multi-dimensional spaces. These spaces are so complex that the human mind cannot intuitively navigate or recognize the patterns within them.[73] This new visibility is not about seeing something that was always there but obscured; it's about constructing a new way of seeing, understanding, and interpreting the world through data.

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[68] Ertel, *Introduction to Artificial Intelligence*, 176-177.
[69] Ibid.
[70] Ibid.
[71] Mackenzie, "The Production of Prediction," 434.
[72] Ibid.
[73] John D. Kelleher, *Deep Learning* (MIT Press, 2019): 4-37.

The image in figure 7 shows a visual excerpt from "Data Tunnel," the primary focus of this chapter. This piece is a 9-minute custom software site-specific data-driven art installation and a prominent component of Refik Anadol's 2021 exhibition, *Machine Memoirs: Space*. The exhibition demonstrates the generative processes and the operating sequences underlying the exhibition's creation. This section of the exhibit explicates how these AI-driven artworks are created. It provides transparent insights into the complex interplay of data and algorithms that constitute the essence of Anadol's art. As the artist articulates, "the audience is greeted with visuals of the raw data and a look into the analysis processes through which they are transformed into pigments, paintings, and sculptures".[74]

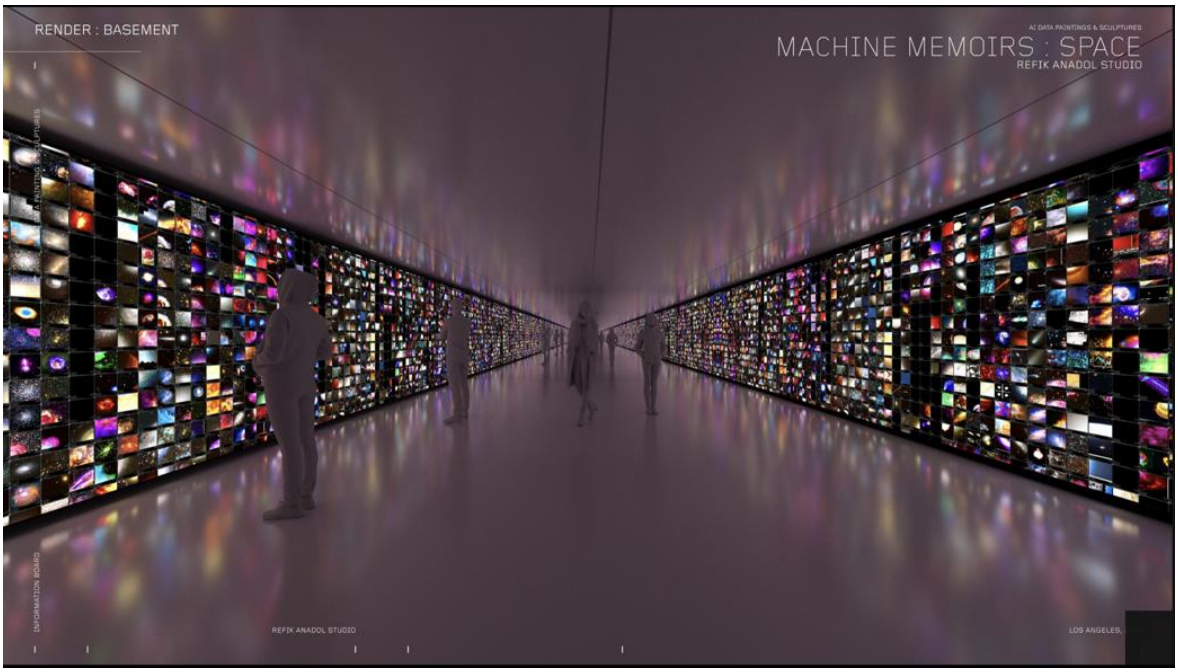

Figure 7. Visualization of NASA's open archives in "Data Tunnel," part of Refik Anadol's *Machine Memoirs: Space* exhibition. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

[74] Anadol, "Machine Memoirs: Space."

Installed at the Pilevneli Gallery in Istanbul, *Machine Memoirs: Space* showcases Anadol's provocative engagement with photographic data of our universe from the archives of NASA/JPL, providing visitors the opportunity to experience "visual travel journals" of some of the most advanced telescopes.[75] The exhibition consists of over 4 million datasets obtained from NASA's open archives, including visual data from the International Space Station (ISS), the Hubble space telescope, and the HiRISE (High Resolution Imaging Science Experiment) telescope on the Mars Reconnaissance Orbiter (MRO).[76] It is showcased on the gallery's ground floor, where two architectural-scale LED screens display the entire data set (figure 7), reflecting the scientific research process underpinning the exhibition and the theme of "being surrounded by data" central to Anadol's artistic exploration.[77]

In Anadol's "Data Tunnel," the observer is encased in a world of dynamic imagery. The artwork is displayed on multiple electronic panels arranged side by side on opposite walls, creating the tunnel effect that the title of the artwork emphasizes. Sometimes, these panels appear as a single, articulated piece. At other times, they resemble a combination of small pieces. They depict various graphical representations that include visuals of raw data sets, software processes, code sequences, rendering phases, and other intricate details that reveal the behind-the-scenes work of AI.[78] As depicted in figure 8, the "Data Tunnel," as an artwork, serves multiple purposes: pedagogical, socio-cultural, and artistic statement.

The artwork offers a visual representation of how AI works as a collaborator to generate data, giving viewers a sense of the machine vision and technological implications of AI in

[75] Anadol, "Machine Memoirs: Space."
[76] Ibid.
[77] Ibid.
[78] Ibid.

contemporary visual culture. In today's context, machine vision shifts towards algorithmic vision,[79] where the emphasis is on the AI's ability to process visual data in more sophisticated and nuanced ways. This involves not just seeing but interpreting, understanding, and interacting with the visual data in a dynamic and adaptive manner. This also shows our changing relationship with technology, urging viewers to delve deeper, ask questions about this new technology, and engage more interactively with the art. It also depicts Anadol's way of demystifying the AI process and/or suggesting that the process itself, not just the output, is an integral part of the artwork.

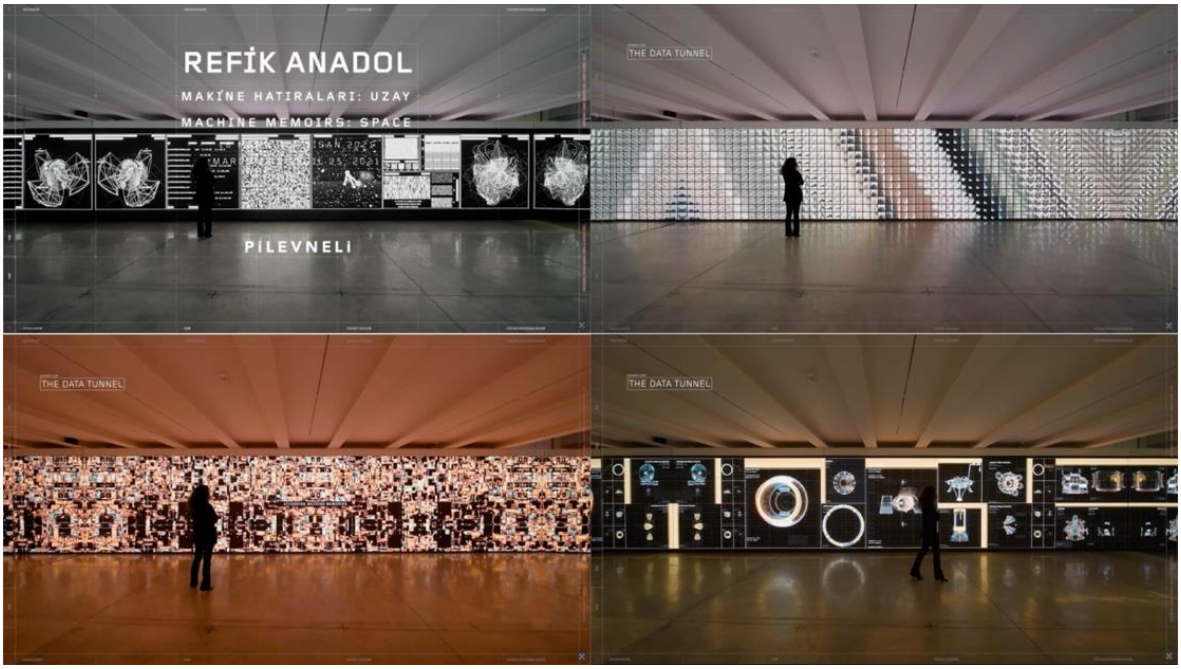

Figure 8. Examples from "Data Tunnel," part of Refik Anadol's *Machine Memoirs: Space* exhibition. Captured from the project's trailer. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

[79] Algorithmic visual culture refers to the impact of computational algorithms on the production, distribution, and consumption of visual media in contemporary society. It focuses on the technological aspect of these processes (Cox et al. 2012).

In this section of the exhibition, visuals and narratives transition between two aspects: abstract and concrete data, and technical processes.[80] In figure 8, we can observe various stages of data transformation, from raw numerical data to complex geometric structures and other abstract visual forms. It is important to note that "raw data" is not truly raw but already a product of certain interpretive processes.[81] Anadol's work takes these constructed datasets and further transforms them from their initial, interpreted state to complex forms. This process allows visitors to "see" what the AI "sees," turning the invisible (the "raw data" and in/visible patterns) into something visible. Machine vision fundamentally redefines the concept of invisibility, leading to new ways of seeing. This evolution alters the traditional use of archives and brings up the creation of a unique form of cinema, which will be discussed in further chapters respectively. In Anadol's "Data Tunnel," AI does more than just convert NASA's archival data into a visible format. It uses this data as a foundation to generate entirely new visual patterns and connections, extending beyond the limits of the data's intrinsic characteristics. "Data Tunnel" thus exemplifies the process and the "in/visibility," while "Machine Memoirs: v.2", the second case study of this research, illustrates the creation of a new aesthetic object, AI cinema, emerging from these "invisible patterns and connections."

This section will address the incorporation of Artificial Intelligence into artistic practices, evidenced through Anadol's artworks, and challenges established definitions and perceptions of in/visibility. This exploration will beg the question of how Anadol's artworks both diverge from and engage with classical interpretations of the invisible. It further provokes discourse on the role of machine vision and the new way of seeing that AI contributes to the utilization of archives and AI cinema. Initially, this part methodically explores the role of Artificial Intelligence in the field of

[80] Anadol, "Machine Memoirs: Space."
[81] Lisa Gitelman, ed., *Raw Data is an Oxymoron* (MIT Press, 2013): 2.

visual art, with a particular emphasis on Anadol's "Data Tunnel." This commences with a comprehensive overview of the current understanding of in/visibility in AI art, which involves a critical review of the existing scholarly discourse on various aspects of invisibility, coupled with a discussion that contextualizes the concept of invisibility within the framework of this research. Finally, I will build upon the foundation laid by previous studies to delve deeper into the notion of invisibility in art and its impact on new ways of seeing. This exploration aims to illuminate the complex interplay between machine-based and human vision, highlighting how AI-induced changes in perception can lead to new visual experiences.

AI, Art, and the Question of Invisibility

Invisibility in visual art represents a complex and nuanced problem, varying according to historical and cultural contexts. Therefore, its definition often changes and evolves over time. However, one thing that does not change in this concept is the investigation beyond the physical. When Anadol particularly discusses AI's purpose within art, Paul Klee references art in a broader sense. However, Klee's assertion that "art does not reproduce the visible; rather, it makes visible" resonates profoundly with the philosophy of AI art in today's new media landscape, particularly in how AI reveals and constructs new visual forms from invisible data patterns.[82]

When Lev Manovich defines AI art, he emphasizes that computers should create something beyond human capability and something that should fluidly transition across various systems and styles within a single piece or across a series of works.[83] In "Data Tunnel," Anadol not only uses AI to explore invisible patterns but also demonstrates the AI's capacity to construct new ways of

[82] Klee, *Creative Confession*, 12.
[83] Lev Manovich, "Defining AI Arts: Three Proposals," in *AI and Dialog of Cultures Exhibition Catalog* (Saint-Petersburg: Hermitage Museum, 2019): 8.

seeing and understanding through data. This not only extends Klee's argument into the field of AI art but also illustrates how Anadol's work both uses and creates something beyond human perception. However, this raises the question: should the value of AI art, as Manovich argues, lie solely in its ability to achieve what humans cannot, or should it also be evaluated on other artistic merits such as aesthetic quality and conceptual depth of in/visibility?

"Data Tunnel" represents the boundless and overwhelming nature of data in the digital age. However, Anadol makes viewers think about the nature of data — not just as cold, invisible facts but as an intrinsic part of our modern lives with aesthetic, emotional, and philosophical dimensions. The tunnel, lined with countless images of celestial bodies, conveys the vastness of space—an apt parallel to the expansiveness of data surrounding us (Figure 7). Immanuel Kant, in his aesthetic theory, emphasizes the intangible and transcendent aspects of art, referring to experiences that exceed human cognitive capabilities.[84] These experiences, such as the vastness of the universe or the raw force of data, can elicit feelings of awe and fear but also pleasure. They embody the sublime and represent an "invisibility" in the sense that they transcend the limits of our sensible experiences and understanding.[85] "Data Tunnel" serves as an example that we exist amidst a dense flow of information that exceeds our awareness and comprehension. Anadol's approach suggests that the raw information we perceive is only a fraction of what is actually there, much like the unseen depths of the ocean. Where Kant's sublime was primarily rooted in natural phenomena, the sublime experience in the context of AI art is born from a digital and data-driven reality. David E. Nye discusses this transition from natural to technological sublime and notes that "because the overwhelming power displayed was human rather than natural, the "dialogue" was now not

[84] Immanuel Kant, *Critique of Judgment* (Hackett Publishing, 1987): ixx.
[85] Hannah Ginsborg, "Kant's Aesthetics and Teleology," in *The Stanford Encyclopedia of Philosophy*, Fall 2022 Edition, ed. Edward N. Zalta and Uri Nodelman, 2022, accessed May 20, 2023, https://plato.stanford.edu/archives/fall2022/entries/kant-aesthetics/.

between man and nature but between man and the manmade".[86] In AI cinema, this "dialogue" is further evolved from technological to digital. This expansion raises questions about the concept of in/visibility, the nature of perception, the limits of human cognition, and our relationship with technology. Unlike the natural sublime that emphasizes human smallness against the vastness of nature, the digital sublime (in the context of AI art) emphasizes the complexity and expansiveness of data and our reliance on artificial systems to make sense of it.

With the "Pale Blue Dot" image, a pixel, a tiny element of a digital image, becomes a symbol of revelation, which lies in the power of visual representation.[87] It demonstrates that Earth was just a small part of a much larger cosmos, and in/visible could challenge human self-perception. Hito Steyerl argues that data is like an ocean of information in which we are immersed and unaware of its influence on our lives.[88] Data in the digital age is expansive and multi-layered, encompassing a wide range of information that goes far beyond what any individual can fully comprehend or explore, just as the vastness and deepness of the ocean, or space as "Data Tunnel," exemplifies. Data permeates all aspects of contemporary life, often without our full awareness.[89] We interact with and are influenced by this data constantly, much like being surrounded by the ocean or space. As Steyerl indicates, we are inundated with more information than we can process, akin to being submerged in the depths of an ocean or lost in the infinity of space.

