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# AI and the Future of Entertainment Technology

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## ABSTRACT

Dive into the future of entertainment where artificial intelligence (AI) elevates viewers from passive audiences to active creators and directors of their own media experiences. This article explores the transformative impact of Generative Artificial Intelligence Applications (GAIAs) across various media, including text, images, audio, and video. Envision creating personalized video games, movies, and narratives with mere spoken commands, tailoring the content to your individual preferences for an unprecedented level of customization. While showcasing AI's potential to blur the lines between consumer and creator, we also discuss the significant challenges and ethical considerations that accompany these technologies. Engage with this critical analysis of how generative AI is redefining our interaction with media, signaling a new era in entertainment technology, but also prompting a need for careful consideration of privacy, security, and the impact on traditional creative roles.

## Introduction

In the rapidly evolving landscape of entertainment technology, the advent of Generative Artificial Intelligence (GenAI) signifies a pivotal shift in how media is consumed and produced. This article explores the transformative potential of GenAI across various media forms—text, including programming code<sup>1</sup>, images and 3D models<sup>2,3</sup>, audio including speech, music, and sound effects<sup>4</sup>, as well as video<sup>5</sup>. Just as streaming platforms like YouTube revolutionized media distribution by democratizing channel access, allowing users to both create and select content at will, we introduce the concept of Generative Artificial Intelligence Applications (GAIAs) which are set to democratize content itself. These technologies empower users to customize every facet of their media experience—be it theme, format, actors, style, or narrative—thus offering an unprecedented level of control and personalization. This shift not only alters the consumption of entertainment but also redefines the creative process, making it more inclusive and user-centric. Through the capabilities of GAIAs, consumers will transition from passive recipients to active directors, curating their entertainment landscapes in ways that were previously unimaginable. This democratization of content creation promises to reshape the entertainment industry, heralding a new era of interactive and tailor-made media experiences.

This article argues that GenAI is not merely enhancing existing digital media platforms but fundamentally transforming them, creating a new paradigm where consumers wield directorial control over personalized media. We will examine how current and prospective GAIAs are redefining engagement by facilitating a shift from passive consumption to active creation, assess the technological advances driving this change, and discuss the broader implications, including ethical considerations and potential challenges.

For example, consider the following, imaginary, situation:

You come home after an exhausting day at work where your boss made your life miserable for some reason. You get into your entertainment room (usually called the living room) put on your Virtual reality (VR) headset and say "Please create a first person shooter akin to *Duke Nukem 3D* where the main villain and all mobs are my boss. Please equip me with rocket launchers and the ability to fly." After a few seconds you hear the words "Game generation complete, initiating demo sequence." The game demo starts up, you find yourself in a post-apocalyptic pixel art world where a lot of zombie-like creatures looking like your boss are trying to attack you while you are shooting them with rocket launchers. You say "Please change the rocket launcher to my hand throwing foul eggs!" A few seconds later the next demo sequence is initiated and instead of shooting with a rocket launcher you see your virtual hand blasting foul eggs into the faces of the zombie boss characters.

On the couch in the corner sits your wife in her favorite dressing gown holding her eBook reader immersed into it. She says "I want to read an interactive fiction fantasy novel with me as the main character. Please make me a barbarian princess on her quest to overthrow the evil orc king which stole my land and imprisoned my parents." Immediately, the screen of the eBook reader starts to fill up with an introduction to a fantasy novel based on the initial prompt and asks your wife to input what she wants to do in this fictional setting, providing various possibilities.

Next to the living room, in his room your teenage son is laying on his bed, holding his tablet and says "I want to watch a cartoon in which *Spiderman* fights against *Goku*, but they become friends and then engage into combat against the *Predator* who hunts them." A few seconds later a cartoon starts playing on the tablet showing exactly the prompted situation.

While such a scenario might sound like science fiction, we are currently not very far away from achieving it. The landscape of entertainment technology has undergone a profound transformation over the past decades, driven primarily by the digital transformation and the introduction of GenAI. This shift signifies a change in the medium of content delivery as well as a fundamental alteration in the nature of content consumption and interaction. The progression from traditional media formats to advanced, user-centric digital platforms illustrates a paradigm shift in how media is experienced, created, and distributed.

Historically, the entertainment sector has been a reflection of technological advancements and societal changes. Vrana (2023) elucidates the dynamic restructuring of the digital media and entertainment sector: the digital media industry, once confined to traditional platforms like newspapers, has now expanded to encompass a vast array of digital shows and services, catering to a generation demanding instant access and personalized content<sup>6</sup>.

This digitalization wave, as Hallur (2023) points out, is largely attributed to the rise of streaming platforms and digital media. The shift to streaming services has rendered traditional public offerings obsolete, changing consumption patterns and cultural paradigms within the media landscape<sup>7</sup>. This evolution mirrors the changing consumer behaviors and the increasing need for content personalization, driven by advancements in data analytics and user experience design.

Further, as Domenghini (2019) argues, the video entertainment industry has been revolutionized by digital technologies, moving from a network-controlled television era to a user-driven streaming service model. This transition signifies a shift from passive consumption to active engagement, where users are no longer bound by fixed schedules or physical locations. Innovative models like Interactive Digital Narrative, Social Viewing experiences, and VR are redefining the boundaries of video entertainment, pointing towards a future where technology dictates new standards of content fruition<sup>8</sup>.

Building upon this digital foundation, the emergence of GenAI technologies has introduced a new dimension to entertainment. Leveraging advancements in machine learning, especially in areas like natural language processing and computer vision, GenAI is reimagining the creation and customization of content. From text-based interactive fiction to immersive VR experiences, AI-driven platforms are empowering users to not only consume but also shape their entertainment narratives. This marks a significant leap from the linear, creator-driven content of the past to a dynamic, user-centric model, where the boundaries between creator and consumer are increasingly blurred. One could say that while in current digital media and streaming services the consumer is an active spectator, the future might put the consumer into a director's role, orchestrating what and how they want to consume.

