CYBERIADA

2024-2025

The publication presents a collection of articles authored by academics involved in the implementation of the Cyberiada Championships in Computer Game Design

Beyond Entertainment:
Academic Approaches to Gamedev Industry

Beyond Entertainment: Academic Approaches to Gamedev Industry

edited by
Paulina Michałowska, Adrianna Gregorczuk, Łukasz Czyżewski and Ireneusz Miciuła

December 2025

Anthology published in Avant Anthology series

Publisher of the series: Avant Project

Co-publisher of the anthology:
Maria Curie-Skłodowska University, Institute of Philosophy

Address of the Editorial Office:
pl. Marii Curie-Skłodowskiej 4, room 203
20-031 Lublin, Poland

Number of pages: 190

Cover design by Justyna Urniaż-Badowska

DOI 10.26913/ava4202501

ISBN 978-83-969444-4-3

Contents

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Foreword

The Cyberiada Championships in Computer Game Design is a nationwide educational and competitive initiative aimed at fostering collaboration between academia, education, and the game development industry. The project supports the development of digital, creative, and interdisciplinary competencies by engaging students, educators, and academic staff in the design and development of computer games.

Cyberiada combines elements of competition, mentorship, and knowledge exchange, creating a space where academic research, teaching practice, and industry experience intersect. The initiative contributes to talent development in the fields of information technology and game development.

The project is implemented with the support of the Ministerstwo Cyfryzacji under Grant Agreement No. 507/CRKC/25. The publication of this work forms part of the implementation of the grant funded by the Ministry of Digital Affairs.

The project is carried out by the Teatrikon Foundation for Creativity, Education and Youth Animation.

Paulina Michałowska, Adrianna Gregorczuk, Łukasz Czyżewski & Ireneusz Miciuła

December 2025

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

The (Un)perverse Symbolism of the Cross and Crusade in *Elden Ring: Shadow of the Erdtree*

Beniamin Barczyński
Karol Godula Upper Silesian Academy of Entrepreneurship, Poland
beniamin.barczynski@gmail.com

Received 2025-06-09; accepted 2025-12-18; published Online First 2025-12-30.

Abstract

The plot of the expansion to *Elden Ring*, titled *Shadow of the Erdtree*, extensively uses the central symbol of Christianity, which is the cross, and also the crusade derived from it. This article describes how the creators of the game and its expansion, the Japanese studio FromSoftware, approached these two terms, transferring them to a fictional fantasy world. The game developers explicitly demonstrated one crusade, which gave rise to the plot of the expansion, and this demonstration can serve as an artistic and at the same time critical commentary on the factual Crusades. But implicitly, the developers also described the second crusade, and not so much described it as allowed the player to take part in it. And this procedure may affect the interpretation of a game. Depending on the player's approach, it can serve as a personal complement to a scathing commentary on actual Christian military campaigns, or simply as an entertaining realization of poetic visions of medieval journeys to the Holy Land.

Keywords: video game, narratology, interpretation, symbolism, Christianity

1. Introduction

Starting from simple entertainment, video games relatively quickly became complex products of human culture in all its meanings, and they also begin to shape this culture in a way that is inaccessible to other media (Cerezo-Pizarro et al., 2023). Contemporary discourse and collective imagination can no longer do without video games. For this reason, virtually every aspect of such digital, interactive works deserves serious academic scrutiny. One such aspect is the symbolism, which, thanks to the possibility of linking it to interactivity of

a game, gains a second layer of interpretation. Bartosz Staniecko, continuing the thought of Lev Manovich about interfaces (Manovich, 2002) and Paul Booth about interactivity (Booth, 2009), calls this *narractivity*. It is a process, not an artefact—it arises as a result of the hybridisation of ludic and narrative activity at the level of 'the navigable space of the imagination' (Staniecko, 2019, pp. 91). Of course, not every video game exploits the full potential of this process, but there are some that do so in a way that is surprising or simply qualitatively good. Such games are not only great entertainment, but also a rewarding subject for research of all kinds.

The significance of studying symbolism in video games goes beyond a plain form of cultural criticism. These digital spaces can serve as proving grounds for understanding how symbols and their systems function in interactive, often public, environments, how players undertake meaning-making processes, and how contemporary creators reinterpret historical, religious, philosophical iconography for modern and broad audiences. The fundamental challenge in research of that stems from three tasks, specified by Michał Kłosiński:

> The first is to generate interpretative questions that problematize the game at hand. The second is to identify the preferred theoretical framework within which the interpretation takes place. The third, and last, task is to help formulate interpretative hypotheses, which are crucial for the process of understanding the nexuses of meanings. (Kłosiński, 2022)

The precision of the above citation would suggest that this is basically all that is needed to interpret video games. However, it should be noted that the specificity of this medium is not only interactivity, but also multimodality, one that Sigrid Norris would describe as high 'modal density' (Norris, 2004). Video games present their content across many simultaneous channels: visual, audial and in some even kinetical (e.g. gamepad's vibration), and in each of these channels, and especially in the visual channel, it is possible for many layers to exist simultaneously, each of which can operate in its own unique way at a given moment. Add to this the aforementioned interactivity and this creates a fourth channel: causative, as the mechanics in the game must be designed just as much as the sound or image and thus also represent a certain content. During gameplay each channel, each layer can reinforce, transform, or contradict each other's symbolic meaning, which usually increases the number of possible interpretations, but can also radically reduce them.

And with that, we return to narractivity. Classically understood interpretation tends to present the studied work as a single, ultimate point, which is inconsistent with the fact that experiencing narrative gameplay is a process. All the more variable the higher the modal density that can be observed. It is not enough to make just one hypothesis. It is necessary to pose a whole series of them. It can be said that when studying a specific game, a scholar has to create

a certain 'story' about that game's story. Without going further into this metaphor, it is worth pointing out that the situation only gets so complicated when we study the absolutely entire game and not just one aspect of it. Fortunately, only the symbolism is addressed in this article.

The scholarly approach to video games no longer relies on borrowed frameworks from other fields of humanities studies. Developing appropriate general research methods from the scratch was difficult and had to take its toll (Consalvo, Dutton, 2006; Simons, 2007), but in the last decade it has resulted in specialised monographs focusing, for example, on interfaces and immersion (Kubiński, 2016) or hermeneutical game studies (Kłosiński, 2018). Semiotics in game studies has not been overlooked either. It has been written about by scholars such as Jason Hawreliak, who targeted multimodality in his work (Hawreliak, 2019), and Gabriele Aroni, who focused on semiotics of in-game architecture alone (Aroni, 2022). Studies of religious symbols in video games, i.e. those most relevant to the topic of this article, have been carried out, among others, by Lars de Wildt and Stef Aupers who described roleplaying aspect of games 'suffused with religious elements' based on interviews with players from different nations and (non-)religious backgrounds (de Wildt & Aupers, 2018). The same year also saw the appearance of an entire monograph on methods for studying video games and religion (in which de Wildt and Aupers included their other work, focused on MMOs). The introduction to this book makes it clear how complex the subject is:

> Games with explicitly religious content appear on the market, coming from diverse religious traditions and backgrounds and ranging from proselytization to education and cultural dialogue. As a consequence, games can reflect, reject, or reconfigure religious ideas and are a source for the construction of religious practices and ideas in modernity. (Zeiler, 2018, pp. 3)

As can easily be seen, games can interact with religions and their motifs in an analogous way to channels conveying game content between themselves. In this article, only one motif will be addressed along with its one derivative—the cross and the crusade. The former is, one might say, the central symbol of a certain religion, and the latter is inseparable from this religion's history. And this is also the case in the game under this study.