Data and algorithms, serving as the foundation for a particular form of invisibility, enable the revelation of the unseen by uncovering hidden patterns, connections, or correlations within vast datasets, thereby disclosing new facets of the visual world that were previously imperceptible. Information and datasets, according to Christiane Paul, "are intrinsically virtual; that is, they exist

[86] David E. Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994): 60.
[87] Chris Russil, "13 Earth Imaging Photograph, Pixel, Program," in *Ecomedia: Key Issues* (Routledge, 2015), 229.
[88] Steyerl, *Duty Free Art*, 82-353.
[89] Ibid., 32.

as processes that are not necessarily visible or graspable, such as the transferral and transmission of data via networks".[90] In the context of algorithms, invisibility often pertains to the unseen infrastructures of data processing.[91] This includes not only the physical components like data center technicians, automated systems, and essential cooling mechanisms but also encompasses the broader network systems, software, and computational architectures that are integral yet often unnoticed.[92] In a similar vein, Steyerl argues that because information "is passed on as a set of signals that cannot be picked up by human senses," they remain invisible to the human eye.[93] In "Data Tunnel," Anadol transforms the imperceptible aspects of information that Paul and Steyerl discuss into a new visual language that reveals the invisible connections within the data. While Paul discusses the virtual nature of data as processes beyond sensory perception, and Steyerl highlights the limitations of human senses in detecting information signals, Anadol challenges these notions by materializing the "invisible."

Neural networks bridge the gap between the visible and invisible, similar to the capacity of photographic and film technologies to capture and reveal details of reality that normally elude human conscious awareness. In this case, neural networks take on the role of Walter Benjamin's camera, extending the concept of the "optical unconscious" into the realm of digital.[94] Benjamin points out, "with the close-up, space expands; with slow motion, movement is extended…" and these camera techniques, he suggests, "brings to light entirely new structure of matter," thereby allowing humans to access different aspects of reality that would remain invisible to the naked eye.[95] Steyerl also emphasizes how the "optical unconscious" has evolved within the field of

[90] Paul, *Digital Art,* 289.
[91] David Ribes and Steven J. Jackson, "Data Bite Man: The Work of Sustaining a Long-Term Study," in *Raw Data is an Oxymoron,* ed. Lisa Gitelman (MIT Press, 2013): 152.
[92] Ibid.
[93] Steyerl, *Duty Free Art*, 1.
[94] Benjamin, "A Short History of Photography," 7.
[95] Benjamin, *The Work of Art in the Age of Its Technological Reproducibility*, 37.

computational image analysis.[96] "Data Tunnel" demonstrates the data collection specific to NASA's archives. Neural networks, in this case, are used for pattern recognition and the process of recognizing and generating new patterns.

Anadol's work bridges the gap between the theoretical imperceptibility of data and its tangible visualization, suggesting that the invisible can be made visible through artistic creativity. In "Data Tunnel," Anadol uses NASA images as a training set for machine learning algorithms. Anadol's employment of advanced AI algorithms created the outputs from archives. However, AI does not just analyze the images or reveal "invisible" dimensions found in the physical realm as in Benjamin's case; it "reimagines" them, creates in/visible patterns and new visual narratives from the existing data, thus expanding the concept of "invisibility" in art. Machine learning algorithms analyze millions of data points, not just display them. They reinterpret them to uncover hidden patterns and generate new patterns within high-dimensional data spaces.[97] The AI "learns" from the NASA images and transforms them into a new visual language, an artistic interpretation that reveals unseen dimensions of the data, thus NASA's archives. "Data Tunnel" immerses visitors in this AI-driven process and allows them to engage directly with the raw data and evolving visuals. This artwork stands out for its transparency, as it explicitly illustrates data interpretation and visualization, as well as the roles of AI and the artist in this process. It shapes our understanding of the roots of AI cinema and its aesthetics. This makes the artwork a significant intervention in cinema, as it demonstrates the potential of AI to not only analyze but also creatively reimagine data, thereby expanding the narrative and aesthetic boundaries of the cinematic experience.

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[96] Steyerl, *Duty Free Art*, 37.
[97] Mackenzie, "The Production of Prediction," 434.; The Museum of Modern Art, "How Refik Anadol Uses AI," 03:27.

Benjamin suggests that the technology of the camera reveals a different "nature" that speaks to humans' unconscious mind, showing us not only what we consciously know and perceive but also the hidden facets of reality that lie beneath the perceivable surface.[98] He states that "nature becomes second nature through the lens. New worlds arise in that which we think we know fully when it is mediated" and "seeing itself is reborn".[99] However, technological mediation does not just change what we see; it changes how we see. "Data Tunnel" interacts with the facets of reality in a new type of un/consciousness. Anadol blurs the line between "nature" and "second nature" through the utilization of AI in the process of analyzing existing patterns and constructing new ones. The visuals during and after the algorithmic process, demonstrated in "Data Tunnel," might seem otherworldly, but they're grounded in real data, adding depth to the viewer's experience. The term "real data" refers to concrete, empirical information, such as NASA's astronomical data, which is the foundation for Anadol's visualizations. Data undergoes a transformative process through AI algorithms. This process creates visual representations that are seemingly otherworldly yet deeply rooted in factual data. "Data Tunnel" shows that our perception of reality can be reborn and transformed through algorithmic mediation. AI offers a new way of looking at and interpreting data, which is a fundamental component of our modern, "mediated" reality.[100]

In "Data Tunnel," Anadol's employment of AI algorithms not only assists human vision but significantly augments it, inviting us to experience and comprehend the world in new, profound ways. This artwork creates a unique visual language that emerges from the synthesis of human and machine perception. More than transforming human vision, Anadol's work expands upon it. The abstract form of the artwork allows viewers the autonomy to interpret and engage with it freely,

[98] Walter Benjamin, *On Photography*, ed. Esther Leslie (London, UK: Reaktion Books, 2015): 121.
[99] Ibid.
[100] Benjamin, *On Photography,* 121.

facilitating a re-evaluation of their perception. Thus, Anadol's approach heralds the advent of a more-than-human visuality. AI plays a crucial role in shaping and expanding the boundaries of how we perceive and interact with art. This expanded visuality, showcased in "Data Tunnel," represents the growing influence of AI in our lives. It opens up new possibilities for understanding and interacting with the world, suggesting a significant shift in the narrative and aesthetic experiences shaped by AI in contemporary art.

In our digitally mediated reality, AI acts as a transformative bridge to the invisible, altering our sociocultural and historical perceptions of reality, particularly in contexts such as outer space exploration. Chris Russill discusses data manipulation and processing, specifically in space photography. She points out that processed images, such as the Blue Marble,[101] are "latent" within the imaging process. This is where data is transformed into a digital, measurable form and visually rendered as a series of images.[102] Furthermore, this shows how a pixel-like Sagan emphasizes and/or data and processes of computer programs, as Russill highlights, shape human perception. According to Russill, "the representation of the earth is a function of the desired technical resolution, and not at all what our eyes would see from space".[103]

Anadol's use of AI algorithms to process and visualize data aligns with Steyerl's idea that modern perception increasingly relies on computational processes and "seeing is superseded by calculating probabilities".[104] Similarly, Jonathan Crary argues that "most of the historically important functions of the human eye are being supplanted by practices in which visual images no longer have any reference to the position of an observer in a "real," optically perceived world".[105]

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[101] It is the first photograph of Earth captured on December 7, 1972, by the Apollo 17 crew (Poole, 2008).
[102] Russil, "13 Earth Imaging Photograph, Pixel, Program," 244-245.
[103] Ibid.
[104] Steyerl, *Duty Free Art*, 32.
[105] Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, Mass.: MIT Press, 1992): 2.

In “Data Tunnel,” the AI essentially calculates probabilities to identify patterns within vast datasets, a process that goes beyond traditional visual perception. Anadol’s art exemplifies the transition from direct visual observation to a form of “seeing” that is mediated by technological processes. According to Crary, our conceptual understanding of image and reality is increasingly situated within a cybernetic and electromagnetic terrain.[106] Therefore, Crary argues that “if these images can be said to refer to anything, it is to millions of bits of electronic mathematical data”.[107] The artwork invites viewers to experience and interpret data through the lens of AI, which could be considered a form of “seeing” that is indeed superseded by computational analysis. “Data Tunnel” allows the viewer to “see” what the AI “sees” — a translation of complex data patterns into a visual format that humans can understand and appreciate, turning the invisible (the raw data and its embedded patterns) into something visible.

In “Data Tunnel,” what the AI “sees” and its method of translating data into visuals differs from human visual perception. AI vision is not about replicating or enhancing what the human eye can see; instead, it is about presenting a completely new perspective derived from the data’s inherent qualities as interpreted by AI. This shift exemplifies a transition from direct human observation to a form of “seeing” mediated by technological processes. Therefore, in “Data Tunnel,” Anadol challenges and expands our traditional understanding of sight and perception. Unlike traditional artistic methods that rely on direct human perception and interpretation, Anadol’s art introduces a hybrid form of vision that combines human and AI-driven perspectives. This redefinition of “seeing” encourages a re-evaluation of the reciprocal relationship between humans and AI. It prompts us to consider the role of AI in shaping our perception of the world, as well as our role in shaping AI. Anadol’s approach taps into fundamental human attributes such as the quest

[106] Ibid.
[107] Ibid.

for meaning, pattern recognition and aesthetic appreciation using technology to enhance and extend our visual vocabulary. The interplay of AI and human perception in "Data Tunnel" reveals a symbiotic relationship where technology augments human artistic expression and understanding beyond what's visible.

Anadol's visualization of invisible patterns implies that invisibility is no longer a human-centric concept but also a characteristic of algorithmic processes. According to Steyerl, in a world where algorithms increasingly shape our understanding and interaction with reality, the "privilege" of invisibility shifts from human agency to the domain of the machine.[108] Steyerl contends that "vision loses importance and is replaced by altering, decrypting, and pattern recognition",[109] which both Paglen and Crary also emphasize.[110] Paglen states that "over the last decade or so, something dramatic has happened. Visual culture has changed form. It has become detached from human eyes and has largely become invisible".[111] Contrary to Steyerl, Crary and Paglen's view of a complete displacement of human vision or superseding traditional seeing, it could be argued that "Data Tunnel" enhances and expands the vision, using AI as a tool to deepen and enrich visual perception.

In Anadol's art, the act of seeing is not entirely replaced but rather complemented by AI's computational capabilities. Throughout the computational design process, Refik Anadol Studio (RAS) constructs its own library and custom software where they can access almost any kind of data, from human memory to machine, and employ an "invisible pattern of data into an invisible layer of noise algorithm".[112] This refers to the underlying algorithms that process and manipulate the patterns but also construct new ones within data which are not visible. These algorithms work

[108] Steyerl, *Duty Free Art*, 32.
[109] Ibid.
[110] Crary, *Techniques of the Observer*, 2.
[111] Paglen, "Invisible Images," 2.
[112] Kyle Raymond Fitzpatrick, "Studio Visit: Artist Refik Anadol," *Cool Hunting*, August 16, 2019, https://coolhunting.com/culture/studio-visit-artist-refik-anadol/.

in the background, transforming and shaping the data in ways that might not be directly observable, as argued by both Steyerl (2017) and Paglen (2016). Paglen's argument that machines generate images not for humans but for other machines holds true in certain contexts, particularly in the context of operational images being invisible to humans.[113] However, as Antonio Somaini explains, machine systems usually operate on data that is produced or influenced by a human factor.[114] For instance, humans are responsible for writing the algorithms and software that drive machine systems. Moreover, humans often decide what data is fed into these systems. This choice can significantly influence the outcomes, as the data serves as the foundation for machine learning and processing. This includes the underlying logic, rules, and functionalities of these systems. This involvement of a human factor, at least partially or momentarily, made data and the process visible to human eyes.[115] There is a more integrated relationship between human perception and machine intelligence, "Data Tunnel" introduces us to various types of invisible and new ways of seeing them. Furthermore, it prepares us for AI cinema, where machines and humans seem to share the same vision.

Manovich highlights the transformative moment in the late 19th century when the automatic generation and projection of images were combined, marking the birth of cinema as a distinct regime of the visible.[116] Drawing a parallel to the 21st-century media landscape, a similar transformative moment can be observed with the advent of AI-generated, data-driven art. This new era could be characterized as the birth of a "regime of the invisible," where unseen data patterns, algorithmic processes, and machine learning capabilities form the core of creative expression.

[113] Paglen, "Invisible Images," 2.
[114] Close-Ups, "The Meaning of 'Vision' and 'Image' in the Age of AI," *Feral File*, November 2021, accessed November 13, 2022, https://feralfile.com/close-ups/the-meaning-of-vision-and-image-in-the-age-of-ai.
[115] Ibid.
[116] Manovich, The Language of New Media, 251.

Unlike the visible regime of traditional cinema, dominated by photographic image and mechanical reproduction, this new regime leverages the unseen, the data-driven, and the algorithmically generated to redefine the boundaries and possibilities of artistic creation and cinematic experience.

Power and Surveillance: Navigating Digital In/visibility

"Data Tunnel" raises critical questions about the balance of power in a digitized world. According to Steyerl, a "new totality" implies that AI, through its pattern recognition, is not just revealing but actively redefining aesthetic and social constructs through in/visible patterns.[117] She mentions that as algorithms gain the capacity to render the invisible visible, the human struggle for invisibility becomes both more challenging and more critical.[118] Steyerl addresses the increasing difficulty of maintaining anonymity in an era where technology has become more pervasive with an increasing number of cameras, sensors, and data collection. Paglen, in particular, emphasizes that "the invisible world of images" represents a cunning exercise of power, intricately designed to infiltrate and influence even the smallest aspects of everyday life, thereby adding a layer of complexity to surveillance and digital invisibility[119]. Both theorists highlight crucial aspects of digital in/visibility, yet their analyses could be expanded to include a more nuanced understanding of the diverse implications of these technologies in art, society, and culture. Anadol reclaims and/or re-contextualizes the often negative connotations of surveillance in the AI context.

Amidst growing concerns about surveillance and power associated with digital media, Anadol's transparency about the data, archives, and software employed in his artworks, along with his open sharing of the AI processes in "Data Tunnel," brings a level of clarity and openness to his

[117] Steyerl, *Duty Free Art*, 37.
[118] Clemens Apprich et al., *Pattern Discrimination, In Search of Media* (Minneapolis: University of Minnesota Press, 2019): 2, 60.; Steyerl, *Duty Free Art*, 38.
[119] Paglen, "Invisible Images," 9.

artistic approach. Reflecting on his *Machine Memoirs: Space* exhibition, Anadol considers space data as the most objective, free from ego and privacy concerns. He believes that within the realm of space, ego and privacy are absent, and one can engage in a purer form of inquiry with the universe. Among the current chaos surrounding AI in art, Anadol perceives data derived from space as less problematic and more honest.[120] Instead of data being something that's solely "extracted" or "mined" for commercial, power or surveillance purposes, it's being used to create, inspire, and communicate. This might lead some visitors to consider how data permeates their own lives and how it can be perceived beyond its usual utilitarian or surveillance-oriented contexts. As noted by Wolfgang Ertel, since 2015, the advancement of deep learning[121] has led to significant improvements in image classification and has even enabled the automatic generation of paintings in the style of Old Masters.[122] "AI becomes creative!" according to Ertel.[123] Today, AI art generators such as DALL-E or Midjourney open this possibility for people. Ertel mentions that deep learning brings a new "subarea of creativity" where neural networks' capabilities reach to generate different art forms.[124] In this sense, "Data Tunnel" not only manifests the invisible through aesthetic means but also subtly shows the potential of it to create new forms of art.