## From Consumers to Creators to Directors

The emergence of video streaming platforms has revolutionized media consumption, shifting the paradigm from passive viewership to active content creation. Chouinard's (2017) study on YouTube's impact underscores this transformation, highlighting how these platforms empower users to become content creators, thus democratizing media production<sup>9</sup>. This also resonates with the sentiment that the term "user" isn't adequate anymore to describe the complex relationships people have with technology today<sup>10</sup>. Similarly, as Kim (2010) elaborates on this cultural shift, exploring how user-generated content on streaming platforms has altered the traditional media landscape, blurring the lines between professional and amateur content<sup>11</sup>.

User involvement has been a driving factor of this transformation, be it through the possibility to comment or review various content on a streaming platform, by creating content to be streamed or by directly interacting with the content and other consumers for example in massively multiplayer on-line role playing games (MMORPGs)<sup>12</sup>. Such user involvement in which users are able to directly influence the (digital) content they are interacting with has a long history from text adventures, interactive fiction and Multi-User Dungeons (MUDs)<sup>13</sup> building on popular table top role playing games (TTRPGs) like Dungeons & Dragons. Interactive fiction, a form of storytelling where the reader participates in the narrative, has significantly influenced the development of user-driven content<sup>14-16</sup>. Various narrative-driven game genres like the mentioned MMORPG but also visual novels, multiplayer online battle arenas (MOBAs), immersive simulations with open worlds and open ended narratives have become extremely popular in recent years whereby user involvement seems to be an important success factor. This is also reflected in community based game development where various platforms like itch.io allow game consumers to directly interact with game creators during the design process and provide valuable feedback and testing. Another area of user involvement is the so called modding community in which players are able to edit and change existing games and share their creations with everyone.

All of the mentioned resonates with the term metaverse defined as "*post-reality universe, a perpetual and persistent multiuser environment merging physical reality with digital virtuality*"<sup>17,18</sup>. And while promoted as the *next big thing* by Meta Platforms Inc., yet it fundamentally echoes longstanding virtual world concepts that have been part of digital culture

for decades<sup>19</sup>. Immersive technologies, particularly VR and augmented reality (AR), play a pivotal role in shaping the future landscape of entertainment. These technologies enhance sensory experiences and offer new dimensions of interaction and engagement in digital environments.

Building on the foundation laid by user-driven content platforms and user involvement in game narrative design, AI-generated content represents the next step in the evolution of personalized entertainment. GenAI technologies are extending this paradigm, enabling users to not only select but also create and modify content in real-time, making them directors which are tailoring experiences to their preferences and interactions. This marks a significant shift towards a more dynamic and user-centric model of entertainment.

## Text and Programming Code

GAIAs have begun to infiltrate various facets of entertainment, changing how content is created, distributed, and consumed. These technologies, leveraging machine learning algorithms, allow for dynamic content generation of text, images, sound effects, music, animation, video and even playable games, that can adapt to user inputs in real-time, offering a personalized entertainment experience that was previously unattainable.

One of the first notable implementations of GAIAs for entertainment is in the domain of interactive fiction and storytelling which have a long history of using AI techniques like natural language processing to provide immersive user experience. Platforms like AI Dungeon<sup>20</sup> represent a pioneering leap, utilizing Large Language Models (LLMs)<sup>1</sup> to create expansive narrative universes that respond to player decisions, effectively allowing users to “write” their own stories through gameplay. While AI Dungeon was (an is) an amazing achievement when it came out in 2019., at the time of writing this article one can easily replicate the most important of its functionality just by using the so called Generative Pre-trained Transformers (GPTs) which are personalized chatbots provided by OpenAI’s ChatGPT<sup>21</sup>. These agents can be created by an average user prompting a GPT using natural language and describing what kind of behaviour we want from it. As an example, we have created the Fantasy Quest Master GPT by using only one prompt of a few sentences. An excerpt of a session using this agent is visible on figure 1. Fantasy Quest Master enables players to craft unique characters and adventures, demonstrating the potential of GAIAs to personalize narrative creation.