2. Cross

The plot of *Elden Ring* (FromSoftware, 2022) takes place in a fictional world, with its own history, traditions, and geography. A complete *topos*, *mythos* and *ethos* is created for the game, as Krzysztof M. Maj would put it (Maj, 2019, pp. 171). Two years later, an expansion came out, entitled *Shadow of the Erdtree* (FromSoftware, 2024), which introduced a new land and a related storyline, focused on a certain crusade. But *Elden Ring* in its original edition was already

playing with some Christian symbols. Most notably with the cross, although not in its most popular visual form. The cross we see in the game looks like this:

Figure 1. One of the many crucified people the player may encounter in the base version of the game. Notably, they are all still alive. Source: FromSoftware, 2022

I used the word 'playing' because Christianity as such does not exist in the world of *Elden Ring*. Every religious motif exists there on the basis of distorted transfictionality—a variation of intertextuality in which the intertext is not only a linguistic expression, but also a fictional character, place or even the entire world. A characteristic feature of transfictionality is the ability to mask the intertextual nature of the reference by avoiding direct mention of other cultural texts and carefully concealing the source of the citation (Maj, 2017, pp. 246). The symbol of crucifixion, which is so widespread throughout our world, can also be transfictional, even if the name Jesus or any other word associated strictly with Christianity does not appear. But, as I mentioned, it is a distorted transfictionality. The non-traditional appearance of the cross itself in-game is a first indication of this. There are others, 'deeper' embedded.

Above all, a cross would not be the cross if it were not for the fact that a figure believed to be a god hung on it. In the world of *Elden Ring*, something like this has also happened.

Figure 2. In this state, the player encounters Queen Marika the Eternal—the divine sovereign of in-game world. Source: FromSoftware, 2022

Figure 3. A closer shot of Queen Marika. A spear-like object can clearly be seen piercing her through. Source: FromSoftware, 2022

The reference is clear and consistent in narrative and visual layers. There is a god(dess) that hangs outstretched, taking the form of a cross, and whose body is pierced. Crucifixion is a punishment that has been used on criminals and blasphemers before (Fig. 1), and it acquired a new meaning this time when the god was crucified. But this novelty only occurred for the player character. For

the players themselves, Marika's crucifixion took on an ‘old’ meaning. The symbol of the crucified god is so strongly marked in a human culture that there was a break in what Linda Hutcheon calls a ‘heterocosm’ (Hutcheon, 1987, pp. 8). All the fictive referents, instead of pointing to each other after the player has spent so long getting to know them (Marika is encountered only at the end of the many hours of gameplay) and constructing a common meaning from them, suddenly have to refer to external texts to become somewhat comprehensible. Or at least this interpretation imposes itself, as there is no explicit information in *Elden Ring* about why the goddess of that world is in such a state. Maybe this crucifixion is meaningless, and any other kind of punishment would serve the same narrative function. Or maybe it has enormous significance, because… And this is where the player’s theories begin (Holiday Engineer 7521, 2023; Rick the Freak, 2024), which is beyond the scope of this article.

The cross in *Elden Ring* is defined by the singular act of crucifying a god. The game does not provide any other information that describes this symbol or this shape differently than the Christian religion does in the current world. So, the cross is a direct reference to Christianity and nothing else. Distortions in the form of gender alteration of the god, little different shape of a cross, lower place where the body was pierced with a spear, it all serves one purpose—to think through, piece by piece, what this symbol means in the game world, and for this we need to think beforehand about what it means in our world, where it is free of these distortions. Conversely, the crucifixion of Jesus is full of distortions compared to that of Marika. In order to know everything about one version, we need to know the other one thoroughly. This is a cultural dialogue and the players’ meaning-making process. Shared when the discussion moves to online forums. They can learn new things about the actual religion through its fictional referent. This is similar or maybe even identical to what the previously mentioned Lars de Wildt described based on interviews with players from around the globe (de Wildt, 2021, pp. 103-140). We can read in his book:

> After games are made, sold and find their ways into players’ homes, the way games are consumed leads to meaningful public debate and individual (ir)religious experience. This, perhaps surprisingly, reasserts inter-religious experiences in public and private spheres, as they are played with and negotiated by players. (pp. 132)

But there is a little more to this matter. Another thesis can also be put forward. The distortions in the transfictional symbols are not to educate, but to indicate, through their nature, the intentions of the game's authors, who did not necessarily want to simply copy ideas from the current world. It is up to the player to decide which interpretative path to take… at least at the beginning of thinking about the world and plot of *Elden Ring*.

3. First Crusade

The symbol of the cross, or rather the symbol of the crucifixion, does not pose the same interpretative challenge to players as the crusade does. There are two reasons for this. Firstly, the crucifixion only shows its narrative depth towards the end of the game and generally does not take up much screen time. And secondly, the whole symbol is almost entirely non-interactive in *Elden Ring*. It does not convey content through the causative channel—the player cannot differently interpret it through the actions of their avatar in the game. The only situation of interactivity in the case of the cross symbol is that the player's last enemy in the plot can grab the player's avatar and perform a spectacular crucifixion on them, thus confirming that this entity was responsible for Marika's crucifixion. Just that and nothing more. If the player plays the game well enough, they will evade this grab attack and not find out this one little piece of information that could have been suspected through other clues.

In contrast, the symbol of the crusade is entirely interactive in *Elden Ring*. Its interactivity, and therefore its narractivity, is divided into two parts: the first crusade and the second crusade. The first crusade in the world of *Elden Ring* took place before the events in which the player takes part, which include the second crusade (but more on that later). The player character encounters in a new land participants of the first crusade when it is formally still ongoing, although it was practically ended long ago. The nature of that expedition is best exemplified by the description of *Crusade Insignia*—the item the player receives after defeating a certain knight involved in this:

> A talisman depicting a raised spear on a backdrop of flames, in remebrance of the lives lost in the sacred crusade led by Messmer.
> Raises attack power after defeating an enemy.
> The warriors who fought in the crusade set aside both honor and mercy to wantonly impale and scorch those deemed impure.
> Those who felt invigorated by each cry of death were the same men who were certain of the sanctity of the campaign. (FromSoftware, 2024)

Wandering through this land where the crusade took place, the player sees every now and then the desolation that was wrought there. It is often very difficult to describe. The people who suffered from the crusade—'those deemed impure'—did not have warm feelings towards their invaders, because to them that is what the crusaders were, nothing else. Especially as the headhunting and oppression never ended, despite the emergence of an undisputed victor in this conflict. The narrative clearly and in many ways conveys who is the monster here and therefore who is to be sympathised with.

But to what does this massacre, this genocide refer? To which of the real, historical crusades? And does it have to refer to history for the player to be able to relate to it themself? To answer the last question first, of course not. The heterocosm is not broken here as with the symbol of the cross. Narration of *Elden*

Ring uses the word ‘crusade’ as belonging to the game world. It describes a military campaign that, at least officially, is fought solely in the name of god(dess). Remarkably close to the historical definition, is it not? How does it differ? The fact that in *Elden Ring* the crusade happened because god(dess) really wanted it to.

> Black armor of Messmer the Impaler. Draped with a red cloak bearing his crest embroidered.
> On his mother's wishes, Messmer made himself a symbol of fear, undertaking the cleansing crusade she desired.
> “Direct thy maledictions, thine ire, and thy grief towards me alone.” (FromSoftware, 2024)

The above quote is a description of the armour belonging to the crusade leader Messmer, who was the son of Queen Marika. She had ordered her child to purge the land, which, as the player may learn during the game, was her native land. The Holy Land, one might say, seeing the reference to history. But while the purpose of this campaign and its instigator are known, it is still unclear why the crusade was called a crusade and not, for example, an expedition against the barbarians. Marika, when she sent her son off to war, was not yet crucified, and it was that crucifixion that gave the cross its godly meaning in this world. The reasons why Messmer’s crusade became internally a crusade are to be found in the game and may or may not be convincing to the player. This is of no deeper significance in the context of this article, as the game undeniably calls this particular military campaign a crusade and therefore triggers at the start a full range of connotations in the player. And it does not matter of what kind exactly either, because ultimately the nature of Messmer's crusade will only confirm the negative ones. The player witnesses firsthand the horrors of the crusaders’ actions and interprets them independently. Only few facts are verbally told to them through descriptions of equipment or conversations with NPCs. But if the player does not explore all the available space, does not look closely, does not analyse, it will all be for naught. This is what the interactivity of the crusade symbol in *Elden Ring* is all about. Its interpretation depends on the player's engagement, conscious or not, in the act of interpretation. The more the player learns, the more critical they will be of the whole idea of a crusade, which may also carry over into thinking about historical crusades.