Exploring the New Ways of Seeing

The creative process of AI-generated art is grounded in hallucination-like interpretations. According to Anadol, AI speculation on data in the process of image-making could be perceived

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[120] Mike Barrett, "Seeing the Invisible: A Conversation with Refik Anadol," *Semi Permanent*, accessed September 20, 2023

[121] Deep learning can be considered as a subfield of machine learning. It work on multiple segments through artificial neural networks. These networks enable algorithms to learn complex patterns from large data sets, leading to advancements in image recognition, natural language processing, and more (Goodfellow, Bengio, & Courville, 2014).

[122] Ertel, *Introduction to Artificial Intelligence*, 7.

[123] Ibid.

[124] Ibid., v.

as it as hallucinating or dreaming.[125] These are not literal hallucinations, but they instead emphasize the creative implication of AI rather than a strictly computational one.[126] This creates a new "subarea of creativity" that alters what is possible and imageable in art.[127] "Data Tunnel" exemplifies machine hallucination as the AI creatively interprets the data, generating visual patterns and forms that do not directly correspond to the raw data. These invisible patterns, unconstrained by the conventional parameters of reality, are characterized by their hallucinatory attributes. While conventional visual art often aims to depict the observable physical world, various visual technologies such as cameras, microscopes, and telescopes facilitate diverse representations of the hidden parts of the visible world.[128] AI's visualization of data does not strictly reflect raw data or the hidden connections. Its results, as illustrated in "Data Tunnel," lead to a representation of a synthesis of data and algorithmic creativity.

Despite finding both concepts "hallucination" and "dream" somewhat problematic, I have chosen to incorporate only hallucination because "dreams," as suggested by Brian Hayes, do not provide an entirely accurate metaphor for the process or the "Data Tunnel". "Dreams" imply mental creations formed when the perceptual system is inactive, whereas, in this context, the visual system in Anadol's exhibition is highly active, generating hallucinations, as Hayes posits.[129] In the field of AI-generated art, there are various techniques employed, one of which is the deep dream technique, often associated with dream-like, surreal imagery. Anadol's art, while it shares some similarities with Google's DeepDream in terms of using AI and data to create visual art, is distinct in its

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[125] Showcase, "Refik Anadol's Machine Memoirs: Space," *YouTube*, March 23, 2021, https://www.youtube.com/watch?v=RO_gOzpQ-js.
[126] Ertel, *Introduction to Artificial Intelligence.*
[127] Ibid., v.
[128] Crary, *Techniques of the Observer.;* Martin Jay, *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought*, A Centennial Book (Berkeley: University of California Press, 1993).
[129] Brian Hayes, "Computer Vision and Computer Hallucinations," *American Scientist*, accessed December 16, 2022, https://www.americanscientist.org/article/computer-vision-and-computer-hallucinations.

approach and underlying technology. While DeepDream modifies existing images, Anadol's art typically starts from data (which could be space data like in this exhibition) and uses AI to translate this data into visual forms. Because of the central role of data, Aanadol's work can be called AI-generated data-driven art.

Steyerl critically examines the metaphorical application of terms such as "inceptionism" and "deep dreaming," which are terms associated with Google's "DeepDream" technique, a process that uses neural networks to generate images from noise.[130] Inceptionism refers to the idea of a neural network "incepting" images or creating new, often surreal visual interpretations by amplifying and modifying patterns recognized in input data.[131] On the other hand, the deep dreaming process involves feeding an image through a neural network and asking the network to enhance and emphasize certain patterns it detects, often leading to intricate, dream-like, and sometimes bizarre visual outputs.[132] Steyerl argues that these AI-generated images do not correspond to traditional notions of hallucinations or dreams. Rather, they can be perceived as expressions or transformations of the existing technological milieu.[133] I agree that these metaphors might detract the visitors' attention from the genuine mechanics and foundational structures of AI-generated images, which are grounded in data, algorithms, and technology. However, eliminating these metaphors entirely would also remove the creative element from AI-generated art.

Expanding on the terminology, the term "hallucination" holds particular significance in the field of AI-generated art. It originates from the Latin verb "hallucinari," meaning "to wander in mind" or "to daydream".[134] AI-generated art exhibits hallucinatory characteristics, as it can create

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[130] Steyerl, *Duty Free Art*, 9.
[131] Alexander Mordvintsev, Christopher Olah, and Mike Tyka, "Inceptionism: Going Deeper into Neural Networks," *AI Google Blog*, July 13, 2015, https://ai.googleblog.com/2015/07/inceptionism-going-deeper-into-neural.html.
[132] Ibid.
[133] Steyerl, *Duty Free Art*, 95-95.
[134] Oxford English Dictionary, s.v. "Hallucination," accessed May 12, 2023, http://www.oed.com/view/Entry/83118.

visual outputs that are not visible in the raw data, so they are unexpected or unusual patterns. Anadol suggests that AI, with its ability to learn, could potentially experience hallucinations while processing the vast amount of data it receives. This concept is visually represented through the abstract, intricate, and often otherworldly images that are unconstrained by conventional rules of reality in his exhibition. However, one issue with hallucination is its frequent association with instances where AI provides nonsensical answers to reasonable questions or vice versa.[135]

In the *Machine Memoirs: Space* exhibition, Anadol offers an artistic redefinition for these new ways of seeing that transcends traditional image creation and reception that invites viewers to experience an expanded reality which is hidden in the "apophenic vision." Recommending and transitioning to a related term, "apophenia," is frequently employed in the disciplines of psychology, neuroscience, and cognitive science, which indicates the tendency to see and interpret the world.[136] Peter Brugger referencing Klaus Conrad, who introduced the term in 1958, describes apophenia as "the unmotivated seeing of connections" along with a "specific experience of an abnormal meaningfulness".[137] Steyerl explores the term "apophenia" in her article "A See of Data," which she describes as a tendency to see meaning, connections or patterns in unrelated or arbitrary data.[138] It refers to a situation that many of us are familiar with, such as interpreting meaning in clouds or seeing patterns in a group of stars. Apophenia can be seen as a form of hallucination wherein the mind establishes connections and patterns based on its intrinsic processes—finding meaningful patterns in randomness.

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[135] Mark Liberman, "AI Hallucinations," *Language Log*, March 10, 2018, https://languagelog.ldc.upenn.edu/nll/?p=37185.
[136] Peter Brugger, "From Haunted Brain to Haunted Science: A Cognitive Neuroscience View of Paranormal and Pseudoscientific Thought," in *Hauntings and Poltergeists: Multidisciplinary Perspectives,* ed. James Houran and Rense Lange (Jefferson, NC: McFarland & Company, Inc., 2001): 13.
[137] Ibid.
[138] Steyerl, *Duty Free Art*, 32.

Neural networks represent a form of statistical induction, and AI algorithms might identify patterns or correlations in data that are not actually meaningful or intentional simply because they are statistically significant within the given dataset.[139] Therefore, I use the term "apophenia" here to describe the "seeing" patterns that are not there in terms of both AI's pattern recognition and human perception of AI-generated art. This underscores the subjective nature of Anadol's artwork. Apophenia considers "meaningfulness in randomness" as a combination of both the process of machine vision and the reception of AI-generated art.[140] Randomness can be perceived as meaningful, but this perception is inherently subjective.[141] It's based on how individuals interpret temporal patterns that appear in random configurations, which contributes to the uniqueness and unpredictability of Anadol's artwork.

Steyerl calls apophenia her "secret ninja technique," which implies the human tendency to actively seek and perceive meaningful patterns within random, overwhelming data.[142] Apophenia is not just a cognitive bias but a deliberate strategy to challenge conventional ways of seeing and interpreting data. This engages with the flood of digital information and imagery that characterizes contemporary culture. It helps us to navigate and to make sense of the chaotic digital landscape, turning random noise into insightful commentary. In "Data Tunnel," the AI algorithm functions as a form of apophenia, sifting through massive datasets to identify and visualize patterns that are not perceivable to the human eye. This represents a new form of digital abstraction, and the visitors engage in apophenic behaviour when interpreting the patterns in the *Machine Memoirs: Space* exhibition.

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[139] Matteo Pasquinelli, "Machines that Morph Logic: Neural Networks and the Distorted Automation of Intelligence as Statistical Inference," *Glass Bead*, 2017: 2-8. https://www.glass-bead.org/article/machines-that-morph-logic/?lang=enview.
[140] Brugger, "From Haunted Brain to Haunted Science," 13.
[141] Ibid.
[142] Steyerl, *Duty Free Art*, 32.

Using Steyerl's "secret ninja technique" in Figure 6 (Raw Dataset of MRO), one might observe the sparkling lights of millions of stars, which can genuinely be seen in Figure 9 (Triangulum Galaxy), suggesting you could float away in the universe of data.[143]

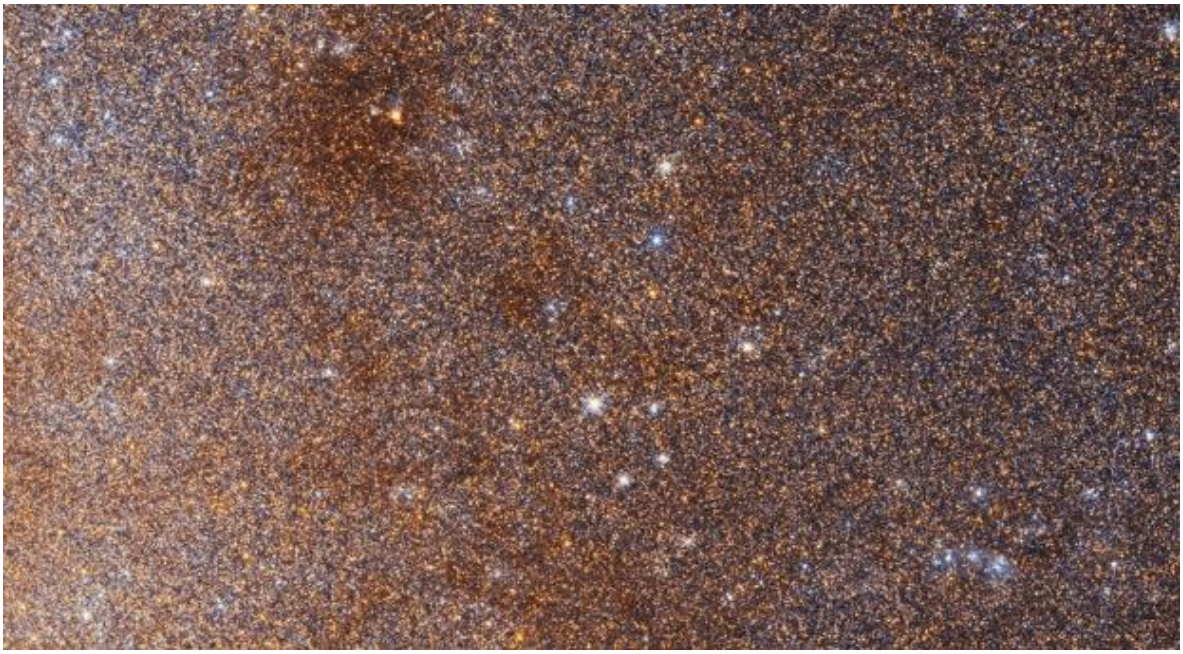

Figure 9. Close-up view of the Triangulum Galaxy, captured using the "zoom tool" from the original image by ESA/Hubble (Photography by M. Kornmesser). Accessed December 2022. https://esahubble.org/images/heic1901a/zoomable/

The images, at first glance, might seem like a random assortment of coloured pixels or noise. However, through apophenia, visitors may begin to perceive patterns or images within this noise. Additionally, Anadol uses AI algorithms to interpret this raw dataset to find and generate patterns and create visual outputs which resemble apophenia. Moreover, "Data Tunnel" demonstrates how technology can both mimic and stimulate cognitive patterns and create a digital consciousness which invites a deeper reflection on the ways we find and create meaning in the data that surrounds

[143] Steyerl, *Duty Free Art*, 34.

us. Aaron Hertzman argues that "images become visually interesting when they comprise unusual juxtapositions of realistic visual cues" (2019, p. 2).

"Formerly, we used to represent things which were visible on earth, things we either liked to look at or would have liked to see," says Paul Klee to define art.[144] Referring to the period of the 1920s, he states, "we reveal the reality that is behind visible things, thus expressing the belief that the visible world is merely an isolated case in relation to the universe and that there are many more other, latent realities".[145] Klee's statement foresees the evolution of art into domains beyond the immediately visible. The *Machine Memoirs: Space* exhibition resonates with Klee's vision by using technology to reveal and visualize patterns and realities not apparent to the naked eye, such as the vast data landscapes of Mars. Furthermore, Anadol's work extends invisibility beyond human cognition and perception to another dimension.

In a technologically optimized society, digital does not denote "virtual," nor does the physical world imply "real"; instead, they "dialectically co-construct each other," and as Nathan Jurgenson argues, the reality is not binary but "increasingly meshed".[146] Conventionally, the digital and physical worlds have been viewed as separate and distinct entities. However, they are intertwined and continuously influence each other, such as in AI-generated art, which often utilizes data from physical sources. Similarly, the existence and functioning of AI itself depend on physical mechanisms. This exemplifies Jurgenson's increasingly meshed reality. The "Data Tunnel" artwork is created through a mutual relationship between the digital and the physical, with each aspect informing and influencing the other. Since they actively shape and redefine each other. This demonstrates that Anadol's artworks have the power to create second nature that exists beyond our

[144] Klee, Creative Confession, 10.
[145] Ibid.
[146] Nathan Jurgenson, "Digital Dualism versus Augmented Reality," *The Society Pages* 24 (2011).

sensory perception; in consequence, "seeing" is optimized in Anadol's art as the capabilities of neural networks transcend digital consciousness. They are another way of exploring and presenting aspects of the broader reality that is not immediately perceptible to human senses but still grounded in the real. According to Aaron Hertzmann, "neural network art is interesting because it exploits networks designed to model the cues of real-world images".[147]

Images in *Machine Memoirs: Space* exhibition showcases an interplay between abstraction and reality. These artworks, while abstract in nature, subtly connect to real-world characteristics, such as the vastness of space, the surface of Mars, or the complexity of mechanical structures. This blend of abstract and real, which are "conflicting clues," according to Hertzmann, "provoke interest".[148] Anadol's installations invite visitors to contemplate the nature of reality and the power of technology to shape our understanding of the universe, reflecting Klee's belief in art's capacity to reveal more than what is seen on the surface.