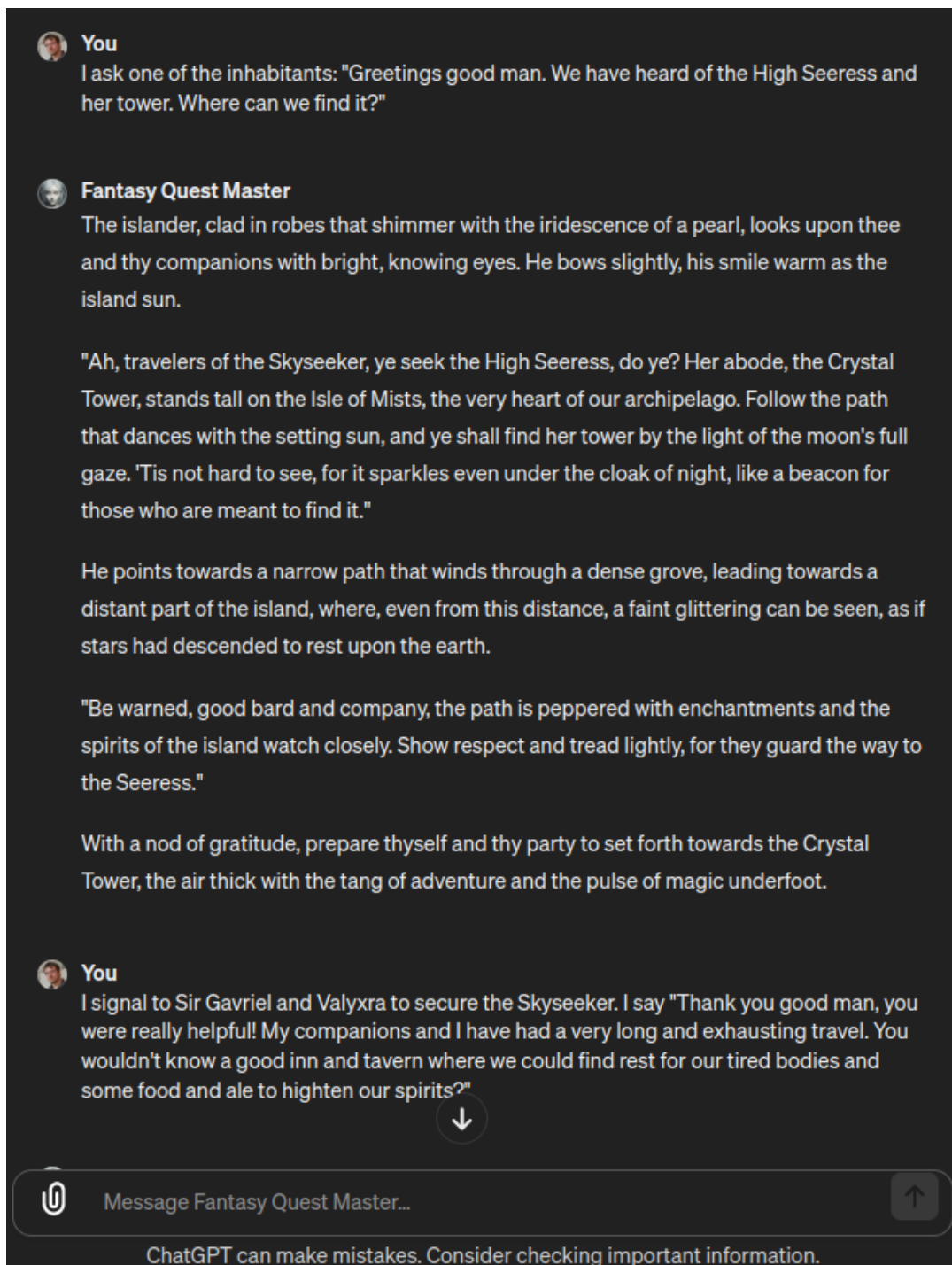
LLMs like ChatGPT and GitHub Copilot<sup>22</sup> have additionally significantly transformed the landscape of coding by providing intelligent code completion and suggestion features. These models are trained on vast datasets comprising source code from numerous programming languages, enabling them to understand context and syntax to suggest accurate snippets and complete blocks of code. For instance, GitHub Copilot can autonomously generate code for entire functions based on a brief comment description, drastically reducing development time and increasing developer productivity. Additionally, these models assist in debugging by suggesting corrections and improvements to existing code, which helps in maintaining code quality and efficiency. Beyond mere code generation, LLMs are also capable of explaining complex code snippets, making them invaluable tools for education and code reviews, enhancing both learning and collaboration among programmers.

While being able to generate programming code is useful to software engineers which understand the particularities of the code being generated, the average user will need at least basic understanding of programming to be able to create a working application. Projects like Auto-GPT<sup>23</sup>, which aims on creating the necessary toolset to create autonomous agents, might change that in the future and thus allow users to generate applications on the fly.

## Images

In the visual arts, tools like DALL-E<sup>24</sup> and MidJourney<sup>25</sup> have introduced capabilities to generate complex images from textual descriptions (prompts), enabling creators to visualize scenes and characters without needing traditional artistic skills. This technology based on Generative Adversarial Networks (GANs), autoregressive methods, and especially diffusion-based methods<sup>2,3</sup> has been effectively utilized in storytelling, where illustrators can rapidly prototype and refine visual ideas that complement the narrative. For example the art for the comic authored by Kris Kashtanova titled “Zarya of the Dawn”<sup>26</sup>, which was the subject of a recent copyright controversy<sup>27</sup>, was created using MidJourney prompting. Additionally, AI-driven tools for 3D model generation enable users to create detailed and complex three-dimensional characters and environments, facilitating deeper immersion in virtual worlds and interactive narratives.

GAIA’s are broadening the scope of possibilities in entertainment technology and enabling highly specific and immersive experiences tailored to individual preferences. These capabilities facilitate the creation of unique and highly personalized entertainment scenarios. For example, by only using OpenAI’s ChatGPT 4 features for generating programming code and images (using the integrated DALL-E 3 model) we were able to generate an application for managing visual and sound effects in table-top role playing games (shown on figure 2) in a matter of hours. This particular use-case, used for private role-playing game sessions, is an example in which a GAIAs have been put to good use to create an experience that would previously been impractical due to time and resource constraints.