4. Second Crusade

The second crusade as a term is not present in the game. There is no description or dialogue that uses this phrase. There is not even one that uses the phrase ‘the first crusade’. Because of that many *Elden Ring* players do not know about the second crusade, even though they are taking part in it after all, because that is what *Shadow of the Erdtree* storyline is about.

If the first crusade is a crusade primarily because it was so named, what constitutes the second crusade? The similarity to the first? Absolutely not, they are not similar. The second crusade is defined by the player themselves through their knowledge of history. It is much simpler for them, because the first crusade has already evoked the proper connotations. They can be positive, and they can be negative. Negative connotations were already explicitly portrayed. In an effort not to confuse this, the positive connotations had to be presented implicitly. And so it is in *Shadow of the Erdtree*. The second crusade is not a loud military campaign, but a quiet pilgrimage to the holy land in search of a god—'the way of the cross'.

> Notably, Pope Urban II did not invent the term 'crusade'. The expedition he launched at Clermont was so novel, and in some ways still so embryonic in its conception, that there was no word with which it could be described. Contemporaries generally termed this 'crusade' simply an *iter* (journey) or *peregrination* (pilgrimage). It was not until the close of the twelfth century that more specific terminology developed, in the form of the word *crucesignatus* (one signed with the cross) for a 'crusader', and the eventual adoption of the French term *croisade*, which roughly translates as 'the way of the cross'. For the sake of convention and clarity, historians have adopted the term 'crusade' for the Christian holy wars launched from 1095 onwards, but we should be aware that this lends a somewhat misleading aura of coherence and conformity to the early 'crusades'. (Asbridge, 2012, pp. 42)

In *Shadow of the Erdtree*, the way of the cross was taken quite literally. During gameplay, the player encounters crosses left by Miquella, another son of Marika. They look like this:

Figure 4. One of the thirteen crosses scattered by the demigod Miquella in his mother's homeland. Source: FromSoftware, 2024

Each cross is a symbol of Miquella's discarding part of his body on the path to godhood. His aim is to replace his mother as the divine sovereign. Miquella's followers are so confident of his success that no one raises a question that he is technically still a demigod. So, to look for crosses is to look for god. It would be hard to imagine a more sacred task.

The player does not have to find all these crosses, although the storyline and mechanics encourage them to do so. But still, they can ignore the second crusade just like the first. What makes this holy pilgrimage different from the earlier military campaign in terms of narractivity is that this time the player has some influence over what they experience. In order for the storyline to progress, there are actions that the player m u s t perform and there are actions that the player c a n perform, and some of them in several diverse ways. It all affects the interpretation process because of the variable potential engagement and the variety of knowledge the player can acquire. In the case of the first crusade, there was no such 'interpretative opulence'. It was practically over by the time the player character reached those lands, making it impossible for them to do anything that would affect its course and change their interpretation in that regard.

But what awaits at the end of the way of the cross? God, of course. Marika's son wants to become a god in the same place where she obtained her divinity. There is a certain resemblance between the two that the people of this world recognise. There is also a second layer of similarity, recognisable only to the player. Both Marika and Miquella are Jesus figures. Marika through the crucifixion, and Miquella through the Stations of the Cross, which are also called 'the Way of the Cross'. There are thirteen Miquella crosses. If we add the player character's meeting with him at the end of the *Shadow of the Erdtree* storyline, we have fourteen encounters, exactly as many as there are stations in the traditional Way of the Cross, which is the story of Jesus fulfilling his divine destiny. So why is it still a symbol of a crusade and not a symbol of the Stations of the Cross? The answer is an ending—a single ending. Despite such freedom of gameplay, resulting in many possible interpretations of everything that is in the game, the ending of *Shadow of the Erdtree* is only one—to slay a god. For although Miquella has become one, he has not yet achieved his goal—he has not replaced his mother. Until he does, he is a usurper. T h e god of this world is still Marika. It is she who, through her power as a ruling deity, grants the player 'Grace'. Grace is a phenomenon that provides the player with many gameplay possibilities in a diegetic way. Without it, the player character would not be able to appear in the game's plot at all. One aspect of Grace is that it visually guides the player through the game world. They do not have to be aware of where it is leading them or why. It just leads them. In *Shadow of the Erdtree*, Grace leads to killing the usurper, Miquella. This is the only solution to the situation that the god allows. Player character—and through the act of playing the player themselves—turns out to be no better than Messmer and his

troops, because despite the noble, even poetic beginnings they end up doing the same thing—invading a foreign land to kill those 'deemed impure'. This is a crusade.

5. Conclusion

The cross stands for power in the world of *Elden Ring*, and the crusade signifies submission to that power. This may be the ultimate conclusion drawn from playing the game and its expansion. But the earlier conclusions are equally important, as the game's narrative impact on the player is determined by the whole interpretative process and how dynamic it was. This dynamic is made possible by the thoughtful structure of the embedded and emergent narrative (Amiri, 2019), and by the extraordinary gameplay challenges (Domingues et al., 2024) for which FromSoftware's games are renowned. Discovering all the storyline content in *Elden Ring* is physically difficult and this is indisputable, because without modifying the game it is impossible to change the difficulty level. Those players who follow the line of least resistance during their gameplay, e.g. due to lack of appropriate skills, will miss out on some of the story's interpretative potential. They will still be able to explore the critical commentary on the factual Crusades by analysing those locations that need to be crossed to reach the ending of *Shadow of the Erdtree*, but probably no thought of their own will be added to it. At least in comparison to this situation in which the player learns everything they can from a single playthrough and therefore has a higher chance to understand how they have been used, and what kind of crimes they have committed because of that. With all this, the spectrum of possible interpretations of *Elden Ring* with *Shadow of the Erdtree* has two extremes. In one, the symbols of the cross and crusade are perverse—stripped of their pious, poetic connotations. In the other, these symbols are relatively untouched and do not evoke negative connotations that might carry over into thinking outside the game. Admittedly, the mechanics push players towards the first extreme, but do not exclude the second. The player still has control over the style of their gameplay and of what comes out of it.

Elden Ring in its original edition sold 30 million copies (GBest, 2025). That is a significant number. Thirty million players have conducted (or at least could have conducted) their own 'existential investigation' (Kłosiński, 2023, pp. 31) based on this game. Their playing could serve as a cultural practice, transforming all its participants—their subjectivity, identity, existence. This is what interpretation is. The ambiguities of the plot in *Elden Ring*, together with the gameplay mechanics, afford an unusual multitude of interpretations, which later clash with others in the online space, expanding and connecting cultural practices of different players. The symbols of the cross and the crusade were and still are an excellent *playground* for this mechanism.

References

Amiri, F. (2019). *Narrative in Story-Driven Video Games: A Comparative Study of Emergent, Embedded and Mixed Narrative Techniques*. ResearchGate. https://www.researchgate.net/publication/353435134_Narrative_in_Story-Driven_Video_Games_A_Comparative_Study_of_Emergent_Embedded_and_Mixed_Narrative_Techniques

Aroni, G. (2022). *The Semiotics of Architecture in Video Games*. Bloomsbury.

Asbridge, T. (2012). *The Crusades. The War of the Holy Land*. Simon & Schuster.

Booth, P. (2009). Narractivity and the narrative database. *Narrative Inquiry, 19*(2).

Cerezo-Pizarro, M., Revuelta-Domínguez, F.-I., Guerra-Antequera, J., & Melo-Sánchez, J. (2023). The Cultural Impact of Video Games: A Systematic Review of the Literature. *Education Sciences, 13*(11), 1116.

Consalvo, M. & Dutton, N. (2006). Game analysis: Developing a methodological toolkit for the qualitative study of games. *Game Studies, 6*(1).

de Wildt, L. (2021). *The Pop Theology of Videogames. Producing and Playing with Religion*. Amsterdam University Press.

de Wildt, L., & Aupers, S. (2018). Playing the Other: Role-playing religion in videogames. *European Journal of Cultural Studies, 22*(5-6).