The concept of "optimization" has been debated in relation to AI, smart technology, and other related topics by Orit Halpern (2017). According to Halpern, smart technologies and big data have been shaping our ways of knowing and experiencing the world. In "The Smartness Mandate," Halpern describes optimization as "a technique by which smartness promulgates the belief that everything -every kind of relationship among human beings, their technologies, and the environments in which they live- can and should be algorithmically managed" (Halpern et al., 2017, p. 119). "Data Tunnel" illustrates that AI processes and interprets complex information and vast datasets such as every photograph ever taken of Mars. These are incomprehensible in their raw form and because of their sizes by human cognition.[149] In this aspect, "Data Tunnel"

[147] Aaron Hertzmann, "Aesthetics of Neural Network Art," *arXiv,* March 18, 2019: 2. https://arxiv.org/abs/1903.05696.
[148] Ibid., 7.
[149] Paglen, "Invisible Images," 6.

demonstrates the possibilities of new ways of seeing the data and optimizes not just the process of information but also the reception of it. Halpern questions the implication of the "smartness mandate," especially the potential loss of agency, reduced human interaction, and the potential for surveillance and control, as both Steyerl and Paglen point out. In contrast, Anadol's application of AI doesn't necessarily suggest that all art should be created in this understanding but rather shows the new possibilities that these technologies bring to the field of visual arts. According to the artist, it is an expansion of the artistic palette, not a mandate. What does this mean for our understanding of memory and archives if they can be optimized in this way?

Chapter 2
AI and the Reconstitution of Archives

Figure 10. Visualization of NASA's open archives in "Data Tunnel," part of Refik Anadol's *Machine Memoirs: Space* exhibition. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

In the contemporary world, the way we remember and recount past information is increasingly mediated through digital technologies. These technologies have broadened the potential for reinterpreting and repurposing archives, enabling filmmakers and artists to engage with history and memory in innovative ways. Traditionally, archives have been repositories of factual history, often understood as authentic materials for reference, study, or evidence. In film, archives are often used to lend authenticity, evoke nostalgia, or provide context.[150] AI technologies, with their ability to analyze and categorize vast amounts of data, and generate complex multi-dimensional connections in datasets, create opportunities for the discovery and reinterpretation of archival materials.

[150] Durba Ghosh, Jeff Sahadeo, Craig Robertson, and Tony Ballantyne, *Archive Stories: Facts, Fictions, and the Writing of History* (Duke University Press, 2006).

The *Machine Memoirs: Space* exhibition is divided into three chapters, each inspired by and structured around a specific data source from particular archives. The data from the International Space Station (ISS), the Mars Reconnaissance Orbiter (MRO), and the Hubble Space Telescope each contribute to the unique visual experiences of the respective chapters.[151] The nature of these data sources, which include various celestial features captured by different technologies, leads to a diverse range of visual outcomes. For instance, data captured from different terrains like land, water, or air would inherently differ in texture, shape, and other physical characteristics. These differences are then translated into the visual experience of the artwork, contributing to unique patterns, colours, and light intensities in each chapter.

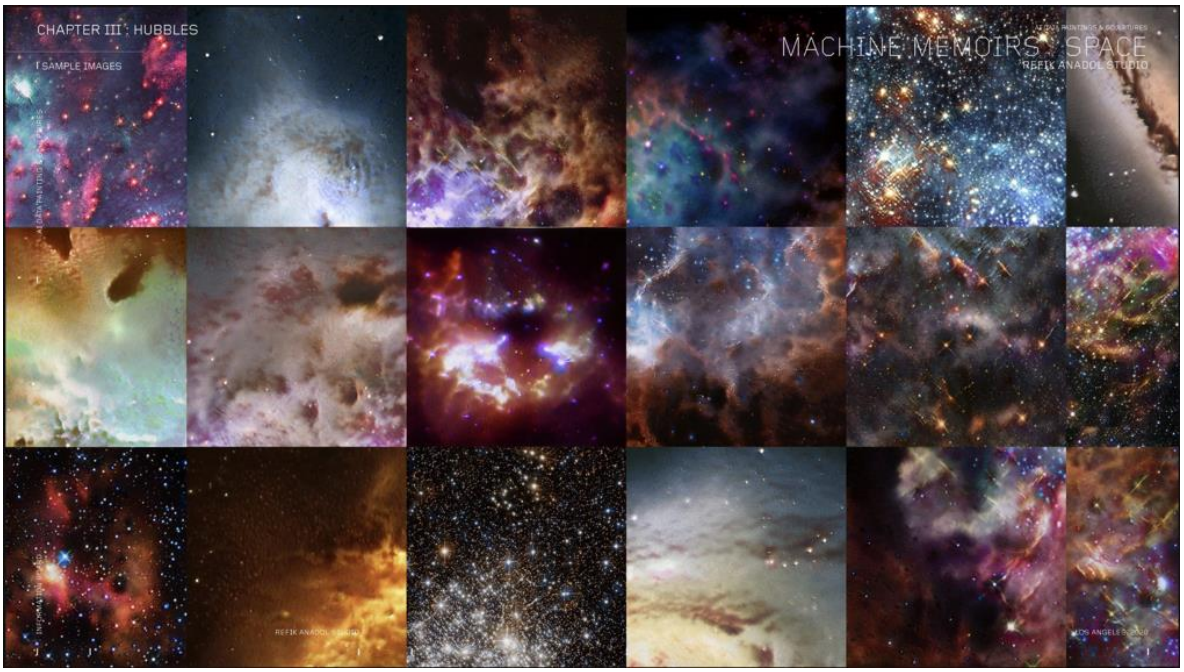

Figure 11. Visualization of Chapter III: Hubble's archives in "Data Tunnel," part of Refik Anadol's *Machine Memoirs: Space* exhibition. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

[151] Anadol, "Machine Memoirs: Space."

Figure 11 presents a selection of celestial images from the Hubble Space Telescope, illustrating a fraction of the visual data that Refik Anadol employs in his *Machine Memoirs: Space* exhibition. These images underscore the significance of archival visuals, serving as both artistic subjects and computational data for AI transformation. These visuals, while derived from scientific observation, present an opportunity for artistic reinterpretation, blending the lines between data representation and creative expression. In the context of Anadol's work, these images become more than just visual inputs; they are integral to the thematic journey from visibility to invisibility, as they are reprocessed and reimagined through AI algorithms to create new ways of seeing that challenge traditional cinematic experiences.

Figure 12. Visualization of Chapter III: Hubble as an immersive AI cinema installation, "Machine Memoirs v.2," which is a part of Refik Anadol's *Machine Memoirs: Space* exhibition. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

Each frame in figure 11 provides a unique view of the cosmos. Initially rendered through NASA's advanced imaging, these visuals are transformed by Anadol's AI, which generates hyperconnections in the data, thereby creating complex patterns and relationships that extend beyond the original imagery. Hubble's interpretations in AI cinema, as illustrated in figure 12, retain a visual connection to the real, often evoking a sense that the resulting art reflects space in a manner that is both representational and abstract. In this vibrant image, visitors witness a convergence of data points that burst forth in a spectrum of colours, creating an almost three-dimensional landscape that envelops the visitors. The patterns visitors witness are the outcomes of machine learning algorithms processing and recognizing patterns, which extract the inherent beauty from the interplay of visible and invisible elements within the raw data.

In Hubble's archive (figure 11), from the warm hues of red and orange to the cool blues and violets, the vivid colours and diverse textures of these images create a visual rhythm that captivates the viewer. The images are digital interpretations of astronomical data such as galaxies, nebulae, star fields and cosmic dust and gas. The use of collage as a technique allows Anadol to juxtapose various elements of cosmic data, blending them into a cohesive whole that communicates more than the sum of its parts. It is a method that speaks to the nature of AI itself: taking discrete pieces of information and synthesizing them into something new and often unexpected. By employing AI algorithms to reinterpret the Hubble data, Anadol is not merely displaying space; he is recontextualizing it, creating a dialogue between the data's origin and its potential for sensory and cognitive exploration. It suggests that the invisible —specifically, hyperconnections— is what makes the outcome unique. The piece encourages a reflection on the nature of perception, the relationship between humanity and the vastness of the universe, and the evolving role of technology in shaping human vision.

Patterns of Inclusion – Interaction of Algorithm and Data

Algorithms gain their relevance and functionality only through their interaction with data, a concept that resonates deeply with the use of AI in repurposing archives in innovative art forms, such as Anadol's "Data Tunnel."

As Tarleton Gillespie points out, algorithms are essentially "meaningless machines" until they encounter and process data.[152] Algorithms can only process and interpret the data available in databases. This distinction becomes pivotal when considering how AI technologies analyze and reinterpret archival materials. In Anadol's work, where AI processes over 4 million datasets from NASA archives, the outcome –an immersive and dynamic experience– is fundamentally shaped by the nature of the data fed into the algorithms. The transformation from traditional archival materials to these new forms of representation underlines the critical role of data in determining the algorithm's function and the resultant narrative. People tend to perceive algorithms and databases as a single functioning unit. However, in reality, they are distinct but deeply interconnected.

The true power of an algorithm emerges only through its interaction with data. This interaction is where the magic – and the complexity – lies. To create datasets and make material machine (algorithm) readable, data has to be selected, "cleaned," and organized. This process involves categorization. In some cases, it can be seen as a step fraught with semantic, cultural or political implications. However, categorization can carry cultural biases or discriminatory practices; in other words, categories are not just neutral labels. For instance, in 2009, the #amazonfail incident served as an illustrative example. A swath of LGBTQ+ books was mistakenly labelled as "adult." This categorization profoundly affected what content was promoted or demoted

[152] Tarleton Gillespie, "The Relevance of Algorithms," in *Media Technologies: Essays on Communication, Materiality, and Society* (2014): 169.

by the algorithm.[153] This incident underscores the potential consequences of categorization errors in digital systems. Similarly, in digital archives, the way data is categorized and interpreted by algorithms can profoundly influence the artistic representation of history, as seen in Anadol's work. The AI's interpretation leads to a reinterpretation of archival materials, where the memory and history are not just recalled but are dynamically reimagined.

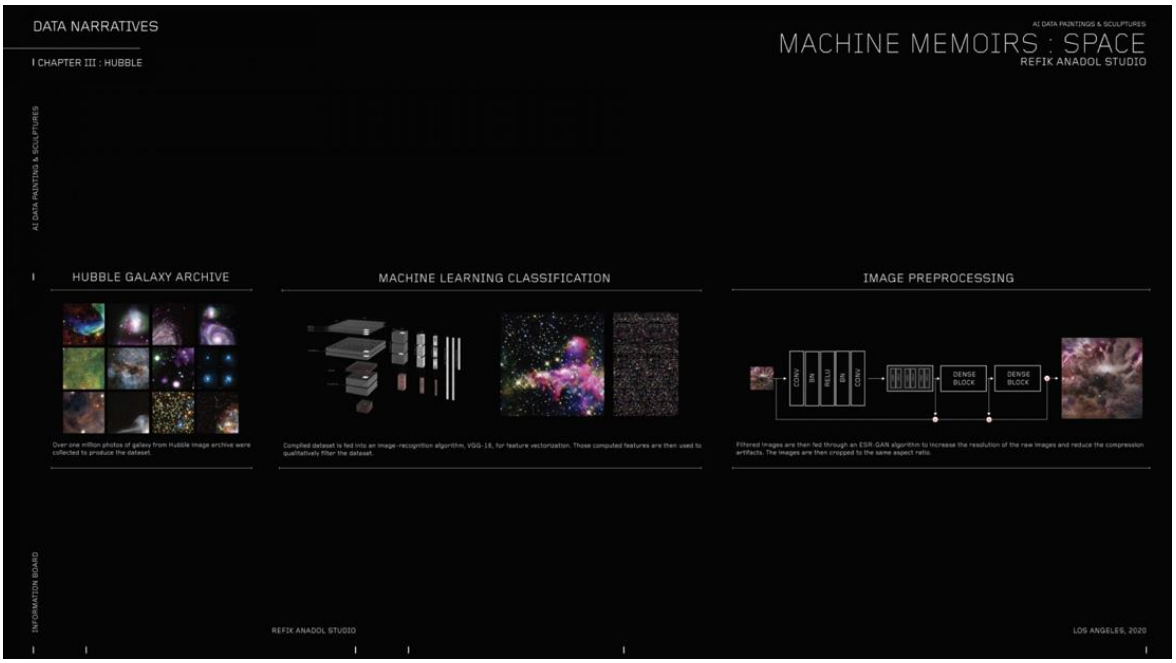

Figure 13. Schematic representation of the process that transforms raw data from the Hubble Space Telescope into visual art. It illustrates the stages of data transformation from the original Hubble galaxy archive through machine learning classification, to image preprocessing in Refik Anadol's *Machine Memoirs: Space* exhibition's Chapter III: Hubble. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

In short, Gillespie's exploration of "Patterns of Inclusion" compels us to look beyond the algorithms themselves to examine the data they interact with. This approach provides a richer understanding of how digital information is curated and its implications for what we see and

[153] Ibid.

understand in the digital world. Building on Gillespie's insights, the *Machine Memoirs: Space* exhibition's importance lies in its commitment to transparency, derived from utilizing open archives and sharing software publicly. This transparency is crucial in today's digital society, where the provenance and openness of data significantly impact the integrity and understanding of digital art. Furthermore, the exhibition, particularly "Data Tunnel," critically examines the process itself. It shows not just the end result but also the journey data takes from being part of an open archive to becoming an element of immersive art.

The exhibition demystifies sophisticated computational processes, granting the audience an insightful look into the complex algorithms that convert extensive datasets into visually coherent representations. Visual breakdowns of the technical processes of each chapter help viewers to understand the intricate steps involved in Anadol's artistic method, from data selection to the application of AI for image enhancement and pattern discovery. By revealing this process, Anadol transparently navigates from raw data to finished art, embodying Gillespie's open-source principles. This transparency is not just didactic; it is a political and aesthetic choice that speaks to the democratization of art in the digital age. The sharing of software and the use of open archives democratize the artistic process, inviting the public not only to experience the artwork but also to understand and possibly replicate or extend the artistic process.[154] This openness aligns with contemporary discussions about the accessibility of art and technology, where transparency is not just ethical but also a creative stimulus for society.

[154] Pena, "Hala En İyi Hayallerimi Ülkeme Geri Getiriyorum."

Data as Memory

According to Ernst van Alphen, there has been a substantial proliferation of memory practices in art and literature since the 1990s.[155] This surge in memory practices can be attributed to multiple factors. Sociopolitical shifts, such as the end of the Cold War, ignited interest in historical narratives and collective memories.[156] Simultaneously, technological advancements, like the advent of personal computers and the internet, provided artists with innovative tools for memory engagement. Furthermore, the postmodern movement's emphasis on the fragmented and subjective nature of human experiences fostered a focus on memory practices to explore personal and collective identities. This context set the stage for contemporary artistic explorations of memory, which have continued evolving alongside technological advancements and global cultural exchanges.[157]

Wendy Hui Kyong Chun argues that in digital culture, memory is often treated as computer storage.[158] The way we reconstruct memory through using digital information (data) reflects both losing and regaining our memory, just like computer data that can get corrupted but also be restored.[159] In "Data Tunnel," data is preserved, yet it undergoes transformation, appearing differently than its original state in its form or meaning. This corresponds to how memory is not static in the human mind; it evolves and changes over time. The transformation may obscure some aspects of the original data while highlighting or creating others, which is a characteristic of AI-generated art. In Anadol's artwork, data transcends its traditional role of mere storage.