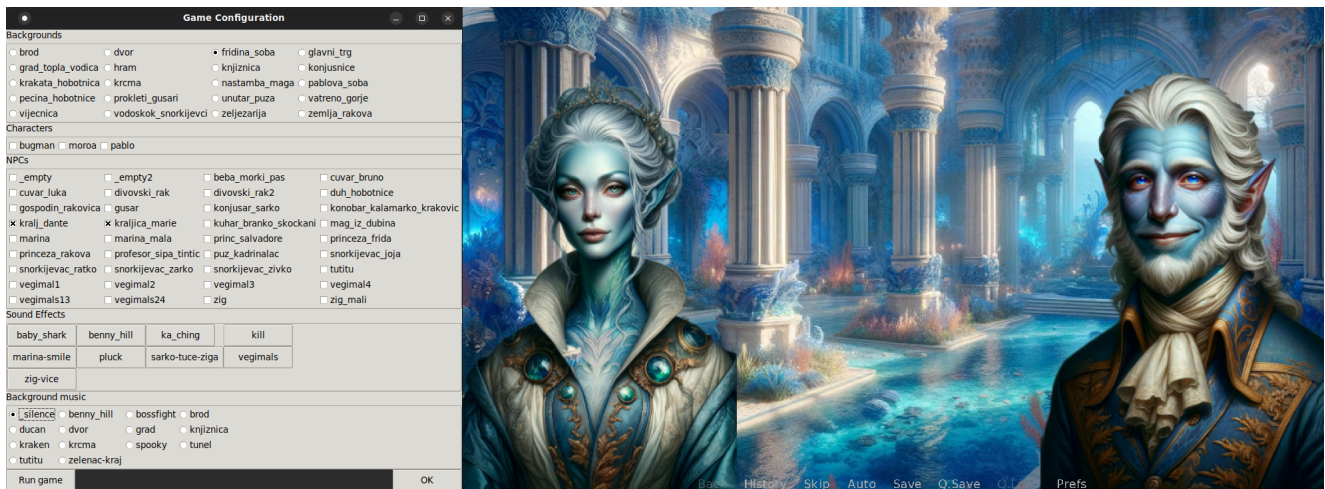


**Figure 1. Fantasy Quest Master GPT.** An excerpt from a session with the Fantasy Quest Master made with OpenAI's ChatGPT. Available at <https://chat.openai.com/g/g-6LEyy2ZKR-fantasy-quest-master>.

## Audio

The audio landscape has also been transformed by GAIAs. New neural network models usually using using various types of deep reinforcement learning techniques<sup>4</sup>, can generate music and sound effects tailored to the mood and setting of a user's interaction or narrative. These technologies are being used to create dynamic soundtracks for games and interactive experiences where the audio evolves in response to user decisions. The potential for personalized music and sound landscapes in entertainment is immense, offering a rich, immersive auditory experience that enhances user engagement.





**Figure 2. Game Master Helper.** An AI generated application for table top role playing games. Code generated using ChatGPT, images generated using DALL-E 3 and edited using Background Eraser. The application is implemented in Python and Ren'Py.

For example, over a weekend we were able to generate a full concept for a musical including narrative, libretto, visuals and music by only minor interventions and manual design of particular elements (shown on figure 3).

## Video

Video generation usually based on various extended diffusion models as with visual arts<sup>5</sup> remains an area ripe with potential, where GAIAs are beginning to make inroads. Current applications focus on creating short video clips and animations from textual or simple visual inputs. Although still in nascent stages compared to text and image GAIAs, the technology promises significant advancements in how visual media is produced and consumed, particularly in the customization of video content to user preferences and contexts. There are many available tools for video and animation generation that focus on particular tasks like animating a character, adding motion capture or providing some 3D effect, but their possibilities are usually limited. On the other hand, OpenAI has recently shown some of the capabilities of Sora, which *"is a generalist model of visual data—it can generate videos and images spanning diverse durations, aspect ratios and resolutions, up to a full minute of high definition video"*<sup>28</sup> which is very promising in the context of user generated video, albeit its capabilities might have been a bit overhyped<sup>29</sup>.

## Gaming

In gaming, GAIAs are being used to create more dynamic and responsive environments. AI-driven NPCs (non-player characters) can now exhibit complex behaviors that adapt to player strategies, making gameplay more challenging and varied. For example, NVIDIA's Covert Protocol, developed in collaboration with Inworld AI, represents a significant advancement in the realm of interactive gameplay. This technology allows for the creation of NPCs that can interact in highly realistic ways with players, enriching the gaming experience with more dynamic and engaging narratives. By integrating cognitive and perceptual systems, it enables NPCs to react organically to player actions, contributing to a more immersive and personalized gameplay environment<sup>30</sup>. Such innovations open up exciting possibilities for game developers, allowing them to craft worlds where players can truly influence and transform their virtual environments through interactions that feel meaningful and consequential. The adaptability of these AI-driven characters ensures that each player's decisions lead to unique narrative outcomes, thereby enhancing the overall engagement and replayability of games<sup>31</sup>.

Moreover, Procedural Content Generation (PCG) techniques are being employed to create endless landscapes and levels, enhancing replay value and user engagement without the extensive resource investment typically required in game development<sup>32</sup>. PCG in video games, historically utilized through various rule-based and grammar-based methods, has been significantly enhanced by the integration of deep learning techniques. These advancements have broadened the scope of PCG, allowing for the generation of complex and diverse game content such as levels, character models, textures and even entire playable games. For example, Genie is a groundbreaking generative interactive environment capable of creating platformer games from various prompts, including text or reference images<sup>33</sup>. Developed by Google DeepMind, this model translates prompts into interactive, playable environments, allowing users to engage directly with the game scenarios it generates. Notably, Genie can convert images—whether synthetic, photographed, or even sketched—into dynamic gaming sequences, providing a seamless interface for users to interact with and influence the game environment in real-time.



**Figure 3. The Spectator.** An AI generated musical concept (available at <https://dragon.foi.hr/spectator>. Generated with ChatGPT 4 (narrative, libretto, code), DALL-E 3 and LeiaPix (visuals, video), udio.com (music). The application has been implemented using Hovercraft.js.

## Technological Challenges

The integration of GenAI in crafting entire solutions like movies or games presents remarkable opportunities, yet it is fraught with substantial challenges, especially in the realm of seamless integration and contextual accuracy. Currently, the field is populated by a multitude of GAIAs, each specialized in handling specific aspects of content creation, such as writing scripts, generating images, or composing music. However, the onus of integrating these disparate elements, often requiring programming skills, falls heavily on the end-user. This fragmentation not only complicates the content creation process but also places a significant barrier to entry for users without technical expertise. Furthermore, context remains a persistent issue, particularly in the realms of image, video, and audio generation. For instance, generating a character's image or voice consistently across multiple sessions poses a considerable challenge due to the probabilistic nature of current AI models, which often results in variations in appearance, style, or sound even under identical input conditions.