Domingues, J. M., Filipe, V., Carita, A., & Carvalho, V. (2024). Understanding the Impact of Perceived Challenge on Narrative Immersion in Video Games: The Role-Playing Game Genre as a Case Study. *Information, 15*(6), 294.

FromSoftware. *Elden Ring* [PC]. (2022). Bandai Namco Entertainment.

FromSoftware. *Elden Ring: Shadow of the Erdtree* [PC]. (2024). Bandai Namco Entertainment.

GBest. (2025, April 28). *ELDEN RING Surpasses 30 Million Copies Sold Worldwide Ahead Of NIGHTREIGN Release*. GameFragger. https://gamefragger.com/multiplatform/role_playing/dark-souls/elden-ring-surpasses-30-million-copies-sold-worldwide-ahead-of-nightreign-release-a27298#gs.mc8w6n

Hawreliak, J. (2019). *Multimodal Semiotics and Rhetoric in Video Games*. Routledge.

Holiday Engineer 7521 [Holiday_Engineer7521]. (2023, April 14). *Why is Marika always depicted in a "crucified" pose?* [Online forum post]. Reddit. https://www.reddit.com/r/Eldenring/comments/12lnajf/why_is_marika_always_depicted_in_a_crucified_pose/

Hutcheon, L. (1987). Metafictional Implications for Novelistic Reference. In A. Whiteside & M. Issacharoff (Eds.), *On Referring in Literature*. Indiana University Press.

Kłosiński, M. (2018). *Hermeneutyka gier wideo. Interpretacja, immersja, utopia* [Hermeneutics of video games. Interpretation, immersion, utopia]. Instytut Badań Literackich PAN.

Kłosiński, M. (2022). How to Interpret Digital Games? A Hermeneutic Guide in Ten Points, With References and Bibliography. *Game Studies, 22*(2).

Kłosiński, M. (2023). *Przygody cyfrowego tułacza. Interpretacje groznawcze* [Adventures of a digital wanderer. Game Studies Interpretations]. Wydawnictwo Uniwersytetu Śląskiego.

Kubiński, P. (2016). *Gry wideo. Zarys poetyki* [Video Games. An Outline of Poetics]. Universitas.

Maj, K. M. (2017). Intertekstualność [Intertextuality]. In Z. Kadłubek, B. Mytych-Forajter & A. Nawarecki (Eds.), *Ilustrowany słownik terminów literackich* [Illustrated Dictionary of Literary Terms]. Ośrodek badawczy Facta Ficta.

Maj, K. M. (2019). *Światotwórstwo w fantastyce. Od przedstawienia do zamieszkania* [Worldbuilding in Fantasy. From Representation to Inhabitation]. Universitas

Manovich, L. (2002). *The language of new media*. MIT Press.

Norris, S. (2004). *Analyzing Multimodal Interaction: A Methodological Framework*. Routledge.

Rick the Freak [rick_the_freak]. (2024, October 8). *Do we know what the red spear piercing Marika is?* [Online forum post]. Reddit. https://www.reddit.com/r/Eldenring/comments/1fz917f/do_we_know_what_the_red_spear_piercing_marika_is/

Simons, J. (2007). Narrative, Games, and Theory. *Game Studies, 7*(1).

Staniecko, B. (2019). User ex machina. Narraktywność jako proces syntopii użytkownika i cybertekstu [User ex machina. Narractivity as a syntopic process of user and cybertext]. In M. Kłosiński & K. M. Maj (Eds.), *Dyskursy gier wideo* [Video Game Discourses]. Ośrodek badawczy Facta Ficta.

Zeiler, X. (2018). Level Up. Methods for Studying Video Games and Religion. In V. Šisler, K. Radde-Antweiler & X. Zeiler (Eds.), *Methods for Studying Video Games and Religion*. Routledge.

Beniamin Barczyński is a professional writer, graduate of Art of Writing (bachelor's degree) and Creative Writing and Publishing Marketing (master's degree), both under the supervision of Michał Kłosiński at the University of Silesia in Katowice. He is also an academic teacher at the Karol Godula Upper Silesian Academy of Entrepreneurship and at his alma mater. His research focuses on narratology as a whole and role-playing video games.

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Embodied Pixels: A Neuroscientific Framework for Cognitive Research using Games

Olgierd Borowiecki
Faculty of Philosophy and Cognitive Science
University of Białystok, Poland
olgierd.borowiecki@gmail.com

Received 2025-06-09; accepted 2025-12-18; published Online First 2025-12-30.

Abstract

Purpose: Traditional cognitive tasks isolate cognitive parameters but miss how cognition naturally operates. I argue that games can be used to study cognition as it unfolds in ecological settings. **Methodology:** Drawing from predictive coding and embodied cognition, I show that the very embodiment in the brain also works with tools and virtual tools. An avatar in a game is treated by the brain as a body part, such as a hand. Given this insight, I derive five design principles for games to reinstate ecological settings in virtual worlds: autonomous goal pursuit, embodied avatar control, consistent rules, continuous temporal flow, and complex environments. **Results**: Commercial games unintentionally include classic cognitive paradigms: racing games demand continuous visuomotor control that can't be accomplished through discrete trials; FIFA leverages executive functions beyond traditional working memory assessments. **Main Contribution:** Given findings of body schema and peripersonal spaces, and embodied mind and predictive coding frameworks, I provide methodological guidance for behavioural, physiological, and neural measurements during gameplay, offering researchers tools to assess cognition while preserving experimental rigour. **Practical Implications:** Beyond novel experimental designs that allow for the exploration of unaddressed neural processes, adopting ecological games has the potential to aid neurodegenerative and neurodiverse conditions.

Keywords: predictive coding, embodied cognition, reinforcement learning, ecological validity, avatar embodiment

1. Introduction

A person sits quietly in a laboratory, pressing buttons as they watch colourful shapes move on the screen. Nearby, someone else is immersed in exploring a virtual world, making quick decisions, managing resources, and tweaking their strategies as they go. Both situations can measure executive function, yet they involve very different brain processes. The former is a discrete task, such as playing chess, whereas the latter is continuous, like driving. In chess, the entire system is known at a given moment, and the next moment depends solely on the current state. When driving, the ongoing dynamics are continuous, as a person navigates the trajectory of the car that depends on the previous state of the system, giving inertia to the car (Kingstone et al., 2008). The former can be tested easily and is widely used in cognitive science; the latter is difficult (Shamay-Tsoory & Mendelsohn, 2019). In this article, I show how to use games for testing the second way in the laboratory.

The field keeps stumbling forward with gaming research (Anguera et al., 2013; Kühn et al., 2014; Pallavicini et al., 2018), and some researchers look for virtual reality applications in research and diagnosis (Bohil et al., 2011; Parsons, 2015). However, these attempts are made without a sufficient theoretical backbone that would guide a standardised way of designing the games. Researchers select design elements based on intuition or by copying what has worked before. This lack of theoretical understanding limits the ability to predict which interventions might succeed or understand why they work.

I propose a framework grounded in neuroscience, drawing on predictive coding (Clark, 2013; Friston, 2010), and embodied cognition (Maravita & Iriki, 2004; Varela et al., 2017). The key findings are that a primate's body schema computed by the brain can be extended with tools and can be projected on a computer screen (Bassolino et al., 2010; Maravita & Iriki, 2004; Serino, 2019). This means that impractical virtual reality games could be an overkill relative to the video games presented on a computer screen. If the neural mechanisms are in fact there, as the evidence suggests, then we should use computer games broadly with all the possible measuring equipment.

To set a waypoint for future studies, I articulate five design principles that emerge from understanding how brains process embodied experience. Rather than claiming superiority over other approaches, I offer one theoretically motivated pathway among many possible routes to ecological validity. These are broad recommendations on what to watch for when designing games with research or clinical applications.

I highlight classical cognitive protocols and provide examples of games embodying these paradigms in continuous environments grounded in well-learned rules. I also review the methodological toolbox for cognitive research with gam-

es (Section 4), highlighting behavioural and neural imaging tools, their potential applications, and challenges with integrating the signal in environments constructed according to the previously outlined five principles.