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[155] van Alphen, *Staging the Archive,* 236.
[156] Ibid.
[157] Wolfgang Ernst and Jussi Parikka, *Digital Memory and the Archive*, Electronic Mediations, vol. 39 (Minneapolis: University of Minnesota Press, 2013).
[158] Jussi Parikka, "Archival Media Theory: An Introduction to Wolfgang Ernst's Media Archaeology," in *Digital Memory and the Archive* (2013): 16.
[159] Ibid.

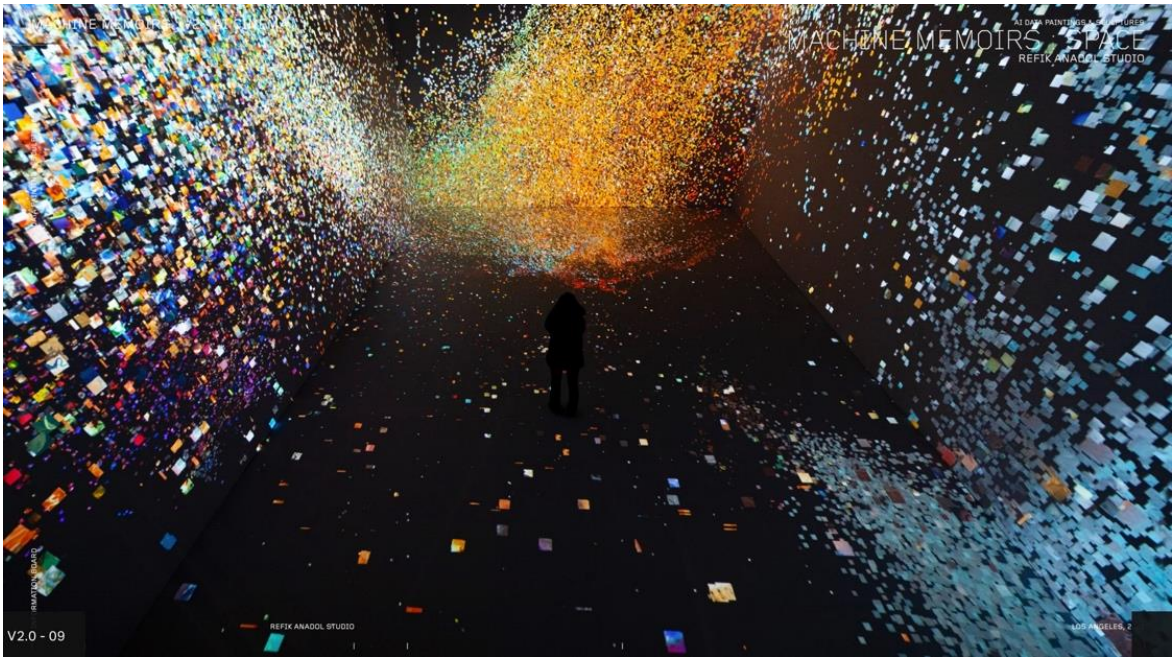

Figure 14. An immersive visualization within the "Machine Memoirs v.2" installation, part of Refik Anadol's *Machine Memoirs: Space* exhibition, showcasing the dynamic transformation of NASA's archival data through AI. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

The *Machine Memoirs: Space* exhibition creates a space for experiencing memory as a fluid and evolving notion rather than a static repository, as illustrated in figure 14. Ernst suggests that technical memory, like in computers, is always changing, not fixed.[160] This dynamic installation transforms the conventional notion of memory by using AI to continuously reprocess and present archival data in new forms (figure 14). This reflects a deeper engagement with data, not just as something to be stored and retrieved but as something that can be experienced and interpreted in multifaceted ways. Jussi Parikka notes this difference between technical memory and human memory, pointing out we need new ways to think about memory in the digital age.[161] Today, digital technologies like artificial intelligence have further optimized archival and memory practices,

[160] Ernst and Parikka, *Digital Memory and the Archive.*
[161] Parikka, "Archival Media Theory," 16.

enabling the exploration of new forms of representation and comprehension, thereby expanding the scope and impact of such practices.

In figure 14, "Machine Memoirs v.2" captures the fluidity of memory through the transformative process, with archival images actively reinterpreted by AI. They are not just passively displayed, instead, they are illustrated as a burst of data points seemingly exploding into a spectrum of colours. The moving images, which cover the walls and floor, along with colours that seem to float and swirl around the viewer, create a sense of depth. This suggests the fluid nature of memory and digital information, embarking on an exploration of digital consciousness where the lines between the real and artificial, tangible and conceptual, are intentionally blurred. This explosive transformation symbolizes the awakening of raw data into meaningful patterns, reflecting the cognitive processes of making sense of these data points. Moreover, the image serves as a metaphor for the evolving nature of memory in the digital age, where our experiences of the past are not fixed but are continuously reconstructed by algorithms and computational processes.

According to Brooke Belisle, "for a computer, an image is a set of numbers describing an array of pixels" (Belisle 2020, 336). The data behind these images (figure 14) can be archived, analyzed, manipulated, and revisited. This data can provide contextual and metadata information, making digital images rich archives in themselves. Jonathan Crary posits that the true reference of digital images if they are to be associated with anything at all, lies in the countless bits of electronic mathematical data that constitute them.[162] However, Anadol argues that AI-generated images emphasize the poetic potential of memory, transcending a mere aggregation of numerical values for both humans and machines. He asserts that data is not simply a mundane entity characterized

[162] Crary, *Techniques of the Observer*, 2.

by binary digits or specific numbers like 1-0 and adds, "at least the data is a memory for me".[163] From this standpoint, the artist suggests that the images machine captures from wind and ocean to space, can all possess memories.[164] Anadol's approach to AI-generated data-driven art proposes the idea that data can possess deeper meaning and artistic significance beyond its numerical representation and thus archives, as exemplified by the "Data Tunnel".

The vast archive of NASA, illustrated in "Data Tunnel," is far beyond the capacity of any human to comprehend in its entirety. However, it is accessed, manipulated, and reinterpreted by AI to create a visual representation of the memory of space exploration. As Trevor Paglen claims, "no human can recall the faces of billions of people," yet he contends that these machines possess an unyielding memory.[165] These include seeing hidden patterns or processing millions of images in a remarkably brief timespan. For the *Machine Memoirs: Space* exhibition, Anadol states, "every photograph ever taken of Mars up to this day amounts to a 12-terabyte dataset. Technically, this would require a person to continuously stare at a screen without breaks for eating or using the restroom for three to four years. In other words, it is an impossible feat for human[s]",[166] as can be seen in "Data Tunnel" (figure 6). Therefore, Anadol argues that working with machines that do not forget presents an invaluable opportunity for creativity and collaboration, and he emphasizes the potential for AI to revolutionize memory and archiving practices by offering new ways of seeing and interpreting that are unique to visual art.[167]

"Data Tunnel" creates an apophenic vision, a new type of seeing that seeks invisible patterns and meaning in archives instead of a strictly algorithmic perspective. While Belisle's

[163] Bimfili, "Sanatın Dönüşümü: Refik Anadol," *YouTube*, May 6, 2021, video, https://www.youtube.com/watch?v=4j09jfe51-k.
[164] Ibid.
[165] Paglen, "Invisible Images," 6.
[166] Bimfili, "Sanatın Dönüşümü."
[167] Bimfili, "Sanatın Dönüşümü."

analysis accurately describes how a computer processes and represents data, Anadol's argument accentuates the creative and interpretive potentialities of AI-generated art. The data - once a static record of space exploration - is now a dynamic, ever-changing entity, flowing and shifting in response to the algorithm's interpretation. "Static" refers to the lack of variability or potential for change in the image, rather than the absence of motion. Anadol introduces an intriguing dimension to the discourse on AI-generated art by stating that data can be perceived as memories for both humans and machines. These datasets, which contain diverse visual elements, allow AI to create its own memories by learning and creating new patterns and structures, and generating new, unique artworks.

Oliver Grau emphasizes how present-day forms of media, including digital ones, have been influenced by and are extensions of earlier technologies and practices.[168] In Anadol's work, this interplay is manifested as AI processes and reinterprets more traditional forms of visual data in archives, such as photographs and optical observations from telescopes. Jonathan Crary suggests, "older and more familiar modes of "seeing" will persist and coexist uneasily alongside these new forms".[169] This blending of new and old visual techniques, thus, adds another layer to our understanding of the reconstruction of reality through data.

Both Walter Benjamin and Crary's discussion on modes of seeing rely on the human eye with our perception of reality rooted in direct optical experiences. However, as digital technologies become more prevalent, these practices are being replaced by new forms of perception that are grounded less in direct optical experience and more in the processing and interpretation of data. At this point, archives, as places where data is kept collectively, turn into the main material for art. This suggests that the memory Anadol's art refers to is data-driven and constructed through the

[168] Oliver Grau, ed., *MediaArtHistories (*MIT Press, 2010): 10.
[169] Grau, *Virtual Art,* 54.

lens of digital technologies, as demonstrated in "Data Tunnel". This reality is redefined from the invisible patterns and connections found in the archives, which are made visible by algorithms. This reflects broader changes in how we understand and engage with the concept of archives, memory, and reality in the digital age.

Reimagining Archives

Catherine Russell notes that "in the digital era, archives have been reconfigured, redesigned, and significantly remade".[170] Anadol not only repurposes NASA's archives and transforms them into visual forms but also redefines them. Algorithms can reveal patterns, connections, or insights in archived materials that might be impossible or incredibly time-consuming for humans to discern. This can lead to new understandings or reinterpretations of existing materials. Thus, the *Machine Memoirs: Space* exhibition represents both the reconfiguration of archival material and a profound transformation of how we perceive and interact with it. "Data Tunnel" and "Machine Memoirs v.2" redefine the very essence of what an archive can be. Anadol's algorithms process the dense layers of data, generating from them a visual form that speaks not only of the past but also of the possible. AI allows for the reimagining of space data, which, although based on factual scientific observations, can now be perceived in a more expansive, experiential manner. This reimagining is not just about presenting data in a new aesthetic form; it is an act of transformation that imbues these materials with new meaning and relevance. Thus, the installations suggest that archives are not simply repositories of inert data but are vibrant, interactive spaces where history, memory, and future possibilities converge.

[170] Russell, *Archiveology,* 20.

Previously, archives only served as a tactile testament to history, preserving moments and memories in tangible forms.[171] These physical repositories were important for retaining a record of the past and were navigable through visible and material means. Nowadays, archives are not just stored in physical locations like libraries and museums.[172] Through computers and other digital technologies, they have become accessible.[173] They are governed by algorithms and computational processes and hold both the promise of comprehensive memory and overwhelming vastness. Hyperconnections extend the content within the archives themselves; certain images, narratives, or histories might become hidden or overlooked amidst the abundance. Daniel Rubinstein and Andy Fisher's observation of the digital-born image as a "hinge" between the physical and digital captures this duality: while we have an unprecedented capacity for storage and representation, we also grapple with the invisibilities introduced by scale and algorithmic complexity.[174]

NASA's archives highlight the collaborative nature of creation in the digital age. Not only because they are open to the public, but archives in nature are a result of collective contribution. Russell states that "…the archive is a living, breathing entity as "documents" are continually added and, more importantly, continually "rediscovered".[175] Thus, archives describe multiple layers of meaning and preserve multiple moments in time which evoke imagination and apophenic vision. In this context, Anadol's installations do not only reflect existing knowledge but actively contribute to the cultural discourse, extending archives into active agents of cultural memory. Additionally, NASA's archives serve as both records of reality and inspire imaginative responses.

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[171] Ibid., 1.
[172] David M. Berry, "The Post-Archival Constellation: The Archive Under the Technical Conditions of Computational Media," in *Memory in Motion* (2017): 103.
[173] Ibid.
[174] Daniel Rubinstein, Johnny Golding, and Andy Fisher, *On the Verge of Photography: Imaging Beyond Representation,* 2013: 8.
[175] Russell*, Archiveology,* 59.

AI, according to Elaine Rich, "is the study of how to make computers do things at which, at the moment, people are better".[176] While Rich's definition emphasizes AI's ability to mimic human abilities, it also underscores advancements in artificial intelligence technologies. These advancements establish new techniques that transcend human capabilities, increasingly influencing visual art and optimizing the utilization of archives. "Data Tunnel" offers viewers a unique glimpse into the "mind" of the machine, revealing new insights and perspectives about outer space exploration and NASA's previously inaccessible archives. Integrating scientific data into his art, Anadol expands its meaning beyond its original scientific purpose. Anadol takes archives based on scientific data, which are often viewed primarily for their informational content, and places them within an aesthetic context. By doing so, he elevates their visual qualities and draws attention to their inherent beauty, often overlooked in scientific analysis. Therefore, by repurposing scientific data as art, Anadol changes the context in which they are experienced. This recontextualization invites viewers to consider these images from new perspectives, finding meaning and narratives that go beyond their scientific origins.

In a scientific setting, images may be seen as objective data points. Anadol's art, however, encourages subjective engagement through apophenic vision, bringing personal interpretations and emotional responses that deepen the images' significance. Anadol's work creates a conversation between art and science, suggesting that the two fields are not separate but interconnected, as Heinz von Foerster argues.[177] Anadol shows that scientific images can inform artistic expression and vice versa, leading to a richer understanding of both. According to Grau, "since the seventeenth century, the view onto reality has been gradually liberated through developments in science".[178] The

[176] Ertel, *Introduction to Artificial Intelligence*, 2.
[177] Hans Ulrich Obrist, "Making the Invisible Visible: Art Meets AI," *Goethe Institut*, accessed December 2022, https://www.goethe.de/prj/k40/en/kun/ooo.html.
[178] Grau, *Virtual Art*, 54.

computational techniques Anadol employs are direct outcomes of advancements in various scientific fields, including computer science, data science, and neuroscience. Thus, his synthesis blurs the lines between science and art in the digital age.

van Alphen argues that "the reason for the current relevance of an exploration of "archival thinking" is a generally cultural one. Whereas the role of narrative is declining, the role of archive, in a variety of forms, is increasing".[179] He argues that as traditional narratives—often grounded in myth and religion—diminish in prominence, there is a growing cultural reliance on archives as repositories of history and knowledge.[180] This shift represents a move from linear, story-driven understandings of the past to more database-like, dynamic and fluid ones. Art has adapted to changing technological developments and trends, representing invisible elements.[181] Anadol's *Machine Memoirs: Space* exhibition demonstrates this transformation, as AI-generated art reflects the immediate cultural repercussions of reimagining vision and constructing memory in the post-operative sphere.

In traditional narratives, stories are selected and shaped to convey particular messages. In contrast, Anadol's "Data Tunnel" does not present a singular, linear narrative. Instead, it offers a non-linear, multifaceted experience that reflects the modern cultural preference for archives. The digital age has reshaped access to information. With the internet, we have become accustomed to engaging with data non-linearly. Hyperlinks, search results, and interactive media all encourage a non-sequential exploration of content, much like browsing through an archive.[182]

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[179] van Alphen, Staging the Archive, 7.
[180] Ibid., 8.
[181] Klee*, Creative Confession.*
[182] Han Woo Park and Mike Thelwall, "Hyperlink Analyses of the World Wide Web: A Review," *Journal of Computer-Mediated Communication* 8, no. 4 (2003): JCMC843, https://academic.oup.com/jcmc/article/8/4/JCMC843/4584289.