Moreover, the lack of contextual understanding in AI models leads to inconsistencies that are especially evident in style and scene details across generated content. Whether it's the slight change in style between two generated pieces of music or visual artwork, or the varying details in scenes like the color of a background object, these inconsistencies can disrupt the continuity and immersive quality of larger projects like films or games. Currently, addressing these discrepancies largely depends on manual interventions such as prompt tweaking, outpainting, or post-processing, which detracts from the efficiency and scalability of using AI in content generation. Despite these challenges, advancements in projects such as AutoGPT promise to streamline these processes in the future. AutoGPT aims to enhance the capability of AI models to handle complex, multi-part tasks more autonomously, potentially reducing the need for human intervention and making the technology more accessible to a broader range of creators.

## GAIAs in the Future

GAIAs represent a class of technologies that leverage advanced machine learning models to dynamically generate personalized content across various media formats. These applications can automate aspects of content creation and tailor experiences to individual user preferences, behaviors, and interactions in real-time. As we look toward the future, the potential applications of GAIAs in entertainment and beyond are vast and varied. Here we outline several innovative possibilities that could redefine the landscape of interactive and personalized media. Besides personalized interactive fiction, which is already available, we



envision the following applications:

**Personalized Movies, Series, and Cartoons** AI could generate visual content tailored to a viewer's genre preferences, including personalized story arcs, characters, and visual styles. For instance, a viewer could choose to watch a detective series where the mystery and characters evolve based on their decisions at the end of each episode, effectively creating a unique story experience each time.

**Personalized Games** Beyond procedural content generation, AI could customize game environments, challenges, and narratives to fit the player's skill level and interests, making gaming experiences more engaging by continuously adapting to the player's evolving strategy and preferences. An example would be a strategy game generated based on a few simple prompts from the player that adjusts its difficulty level and introduces new challenges based on the player's past performance and tactical choices.

**Immersive Multiplayer RPGs** These applications could transform traditional tabletop role-playing games into fully immersive experiences. Utilizing VR and AR technologies integrated with AI-driven narrative engines, players could see and interact with the game world and its elements as if they were physically present. For example, players could embark on a quest in a fantastical realm, interacting with AI-controlled characters and environments that respond dynamically to their strategies and actions.

**AI-Driven Virtual Live Events** Concerts, plays, musicals and performances could be hosted in virtual spaces, where the set design, music, and performance adapt dynamically to the virtual audience's reactions. AI could customize the music and stage effects in real-time at a virtual concert based on audience interactions and preferences, providing a uniquely tailored entertainment experience.

**Interactive Learning and Educational Content** AI could create adaptive learning environments that tailor educational content to the learning style and pace of individual users. For example, a medical student could engage in a virtual surgery simulation that adjusts based on their decision-making and skills, providing immediate feedback and varied scenarios to enhance learning.

**Virtual Personal Assistants in Gaming and Media Consumption** These AI-driven characters could act as companions within various media platforms, providing narrative insights, background information, and interaction, enhancing user engagement and deepening the narrative experience across different media forms. An example could be a virtual assistant in a historical documentary that offers in-depth explanations or context for the events being described, enhancing the viewer's understanding and engagement.

**Cross-Platform Narrative Experiences** Imagine a narrative that begins in a novel, progresses through a video game, and concludes in a virtual reality setting. AI could manage the continuity and development of the story across these platforms, ensuring a cohesive and engaging experience. For example, a user could read a novel about a mystery, play a detective in a related video game to gather clues, and finally solve the case in a VR environment, interacting with the story's characters and environments in a fully immersive way.

Each of these applications highlights the capabilities of GAIAs to enhance entertainment experiences and underscores the importance of addressing the ethical and privacy concerns that come with advanced personalization and interaction. As these technologies develop, it will be crucial to balance innovation with responsible usage, ensuring that GAIAs enhance user experiences while safeguarding personal data and promoting content diversity.

## Legal and Ethical Considerations

To address the *elephant in the room*, ethical considerations and copyright issues are paramount in the discourse surrounding GenAI technologies, especially as they pertain to the creation and distribution of entertainment content. These concerns involve multiple stakeholders, each with distinct perspectives and stakes in the evolving landscape.

**Artists and content creators** are increasingly concerned about how AI can use their original works without explicit permission or adequate compensation. There is a growing call for mechanisms that ensure creators are recognized and rewarded when their works are used to train or are replicated by AI systems. This includes concerns about the potential devaluation of unique artistic skills and the dilution of individual creativity that AI replication might entail.



**Media companies**, including publishers and production studios, are exploring how AI can be leveraged to reduce costs and increase output. While they benefit from the efficiencies AI technologies bring, they also face challenges in protecting their intellectual property from unauthorized AI-generated reproductions. These companies are often in favor of stringent copyright laws that protect their assets but may inhibit innovation and the broader use of AI technologies in content creation.

**AI companies and developers** advocate for more flexible copyright norms that can accommodate the rapid advancements in technology. They argue that overly restrictive copyright laws could stifle innovation and prevent the beneficial uses of AI in society, including in education, research, and entertainment. However, they also face ethical dilemmas about the extent to which AI should be allowed to replicate human creativity and the potential societal impacts of displacing creative jobs.

**End-users and consumers** enjoy the benefits of AI-generated content, which can provide personalized and diverse media at a lower cost or even for free. However, there is also a rising awareness and concern among consumers about the ethical implications of using AI in ways that may undermine the economic rights of creators and the cultural significance of human-made art and narratives.