2. Literature review

2.1. The embodied brain in action

The brain is a prediction machine constantly generating expectations about the future information (Bubic et al., 2010; Clark, 2013; Friston, 2010). Neural circuits anticipate incoming flow, compare these predictions against the expectations and update them when surprised by prediction errors. The details of the neuroscientific and philosophical understanding of how the brain adjusts computations are intensively debated. Some argue that the brain is ecological-enactive (Bruineberg et al., 2018), others defend the position that it is mainly representational (Constant et al., 2021). Here, I incorporate the idea about predicting future information and analyse how the brain predicts the position of the body.

Recognition that the body is essential for cognitive processes has been articulated as an extended mind thesis in the late 90s (Clark & Chalmers, 1998). We use external artefacts as a means to extend the mind by shaping decisions and metaphors (Chemero, 2009; Wilson, 2002). However, this embodied cognition isn't only philosophical speculation. The brain predicting the position of the body relies on continuous streams of information, navigating multiple trajectories at once (Adams et al., 2013; Chiel et al., 2009; Cisek, 2007). I demonstrate how it is measurable in neural architecture, based on experiments involving body and space computation in the brain.

The brain's map of the visual space near the body is called peripersonal space (Serino, 2019). Objects near hands, arms, trunk, head, eyes, or body are coded by the brain in a privileged way. This visual space around body parts is attached to them and allows for grasping and defensive actions (Bufacchi & Iannetti, 2018; Canzoneri et al., 2012; Di Pellegrino & Làdavas, 2015). For example, Maravita & Iriki's (2004) rake-using monkeys remain the canonical demonstration of the plasticity of peripersonal space. Monkeys trained in rake use extend the peripersonal space from around the hand to the rake tip. The tool becomes part of the body schema.

Crucially, this worked even when the monkey's hand was displayed on the computer screen (Maravita & Iriki, 2004). The findings have been replicated in humans using virtual tools. Consistent visual feedback from cursor movements, robotic arms, or game avatars triggers the same incorporation (Bassolino et al., 2010; Holmes, 2012; Serino, 2019). Pixels become extensions of self, measurable in neural activation, reaction times, and behavioural responses (Kilteni et al., 2012). Virtual embodiment isn't cyber-fantasy. It's neurologically real.

These neuroscientific observations show that computer games can be neurobiologically immersive and, hence, can be used in cognitive science experiments. Surprisingly, this has been rarely done. The majority of experiments used in the laboratory are discrete tasks akin to slideshows (Dolan & Dayan, 2013; Janacsek et al., 2020; Keele et al., 2003). On the one hand, it is understandable as the sterile experimental paradigms allow for clear data collection and analysis. On the other hand, however, real life is continuous. I argue that to understand the brain in its natural context, we must be brave in implementing paradigms that resemble these conditions. In the next section, I present guidelines on how to use computer games as such measures.

3. Theoretical framework

3.1. Defining ecological validity through the five principles

What makes a cognitive task ecologically valid? How to capture the real-life conditions? I understand that real life is pursuing meaningful goals within continuous, consistent environments. Actions and their consequences are bound during classical and instrumental conditioning through midbrain dopaminergic circuits tracking rewards and punishments (Beier et al., 2015; Schultz, 2017). This ancient system drives behavioural adaptation across species (Loonen & Ivanova, 2015), from worms to humans.

Games have cracked the code on these circuits. Achievements and progression systems all hijack dopaminergic learning, but that's not the real story (Koepp et al., 1998). Players experiment, fail, adapt, and improve through exactly the iterative process reinforcement learning evolved to support (Howard-Jones et al., 2016). Below, I propose five principles that are, in my opinion, needed for the ecological validity of a game:

1. **Autonomous Goal Pursuit:** Players need to pursue goals with their own paths by engaging in self-determination (Ryan et al., 2006). Brain dopaminergic circuits activate when exercising genuine choice, transforming mundane tasks into an intrinsically rewarding experience (Przybylski et al., 2010). Each crossroads decision (sneak through shadows or charge directly? Gather resources or race against time?) sparks cascading neural activity. This transformation from puppet to puppeteer activates the brain networks deeply rooted in our evolution when one has agency over the direction that is pursued.
2. **Embodied Avatar Control:** The other factor is agency over the game's avatar or a perspective in the case of first-person games. As the example with the body schema and peripersonal spaces shown, avatars on the computer screen transcend external object status to become genuine body schema extensions through consistent sensorimotor correspondence and immediate feedback (Bassolino et al., 2010; Maravi-

ta & Iriki, 2004). This embodiment operates regardless of perspective or avatar visibility; whether controlling humanoid characters, piloting spacecraft, or experiencing worlds through implied first-person presence, systematic **intention-action-consequence** mapping matters most (Gonzalez-Franco & Peck, 2018; Kilteni et al., 2012). Predictive coding mechanisms generate sensory consequence predictions that strengthen the avatar's neural representation (Apps & Tsakiris, 2014; Seth, 2013). A player interacts through the embodied avatar as if this virtual perspective were his own.

3. **Consistent Rules:** The intentions-actions-consequences mapping requires learnable patterns for world model construction, making consistent rules essential regardless of realism or complexity (Friston, 2010; Rao & Ballard, 1999). When mechanics follow reliable patterns (realistic physics or fantastical magic), players form hypotheses and test strategies, experiencing dopamine-mediated prediction success rewards (Schultz, 2017). Predictability paradoxically enables creativity; internalising rules allows novel combinations, discovering emergent solutions, which engage prefrontal and striatal circuits supporting real-world problem-solving (Botvinick et al., 2019). Keys lie in consistency, not realism: fireballs always damage enemies, and momentum or icy tires predictably affect driving. These relationships create generative models allowing mental outcome simulation before acting (Clark, 2013).

4. **Continuous Temporal Flow:** In contrast to discrete tasks akin to chess puzzles, real cognition unfolds as unbroken perception-action streams. The continuous temporal flow principle is crucial for maintaining the embodiment in the game (Csikszentmihalyi, 1990). Flow emerges when players remain cognitively engaged across transitions, preserving the activity of attention and control networks (Klasen et al., 2012; Ulrich et al., 2016). The continuous ongoing flow is crucial for ecological validity as the everyday experience consists of continuous episodes (Ben-Yakov & Henson, 2018).

5. **Complex Environments:** The final principle is scalable as environmental complexity operates spectrally: minimalist Tetris to sprawling open worlds, each engaging different cognitive architecture aspects (Gee, 2003; Wasserman & Banks, 2017). Complex environments simultaneously activate multiple networks (Mathiak & Weber, 2006), revealing cognitive system coordination under realistic information demands (Pallavicini et al., 2018). Yet simpler environments enable deeper focus on specific operations like spatial reasoning or pattern recognition (Li et al., 2016). Researchers should match complexity to research questions; focused attention benefits from minimal environments while cognitive flexibility leverages dynamic worlds.

These principles synergise into the definition of ecological context. The task is ecologically valid when a participant controls an **embodied avatar** within **continuous**, **complex environments** with **consistent rules,** while **pursuing goals autonomously**. These conditions create cognitive engagement that mirrors real-world complexity while maintaining experimental rigour.

3.2. Classical tasks in ecological environments

The five principles serve as both a lens and a compass: they reveal the sophisticated cognitive experiments already hidden within existing games. Researchers can reuse games refined through decades of player engagement to run cognitive tests. Games that survived the brutal selection pressure of the marketplace often did so because they successfully tapped into fundamental cognitive operations. The outlined principles help to recognise these accidental experiments and understand why they work.

