

The Extended Reach of Game Engine Companies: How Companies Like Epic Games and Unity Technologies Provide Platforms for Extended Reality Applications and the Metaverse

Social Media + Society
April-June 2022: 1–12
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DOI: 10.1177/20563051221107641
journals.sagepub.com/home/sms

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Abstract

Game engines have come to feature in areas well beyond gaming—such as architecture, artificial intelligence, manufacturing, public planning, and film and television production. Accordingly, companies developing, providing, and maintaining game engines—such as Epic Games or Unity Technologies—are set to become influential actors in all social and economic arenas that start to rely on game engines for the provision of software or services. This makes them an important subject to the study of platforms as they provide increasingly crucial building blocks in the digitization of economic, political, and social life. In this article, we present three dimensions demonstrating platform functions of game engines beyond gaming. We rely on the example of two important game engine developers: Epic Games and Unity Technologies. The dimensions are (1) the growing area of extended reality applications, (2) cross-platform and cross-media story- and brand worlds, and (3) the management of user payments, identities, and social graphs. The article shows how companies providing game engines challenge the current balance of power between established platform companies, demonstrating that game engines have emerged as an important new type of platform that demands academic and public attention.

Keywords

platforms, extended reality, metaverse, Fortnite, game engines

The Extended Reach of Game Engine Companies

Game engines, such as Unreal and Unity, provide crucial infrastructures that can speed along the development of digital games (also video games, computer games). Engines are software products that supply developers with tools and ready-made solutions for foundational programming tasks in creating games and virtual and digitally augmented environments. Engines thus enable game developers to build on shared foundations. Over time, a small ecosystem of third-party developers and service providers has emerged around game engines, facilitating, for example, the trade of engine-specific software or training services. By developing, providing, and maintaining shared infrastructures and standards for game development, game engine companies have contributed to the immense commercial success of the games industry. Meanwhile, these companies have become powerful actors by providing opportunities for third parties to offer

services and software specific to their engine and explicitly and implicitly shaping the options of those working with and relying on said engine. In other words, they provide platforms (Chia et al., 2020; Foxman, 2019; Freedman, 2020; Whitson, 2018).

Recently, however, game engines have been introduced in areas outside gaming, such as architecture, artificial intelligence, manufacturing, public planning, and film and television production. This makes the companies developing, providing, and maintaining game engines, such as Epic

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Games (EG) and Unity Technologies (UT), influential actors in all social and economic arenas that start to rely on game engines for the provision of software or services. We are arguably witnessing the emergence of a new type of platform company with pervasive reach into different vital arenas of culture, the economy, and public life. In fact, game engine companies challenge today's established platform companies and might even end up shifting the current power balance between them.

We have grown used to the dominance by platform companies in commercial, public, and private life (van Dijck et al., 2018). Alphabet/Google, Amazon, Apple, Meta/Facebook, and Microsoft are prominent companies providing spaces for producers and consumers of content, goods, and services to meet and interact (Barwise & Watkins, 2018). Their success is driven by the power of platforms to act as intermediaries between producers and customers. By establishing and maintaining many-sided markets (Rochet & Tirole, 2006), platform companies allow businesses and entire economic sectors to emerge that otherwise remain invisible to customers and to fulfill consumer needs that otherwise would have remained unheeded (D. S. Evans & Schmalensee, 2016). While economists have hailed this as a "platform revolution" (Parker et al., 2016) and emphasized its economic benefits (D. S. Evans & Schmalensee, 2016; Shapiro & Varian, 1999), social scientists have pointed to externalities, hidden costs, and associated power imbalances driven by network effects as causes for skepticism and critique (van Dijck et al., 2018; Gillespie, 2010; Gorwa, 2019). The growing use of game engines as platforms in ever more cultural, economic, and societal fields and the growing influence of the companies developing, providing, and maintaining game engines make them an important subject in the discussion about platforms.

The platform perspective, in turn, has been very productively employed in the role of game engines for game development and the mutual shaping of option spaces and interactions between game developers and game engine providers (Chia et al., 2020; Foxman, 2019; Freedman, 2020; Nicoll & Keogh, 2019; Whitson, 2018). However, the growing uses of game engines far beyond game development make an extension of this discussion necessary, for example, by adding their role in the popularization of extended reality, such as virtual and augmented reality applications, and video game forms as organizational schemes and business models.

We will show how game engines serve as powerful platforms and how companies developing them have an eye on extending their reach far beyond gaming. Focusing predominantly, but not exclusively, on EG and UT, we will present three dimensions that help us triangulate the strategic position and future trajectory of game engine companies and demonstrate their ambition to challenge established platform companies. In our approach, we follow the critical analytical method and combine interdisciplinary perspectives from both

the social sciences and the hermeneutical humanities. We engage our chosen cases through structuralist, rhetorical, and market analyses to outline the implications of the extended reach of game engine companies. Our goal is, first, to identify the continuities between strategic market positioning, software design, and public rhetoric of game engine companies within the field of platform studies beyond gaming. Integrating these sensibilities allows us to attend to disparate analytical objects (market survey, symbolic structures, and public rhetoric), as we respond to calls to consider the social implications of software and computation in context (Freedman, 2020, p. 6). Second, our interdisciplinary approach enables us to simultaneously attend to three discrete, yet mutually implicated, tracks (functional, rhetorical, and legal) along which game engine companies move into the platform market space. Sketching out these trajectories, we acknowledge, prevents us from making in-depth technical arguments about either one area we survey. However, we think the yield of strategic oversight outweighs this potential shortcoming.