The current legal frameworks often struggle to keep pace with the rapid development of AI technologies. There is an ongoing debate about how copyright law should evolve to address the unique challenges posed by AI, including the question of authorship for AI-generated content and the liability for copyright infringements by AI systems. Discussions also focus on potential models for copyright reform, such as the introduction of new licensing structures or the adaptation of existing ones to better suit the digital and AI-driven age. The intersection of copyright law, ethics, and generative AI technologies in entertainment is complex and fraught with conflicting interests. Stakeholders from all sides are calling for thoughtful consideration of how best to balance innovation with the rights and livelihoods of creators. As these discussions continue, they will shape the frameworks and business models that govern the creation and consumption of AI-generated content, potentially setting precedents that could influence other sectors as well.

Parallel to the creation of fanfiction, where enthusiasts create derivative works that celebrate original narratives, AI-generated content like movies, games, or interactive fiction crafted by users using prompts raises similar copyright and legal issues. For personal use, such as creating a game or a story for family and friends, copyright concerns are generally minimal. However, when such content is commercialized, it becomes imperative to acquire appropriate licenses and provide compensation to the original copyright holders. This distinction mirrors the legal landscape of fanfiction, where non-commercial works typically enjoy more leniency under copyright law, whereas profit-driven projects require strict adherence to copyright regulations. Just as fanfiction communities have developed norms and guidelines for ethical and legal sharing of content, the AI entertainment sector must also establish robust frameworks to govern the use of generative technologies in a way that respects the rights and contributions of all creators.

The recently past Artificial Intelligence Act of the EU<sup>34</sup> *"seeks to develop harmonised standards involving abstract normative concepts such [as] transparency, fairness, and accountability"*<sup>35</sup>. These three concepts provide us with a simple yet powerful framework for addressing the ethical and copyright issues associated with GenAI in entertainment. As the industry evolves, these concepts must be thoroughly integrated into the operational and legal practices of companies developing and using GAIAs.

**Transparency** is crucial in the use of generative AI technologies. Development companies should fully disclose not only the AI models and their versions but also the datasets used for training these models. This transparency allows authors, artists, and copyright holders, whose work may have been utilized (either directly or indirectly), to be identified and informed. Such disclosure should be clear and accessible, ensuring that all parties understand how the works are being used and can verify that their intellectual property rights are respected. This level of openness is essential not only for ethical reasons but also for maintaining public trust in AI-driven content creation.

**Fairness** in the context of GenAI means ensuring that all authors, artists, and copyright holders whose works contribute to the training and operation of AI systems are fairly compensated. This extends to the digital reproduction and dissemination of their creative outputs. Fair compensation mechanisms must be developed that reflect the value AI-derived works generate for media companies and other commercial entities. This approach should also consider the scale of use and the revenue generated from AI-enhanced products to ensure that compensation is commensurate with the economic benefits derived from the original works.

**Accountability** involves holding AI companies and developers responsible for the content their systems produce. This includes ensuring that AI-generated content does not infringe on existing copyrights and adhering to ethical standards that respect the rights of creators. Companies must manage the capabilities of their AI systems to prevent unauthorized use of

copyrighted material, allow opting-out of existing systems and ensure that any contentious issues are quickly addressed. When infringements occur, there should be clear and enforceable paths for recourse available to affected parties.

Creating datasets categorized by licenses would significantly benefit the field of GenAI, ensuring that users and developers are aware of the usage rights associated with the content they are utilizing. For instance, a dataset exclusively containing public-domain images would provide clear guidelines that these assets can be freely used without legal or financial obligations. Similarly, compiling datasets under Creative Commons licenses would help users understand the specific conditions under which the content can be used, such as attribution requirements or restrictions on commercial use. Additionally, establishing a commercial dataset where all artists have explicitly granted permission for their works to be used in exchange for fair compensation would streamline the process for AI companies and developers to legally utilize these resources while respecting and remunerating the original creators appropriately. Organizing datasets in this manner would simplify legal compliance, enhance transparency and foster a more respectful and sustainable ecosystem for leveraging artistic works in generative AI applications.

The use of personal data to generate content via GenAI raises significant privacy concerns<sup>36</sup>. As users integrate more of their personal information to tailor experiences—whether in gaming, media consumption, or virtual interaction—there is an increasing risk of misuse of such data. This might include unauthorized sharing, profiling, or even identity theft if data security is compromised. Moreover, the creation of deeply personalized content could lead to scenarios where AI-generated outputs inadvertently reveal private aspects of a user's life or preferences that were intended to be confidential. To mitigate these risks, robust privacy protection measures need to be implemented, ensuring that personal data used in generative AI processes is handled securely and ethically, with clear user consent and transparency about how data is used and stored.

Additionally, the potential for misuse of AI technologies in personalizing content raises significant ethical concerns. For instance, in the hypothetical scenario where a user creates a game with their boss as the antagonist, there are implications regarding privacy, consent, and the potential for harassment. Such use cases highlight the necessity for robust ethical guidelines that prevent the use of personal data or likenesses without consent. These guidelines must address the broader implications of using generative AI to create content that could be deemed defamatory, invasive, or harmful. While the democratization of content creation offers exciting opportunities for customization and engagement, it also necessitates careful consideration to ensure that these technologies are not used to perpetuate harm or violate personal boundaries.

## Future Business Models

The advent of generative AI has introduced significant challenges in the realm of copyright and compensation for artists whose works contribute to the training of AI models. Herein we discuss potential business models that could ensure fair compensation for artists and creators in a landscape increasingly dominated by AI-driven content creation.

The presented business models each offer distinct approaches to ensuring fair compensation for artists in the context of GenAI, addressing the crucial aspects of transparency, fairness, and accountability. As the technology advances, these models may evolve or converge to better align with the dynamic needs of creators, companies, and consumers alike. It is imperative that stakeholders continually assess the efficacy and ethical implications of each model, considering the rapid pace of technological innovation and its impact on copyright norms. To foster an environment of innovation while safeguarding the rights and incomes of artists, a hybrid approach may emerge as the most practical solution—combining elements of royalty sharing, licensing, and micro-payments supported by robust legal frameworks and advanced tracking technologies. Such a nuanced approach would encourage creative contributions as well as ensure that those contributions are fairly rewarded, thereby maintaining a vibrant and sustainable ecosystem for both the production and consumption of AI-generated content.