Consider how classic games unknowingly recreated textbook cognitive paradigms (Table 1). Pac-Man's power pellet mechanic brilliantly implements the Stroop effect: players must override their deeply learned "flee from ghosts" response to suddenly chase them, creating cognitive conflict under intense time pressure. While Pac-Man has attracted significant research attention, it has primarily been a testbed for artificial intelligence and reinforcement learning algorithms (Bom et al., 2013; Schrum & Miikkulainen, 2016). Next, the Serial Reaction Time Task can be implemented in Mike Tyson's Punch-Out!!, as players unconsciously learn each opponent's attack patterns, decreasing the response time with practice. Alternatively, games in the sport, and music genres offer fantastic measures of the automatisation of sensorimotor sequences. Furthermore, studying players who are exceptional in classic games can reveal mechanisms behind automated navigation through the game's environment. The degree of variation in games remains predictable enough to enable model building yet variable enough to prevent habituation (Gee, 2003). These environments maintain sustained engagement of predictive circuits that standard tasks only briefly activate.

Traditional Task	Original Task Description	Core Cognitive Function	Classic Game Implementation	Why It Works?
Stroop Task	Name the color of ink while ignoring the written color word (e.g., "RED" printed in blue ink)	Inhibitory control, conflict resolution	**Pac-Man (Power Pellet sequences)**: When eating a power pellet, ghosts turn blue and player must override	Reversal of learned contingencies. Time pressure from pellet duration. Clear visual conflict between threat and target.

			the learned "flee" response to chase them instead.	
Serial Reaction Time	Respond to stimuli appearing in repeating sequences.	Implicit learning, procedural memory	**Mike Tyson's Punch-Out!! (opponent patterns)**: Each boxer has specific attack sequences; players learn patterns and respond faster with practice.	Hidden sequential patterns in opponent behavior. Measurable speed improvement with exposure.
Task Switching	Alternate between two different tasks (e.g., odd/even vs. high/low number judgments)	Executive control, set shifting	**Super Mario Bros (pipe/water transitions)**: Switch between land controls (running/jumping) and water controls (swimming/floating) when entering pipes.	Distinct control schemes require set shifting signalled by environmental cues. Switching costs evident in player errors.
Go/No-Go Task	Press button for certain stimuli (Go), withhold response for others (No-Go)	Response inhibition	**Duck Hunt (Don't Shoot the Dog)**: Shoot flying ducks but must not shoot the dog who retrieves them.	Clear go/no-go distinction. Response inhibition under time pressure. Natural consequences for inhibition failure.

Table 1. Classical Tasks in Ecological Environments. Examples of existing games that implement the same mechanics as cognitive tests.

Besides the replications of the classical games listed in the table, at least two areas worth intensive studies emerge. One area covers racing games. They provide unparalleled windows into continuous visuomotor control, particularly for controlling car trajectories in different conditions and inputs. These studies are already being conducted. Some lines of research use virtual driving simulators like Autobahnraser II (Walter et al., 2001) and Need for Speed II (Calhoun et al., 2002), demonstrating how racing games can be used in cognitive studies. Some simulators using immersive physical rigs inside the fMRI scanner allow measuring brain activity of the players (Choi et al., 2017; Chung et al., 2014; Kan et al., 2013; Schweizer et al., 2013). This direction promises a wide array of applications in testing ecologically valid tasks.

A second promising direction involves games like FIFA, which add an interpersonal component to sensorimotor coordination. Recent research has shown that soccer players' tactical decision-making under time pressure engages working memory capacity across all expertise levels, with professional players demonstrating superior performance but still showing sensitivity to cognitive

load (Glavaš et al., 2023). The possibility of simultaneous recording of competing and/or cooperating players opens a totally novel window to observe the mutual predictive dynamics of the brains in ecological settings.

The profound implication for researchers is that ecological validity and experimental control need not be enemies. Traditional cognitive paradigms are like testing a supercomputer's capabilities using only a calculator app: you can verify basic arithmetic, but you miss a lot. The human brain evolved to navigate dynamic environments, not pressing buttons in response to colored shapes. With games, we are finally giving the supercomputer problems worthy of its architecture.

4. Methodological toolbox for cognitive research with games

Implementing ecologically valid gaming research requires specialised measurement approaches. Here, I outline key methodological tools for capturing behavioural and neural signatures during continuous gameplay.

4.1. Behavioural and physiological measures

Eye tracking is one of the simplest behavioural measures, allowing for the collection of rich data on eye movements and pupil dilation. Pupil diameter is a reliable indicator of mental effort and task difficulty (Beatty & Lucero-Wagoner, 2000; Klingner et al., 2008; Van der Wel & Van Steenbergen, 2018). Eye trackers can automatically provide hundreds of pupil size measurements per second (Chen & Epps, 2014), while pupil diameter changes and microsaccade patterns effectively discriminate cognitive load levels (Duchowski et al., 2018; Krejtz et al., 2018). This measure is extensively used in racing simulators with a great amount of data on occulomotor coordination already being collected (Lappi, 2016, 2022).

Game telemetry provides unprecedented access to player behaviour with millisecond-precision recordings of all commands issued in games (Thompson et al., 2013). This approach enables analyses of motor chunking, action latencies, and complex cognitive-motor skill learning impossible with traditional tasks (Thompson et al., 2017). Large-scale telemetry datasets, sometimes including thousands of players across multiple skill levels, offer unique insights into expertise development and behavioural patterns (Thompson et al., 2014). Recent advances show that telemetry from racing simulators can be leveraged with machine learning to predict driving performance and distinguish fast from slow drivers based on the telemetric data (Hojaji et al., 2024). Game telemetry, combined with advances in artificial intelligence, enables the extraction of structure from large datasets in ecological tasks, thereby facilitating data analysis.

Motion capture of the participant's body parts provides information about the degrees of freedom that a body has and forces generated by the body (Di Domenico, 2020; Humphrey & Delange, 2004; Keogh & Hume, 2012). Research using Kinect sensors has demonstrated how gross body gestures can manipulate on-screen content while measuring learning gains (Johnson-Glenberg et al., 2014; Johnson-Glenberg & Megowan-Romanowicz, 2017). Modern biomechanical markerless systems allow natural movement tracking without the constraints of traditional markers, making them particularly suitable for gaming contexts where real-time transmission of natural human movement to virtual avatars enhances immersion (Lam et al., 2023; Wade et al., 2022). This approach enables the recording of players with ultra-sensitive cameras, collecting data to millisecond precision, and thus measuring the exact movements as they engage in ecological play.

Physiological measures complement behavioural data. For example, galvanic skin response (GSR) provides unfiltered insights into emotional arousal and stress levels through changes in skin conductivity (Affanni et al., 2018). GSR measurements are particularly effective when combined with other sensors, as they indicate arousal intensity but not valence (Sánchez-Reolid et al., 2022). Additional measures include heart rate variability (Mandrick et al., 2016) and synchronised event markers, ensuring millisecond-precision temporal alignment across all data streams (Whitford & Klimley, 2019). This stream of data provides an additional channel that can be used for enriching our understanding of the brain in the wild.

4.2. Neuroimaging approaches

EEG is the most common neuroimaging tool used in cognitive science research. It's cheap, easy to use and offers the possibility to measure electrical brain activity with millisecond temporal resolution, which is ideal for tracking rapid cognitive events during gameplay. Studies have captured increased cortical complexity and prefrontal activation patterns during gaming tasks (Amjad et al., 2019; Palaus et al., 2017). While portable and allowing natural postures, EEG requires careful artefact removal and provides limited spatial resolution compared to other neuroimaging methods.

fNIRS complements EEG as it is also portable, but allows for better spatial resolution by measuring cortical blood flow through wearable optical sensors. Research demonstrates fNIRS sensitivity to cognitive load and state, with activation scaling linearly with working memory demands (Fishburn et al., 2014; Pinti et al., 2020). This technology is particularly suited for sustained cognitive state monitoring during active gameplay and executive function assessment (Causse et al., 2017), though coverage is limited to cortical surface regions.

fMRI is the standard tool for measuring brain activity with excellent spatial but poor temporal resolution, albeit supine positioning and movement restrictions limit natural gameplay. Nevertheless, some laboratories modify the equipment to fit into the fMRI scanner (Choi et al., 2017; Chung et al., 2014; Kan et al., 2013; Schweizer et al., 2013). Note that these studies put a fully functional steering wheel with pedals into the scanner, projected the video through glasses and enabled participants to play the game while lying in the scanner. Now combine this with the progress in prospective motion correction using real-time tracking systems (Maziero et al., 2020). The technology is ready to test continuous tasks even in the fMRI scanner.