We begin by explaining how EG and UT both have successfully positioned their engines outside of gaming in areas as diverse as artificial intelligence, architecture, product design, and film and television production. Game engines thus have already factually assumed the role of platforms in various fields by providing the basis for augmented and virtual reality applications and thus drive the large-scale digitization of work, entertainment, and services.

Second, we discuss how games run by companies that also provide engines offer examples for cross-platform and cross-IP storyworlds and how these concepts are indicative of the non-game services we can expect to emerge soon. An early example is EG's multiplayer online game Fortnite, which in short time has morphed from a moderately innovative online game to a versatile space in which users slip into the skin of their chosen avatars to play, shop, converse, and consume media. Fortnite manages to bring together different high-profile entertainment properties (e.g., Star Wars, Marvel Comics) and allows gamers to combine content and narrative universes that otherwise remain strictly separate. Our second task in this section will therefore be to apprehend video games in general as facilitators of transmedia narratives to comprehend how this emergent game-engine-based platform provides a template for cross-platform and cross-media story- and brand worlds beyond gaming.

Finally, we show how game engine companies become identity hubs, verifying users' identities in interactions with others and managing payments and how they begin challenging current platform hegemony on this terrain. Case in point is EG's challenge of Apple, one of the strongest platform companies, dominating the mobile app and commerce ecosystem. Game engine companies can grow into contenders in the competition over which companies will be able to manage users' identity, payments, and their social graph, thereby reigning over a key feature of the future of digital exchanges and commerce.

The article shows how game engines, while sharing some of the characteristics of existing key platforms, introduce new questions platform studies should address. At the same time, we add to the study of games by showing how the game *Fortnite* should be considered an important stepping stone toward what Matthew Ball and others have called a seamless, interoperational media space, or, in reference to speculative fiction author Neal Stephenson, a metaverse (Ball, 2020). This also illustrates the importance of recognizing what Digital Game Studies can tell us about future developments in which game logics come to feature beyond gaming proper.

Game Engines as Platforms

Platforms are an important feature of contemporary digital environments (D. S. Evans & Schmalensee, 2016). Accordingly, the social and economic influence of companies and organizations providing and maintaining them—such as Alphabet/Google, Amazon, Apple, Meta/Facebook, or Microsoft—have grown (van Dijck et al., 2018). While the term “platform” has developed into a near catch-all term for companies providing digital services, it denotes digital, physical, or service infrastructures that provide specific functions. A general definition identifies a platform as a structure that

(. . .) [enables] value-creating interactions between external producers and consumers. The platform provides an open, participative infrastructure for these interactions and sets governance conditions for them. The platform’s overarching purpose: to consummate matches among users and facilitate the exchange of goods, services, or social currency, thereby creating value creation for all participants. (Parker et al., 2016, p. 5)

There is considerably variety among platforms and their service constellations. There are platforms that allow people to exchange information (such as Facebook, Twitter, or Google), those that allow people to exchange goods and money (such as Amazon, eBay, Google Pay, or PayPal), those that provide computing power or server space for producers to develop apps or services that customers can use (such as Amazon Web Services, Google Cloud Platform, or Microsoft Cloud), those that provide people with the opportunity to run businesses and provide services (such as Microsoft), and those that circumvent established labor and legal institutions to provide cheap—or downright exploitative—labor or services to customers (such as Airbnb or Uber). Each of these platform types comes with different governance challenges and societal effects, and several scholars have noted that scholarship must “engage with alternative trajectories and potentialities of platform governance” (Chia et al., 2020, p. 20). By providing an interface between customers and producers and a place for them to find each other, platform companies are exercising considerable power over producers, suppliers, and consumers.

Platform companies set the de facto rules governing exchanges. Unsurprisingly, this has led to increased academic and regulatory attention toward the external and internal governance of platforms and their embeddedness in specific economic, political, or societal areas and their associated effects (van Dijck et al., 2018; Gillespie, 2018; Gorwa, 2019).

Platform studies remain a useful lens through which to examine the growing presence and importance of game engines as yet another type of platform in social and economic life. We propose bridging the discourses about platforms (in the social sciences and software studies) and game engines (in Digital Game Studies) in new ways by discussing the extant uses of game engines and their future viability as platforms along the vectors of design, business strategies, and public rhetoric. Companies, such as EG or UT, increasingly extend their traditional platform-based service as providers of game engines and move into sectors as diverse as architecture, the automotive industry, or film and television entertainment. By providing customers with advanced simulation and planning environments, game engines today already underlie more brick-and-mortar businesses than we realize. This makes them important platforms with a different focus and scope than those traditionally in the focus of academics.