## Conclusions

The future landscape of GAIAs in entertainment is poised for transformative developments that promise to further democratize content creation and enhance user experiences. However, the realization of these prospects is contingent upon overcoming significant technological and ethical challenges.

In the near term, advancements in AI algorithms and computing infrastructure are expected to enable more sophisticated and seamless GAIAs. These improvements could lead to more natural and immersive interactions in virtual environments, enhanced realism in AI-generated audio and visuals, and more nuanced storytelling capabilities in interactive narratives. Looking forward, we might see GAIAs that can produce full-length films or orchestrate complex virtual events involving thousands of participants in real-time.

The integration of AI across different media types—combining text, image, audio, and video seamlessly—is another crucial goal. Future GAIAs could offer holistic multimedia experiences where elements are generated in a unified manner, adapting dynamically to user interactions. This would enhance the depth of engagement and open new avenues for cross-media entertainment formats.

Business Model	Description	Advantages	Disadvantages
Royalty Sharing Models	Implementation of royalty sharing models where artists receive a percentage of the revenues generated by AI systems using their works. Automated using blockchain technology to track usage and distribute earnings.	Provides continuous income based on actual usage of artworks, encourages ongoing participation by artists.	Depends on accurate tracking and reporting of content usage, which may be complex to implement and maintain.
Licensing Agreements	Structured licensing agreements requiring companies to obtain licenses from artists beforehand. Includes compensation for each artwork use or a flat fee for broader AI-generated uses.	Ensures upfront compensation and clearer contractual terms between artists and companies.	May limit the flexibility of AI applications in rapidly iterating new content.
Subscription Models	Subscription models include a fund specifically for compensating artists. Consumers pay a fee, part of which is distributed among creators whose works trained the AI.	Provides a steady revenue stream that supports all contributing artists.	The actual compensation each artist receives may be minimal, depending on the number of contributors and total revenue.
Government Regulation and Collective Bargaining	Government sets industry standards for the use of copyrighted materials in AI datasets. Artists form bargaining units to negotiate fair compensation terms.	Potentially provides standardized compensation and legal protections for artists.	Regulatory processes can be slow and may not keep up with technological advancements.
Micro-Payment Systems	Introduction of micro-payment systems that facilitate small, automated payments to artists each time their work is used by an AI to create new content.	Allows artists to receive compensation aligned with the exact use of their works.	Requires robust technical infrastructure and widespread adoption by platforms and users.

**Table 1.** Potential business models for compensating artists in the era of generative AI.

Advancements in AI personalization are expected to tailor content even more closely to individual preferences and cultural contexts. This could lead to a new era of "hyper-personalized" entertainment, where every aspect of a media experience, from the storyline to the visual style and soundtrack, is customized. Furthermore, as these technologies become more accessible, they could lower barriers to content creation, allowing anyone with a creative vision to produce professional-quality media without the need for extensive resources.

Addressing ethical considerations and societal impacts is essential for the acceptance and success of future GAIAs. This includes ensuring fairness in AI algorithms, protecting user privacy, and managing the economic impact on traditional roles in the entertainment industry. Transparent practices and ethical AI design will be critical in maintaining public trust and fostering an environment where creative AI tools are used responsibly.

Revised regulatory and copyright frameworks will need to keep pace with AI developments to support innovation while protecting the rights of all stakeholders. Future GAIAs will require a legal environment that encourages experimentation but also safeguards against misuse. The development of international standards for AI-generated content and the establishment of rights management systems for AI interactions could be pivotal.

Predicting a precise timeline for these developments is challenging due to the rapid pace of change in AI technologies and the varying global regulatory landscapes. However, significant strides in AI capabilities could be expected within the next decade, with incremental advancements leading up to a more integrated and ethically aligned deployment. Achieving these goals will depend on continuous collaboration among scientists, technologists, policymakers, creators, and the public.

**Recommendations:** For *policymakers*, it is recommended to proactively revise and adapt regulatory frameworks to accommodate the rapid evolution of AI technologies, ensuring that these innovations benefit society while mitigating risks. Developing clear guidelines and standards specifically for GAIAs can help manage the ethical and legal complexities these technologies bring.

*Developers* and *technology providers* should prioritize the integration of ethical considerations into the design and deployment of AI systems. This involves conducting thorough impact assessments and engaging with diverse stakeholders to understand potential repercussions in various cultural and social contexts. Additionally, investing in robust security measures to protect user data and prevent misuse is critical.

*End-users* should be empowered with knowledge and tools to understand and navigate the landscape of AI-driven media. Educational initiatives and transparency from developers about how AI systems work and their potential implications can help build informed user bases that can advocate for their interests and privacy.

The future of GAIAs in entertainment is bright, with potential for profound impacts on how we create, consume, and interact with media. By overcoming current challenges and focusing on sustainable and ethical development, the next generation of GAIAs could offer unprecedented experiences that are both universally accessible and deeply personal.

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Most of the text in this article was generated using ChatGPT 4. I am aware about the ethical and legal implications of using such an approach, but the reason was not to deceive anyone or make my life easier (albeit it did) but to prove a point: AI is on its way to transform media shifting the role of the consumer from spectator to director, from creator to conductor and orchestrator.