4.3. Integration challenges

The greatest challenge in cognitive research on ecological games with multimodal recordings is the amount of data from multiple sources. Time synchronisation between recording systems is essential, with modern solutions achieving median errors of 40ms between devices (Whitford & Klimley, 2019). Fortunately, progress in data management strategies handles the potentially massive datasets generated by continuous telemetry recording (Drachen et al., 2012). Close collaboration with game developers enables proper instrumentation while maintaining engaging gameplay (El-Nasr et al., 2016). The design of the experimental setup requires careful consideration of the game and the tools to be used, as well as a technical approach to collecting and analysing data.

This is a difficult task, as continuous paradigms provide an enormous amount of data amplified by the number of potential imaging methods. Despite this complexity, these integrated approaches offer a chance to reveal how cognition unfolds during naturalistic interaction. If our goal is to understand the brain as it works in natural conditions, the difficulty of the task should not limit our attempts.

5. Discussion

Obviously, this opportunity brings complexity. Traditional paradigms offer simplicity: one variable, one measure, clear causation. Gaming environments present rich data streams where multiple brain systems interact dynamically (Cardoso-Leite & Bavelier, 2014). A single racing game simultaneously engages visuomotor control, spatial prediction, risk assessment, and strategic planning. Disentangling these threads requires sophisticated analytical approaches that require interdisciplinary teams (Yannakakis & Togelius, 2018). The curse of ecological validity is its complexity (Holleman et al., 2020). The framework complements the traditional approaches, offering a path to study cognition as it naturally operates while maintaining scientific rigour (Washburn, 2003).

The framework also challenges the conception of experimental control as the systematic variation is unavoidable (Powers et al., 2013). Individual differences in gaming experience become valuable data about skill acquisition and transfer (Bediou et al., 2018). It's time to acknowledge that every person is different and investigate how these differences are distributed statistically. For example, varied participant expertise becomes a strength by modelling cognitive adaptation across expertise gradients (Colzato et al., 2013).

Consider the implications for clinical assessment. Traditional neuropsychological batteries feel artificial to patients, reducing compliance and ecological relevance (Burgess et al., 2006). Assessments with games could revolutionise diagnosis by embedding cognitive measurement within engaging experiences (Lumsden et al., 2016). Imagine detecting early Parkinson's through subtle changes in racing game performance (Garcia-Agundez et al., 2019), or monitoring ADHD medication effectiveness through sustained attention metrics in strategy games (Mishra et al., 2016). The ecological principles outlined in this article allow for immersive experience and potentially provide a tool for investigating the neurodegenerative and neurodiversive conditions as never before.

6. Conclusion

This paper began with a simple observation: cognitive science faces a persistent tension between experimental control and ecological validity. Understanding that the brain extends into its environment is philosophically grounded in the cognitive sciences. I pushed this further, recognising how *exactly* the brain processes the body and tools in areas of computing body schema and peripersonal spaces. This line of research shows that the extension takes place also when body/tools are displayed on the computer screen, creating the rationale for virtual extension encoded in the brain. For the brain, an avatar on the screen is as much part of the body as a real hand.

This observation justifies that games can be used as an ecological environment to study cognition as it appears in the real world. I conceptualise this further by providing five principles describing ecological tasks. **Autonomous goals**, achieved while controlling an **embodied avatar** within **continuous**, **complex** environments built upon **consistent rules**, are pinnacles for replicating real-life conditions in the laboratory.

Ecological games are challenging to implement due to the vast amount of data and potential tools required for their collection. But this should not prevent us from trying. Physicists embark on nearly impossible tasks to understand the nature of the universe. It's time for cognitive scientists to be brave and try to understand the human brain as it really is in everyday life. I believe that games are tools that finally make it possible.

Bibliography

Adams, R. A., Shipp, S., & Friston, K. (2013). Predictions not commands: Active inference in the motor system. *Brain Structure and Function*, *218*(3), 611–643. https://doi.org/10.1007/s00429-012-0475-5

Affanni, A., Bernardini, R., Piras, A., Rinaldo, R., & Zontone, P. (2018). Driver's stress detection using Skin Potential Response signals. *Measurement*, *122*, 264–274. https://doi.org/10.1016/j.measurement.2018.03.040

Amjad, I., Toor, H., Niazi, I. K., Pervaiz, S., Jochumsen, M., Shafique, M., Haavik, H., & Ahmed, T. (2019). Xbox 360 Kinect Cognitive Games Improve Slowness, Complexity of EEG, and Cognitive Functions in Subjects with Mild Cognitive Impairment: A Randomized Control Trial. *Games for Health Journal*, *8*(2), 144–152. https://doi.org/10.1089/g4h.2018.0029

Anguera, J. A., Boccanfuso, J., Rintoul, J. L., Al-Hashimi, O., Faraji, F., Janowich, J., Kong, E., Larraburo, Y., Rolle, C., Johnston, E., & others. (2013). Video game training enhances cognitive control in older adults. *Nature*, *501*(7465), 97–101.

Apps, M. A. J., & Tsakiris, M. (2014). The free-energy self: A predictive coding account of self-recognition. *Neuroscience & Biobehavioral Reviews*, *41*, 85–97. https://doi.org/10.1016/j.neubiorev.2013.01.029

Bassolino, M., Serino, A., Ubaldi, S., & Làdavas, E. (2010). Everyday use of the computer mouse extends peripersonal space representation. *Neuropsychologia*, *48*(3), 803–811. https://doi.org/10.1016/j.neuropsychologia.2009.11.009

Bavelier, D., Bediou, B., & Green, C. S. (2018). Expertise and generalization: Lessons from action video games. *Current Opinion in Behavioral Sciences*, *20*, 169–173. https://doi.org/10.1016/j.cobeha.2018.01.012

Beatty, J., & Lucero-Wagoner, B. (2000). The pupillary system. In *Handbook of psychophysiology, 2nd ed* (pp. 142–162). Cambridge University Press.

Bediou, B., Adams, D. M., Mayer, R. E., Tipton, E., Green, C. S., & Bavelier, D. (2018). Meta-analysis of action video game impact on perceptual, attentional, and cognitive skills. *Psychological Bulletin*, *144*(1), 77–110. https://doi.org/10.1037/bul0000130

Beier, K. T., Steinberg, E. E., DeLoach, K. E., Xie, S., Miyamichi, K., Schwarz, L., Gao, X. J., Kremer, E. J., Malenka, R. C., & Luo, L. (2015). Circuit Architecture of VTA Dopamine Neurons Revealed by Systematic Input-Output Mapping. *Cell*, *162*(3), 622–634. https://doi.org/10.1016/j.cell.2015.07.015

Ben-Yakov, A., & Henson, R. N. (Eds.). (2018). The Hippocampal Film Editor: Sensitivity and Specificity to Event Boundaries in Continuous Experience. *The Journal of Neuroscience*, *38*(47), 10057–10068. https://doi.org/10.1523/JNEUROSCI.0524-18.2018

Bohil, C. J., Alicea, B., & Biocca, F. A. (2011). Virtual reality in neuroscience research and therapy. *Nature Reviews Neuroscience*, *12*(12), 752–762. https://doi.org/10.1038/nrn3122

Bom, L., Henken, R., & Wiering, M. (2013). Reinforcement learning to train Ms. Pac-Man using higher-order action-relative inputs. *2013 IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL)*, 156–163. https://doi.org/10.1109/ADPRL.2013.6615002

Botvinick, M., Ritter, S., Wang, J. X., Kurth-Nelson, Z., Blundell, C., & Hassabis, D. (2019). Reinforcement Learning, Fast and Slow. *Trends in Cognitive Sciences*, *23*(5), 408–422. https://doi.org/10.1016/j.tics.2019.02.006

Bruineberg, J., Rietveld, E., Parr, T., Van Maanen, L., & Friston, K. (2018). Free-energy minimization in joint agent-environment systems: A niche construction perspective. *Journal of Theoretical Biology*, *455*, 161–178. https://doi.org/10.1016/j.jtbi.2018.07.002