For long, the study of platform infrastructures and their features have played an important role in game studies (Chia et al., 2020; Montfort & Bogost, 2009; Nieborg & Poell, 2018). This includes the study of hardware as platform infrastructure (Custodio, 2020; Jones & Thiruvathukal, 2012; Maher, 2012; Montfort & Bogost, 2009), software for the development of games (Chia et al., 2020; Foxman, 2019; Freedman, 2020; O’Donnell, 2013; Perks, 2021; Whitson, 2018; Young, 2021), and monetization tactics within and across games (Joseph, 2021; Nieborg et al., 2020; Perks, 2021). These studies show a wide variety in the constellation of platform infrastructures (Chia et al., 2020) but clearly document the power that platform providers have in shaping the option space and incentives for developers and gamers (Foxman, 2019; Freedman, 2020; Nieborg & Poell, 2018; Whitson, 2018). The role of game engines as platforms has featured strongly in this discussion (Chia et al., 2020; Foxman, 2019; Freedman, 2020; Nicoll & Keogh, 2019; Whitson, 2018); at the same time, game engine companies have always shaped their suite of services according to feedback from a heterogeneous group of makers, including big-budget publishers and everyday game makers (Young, 2021, pp. 142–143).

Game engines are platforms in that they provide developers with tools containing ready-made solutions for foundational programming tasks for games, virtual, and digitally augmented environments. These solutions include rendering of graphics, physics of environments, collision detection for objects, or artificial intelligence (Gregory, 2018). This cuts development time, allows many smaller game developers to

offer games with sophisticated look and feel, and over time allows the emergence of an open ecosystem of third-party developers and service providers that enrich and support the shared use of the underlying engine. Currently, the market for game engines is dominated by two companies, EG and UT. EG has cornered the market on high-end, extensive console games with their Unreal engine. In contrast, UT holds sway with their Unity engine over the market for independent game producers and mobile gaming (Chia et al., 2020; Foxman, 2019; Nicoll & Keogh, 2019). But their reach goes well beyond gaming and by now extends into architecture, artificial intelligence, manufacturing, public planning, and film and television production. In fact, by providing platform-based services for extended reality, game engines are poised to become one of the most important building blocks in the future of digital infrastructures.

Game engine companies have also begun to reshape the landscape of the entertainment industry by crafting digital environments that seamlessly integrate brand- and storyworlds, collapsing traditional silos demarcated by intellectual property by allowing users to interact across devices. Currently, this takes the form of gaming environments but promises to shift into environments for broader digitally enhanced sociality. A prominent example for this is the game Fortnite, provided by EG. Game engine companies thus provide platforms allowing for seamless interaction between users and seamless integration of brand- and storyworlds.

Finally, by providing platforms for developers and brand- and storyworlds, game engine companies can establish a strong position in the wider ecosystem of the management of user identities and online payments. As can be seen with the introduction of EG's Epic Game Store, companies formerly known for primarily developing and licensing game engines to developers become powerful competitors in the current ecosystem of digital identity management and payments.

Game Engines as Platforms for Extended Reality Applications

Game engines serve as platforms for the digitization of an ever-increasing share of cultural, economic, and social life (Freedman, 2020). These digital shadows can be easily integrated in diverse applications running on the respective engines, thereby creating an ever increasingly networked digital environment. With this, game engines are platforms crucial for the next step in the digitization of society by providing the basis for augmented and virtual reality applications, what some commentators have started calling the "metaverse" (Ball, 2020).

For long, extended reality—an umbrella term collecting the terms virtual, augmented, and mixed reality (Greengard, 2019, p. 17)—seemed like that obstinate part of the digital transformation which just would not materialize (Lanier, 2017; Rheingold, 1991; Schroeder, 1996). However, steady improvements in sensor technology and software have made extended

reality increasingly important for various sectors, such as industrial design, the development of artificial intelligence for driverless cars, or gaming (Bailenson, 2018; René et al., 2019; Schroeder, 2010). The need for remote-work and -socializing solutions during the COVID-19 pandemic has accelerated the development and wide-spread adoption of extended reality devices, technology, and services further (Jha, 2020).

Companies, such as Alphabet/Google, Apple, Meta/Facebook, or Microsoft, are all developing their presence in the space of extended reality. They do so usually with a focus on their proprietary hardware devices, such as the iPhone, Google Glass, Oculus Rift (Egliston & Carter, 2022), or Valve Index. But the success of extended reality depends crucially on the underlying software: rendering virtual environments and objects, and mapping physical movements of eyes, hands, body, and senses onto digital space. Hardware developers thus turn to game engines for ready-made solutions in these areas, yet only very few companies, such as EG and UT, provide engines versatile enough for broad-scale implementation across product lines. This alone instantly turns game engine providers into key players in the platform market, whose power is only going to increase with the rise of the importance of extended reality features.

These expectations might recall earlier cases when virtual reality applications were just about to revolutionize digital communication, most notably the discussion around Linden Lab's virtual world game Second Life. In the mid- to late-2000s, Second Life generated considerable buzz among investors, businesses, and researchers, announcing itself as the future of online communication, only soon to be eclipsed by less involved but easier to use social networking platforms, such as Facebook or Twitter. Why should the future of virtual or extended reality be different this time around? For one, technology advanced considerably, making connectivity and access to virtual and extended reality much easier than even a few years ago. More important than purely technological advances, however, are the broader application and seamless—invisible—implementation of associated apps and services. In fact, the purely virtual might not be the most broadly adapted and therefore important feature. Instead, extended or augmented reality applications, underlying many mundane interactions and transactions, might turn out to be the feature that determines the success of the coming metaverse. Here, the existing areas of usage of game engines may reasonably be thought to augur future developments: movie and television production, product design and engineering, providing environments of simulations for the training of artificial intelligence, and in architecture and public planning.