Archives, as a means of historical documentation, allow interpretation of the past and reconstruction of memory and have provided artists and filmmakers with a wealth of content—ranging from documentary footage to historical images.[183] They have used these materials to evoke collective memory and contextualize narratives within broader social and historical frameworks.[184] The role of archives in art and cinema has been historically significant, serving as repositories of culture and memory. They have always possessed an aesthetic value, especially in the context of cinema. The use of archival footage or imagery often evokes a specific ambiance, emotion, or historical context. Their grainy textures, colours, or even imperfections become elements of a particular aesthetic that filmmakers often exploit for emotional or narrative impact. Russell suggests that in cinema, archives are not just sources of origin or historical evidence, but they hold their own meanings and secrets beyond their apparent use.[185] Anadol expands upon the conventional use of archives and he reimagines them, creating new meanings and experiences that go beyond their traditional role as mere historical documents. This fusion of cinematic and digital perspectives in Anadol's artwork offers a deeper, more complex understanding of archives in contemporary art. Anadol's "Data Tunnel" can be viewed as a contemporary interpretation of cinematic montage. While classic montage juxtaposes sequential images to generate meaning or evoke emotion, Anadol's AI-driven montage transcends linear time. It collates vast datasets from NASA's archives to create a multidimensional experience in "Machine Memoirs v.2" where historical sequences are not merely placed side by side but are algorithmically woven into an intricate tapestry of time and space. His methods transcend the conventional linearity of time, as historical imagery is not merely sequenced but dynamically integrated, and continually evolves

[183] Okwui Enwezor, "Archive Fever: Photography Between History and the Monument," *Archive Fever: Uses of the Document in Contemporary Art* 1 (2008): 22.
[184] Ibid.
[185] Russell, *Archiveology*, 13.

through AI's real-time processing. Consequently, each interaction with "Machine Memoirs v.2" becomes a unique experience, as the AI's interaction with the archival data presents a unique visual and emotional journey for every viewer, making every "screening" in the installation a unique exploration of time, memory, and space. The digital era, as described by Ernst (2013), has seen a shift in how archives are used and perceived, with AI transforming them into dynamic datasets. Materials can be continually reorganized, reinterpreted, and represented based on new information or insights given to algorithms.

The archival approach of "Data Tunnel" mirrors the contemporary experience of managing and making sense of large amounts of information, reflecting how people interact with data in their daily lives. Lev Manovich, referencing Jean-François Lyotard's concept of "computerized society," attributes the shift in narrative to the emergence of computerized society, which has led to the replacement of narrative with the database as the dominant symbolic form.[186] While Lyotard spoke about the diminishing of grand narratives in the postmodern era, it is Manovich who more directly ties the rise of the database to the digital revolution and its impact on cultural forms. Where traditional narratives (such as novels and historical writing) present a story with a beginning, middle, and end, "Data Tunnel" creates and represents the world as a collection of data entries that can be sorted and accessed in a myriad of ways. This represents a fundamental shift in how information and cultural products are structured, understood, and engaged.

One could argue that Anadol's AI-generated artworks contribute to the decline of narrative by focusing on visual forms and aesthetics. However, AI does not necessarily replace narrative with visualization or diminish narrative; rather, it optimizes the use of archives to generate diverse narratives. AI enables the exploration of various perspectives and the formation of new narratives,

[186] Manovich, *The Language of New Media*, 194.

particularly those derived from the invisible. Therefore, the narrative emerges not through traditional storytelling but through the interpretation of these visuals.

Although both Lyotard and Manovich distinguish between narrative and database forms, data can embody narrative features, and scientific archives, such as those from NASA, can possess their own narratives. The distinction between narrative and database forms is not absolute, and the relationship between them can be quite complex. Archives can now be blended, morphed, and reshaped, giving birth to visuals that are both familiar (rooted in the authentic) and alien (transformed by AI). By processing and visualizing data from space exploration, the exhibition interprets the story of the universe as documented by NASA. Each visualization is a moment of a larger cosmic narrative, encompassing the history of space, the physics of celestial bodies, and the human endeavour to explore beyond Earth. This familiarity extends to another form as AI keeps processing it until it becomes an apophenic vision. This abstraction challenges our perceptions and encourages viewers to engage with the material more interpretatively, rather than just accepting it as a representation of reality.

Modern audiences often want to be active participants in the creation of meaning rather than passive recipients of a pre-formed narrative. The utilization of archives in Anadol's art invites this kind of engagement, with users exploring and creating connections between disparate pieces of information. As visitors walk through "Data Tunnel" and "Machine Memoirs v.2," they are immersed in a dynamic environment where the archive is not just a thing of the past but a living entity that evolves and morphs in real-time. The abstract forms and patterns invite individuals to interpret and find their own meanings, essentially becoming co-creators of the narrative.

Conclusion

AI + Cinema: Emergence of AI Cinema

> "Abstraction allows man to see with his mind what he cannot see physically with his eyes... It is an exploration into unknown areas."
>
> Arshile Gorky

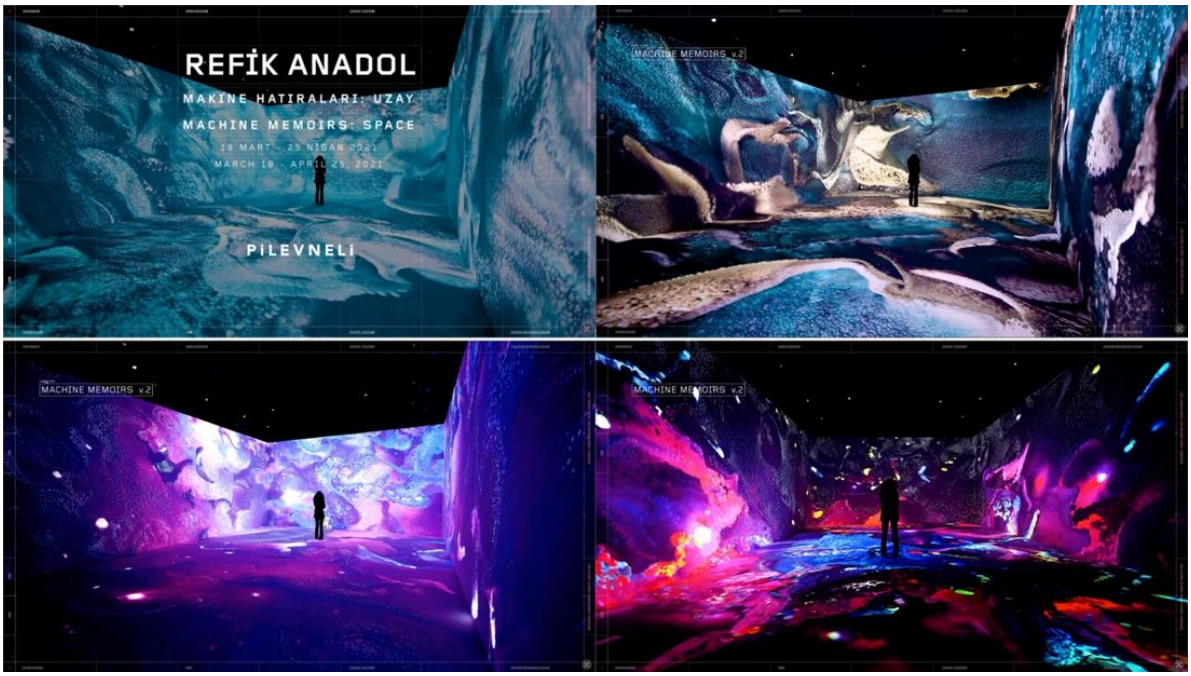

Figure 15. Examples from "Machine Memoirs v.2," part of Refik Anadol's *Machine Memoirs: Space* exhibition. Captured from the project's trailer. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

The emergence of Artificial Intelligence (AI) in the arts has initiated a transformative journey, pushing beyond established norms and elevating our understanding of storytelling and aesthetics to new heights. Christiane Paul captures this transformation as a complex dynamic that

can be challenging to comprehensively define and understand.[187] Refik Anadol's "Machine Memoirs v.2", a part of the *Machine Memoirs: Space* exhibition, vividly embodies this evolution in the art world. This space-themed artificial intelligence speculation not only illustrates the complexity of AI's integration into art but also serves as a testament to AI's capability to reimagine cinematic aesthetics and storytelling and pave the way for his conceptualization of "AI cinema".[188]

The artwork converts NASA's archive into an 18-minute audio-visual performance within an 18-channel immersive environment. Multi-surface projections turned the space into a dynamic canvas, embodying a dynamic interplay between the archival content and the visual design of the environment (shown in figure 15). This visual experience is augmented by an eight-channel audio system that creates an encompassing sound environment and immerses visitors in a cohesive integration of visual and auditory stimuli. This new form of visual expression does more than showcase innovative technologies, such as data visualization techniques, machine learning, and AI algorithms. It signifies a radical departure from traditional forms of cinema by creating perceptions and experiences that extend reality.[189] Jean-Jacques Lebel states that the essence of art lies in its ability to create something entirely new.[190] However, it should not just represent or reflect the existing reality, instead, it should create its own reality.[191]

"Machine Memoirs v.2" does not simply replicate or represent the world as it is, but creates new, uncharted territories that extend and alter the reality we know. The images are not direct representations of reality but are instead unique, AI-constructed interpretations. Computational processes result in the creation of new, unfamiliar visual territories. By doing so, the artwork

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[187] Paul, *Digital Art,* 164.
[188] Anadol, "Machine Memoirs: Space."
[189] Extended reality experiences refer to the fusion of physical and digital environments, enabling interactions with a blend of real-world and computer-generated elements. This includes Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) experiences (Demetriou 2018, p. 183).
[190] Jean-Jacques Lebel, "On the Necessity of Violation," *The Drama Review* 13, no. 1 (1968): 89-105.
[191] Ibid.

extends beyond conventional reality, offering viewers an alternative, AI-altered perspective of the world. It depicts the ever-changing abstract patterns and geometrical compositions, which are projected on the walls and floor, thereby creating an immersive environment (figure 15). Anadol's work, guided by algorithmic processes, apophenic vision and the invisible patterns unveiled by AI, underscores his distinctive contribution to the evolution of cinema by constructing a new aesthetic paradigm. According to the artist, "machine-based visual speculations" that can see beyond what's already visible, generate "an alternate data universe of abstract forms where reams of visual information produce open-ended aesthetic possibilities," which we can discuss as a "machinic extension of abstract expressionism".[192]

According to Anadol, data serves as the foundation for machine memory. The AI's processing of this data initiates what Anadol metaphorically describes as "dreaming" or "hallucination".[193] While I agree with the use of "hallucination," I propose that the term "apophenic vision" more precisely captures the AI's creation of previously invisible or non-existent patterns and connections within the data. This processing of data results in new insights, forming a "new" memory of space. These memories are unique configurations of data that the AI brings forth, not merely reproductions of the existing telescope data but unique outcomes of the AI's processing. By transforming the data into new aesthetic objects and creating a new understanding of realism in cinema, Anadol gives rise to diverse forms of cinema, one of which he designates as "AI Cinema".[194] He reinterprets and reconstructs archives through the lens of machine intelligence and creates an entirely new visual language and narrative structure, distinct from traditional cinema. Thus, in AI cinema, the storytelling is driven by data and algorithms' interpretation rather than an

[192] Anadol, "Machine Memoirs: Space."; Paul, *Digital Art*, 78.
[193] Anadol, "Machine Memoirs: Space."
[194] Anadol, "Machine Memoirs: Space."

anthropocentric view. This new form of cinema is shaped by the unique interactions between the artist, AI algorithms, and the data they process.

In the "Data Tunnel" segment of the *Machine Memoirs: Space* exhibition, Anadol reveals raw data from NASA's archives and demonstrates how AI sees and transforms the archives through the concept of invisibility and apophenic vision. This chapter shifts its focus to "Machine Memoirs: v.2," another segment from the same exhibition. Here, visitors transition from observing the transformation of data and archives in the "Data Tunnel" to experiencing one of the final masterpieces of the exhibition. This chapter explores the AI cinema's distinct characteristics and its significance within cinema while considering its broader socio-cultural implications. It focuses on the intricate interplay between technology and cinema and the transformative influence of in/visibility and archives on this new aesthetic form. This chapter is structured as follows: Initially, it will explore the nature of AI cinema, discussing its distinctive characteristics and how it distinguishes itself from traditional cinema. Subsequently, I will investigate how this innovative approach contributes to broader discourses about the representation of reality in cinema, considering the unique ways in which AI "sees," modifies "memory," and reinterprets NASA's archival data.

Reimagining Cinema

Digital and computational technologies enable the creation of images with colours, and forms that may not have been possible with traditional film. Gene Youngblood states that "the essence of cinema is precisely "dynamic movement of form and colour," and their relation to sound".[195] AI cinema evokes a multi-sensory experience, particularly through the use of colour,

[195] Youngblood, *Expanded Cinema,* 157.

form, and movement to suggest ideas and sensations beyond our understanding of cinematic form and aesthetics. He describes cinema as "the art of organizing a stream of audiovisual events in time".[196] Anadol's work is firmly rooted in contemporary digital and AI technologies, which mark a significant departure from the analog techniques and bring vastness and digital nature through "otherworldly" audiovisual experience, which Youngblood refers to as "superempirical".[197]

Figure 16. "Machine Memoirs v.2," an immersive AI cinema installation, part of Refik Anadol's *Machine Memoirs: Space* exhibition. Accessed September 2022. https://refikanadol.com/works/machine-memoirs-space/.

Data is the contemporary equivalent of art material, and it finds itself a place in the visual culture which has been shaped by "pigments, dyes, oils, acrylics, silver nitrate and gelatin… cathode ray tubes and liquid crystal displays emitted light at frequencies our eyes perceive as colour

[196] Gene Youngblood, "Cinema and the Code," *Leonardo*, Supplemental Issue (1989): 27.
[197] Youngblood, *Expanded Cinema,* 158.

and densities we perceive as shape".[198] William J.T. Mitchell states, "computational tools for transforming, combining, altering, and analyzing images are as essential to the digital artist as brushes and pigments to a painter".[199] Considering that digital images are not confined to any specific physical medium, they can be displayed in various formats and types.[200] The conceptualization of in/visibility in AI art and exploration of archives beyond their visible forms open up the possibilities of AI cinema.

"Machine Memoirs v.2" is a testament to the evolution of the AI cinema. Building on the analysis from the first chapter, "Machine Memoirs v.2" is grounded in millions of real-world data and the in/visible connections between those datasets. Figure 16 illustrates a cavernous space illuminated by points of light that may represent millions of data points. The splashes of pink, orange, and purple against the monochrome background add depth and could indicate complex interconnections within the data that surpass human understanding. The immediate sense of depth and texture underscores the sophisticated data visualization at play. Additionally, the fluidity of the image suggests continuous expression. In the realm of AI cinema, the medium transcends physical reality, delving into the abstract domains of data and patterns, thereby forging new paths for creative expression and storytelling.