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## References

1. Yao, Y. *et al.* A survey on large language model (llm) security and privacy: The good, the bad, and the ugly. *High-Confidence Comput.* 100211 (2024).
2. Zhang, C., Zhang, C., Zhang, M. & Kweon, I. S. Text-to-image diffusion model in generative ai: A survey. *arXiv preprint arXiv:2303.07909* (2023).
3. Liao, J. Z. L. J., Cao, Y.-P. & Shan, Y. Advances in 3d generation: A survey. *arXiv preprint arXiv:2401.17807* (2024).
4. Latif, S. *et al.* A survey on deep reinforcement learning for audio-based applications. *Artif. Intell. Rev.* **56**, 2193–2240 (2023).
5. Xing, Z. *et al.* A survey on video diffusion models. *arXiv preprint arXiv:2310.10647* (2023).
6. Vrana, V. & Das, S. *Dynamic Restructuring of Digital Media and Entertainment Sector: Role of Urbanization, Industrial Innovation, and Technological Evolution*, 15–34 (Springer Nature Singapore, Singapore, 2023).
7. Hallur, G. G., Aslekar, A. & Prabhu, S. G. *Digital Solution for Entertainment: An Overview of Over the Top (OTT) and Digital Media*, 35–53 (Springer Nature Singapore, Singapore, 2023).
8. Domenghini, A. The digital evolution of the video entertainment industry and innovative fruition models due to the emerging technologies (2019).
9. Chouinard, A. *From Fan Videos to Crowdsourcing: The Political Economy of User-Driven Online Media Platforms and Practices*. Ph.D. thesis, Concordia University (2017).
10. Majewski, T. It's time to retire the term "user". *MIT Technol. Rev.* (2024).
11. Kim, J. *User-Generated Content (UGC) Revolution?: Critique of the Promise of YouTube*. Ph.D. thesis, University of Iowa (2010).
12. Schatten, M. & Đurić, B. O. Social networks in "the mana world"-an analysis of social ties in an open source mmorpg. *Int. journal multimedia ubiquitous engineering* **11**, 257–272 (2016).
13. Schatten, M., Đurić, B. O. & Peharda, T. An agent-based game engine layer for interactive fiction. In *International Conference on Practical Applications of Agents and Multi-Agent Systems*, 385–389 (Springer, 2021).
14. Montfort, N. Riddle machines: The history and nature of interactive fiction. *A companion to digital literary studies* 267–282 (2013).
15. Ziegfeld, R. Interactive fiction: A new literary genre? *New Lit. Hist.* **20**, 341–372 (1989).
16. Plotkin, A. *Characterizing, If Not Defining, Interactive Fiction*, 59–66 (Transcript On Press, Boston, MA, 2011).



17. Mystakidis, S. Metaverse. *Encyclopedia* **2**, 486–497, DOI: [10.3390/encyclopedia2010031](https://doi.org/10.3390/encyclopedia2010031) (2022).
18. Ning, H. *et al.* A survey on the metaverse: The state-of-the-art, technologies, applications, and challenges. *IEEE Internet Things J.* (2023).
19. Levine, G. The elder scrolls online creative director on metaverse: "they should stop treating it like it's new". *80 Level* (2024). Accessed: 2024-04-27.
20. AI Dungeon. Ai dungeon. <https://aidungeon.com> (2024). Accessed: 2024-04-21.
21. OpenAI. Chatgpt: Generative pre-trained transformer for conversational agents. <https://openai.com/chatgpt> (2024). Accessed: 2024-04-21.
22. GitHub. Github copilot: Your ai pair programmer. <https://copilot.github.com> (2024). Accessed: 2024-04-21.
23. Auto-GPT. The official website for auto-gpt. explore the new frontier of autonomous ai and try the fastest growing open source project in the history of github for yourself. <https://news.agpt.co> (2024). Accessed: 2024-04-21.
24. OpenAI. Dall-e: A neural network for generating images. <https://openai.com/dall-e> (2024). Accessed: 2024-04-21.
25. MidJourney. Midjourney: An independent research lab exploring new mediums of thought. <https://www.midjourney.com> (2024). Accessed: 2024-04-21.
26. Kashtanova, K. Zarya of the dawn: An ai-assisted comic book. <https://www.kris.art/portfolio-2/project-one-ephnc-jamy8> (2024). First AI-assisted comic book granted a copyright in the US. Translated into 30 languages by the community. Tools used: Midjourney, Comic Life 3. Accessed: 2024-04-21.
27. Analla, T. Zarya of the dawn: How ai is changing the landscape of copyright protection. <https://jolt.law.harvard.edu/digest/zarya-of-the-dawn-how-ai-is-changing-the-landscape-of-copyright-protection> (2023). Edited by Anirudh Jonnavithula, Accessed: 2024-04-21.
28. OpenAI. Video generation models as world simulators. <https://openai.com/research/video-generation-models-as-world-simulators> (2023). Accessed: 2024-04-27.
29. McLoughlin, A. Turns out the viral 'air head' sora video wasn't purely the work of ai we were led to believe. *TechRadar* (2023).
30. NVIDIA. Nvidia digital human technologies bring ai game characters to life (2024). Accessed: 2024-04-27.
31. Weatherbed, J. Nvidia ai ace redefines video game characters with covert protocol. *The Verge* (2024). Accessed: 2024-04-27.
32. Liu, J. *et al.* Deep learning for procedural content generation. *Neural Comput. Appl.* **33**, 19–37 (2021).
33. Bruce, J. *et al.* Genie: Generative interactive environments (2024). [2402.15391](https://arxiv.org/abs/2402.15391).
34. European Commission. Proposal for a regulation of the european parliament and of the council laying down harmonised rules on artificial intelligence (artificial intelligence act) and amending certain union legislative acts. EUR-Lex (2024). Accessed: 2024-04-27.
35. Laux, J., Wachter, S. & Mittelstadt, B. Three pathways for standardisation and ethical disclosure by default under the european union artificial intelligence act. *Comput. Law & Secur. Rev.* **53**, 105957, DOI: <https://doi.org/10.1016/j.clsr.2024.105957> (2024).
36. Bodimani, M. Assessing the impact of transparent ai systems in enhancing user trust and privacy. *J. Sci. & Technol.* **5**, 50–67 (2024).