Game engines have become an important feature in film and television production. Tentpole movies, such as *The Lion King* (2019) (Seymour, 2019), and various television series, such as *The Mandalorian* (2019) (Farris, 2020; Seymour, 2020a, 2020b), the third season of *Westworld* (2020) (Mayeda, 2020), or *His Dark Materials* (2019) (Lumsden, 2020), are all relying on game engines to create partly virtual

environments their characters interact in. At the same time, game engines provide sets for sports and the news programs (Hatch, 2020). With the advent of the COVID-19 pandemic, game engines have been used to create virtual audiences at sporting events (Gartenberg, 2020) effectively turning them into augmented reality events.

In film and television, this practice is called “virtual production.” Production sets are surrounded by large LED screens on which virtual environments are rendered by game engines. These projections adjust for camera movements and thus offer much more flexibility for filmmakers than traditional green screens (Seymour, 2020c). By tinkering with the digital environment, film makers can adjust and improvise on the fly and in real time. Also, these environments prove much more immersive for actors and other creatives on set and thus improve on the often creatively sterile conditions in which actors must interact with tennis balls and special effects are only added long after filming has wrapped up. More important still from a business perspective, once environments and sets of prominent movies and television shows are digitized, they can be ported to other media environments using virtual or augmented reality. The desert plains and ice worlds traversed by the Mandalorian, for example, are thus directly available for use in theme parks or virtual gaming environments. Similarly, virtual characters or props are also directly available in these environments and offer the basis for fresh stories or immersive experiences for fans, even across traditional borders of creative brands or intellectual property (Freitag et al., 2020). Virtual environments can thus become the staging area for competition between fan-favorite characters from different entertainment universes or shows. The beginnings of this development can already be seen in Fortnite, as we show below (The Fortnite Team [TFT], 2020). It goes without saying that these cross-media and cross-brand opportunities only arise once the same engine is used across all prospective channels and outlets. This gives existing game engine companies a massive first-mover advantage over the competition and creates strong lock-in and network effects as each user of the game engine profits from an increase in the user base.

The patterns identified in the entertainment industry are also apparent in product and industrial design. For example, both Unity (UT, 2021b) and Unreal (EG, 2021b) have been prominently employed in the design of automobiles and motorcycles. This allows for similar cross-platform and cross-media uses as described in entertainment. New prototypes of cars or motorcycles can thus directly be used in television projects, games, or virtual and augmented realities based on the same engine.

Even more important, the virtualization of industrial products allows the use of artificial intelligence in improving them and provides the basis for predictive modeling and statistical learning. Digital objects can be used in simulations to train artificial intelligence models. The most prominent example for this is the testing of driverless cars in virtual

environments developed in Unity (Davis, 2020). Game engines are thus crucial components in the use of artificial intelligence in society and providing safe environments to train and test artificial intelligence-driven products, objects, and services.

Architects, city planners, and engineers design new buildings, products, or projects in digital environments built in game engines such as Unity (UT, 2021a) and Unreal (EG, 2021a). At the same time, they are digitizing existing buildings and products to improve them, include them in their planning, or making them available in virtual, augmented, or mixed realities. One of the most prominent examples for this is the Hong Kong International Airport (HKIA), whose planners developed a large-scale virtual 3D model (Sharon, 2019) that allowed them to simulate emergencies or architectural changes. Such models can also serve as the basis for commercial applications, for instance, by facilitating visits of these digitized structures and allowing businesses to advertise and provide services in augmented and virtual spaces. Simulations based on game engines are also used by the military (Fawkes, 2021; Klepek, 2021).

These examples show that game engines, especially Unity and Unreal, are poised to develop into dominant platforms in a market that increasingly emphasizes extended reality environments. This makes them important research objects. Platform studies have shown that digital infrastructures are powerful actors in shaping the opportunities of producers and consumers growing increasingly dependent on their services (van Dijck et al., 2018). The emerging importance of virtual, augmented, and mixed realities in business and society thus simultaneously snaps into view the importance of understanding the hidden power of game engines in this environment (Chia et al., 2020; Foxman, 2019; Freedman, 2020; Whitson, 2018). We may ask how technology used predominantly for intramedia storytelling may denote and reconstitute the essential features of brick-and-mortar businesses in virtual, augmented, and mixed realities (De Vynck, 2020) and how games and apps train end users for the coming virtual, augmented, and mixed realities. For this, EG's Fortnite provides a testing ground.

Fortnite as a Prototype of a Seamlessly Integrated Digital Space

For consumers, game engine-based platforms promise to provide arenas for mixed brand- and storyworlds that previously were siloed off or sharply divided along intellectual property lines. The economic and creative potential of intersecting brand- and storyworlds provided in EG's Fortnite may herald what some have called the metaverse, a digital space that affords seamless interaction via extended reality applications (Ball, 2020; Baszucki, 2021). The term metaverse has started to feature prominently in the rhetoric of tech executives when outlining the future trajectory of their respective companies. Perhaps most prominently, Mark

Zuckerberg, in May 2021, announced that the metaverse would be a guiding principle for Facebook's future development. The announcement culminated in the rebranding of the company Facebook as "Meta." The future of platforms, according to Zuckerberg, is tied to their ability to offer a variety of interconnected, interactive experiences, generating an "embodied internet" (Newton, 2021). Similarly, EG has argued that it too wants to build a metaverse with Fortnite. In addition, there are less centralized metaverse projects already online, such as Decentraland, a virtual online platform where users plot out land to build their own worlds (Herrman & Browning, 2021). If nothing else, these projects illustrate the perceived earning potential the metaverse concept holds among established and prospective platform companies. Many seem to see the future of platforms in their affordances of seamless, playful engagement in virtual or augmented digitally connected environments. Examining interactive online gaming closely will thus give us a sense of how this might turn out. Therefore, we turn to Fortnite.