Today, celluloid's tangible grains are transformed into malleable data; digital cameras give way to AI-driven imaging technologies, marking a move from camera to computer, from manual editing to software-centric filmmaking. There is not just one way to visualize any set of data.[201] There are multiple visual representations that can be created, each potentially offering a different perspective or insight. "Machine Memoirs v.2" expands on Paul's argument as it offers continuous

[198] Paglen, "Invisible Images," 2.
[199] Manovich, "What is Digital Cinema?" 30.
[200] Grau, *Virtual Art*, 250.
[201] Paul, *Digital Art*, 290.

and ever-evolving visuals.[202] This underscores the versatility and creativity in data visualization, where choices in design and presentation can lead to varied experiences and understandings of the same data. “Machine Memoirs v.2” is characterized by a sense of unpredictability and randomness because the visuals never repeat.[203] It challenges the audience to find their own narrative threads within a tapestry woven by algorithms, suggesting a future where stories are not told but discovered.

Additionally, it challenges the conventions of fixed temporal progression in cinema. The shift from traditional cinema to post-cinema is also characterized by time and space structure.[204] Instead of following a linear, logical progression of time, post-cinema presents time and space in non-linear, non-sequential, or in other words, unconventional ways.[205] AI cinema, as demonstrated by Anadol’s work, is an exploration of non-linear, generative storytelling. In traditional cinema, the audience often gauges time by narrative progression such as climax. In a non-linear context, a climax might not be a single, well-defined moment. Instead, there could be multiple climactic moments scattered throughout the narrative, or the climax might be more diffuse, spread across different narrative threads. The concept of climax becomes more about a peak in thematic, emotional, or conceptual intensity rather than a definitive plot point. However, in AI-generated art, visualization continues endlessly, illustrating both the vastness of data and the machine vision. The absence of traditional markers leads to a more fluid and open-ended perception of time. Youngblood points out that the medium has a unique capacity to manipulate time and space.[206]

[202] Showcase, “Refik Anadol's Machine Memoirs: Space,” 01:49.
[203] Ibid.
[204] Denson, *Discorrelated Images*, 9.
[205] Ibid.
[206] Youngblood, *Expanded Cinema*, 324.

Anadol manipulates time and space to expand the human experience. The question becomes less about "how long is the film?" and more about "how long do you want to experience it?"

In AI-generated art, the underlying data and the AI's processing methods are often not immediately apparent to the viewer unless the artist explicitly provides this context. However, Anadol addresses this in his exhibitions by incorporating elements that illuminate both the data and the AI processes involved in his art. For instance, in his "Data Tunnel" installation, Anadol explicitly showcases the raw data alongside its AI-transformed state, offering a direct visual comparison. Additionally, he provides information screens adjacent to each piece of artwork (figure 17).

Figure 17. Information screens at the entrance of "Machine Memoirs v.2," part of Refik Anadol's *Machine Memoirs: Space* exhibition. Accessed June 2022. https://www.youtube.com/watch?v=5JSBv3iJ-bU

These screens offer detailed insights into the specific data sets and AI methodologies employed, enhancing the viewer's understanding of how each piece was conceived and executed. However, as Oliver Grau points out, while this approach can sometimes limit subjective perception, machine

vision opens new possibilities.[207] His art provides an abstract visual language and reveals apophenic connections within the archives of data. Being transparent offers visitors a glimpse into a world of hyperconnections that are otherwise inaccessible. Through openness, the artists invite viewers to engage in a deeper, more informed interaction with the artwork. Anadol's transparency not only demystifies the AI process but also encourages viewers to explore and contemplate the complex interplay between technology, data, and artistic expression. This approach fosters a dialogue between the viewer and the artwork, where the viewer is not just a passive observer but an active participant in deciphering and interpreting the intricate patterns and meanings created by AI.

Regardless of cultural, geographical, or linguistic differences, the universe is a shared wonder. The stars, planets, and galaxies that Anadol's art represents are not tied to any one nation or culture; they are a shared heritage of all humanity. In this way, his art serves as a unifying medium, reminding viewers of our shared curiosity about the universe. However, as much as shared, it is also personal that everyone sees different things when they look at it. While Anadol's artworks often incorporate recognizable forms (such as an ocean, volcanic surface, icy landscape), they primarily engage with abstract elements like shapes, colours, and forms in a way that transforms and transcends conventional visual realities. Ernst H. Gombrich suggests that colour has the power to engage not just our sensory perception but also deeper aspects of our minds.[208] While shapes and forms are fundamental to recognizing objects, colour often adds depth, emotion, and meaning to these objects.

In AI cinema, colour becomes a key to understanding patterns and insights that might otherwise remain ambiguous to the viewers. For instance, shades and intensities might correspond

[207] Grau, *Virtual Art.*
[208] oungblood, *Expanded Cinema*, 158.

to different data variables, making the invisible world of data not only visible but also intuitively understandable. Anadol's choice of colours immediately seizes attention—his palette often comprises vibrant, dynamic hues that morph and flow in mesmerizing patterns (figure 15 and 18).

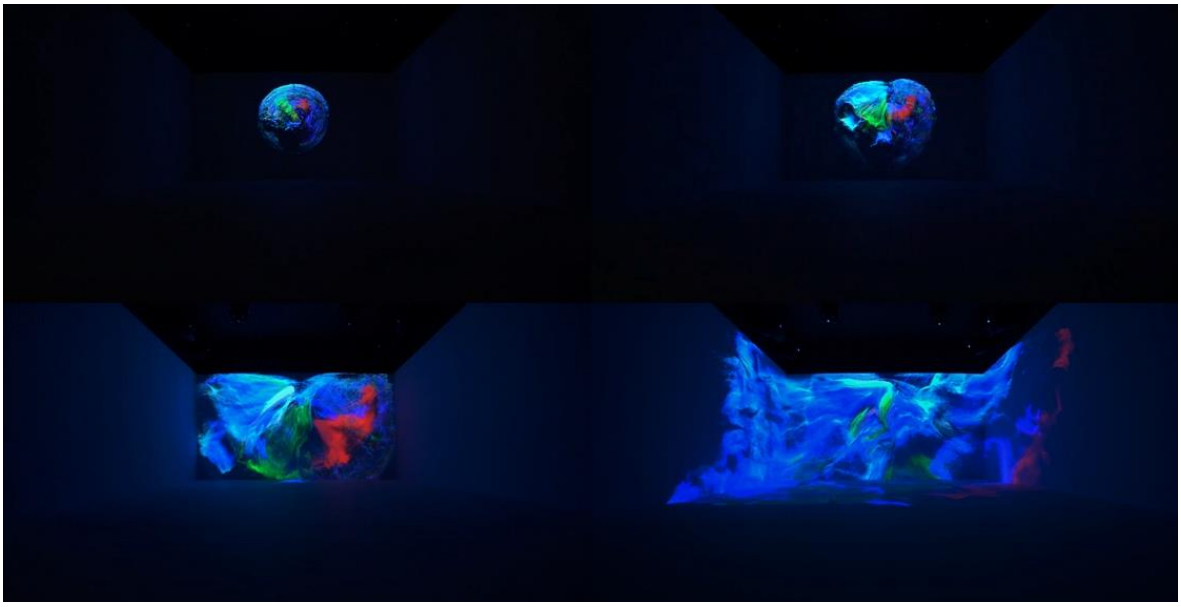

Figure 18. Examples from "Machine Memoirs v.2," part of Refik Anadol's *Machine Memoirs: Space* exhibition. Accessed June 2022. https://www.youtube.com/watch?v=5JSBv3iJ-bU

Anadol draws the viewer into a deeper engagement with the artwork. Moreover, in his art, colour transcends its traditional role as a mere aesthetic element and becomes a narrative device. Subtle changes in hues, the contrast between warm and cool tones, or the transition from muted to saturated colours can evoke a sense of story, emotion, or conceptual movement. For the artists, this journey through changing colours, shapes and forms can stimulate a cognitive process akin to piecing together a narrative, where each colour shift suggests a new chapter, such as ISS, MRO or Hubble's dream (figure 15).

This new form, as exemplified by "Machine Memoirs v.2," effectively situates itself within the "expanded cinema" as envisioned by pioneering thinker Gene Youngblood.[209] Yet, it compels us to question whether the convergence of AI with artistic creation is simply an evolution of the 1970s analog video imagination or a radical departure that redefines the boundaries of the medium. Youngblood posits that "expanded cinema does not mean computer films, video phosphors, atomic light, or spherical projection." He posits that the notion of "expansion" is not confined to the mere integration of new technologies or apparatus. Instead, it fundamentally pertains to the strategic application of these technologies with the objective of expanding or transforming human perception and understanding.[210] Anadol's work appears to encapsulate this philosophy, yet it also prompts us to interrogate the novelty of his methods. "Machine Memoirs v.2" uses AI, algorithms and other innovative technologies not as tools for image-making but as extensions of human cognitive capacities and new vision. Are we witnessing a reinvention of vision and process, or are these novel technologies enacting a long-predicted revolution in how we interact with and interpret our worlds?

Anadol states, "what was once invisible to the human eye become visible, offering the audience a new perspective on, and narrative of their worlds" through machines.[211] This approach hints at a broader potential: a new narrative constructed not by the artist but by the collaboration between the artist's intent and the machine's algorithmic interpretations. In this context, "Machine Memoirs v.2" may not be critiquing the technologies it employs; instead, it celebrates them, positioning Anadol as both an optimist and a pioneer in the field. His work navigates the nuanced interplay between the archival and the generative, suggesting a future where cinema artfully

[209] Youngblood, *Expanded Cinema.*
[210] Ibid., 41.
[211] Refik Anadol, "Biography," *RefikAnadol*, accessed December 13, 2022, https://refikanadol.com/information/.

balances capturing human experiences with creating new ones. By employing AI to both preserve and reimagine these experiences, "Machine Memoirs v.2" not only reflects on our collective past but also constructs a realm where these memories serve as the foundation for new, machine-mediated narratives.

Anadol's artwork surrounds the viewer with its vastness, intricacy, and movement, taking over one's entire perceptual field. Furthermore, the sensation is like being submerged, surrounded by vast depths and intricate details.[212] Kant believed that the feeling of the sublime is not just about what is seen but also about what is felt in the presence of something that cannot be fully seen or understood.[213] "Machine Memoirs v.2" is not just a visual display; it is an environment that entirely envelops visitors, allowing them to experience data multi-dimensionally. As one walks through this cave-like space, the AI-generated visuals change and morph, which indicates the dynamic processes of machine learning algorithms at work. The effect is akin to being inside a data stream, with the walls and the floor acting as interfaces that bring abstract datasets to life. This experience is designed to create thought-provoking art which causes people to question your existence in the vastness of the universe, data, and space. Anadol's work can be seen as a modern reinterpretation of the sublime, where the overwhelming and incomprehensible nature of data and its AI-mediated transformation into visual art evokes sublime-like reactions. However, the contemporary sublime, one shaped by the complexities and capabilities of artificial intelligence and large-scale data, is born from the digital age's complexities, rather than the raw, unmediated power of nature.

[212] Janet H. Murray, *Hamlet on the Holodeck, Updated Edition: The Future of Narrative in Cyberspace* (MIT Press, 2017).
[213] Ginsborg, "Kant's Aesthetics and Teleology," 21.

Redefining Cinema Through Immersion

Siegfried Zielinski describes the immersive experience of early cinema. He compares the audience to the captives in Plato's Allegory of the Cave. This analogy stems from how viewers are seated in a dark room, where they are presented with illusions of movement on a screen, much like the shadows on the wall of Plato's cave.[214] The cinema environment is one where art is enjoyed, emotions are heightened, and reality can be both challenged and augmented through the interplay of light, dark, and sound. Zielinski suggests this experience can lead to a range of reactions, from enjoyment to a sort of hallucination, as they surrender to the narrative and sensory stimuli orchestrated by the film. Lev Manovich extends this idea by referring to movie theatres as "large prisons" that hold the viewers captive by limiting their mobility.[215] Both commentaries underscore the contrast between the dynamic visual experience and the static physical reality of the audience, highlighting a kind of sensory contradiction inherent in traditional cinema.

Anadol's immersive installations serve as a lens through which to explore the evolving landscape of AI cinema. Anadol reimagines the concept of the cinema as not just a passive viewing space but as an interactive environment that responds to and evolves with data inputs. Visitors are actively "submerged" in a reality that's constructed from data and algorithms. Christiane Paul highlights the impact of digital technology on art and how it changes our understanding of what is real. She states that digital tools have evolved the techniques of collage, montage, and compositing, but they have also introduced the ability to create alternative realities.[216] To reinforce this connection, the immersion bridges the gap between the abstract world of data and the tangible human experience, providing a unique perspective on the interplay between humans, technology,

[214] Grau, *Virtual Art*, 151-152.
[215] Manovich, *The Language of New Media,* 108.
[216] Paul, *Digital Art*, 27.

and art in the era of AI cinema. Since John Belton's assertation about digital cinema at the beginning of the 2000s did not transform the nature of the motion-picture experience, technology has gone beyond traditional cinema's flat screen.[217] A common characteristic among artworks Anadol categorized as "AI cinema" is the emphasis on the artwork's surrounding nature; walls around the visitors become part of the projected audio-visual experience. It creates a fully immersive environment that viewers can walk within, as observed in *Renaissance* Dreams (Figure 19).

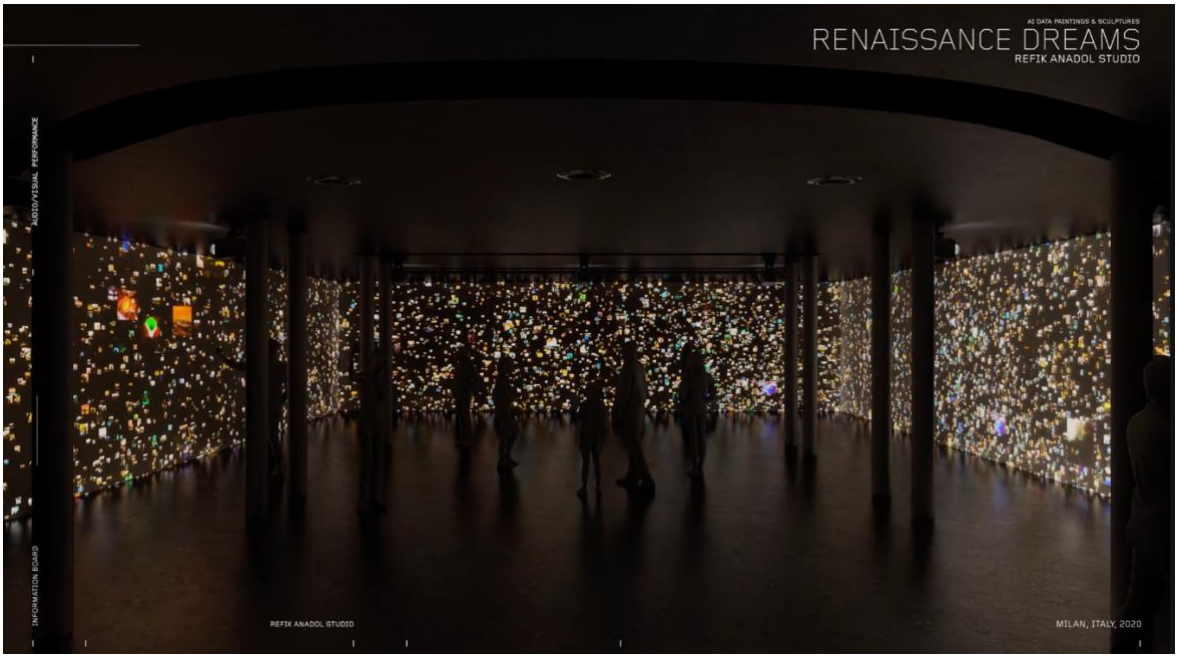

Figure 19. *Renaissance Dreams*, an immersive AI cinema installation of Refik Anadol. Accessed June 2022. https://refikanadol.com/works/renaissance-dreams-ai-cinema/

This utilization of space diverges from traditional cinema, which relies on a single screen, positioning Anadol's work at the crossroads of cinema and immersive art installations. Yet, in subsequent AI cinema works like *Machine Hallucination: NYC* and "Machine Memoirs v.2," the

[217] Belton, "Digital Cinema," 104.

evolution of AI cinema becomes evident with the inclusion of the floor in the immersive experience, suggesting a broader conceptualization of the term.