Fortnite: Battle Royale is an action game in which up to 100 players get dropped simultaneously into a combat arena, duking it out in a last-person-standing style, armed contest. As of May 2020, Fortnite boasted 350 million registered players worldwide. The game's success has allowed its publisher, EG, to raise its value to US\$17 billion dollars. Its base of monthly active players ranges between 60 and 80 million, ranking it third in monthly audience activity behind its competitors Roblox and Minecraft (Iqbal, 2020). While its player base is predominantly male and between the ages of 18–24 years, Fortnite generates between 100 and 150 million views by non-gamers (often female) on streaming platforms, such as Twitch and YouTube (Ball & Navok, 2020b). The game is free to play; revenue is driven by in-game purchases through which players buy outfits and accessories for their avatars or get access to special world maps and modes but cannot buy competitive advantages. Since launching on Apple's iOS, Fortnite has generated revenues of roughly US\$1 million a day on iOS alone, and roughly US\$200 million in May 2019, making it the top free-to-play game in the West. But where the game rises above its competitors is in the number of hours consumers spent playing: As of April 2020, players logged a cumulative 3.2 billion hours, a number significantly higher than the ones put up by its competitors, relative to their respective player bases. Half of its US player base plays Fortnite exclusively (Iqbal, 2020). These statistics illustrate Fortnite's ability to attract and retain players, to make them commit to its ecosystem, and to animate them to engage with it. The time spent within the game is crucial for any company that monetizes user activity not through a subscription model but through recurring small transactions for skins or loot boxes by power users induced within the process of actual play. It also positions EG competitively within a market environment in which companies vie for users' time by offering seamless, convenient ways to engage with multiple media experiences more broadly.

This is illustrated by Netflix CEO Reed Hastings identifying Fortnite as the strongest competitor of his streaming service instead of other high-profile streaming services, such as HBO (Hastings, 2019, p. 5).

What makes Fortnite an extended reality space is "Party Royale," a non-combative game mode that was added in 2020. Here, players interact with each other, attend concerts, or watch feature-length films, all through their avatars. On its face, the addition of Party Royale expands and simultaneously diversifies Fortnite's player base by attracting players who are otherwise averse to the shooter genre. While Fortnite's short-term success seemed to rest on its adaptation of the battle royale genre, its long-term viability may well depend on its non-competitive modes, such as event hosting, and especially its editor functions (Abend, 2020).

Another possible explanation of Fortnite's appeal is that it smartly foregrounds the logics of storytelling over those of combat. The game uses broad narrative structures to create continuity and register change in its game world. However, 2017 saw the introduction of season and chapter structures in the competitive modes. Each season brings narrative changes that become reflected in the in-game island's topography and includes special offers in the store front. Seasons also contain special-timed story events and collaborative combat missions. They can also be themed and cross-branded with other media IPs—for instance, Season 5 introduced the threat of the Marvel Comics villain Galactus, against whom players must defend the Fortnite universe (TFT, 2020). These seasons form "serialized" and "composite environments" that bear all the hallmarks of an organic "ecosystem," including longevity and most importantly "resilience" (Innocenti & Pescatore, 2017, p. 177).

At the same time, these stories and franchises merely function as lures, from the perspective of the platform holders (Steinberg, 2017, p. 155). In fact, to operate effectively, storyworlds require a cohesive "single worldview" (Steinberg, 2017, p. 152). Fortnite offers dense referentiality but does not demand intricate knowledge of its storyworld lore or of the individual franchises from which it synthesizes its world. Instead, it piggybacks on the emotional resonances, communal ties, and meanings provided by extant franchises and thereby enriches the gaming and social co-presence experience. Fortnite fosters a "meta-community"—a community incorporating multiple diverse fan communities—in a unified space. This may be the reason why the game has been able to maintain broad appeal and has avoided becoming hermetic.

Various roadblocks bar the way to a fully integrated and truly seamless platform experience, however. Some see true "media convergence" hindered by the organizational deadlock between the creative and collaborative thinking that underpins design, on the one hand, and the protective and individualist animus that governs the stewardship of intellectual property, on the other hand (Jenkins, 2008, p. 109). Others emphasize that the technology does not currently exist

to host a synchronous experience for millions of users (Ball & Navok, 2020b). Platform integrity, or lacking interoperability between platforms, presents another obstacle. Both arguments give us useful, albeit negative, markers for tracking the nascent metaverse from a design perspective.

And yet digital platforms have proven capable of bringing coherence to hybrid mediascapes by allowing continuous feedback and interaction among users and generating a sense of “liveness” and “eventfulness” (Ytreberg, 2009, p. 480). Rap-artist Travis Scott’s “Astronomical” online concert—a prelude to the live concert “Astro World” that saw several attendants get injured and killed—figures as such an event. Here, players converged on a Fortnite stage during several “tour dates.” Scott would appear as a giant stylized figure to perform his songs and deploy a stage show with psychedelic lighting and gravity effects. During the event, players—who could move freely but could not engage in combat—were affected by the changes in environment and gravity. Other events include more linear experiences, for instance, the sneak preview clip of *Star Wars: Rise of Skywalker* on a giant in-game video screen. Both events generate a feeling of shared, spatially bound group experience, while facilitating multi-channel communication, for instance, players streaming concerts through their YouTube channels.

Fortnite may allow users to interact rudimentarily across brand- and storyworlds, while simultaneously creating a sense of place and narrative continuity, even if these features seem a far cry from the vision of a seamless universal platform of platforms. The true metaverse “may have some game-like goals, including games, and involve gamification” and may be “oriented around specific objectives” (Ball & Navok, 2020b). But even that description begs the question how much navigating the metaverse will require users to adopt strategies they know from online gaming. As it stands, most interactions in Fortnite occur under the rubric of conspicuous consumption: players purchase for their avatars branded outfits that represent different entertainment franchises or non-verbal emote gesture, which they can engage in during events. But besides liveness at communal events, it stands to reason that the prospect of seeing different franchises interact in shared storied spaces, whether competitively or casually, holds some significance for players. Fortnite’s sense of place, arguably, stems from the fact that it forms a kind of nexus of franchised storyworlds where players may perform their brand allegiances and thus infuse their play with meaning. A closer examination of the ludic character of this convergence may allow us to glimpse the operational logic of a game-engine-based metaverse.

From a design perspective, games are disinterested worlds that can be enjoyed for their own sake and may thus generate emergent user activity, that is, player actions that exceed design intentions (Salen & Zimmerman, 2003). We see this feature increasingly in open-world game design that focuses on allowing players to inhabit a world rather than fulfilling mission objectives, thereby generating unforeseen communal

activities and emergent forms of play. For instance, players of the hit Western action role-playing game *Red Dead Online* in 2019 rallied together to walk from one end of the game map to the other, carrying bowls of soup while foregoing the game’s combat (Zwiezen, 2019). Such system-centered game design that invokes “meaningful play” (Salen & Zimmerman, 2003) becomes increasingly significant for platform holders, as it responds to the twin objectives of player engagement and retention. As with games, we can expect user behavior to be shaped by the digital structures provided by game engines in the platform space, and these same structures may in turn be shaped by unintended user behavior that carries unexpected but shared meaning.

Fortnite’s appeal as a brand platform is its ability to generate what narratologists and media studies scholars call “storyworlds.” These worlds are characterized by a threefold mediality consisting of “semiotic substance” (image, sound, etc.), a “technical dimension” (technology, modes of production, and material support), and a “cultural dimension” that makes the world recognizable to players by including elements of the real world (Ryan & Thon, 2014, pp. 29–30). Video games offer particularly compelling storyworlds because they require perpetual interaction and offer players a variety of choices, which in turn necessitate multiple play sessions (Ryan & Thon, 2014, p. 41). Once again, our contention is that Fortnite is worthwhile considering for this feature because organizational properties, such as narrative convergence, will continue to matter in game-engine-based platforms once they move in fields beyond gaming, for example, illustrated in the novel “Halting State” by Charles Stross (2007).

Anthropologists and media studies scholars, such as Mark Wolf, point out that imaginary worlds have always been part of human cultural practice. The term “world” in this context encompasses, “everything that is experienced by the characters involved, the elements enfolding someone’s life” (Wolf, 2013). Virtually, all cultures create such worlds that they then “decouple” from everyday experience. Imaginary worlds allow us to “engage emotion systems while disengaging action systems,” cycling through scenarios, testing hypotheses, and pondering counterfactuals (Wolf, 2013, p. 4). Online game worlds are networked, persistent, feature large spatial extensions. They are explorable by multiple users simultaneously and include role-playing elements, insofar as player avatars evolve across multiple play sessions (Klastrup, 2014). Fortnite’s in-game island structure, for instance, reflects this flexibility by simultaneously constituting an explorable space and a place from which players can mount a variety of activities.

While Fortnite may not yet be a metaverse, its unique synthesizing of stories, franchises, and its ambition to be a place rather than a storefront make it into a compelling prototype for cross-platform and cross-media story- and brand worlds. Overall, Fortnite offers developers and researchers a valuable microcosm for studying the effects of technical and

narrative design choices on player behavior and retention. With Fortnite, we clearly see the simulational and ludic affordances that game engines provide as platforms. These design goals exceed the requirement of programmability and the logics of social hubs and marketplaces by inviting emergent play. Introducing this ludic logic suggests that platforms will provide digital environments that are both seamlessly expansive spaces and that house a wide range of social and economic activities that are not easily codified. These environments will be navigated like games, that is, navigation will require users to develop strategies of wayfinding as they do in ergodic media, such as games. Beyond this, Fortnite also illustrates how game engine companies work on changing the established balance of power between platform companies. Relying on the user base and popularity of Fortnite, EG has challenged established platform companies in core areas of their business, the management of user identities, and online payments.