Figure 20. *Machine Hallucination: NYC*, an immersive AI cinema installation of Refik Anadol. Accessed June 2022. https://refikanadol.com/works/machine-hallucination-nyc/

This practice of immersive installation is pivotal in Anadol's AI art, differentiating it significantly from both traditional and digital forms of cinema. These immersive environments challenge the conventional boundaries of spectatorship, as viewers are not merely in front of the art but enveloped within it. Instead of a passive, frontal engagement, viewers navigate through an interactive realm where their movements and perspectives actively influence their experience of the artwork. The distinction and convergence between cinema and immersive art installations go beyond semantics, reflecting deeper shifts in our engagement with and conceptualization of art in the digital age. In both traditional and experimental cinema, the physical space often plays a secondary role to the visual and auditory experience. In contrast, physical space is a fundamental

component of immersive art installations. However, in Anadol's artwork, the visual and auditory experience becomes an integral part of the physical space. Anadol carefully considers the architecture and dimensions of the installation space, utilizing these elements to shape the viewer's experience. As a result, "Machine Memoirs v.2" integrates cinematic elements with the immersive qualities of art installation, blurring the lines between traditional cinematic experiences and interactive artistic environments.

As digital artworks increasingly blend the boundaries between cinema and art installations, the need to distinguish between them becomes less evident. Anadol's creations exemplify the hybrid nature of contemporary art, challenging conventional boundaries and inviting a broader interpretation of cinematic experiences. Notably, some of Anadol's works, such as *Infinite Space* or *Machine Hallucination: Sphere*, incorporate these immersive features but are not categorized as AI cinema. This situation reflects the fluid nature of digital art and the challenges of categorization in an era of hybrid art forms, underscoring the importance of embracing contemporary art's hybridity and complexity. Encouraging dialogue beyond conventional categorizations fosters a deeper appreciation for the innovative integration of technology and creativity.

Anadol recently introduced *Machine Hallucination: Sphere,* which is an AI-generated art installation, at the Las Vegas Exosphere (Anadol, 2023). This new addition, which complements the *Machine Memoirs: Space* exhibition, is featured on the world's largest LED screen. Anadol pushes the boundaries of digital art, offering an unprecedented scale of immersive experience. Both installations are part of Anadol's ongoing project "Machine Hallucination" series (Anadol, 2023). His projections envelop the viewer in the artwork, allowing them to feel as though they are "inside" the piece. The ability to move around and engage with the art from different perspectives allows viewers to become active participants in the experience, rather than passive observers. This not only amplifies the visual impact but also redefines the very act of viewing, making each

interaction unique and deeply personal. In this context, Anadol's work represents a significant evolution in the concept of cinema and digital art, where the spatial and experiential aspects of viewing are as vital as the visual content itself.

While Anadol's immersive installations offer a captivating exploration of the potential of digital art, it is also crucial to consider the challenges that arise, such as technical malfunctions. This offers an opportunity to reassess the complexities of projection dynamics and the relationships between viewers and artworks. Shane Denson mentions that certain visual elements, such as digital glitches or lens flares in digital media, can signify a disjunction or disconnection between the medium and the human sensory experience.[218] Imagine you are in a movie theatre, and one of the screens is damaged and pitch black inside the multiple-coloured installation. It can remind the viewer of the artificiality of the digital medium, its distinctness from natural human perception, and the complex interplay between technology and sensory experience.[219] A malfunctioning screen in a digital art installation can alter the intended visual experience in different ways, but it does not have to be negative. The disruption caused by non-working screens can shift the viewer's focus, leading to an unexpected aesthetic or different interpretation or emotional response.

Anadol's work clearly shows how digital projection can transform an audience's experience by creating an active, engaging environment that challenges the viewer's perception of space and reality. In Anadol's "Machine Memoirs v.2," the form and experience of cinema take on a new dimension. This transformation creates a unique intersection between the immersive artwork and the viewer's perception, subsequently reshaping both the aesthetics and narratives of the cinematic experience. As theorist Marie-Laure Ryan asserts, immersion "is a technologically induced

[218] Denson, *Discorrelated Images*, 3.
[219] Ibid.

phenomenon, the experience of being surrounded by data"[220], an idea she primarily connects to virtual reality (VR). By suggesting that immersion is an experience of "being surrounded by data," she offers a concept of immersion that aligns well with the experience provided by Anadol's AI cinema. The viewer is "being surrounded by data" in the sense that they are fully immersed in a space where every visual aspect is a representation or interpretation of data by AI (Anadol, 2022). While Anadol's AI cinema provides an immersive experience that has some similarities to VR in the sense of enveloping the audience in an alternate environment, it is not VR in the conventional definition of the term. Anadol's AI cinema is an expansion and recontextualization of this concept.

In Anadol's work, the concept of an "active, engaging environment" transcends the general interactivity found in digital realms like Web 2.0, gaming, or VR/AR. In "Machine Memoirs v.2," the use of XR, extended reality equipment, is set aside in favour of creating an environment that instigates mental shifts, fostering the sensation of stepping into an alternate abstract reality.[221] This part of the exhibition challenges traditional cinema's reliance on the darkened room and the screen's frame. Rather than driving the viewers into a defined space, the AI-generated moving images subtly insinuate themselves into the viewer's perception, evoking a feeling of immersion in suggestive, ever-changing image spaces. AI expands and reimagines what cinema and cinematic experience are and creates a new aesthetic paradigm for cinema by expanding consciousness. John Belton emphasizes, "the cinema is a site where aesthetic machinery provides its subjects/spectators with an aesthetic experience".[222] The immersive experience that "Machine Memoirs v.2" creates encourages viewers to contemplate the relationship between their own memories and the infinite

[220] Marie-Laure Ryan, *Narrative as Virtual Reality 2: Revisiting Immersion and Interactivity in Literature and Electronic Media* (Baltimore: Johns Hopkins University Press, 2015): 61, doi:10.1353/book.72246.
[221] Bimfili, "Sanatın Dönüşümü," 11:17.
[222] John Belton, "If Film Is Dead, What Is Cinema?" Screen 55, no. 4 (2014): 468.

possibilities of the universe. Using apophenia like Hito Steyerl, one might find their way through the vastness of the universe.[223]

One of the challenges of immersive space is distraction, beyond that caused by the overwhelming scale and sensory input. As Manovich argues, this particular challenge affects social interaction.[224] Mavonich and Zielinski criticize the seats in movie theatres because of their restriction on the mobility of the audience. However, when seats are removed from the room, distraction occurs from the disorder. Any element that comes between the art and the viewer, in this case, other people, affects subjective experience. Many visitors have talked about how crowding negatively affected their experience, particularly in "Machine Memoirs v.2". When dark movie theatre becomes a space of light and immersion and allows people to walk around to experience, it can start affecting others' experience and perception, thus preventing detachment from the outside world, or getting inside the art.

This challenge of distraction in immersive spaces leads us to consider Denson's insights on the evolving relationship between viewers and artworks in the digital age. Denson argues that in the context of post-cinematic media, both the perception of individuals and the objects being perceived are significantly altered due to operational and computational processing. The traditional relationship between a human subject and a photographically fixed object is breaking down, and new relationships are being formed in the micro-temporal intervals of algorithmic processing.[225] Denson's observation implies that the emergence of artificial intelligence and algorithm-driven creativity redefines how we engage with and comprehend artistic works. Instead of the familiar interaction between a viewer and a traditional, static piece of art, we are now experiencing a

[223] Steyerl, *Duty Free Art*, 32.
[224] 1. Lev Manovich, "The Poetics of Augmented Space," in *Mediatecture* (Vienna: Springer, 2010): 304-318.
[225] Denson, *Discorrelated Images*, 1.

dynamic exchange in which the artwork itself is influenced by and interacts with algorithmic processes. This evolving relationship challenges our preconceived notions of artistic production, perception, and interpretation as we grapple with the implications of this new media landscape.

Anadol achieves this cinematic experience through the combination of architectural space, data visualization, and the transformative properties of light and sound. He mentions that the relationship between light and space has always been the focus of art, but data was absent.[226] Anadol exploits the properties of light to bring his data visualizations to life. According to the artist, "Light is the best material in the world, that can project imagination into a built environment… It can travel infinitely if there is no barrier".[227] In traditional cinema, light is a crucial component of capturing and projecting images. The captured light forms an image on the film (or sensor in digital cameras), which is then projected using light in a cinema hall. It simply brings pre-captured images to the audience, and the visuals themselves are not fundamentally altered during the projection process. On the other hand, light, in Anadol's view, is a material of infinite possibilities that can manifest imagination and challenge the limits of space and perception. He treats light as a dynamic, malleable material, rather than static and monolithic. In "Machine Memoirs v.2", light is not just a medium for projection; instead, its intensity, colour, direction, and even how it interacts with the environment become an integral part of the artwork itself.

Light is manipulated, transformed, and even algorithmically controlled to add another layer of complexity and dimension to his installation. Anadol uses it to craft intricate, dynamic visual patterns and shapes, generate depth, texture, and motion that ebb and flow in harmony with the AI algorithms, and transform the architectural space in "Machine Memoirs v.2". Light intensities and colours are continually shifting to evoke movement and depth, creating a feeling of being

[226] Fitzpatrick, "Studio Visit: Artist Refik Anadol."
[227] Ibid.

enveloped by the artwork. This creative use of light allows the artwork to transcend the physical limitations of the space, fostering a sense of stepping into an immersive space.

Final Reflections: Reimagining Archives and Cinema in the Age of AI

With the advent of AI, art evolves beyond mere technological progression, creating a nexus where traditional and emergent forms intermingle and evolve. AI cinema, thus, is defined not just by technological prowess but by the new aesthetic experiences it fosters and the challenges it poses to our understanding of "seeing." Furthermore, AI's impact extends beyond the canvas and screen, reshaping our perception of in/visibility in a future increasingly defined by human-machine collaboration. AI cinema, through data reimagining and the concept of machine hallucination, and apophenic vision broadens our understanding of AI-generated art.

AI transforms scientific data into unique visual experiences, challenging traditional art, science, and technology boundaries. Its efficiency in exploring vast archives unleashes new artistic potentials, making invisible patterns visible through generating hyperconnections between data points and opening doors to new forms of vision. In this context, examining Anadol's artworks, "Data Tunnel" and "Machine Memoirs v.2," illuminates how AI challenges existing film theory and aesthetics. This research directly responds to our initial inquiry into the emergence of AI cinema as a distinct form, demonstrating how AI, as evidenced in Anadol's art, redefines vision and the concepts of in/visibility and archival use, thereby marking the inception of a distinct AI-driven cinematic form.

Anadol's works raise pertinent questions about AI's role in redefining vision, the impact of AI-generated art on archival experiences, and the emergence of new forms through in/visible connections. It is important to acknowledge that the categories of in/visibility might overlap and intersect, as the concept is complex and multifaceted. AI reveals high-dimensional patterns within

data that are not visible, influencing our perception of reality. Anadol's works demonstrate this, engaging with unseen aspects of reality and revealing hidden structures within data-driven worlds. Data Tunnel, in particular, shows how in/visibility operates at various levels, encompassing us. Classifications of in/visibility serve as a starting point for further exploration and analysis of the ways of seeing in Anadol's art, enabling a more comprehensive understanding of invisibility in different artistic and technological contexts. In this sense, Anadol's artwork stays in the fine line between AI-driven in/visibility and the other categories of in/visibility, including socio-cultural aspects.

In/visibility is also productive. AI-driven in/visibility is about generating new forms and experiences from in/visible patterns and connections. Anadol's work explores the intricate relationship between invisibility and information, showing that archives are more than repositories. They emerge as a dynamic area where algorithms actively mould and redefine our perception and interpretation of stored information. The concepts of hallucination, though used differently in AI research,[228] and apophenic vision in Anadol's work are rooted in reality and reflect on connections within information. Thus, Anadol's vision of cinema is of a fragmented and constantly shifting reality, where different forms of invisibility transform cinematic aesthetics and experiences over time.

To further advance the field of AI art and cinema, future research should focus on several key areas. One of the primary areas is the enhancement of artistic accessibility and audience engagement through AI, which is reshaping public interaction with art. This necessitates a focused examination of AI cinema's impact on audience perception and cultural narratives, especially considering how these innovative forms profoundly and innovatively shape storytelling and

[228] Hallucination in AI research refers to false or misleading responses or reflections generated by AI (Hayes 2022).

audience engagement. Additionally, the field calls for an exploration into the technical advancements in AI, aiming to revolutionize cinematic production and storytelling techniques. This involves transitioning AI from being an expert-only tool to a medium that is widely accessible and user-friendly.

Furthermore, it is crucial to delve into the ethical and philosophical implications of AI in cinema, with a specific focus on authorship and authenticity. While these discussions have begun in the broader context of visual art, particularly focused on new media art, they have yet to be extensively explored in the relatively new field of AI cinema. This gap presents an opportunity to investigate not only the potential challenges but also the positive contributions AI can bring to the cinematic landscape. There is a need to balance the narrative around AI in visual art, which has predominantly negative connotations. A balanced approach could illuminate how AI might enrich cinematic expression, enhance narrative complexity, and offer new perspectives in film-making while considering its ethical and philosophical implications.

In conclusion, the convergence of technology and creativity heralds a new era where machines are not just tools but collaborators. Antonio Somaini suggests that the emergence of AI-generated images should not be interpreted as a dramatic shift from human to machine agency in the realm of visual production. Instead, it represents yet another phase in the evolving relationship between humans and technology, as they collaborate to generate, process, and transfer images.[229] Anadol's art does not just represent a shift in cinematic techniques; it signifies a broader transformation in the way we perceive and interact with cinematic storytelling, suggesting a future where AI's role in cinema is both foundational and revolutionary. This understanding deepens our

[229] Close-Ups, "The Meaning of 'Vision' and 'Image.'"

appreciation of AI cinema's potential and offers valuable insights into the future possibilities of this art form, where cinema will likely become more immersive, interactive, and personalized.

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