The Fight Over Identities: EG's Challenge of Apple

Three important areas where contemporary platform companies battle for dominance are the management of people's identity, payments, and social graph. For one, the secure identification of people matters immensely in a world where commerce moves online, connected devices manage homes and cars, and people interface in virtual environments. Various platform companies are competing in this space to replace the established username/password pairing by allowing users to use their platform accounts to access content or services (B. Evans, 2015). Second, platforms compete to authenticate purchases and transfer money. You might not necessarily trust that little internet-based shop with the dodgy website with your Credit Card information, but through an intermediary like PayPal, the transaction reduces risk and becomes viable. It is no surprise to find various dominant platform companies providing their users with payment services of increasing ubiquity: Apple Pay, Google Wallet, Amazon Pay, and PayPal are all in the market of becoming the dominant payment processor for online transactions. They try to become trusted payment intermediaries between customers and suppliers, thereby being able to control access to customers and take a cut from each transaction. It is this area where we find EG overtly challenging the established platforms. Third, users' social graphs have become a valuable commodity for platforms for the marketing of products or distribution of information.

At the heart of Epic's challenge to established platforms lies The Epic Game Store, which opened in December 2018 as part of Fortnite's game launcher application (Ball & Navok, 2020a). The Epic Game Store took advantage of Fortnite's player base to break into the online retail market. It first competed against Valve's PC game store, Steam, by offering developers lower license fees—Epic takes 12% of

revenues from purchases on its marketplace, while Steam took 30% (Statt, 2019). While the Epic Game Store initially did not provide the same conveniences as Steam, it exploited the fact that Steam was beginning to drive away developers due to high costs and a lack of content curation. Epic painted itself as the scrappy startup who champions developer rights and consumer choice, although this picture clashed somewhat with its policy of cordoning off games by making (temporary) exclusivity deals with developers to undermine its competitors.

With the establishment of The Epic Game Store, EG positioned itself as a gateway to multiple games, providing the basis of the subsequent central management of gamers' identities and payment to game developers and the users social graphs of interconnections with other players. This strategy will only gain relevance as consumers get accustomed to moving cross-platform over multiple games with the same player identity. In a second step, EG showed that their challenge does not only pertain to competitors in the gaming sector but also extends to much larger platform companies.

After gaining a foothold in the market, EG has begun contesting Apple's and Google's licensing fees for developers in their respective stores in legal court. This latest skirmish is of particular interest because it shows Epic's long-term ambitions of becoming a player in the transmedia platform marketplace. Apple's App Store is a vital element in the success of its iPhone, the company's balance sheet, and a fundamental element in the functioning of the mobile computing ecosystem. For one thing, Apple offers customers a trusted environment to interact with developers. You might not trust a developer of your app of choice with your contact or financial information. By Apple stepping in as a trusted intermediary, the transaction becomes viable, as Apple has said information anyway and can vouch for both parties in return for a 30% cut of each interaction fulfilled on its store. In addition, through Apple's intensive vetting process of Apps on its storefront, users have an additional layer of trust and security in the functioning of the app and it's not being able to uncontrollably siphoning data or personal information. Apple enables transactions between users of its hardware devices and software suppliers, thereby increasing the overall value of its transaction feature and the overall use value of its hardware, while also having third-party developers providing more software and thereby more uses for the devices (B. Evans, 2020). But the quality of this intermediation has become increasingly contested (McGee, 2021).

Apple's strategy comes at the expense of a comparably high level of interference and dependency of developers on the company and at a high price for developers, namely 30% of each in-app purchase. This perceived practice of invasive control is the rhetorical basis of Epic's challenge. Epic's recent lawsuit was accompanied by a media blitz, which emphasized the media historical stakes of the contest for platform supremacy that we discuss here. Epic released a video titled "Nineteen Eighty-Fortnite" via its Fortnite YouTube

channel, it also screened as a live event within Fortnite and was accompanied by various social media hashtags. In it, Epic announced that it “had defied the App Store Monopoly” and that Apple had retaliated by ejecting Epic from its store (Nineteen Eighty-Fortnite—#FreeFortnite, 2020). The video parodies Apple’s “1984” (dir. Ridley Scott) Superbowl television commercial for its Macintosh II, in which Apple appeared as the scrappy underdog who defied IBM’s monopoly on personal computing. Both commercials draw inspiration from George Orwell’s dystopian novel *Nineteen Eighty-Four* (1949), and both adapt the aesthetic of Michael Radford 1984 filmic rendition of the 2-min hate ritual described in the novel. Both depict the respective monopoly holder as a totalitarian Big Brother, peering down from a big screen onto a sea of servile workers. The commercial’s militaristic rhetoric indicates that Apple had itself become that which it formerly professed to despise, a repressive and totalitarian hegemon who (creatively) stifles and subjugates its costumers. A court ruling in September 2021 upheld Apple’s sovereignty over its App store, denying Epic’s charges of monopoly while allowing Epic and other developers to direct customers outside Apple’s ecosystem to their own stores (Sorkin et al., 2021).

The case shows EG’s willingness to challenge established platform companies in their core business functions. It also reveals the competition for the expected value generated by the coming market for purchases within virtual or extended reality applications, of which the current in-game and in-app purchase economy should be a meek foreshadowing. The outcome of this legal skirmish suggests that these prospects will turn into fiercely contested market shares once game engines start to provide augmented reality overlays outside of exclusively virtual gaming environments. Here, not in exclusively virtual worlds, can we expect the actual value of the metaverse to manifest and therefore the fiercest competition between platform companies to emerge. So far, however, jurisprudence seems to side with the established platform holders.

Providing Engines for More Than Just Games

We have charted three areas in which game engine companies have started to extend their business beyond gaming and how the game engines developed, provided, and maintained by them are evolving into crucial building blocks of digital technology more broadly. Game engines provide the hidden backbone to an ever-increasing digitization of social, economic, and political life. Accordingly, the characteristics of game engines as platforms in the various fields they have come to touch will have to feature more prominently in the emerging literature on the role and impacts of platforms in society. The vibrant discussion of game engines as platforms in gaming and cultural production offers many promising connection points for this discussion but its insights will

have to be transposed to the specific contexts beyond gaming (Chia et al., 2020; Foxman, 2019; Freedman, 2020; Nicoll & Keogh, 2019; Whitson, 2018).

Our discussion of the uses of the Unreal and Unity engines has shown their importance in the development of extended reality applications in diverse fields, such as architecture, artificial intelligence, entertainment, or public planning. The evolution of the online game Fortnite provides a prototype for dynamics and developments for cross-platform and cross-media story- and brand worlds. While still situated in the realm of gaming, the associated patterns can be expected to translate to larger extended reality applications well beyond narrow gaming environments and therefore may presage future developments in larger social, economic, and political contexts. By providing solutions to payment processing, identity management, and the social graph of their users, game engine companies move in on crucial economic turf of established platform companies and challenge the current balance of power there. Game engines clearly constitute an important new type of platform and therefore demand academic and public attention.

In this article, we have drawn on analytical logics, themes, and theories from communication studies, culture studies, and digital game studies. Still, this article remains an initial survey of new, if fertile, territory. We sought to broaden the existing conversation on platform companies by shedding light on a new, powerful player on the board that had remained, for the most part, undetected in academic conversation. We aimed at explicating the technological foundation, cultural penetration, and business strategies behind expanded-reality platforms and traced out the shape and size of its challenge to established platform companies. We have focused on two specific platform companies, EG and UT. We chose both cases for their prominence and their comparatively well-documented activities. Other companies—such as Roblox, Valve, or for a more Asian-focused discussion Tencent—could have also served as exemplars and await further scrutiny. We have mapped the topography of the topic but have not provided an in-depth analysis of the different roles that game engines may play as platforms. Here, a series of theoretical and empirical extensions of platform studies awaits.

For one thing, the growing use of game engines by traditional brick-and-mortar business—such as architecture, public planning, or the automotive industries—demands an extension of empirical work on understanding the relationship between these sectors with these new platform companies to identify mutual dependencies and power relationships. How are game engine companies shaping the practices and power dynamics in the fields they come to touch? Also, how are they shaped by the new environments they enter? Considering the role of platforms in other industries—such as culture, public transport, news media, or hospitality—can serve as a promising starting point.

The growing use of game engines to provide simulated environments for the development and testing of artificial intelligence applications also opens an important new research area. Currently, social science discussion of artificial intelligence focuses on biases inherent in pre-existing datasets and algorithms. And while this critical focus on the here and now remains important, we must add to it constructive considerations of the role simulated environments will play in the development and functioning of algorithms and artificial intelligence applications. Here, the relationship between game engine companies and those developing artificial intelligence applications and their design and testing practices provide a rich new research field.

Much attention has been paid to the emergence of cross-platform and cross-media story- and brand worlds in gaming environments, such as Fortnite. Here, scientists need to critically examine the intertwining narrative and commercial practices to understand their impact on engagement and community formation. These environments provide early staging grounds for principles that will matter a great deal for the future of digitally mediated social, economic, and political interaction. Here, the interdisciplinary exchange between scientific and scholarly disciplines seems especially promising, as the phenomenon under study touches on areas and mechanisms traditional in the focus of distinct scientific fields, such as communication studies, culture studies, digital game studies, political science, and sociology.

Finally, the discussion of EG's challenge of Apple through its game store shows that platform studies should take a close look at the underlying economics of platforms (Joseph, 2021; Nieborg et al., 2020; Perks, 2021). Current debates on platforms, such as Facebook, Twitter, or YouTube, tend to focus on the monetization of user information through ad-based business models of platforms. Consumers are only one entity in the many-sided markets provided by platform companies. This perspective leaves out the implications of, for example, business-to-business interactions (van der Vlist & Helmond, 2021). The economic strategies of monetizing suppliers of applications or information on platforms is just as important and provides a crucial key to the understanding of the market power of platforms. The severity of the conflict between EG and Apple has shown the importance of this side of platforms' business models and their readiness to defend their position heavily.

Platform studies need to follow the ongoing shifts in the architecture of digital technology. The emergence of game engines as platforms for the increasing digitization of economic, social, and political life in combination with what some have started calling the metaverse—in other words, the emergence of extended reality applications and services—represents such a shift. As we have shown in this article, the current developments fit into not only the analytical framework of platform studies but also demand extensions. These extensions can be achieved through broader interdisciplinary efforts, especially toward digital

game studies. As the reach of platforms extends and their variety grows, platform studies will enjoy growing attention, but it will also have to recognize an increased need for interdisciplinary research and keep an open mind toward new developments in the growing digitization of social, economic, and political life and associated new players, infrastructures, business models, and practices.

Acknowledgements

The authors thank David Karpf, Oliver Posegga, and three anonymous reviewers for their valuable feedback on earlier versions of the article.


Declaration of Conflicting Interests


The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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