Bubic, A., von Cramon, D. Y., & Schubotz, R. I. (2010). Prediction, cognition and the brain. *Frontiers in Human Neuroscience*, *4*, 25. https://doi.org/10.3389/fnhum.2010.00025

Bufacchi, R. J., & Iannetti, G. D. (2018). An Action Field Theory of Peripersonal Space. *Trends in Cognitive Sciences*, *22*(12), 1076–1090. https://doi.org/10.1016/j.tics.2018.09.004

Burgess, P. W., Alderman, N., Forbes, C., Costello, A., Coates, L. M.-A., Dawson, D. R., Anderson, N. D., Gilbert, S. J., Dumontheil, I., & Channon, S. (2006). The case for the development and use of "ecologically valid" measures of executive function in experimental and clinical neuropsychology. *Journal of the International Neuropsychological Society: JINS*, *12*(2), 194–209. https://doi.org/10.1017/S1355617706060310

Calhoun, V. D., Pekar, J. J., McGinty, V. B., Adali, T., Watson, T. D., & Pearlson, G. D. (2002). Different activation dynamics in multiple neural systems during simulated driving. *Human Brain Mapping*, *16*(3), 158–167. https://doi.org/10.1002/hbm.10032

Canzoneri, E., Magosso, E., & Serino, A. (2012). Dynamic Sounds Capture the Boundaries of Peripersonal Space Representation in Humans. *PLoS ONE*, *7*(9), e44306. https://doi.org/10.1371/journal.pone.0044306

Cardoso-Leite, P., & Bavelier, D. (2014). Video game play, attention, and learning: How to shape the development of attention and influence learning? *Current Opinion in Neurology*, *27*(2), 185–191. https://doi.org/10.1097/WCO.0000000000000077

Causse, M., Chua, Z., Peysakhovich, V., Del Campo, N., & Matton, N. (2017). Mental workload and neural efficiency quantified in the prefrontal cortex using fNIRS. *Scientific Reports*, *7*(1), 5222. https://doi.org/10.1038/s41598-017-05378-x

Chemero, A. (2009). *Radical embodied cognitive science* (pp. xiv, 252). MIT Press.

Chen, S., & Epps, J. (2014). Using task-induced pupil diameter and blink rate to infer cognitive load. *Human-Computer Interaction*, *29*(4), 390–413. https://doi.org/10.1080/07370024.2014.892428

Chiel, H. J., Ting, L. H., Ekeberg, Ö., & Hartmann, M. J. Z. (2009). The Brain in Its Body: Motor Control and Sensing in a Biomechanical Context. *The Journal of Neuroscience*, *29*(41), 12807–12814. https://doi.org/10.1523/JNEUROSCI.3338-09.2009

Choi, M.-H., Kim, H.-S., Yoon, H.-J., Lee, J.-C., Baek, J.-H., Choi, J.-S., Tack, G.-R., Min, B.-C., Lim, D.-W., & Chung, S.-C. (2017). Increase in brain activation due to subtasks during driving: fMRI study using new MR-compatible driving simulator. *Journal of Physiological Anthropology*, *36*(1), 11. https://doi.org/10.1186/s40101-017-0128-8

Chung, S.-C., Choi, M.-H., Kim, H.-S., You, N.-R., Hong, S.-P., Lee, J.-C., Park, S.-J., Baek, J.-H., Jeong, U.-H., You, J.-H., Lim, D.-W., & Kim, H.-J. (2014). Effects of distraction task on driving: A functional magnetic resonance imaging study. *Bio-Medical Materials and Engineering*, *24*(6), 2971–2977. https://doi.org/10.3233/BME-141117

Cisek, P. (2007). Cortical mechanisms of action selection: The affordance competition hypothesis. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *362*(1485), 1585–1599. https://doi.org/10.1098/rstb.2007.2054

Clark, A. (2013). Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and Brain Sciences*, *36*(3), 181–204. https://doi.org/10.1017/S0140525X12000477

Clark, A., & Chalmers, D. J. (1998). The Extended Mind. *Analysis*, *58*(1), 7–19. https://doi.org/10.1093/analys/58.1.7

Colzato, L. S., van den Wildenberg, W. P. M., Zmigrod, S., & Hommel, B. (2013). Action video gaming and cognitive control: Playing first person shooter games is associated with improvement in working memory but not action inhibition. *Psychological Research*, *77*(2), 234–239. https://doi.org/10.1007/s00426-012-0415-2

Constant, A., Clark, A., & Friston, K. (2021). Representation Wars: Enacting an Armistice Through Active Inference. *Frontiers in Psychology*, *11*, 598733. https://doi.org/10.3389/fpsyg.2020.598733

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience* (Vol. 1990). Harper & Row New York.

Di Domenico, F. (2020). From biomechanics to learning: Continuum for the theory of physical and sports education. *Journal of Human Sport and Exercise - 2020 - Winter Conferences of Sports Science*. Journal of Human Sport and Exercise - 2020 - Winter Conferences of Sports Science. https://doi.org/10.14198/jhse.2020-.15.Proc2.18

Di Pellegrino, G., & Làdavas, E. (2015). Peripersonal space in the brain. *Neuropsychologia*, *66*, 126–133. https://doi.org/10.1016/j.neuropsychologia.2014.11.011

Dolan, R. J., & Dayan, P. (2013). Goals and Habits in the Brain. *Neuron*, *80*(2), 312–325. https://doi.org/10.1016/j.neuron.2013.09.007

Drachen, A., Sifa, R., Bauckhage, C., & Thurau, C. (2012). Guns, swords and data: Clustering of player behavior in computer games in the wild. *2012 IEEE Conference on Computational Intelligence and Games (CIG)*, 163–170.

Duchowski, A. T., Krejtz, K., Krejtz, I., Biele, C., Niedzielska, A., Kiefer, P., Raubal, M., & Giannopoulos, I. (2018). The Index of Pupillary Activity: Measuring Cognitive Load vis-à-vis Task Difficulty with Pupil Oscillation. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, 1–13. https://doi.org/10.1145/3173574.3173856

El-Nasr, M. S., Drachen, A., & Canossa, A. (2016). *Game analytics*. Springer.

Fishburn, F. A., Norr, M. E., Medvedev, A. V., & Vaidya, C. J. (2014). Sensitivity of fNIRS to cognitive state and load. *Frontiers in Human Neuroscience*, *8*, 76.

Friston, K. (2010). The free-energy principle: A unified brain theory? *Nature Reviews Neuroscience*, *11*(2), 127–138. https://doi.org/10.1038/nrn2787

Garcia-Agundez, A., Folkerts, A.-K., Konrad, R., Caserman, P., Tregel, T., Goosses, M., Göbel, S., & Kalbe, E. (2019). Recent advances in rehabilitation for Parkinson's Disease with Exergames: A Systematic Review. *Journal of Neuroengineering and Rehabilitation*, *16*(1), 17. https://doi.org/10.1186/s12984-019-0492-1

Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in Entertainment (CIE)*, *1*(1), 20–20.

Glavaš, D., Pandžić, M., & Domijan, D. (2023). The role of working memory capacity in soccer tactical decision making at different levels of expertise. *Cognitive Research: Principles and Implications*, *8*(1). https://doi.org/10.1186/s41235-023-00473-2

Gonzalez-Franco, M., & Peck, T. C. (2018). Avatar Embodiment. Towards a Standardized Questionnaire. *Frontiers in Robotics and AI*, *5*, 74. https://doi.org/10.3389/-frobt.2018.00074

Hojaji, F., Toth, A. J., Joyce, J. M., & Campbell, M. J. (2024). AI-enabled prediction of sim racing performance using telemetry data. *Computers in Human Behavior Reports*, *14*, 100414. https://doi.org/10.1016/j.chbr.2024.100414

Holleman, G. A., Hooge, I. T. C., Kemner, C., & Hessels, R. S. (2020). The 'Real-World Approach' and Its Problems: A Critique of the Term Ecological Validity. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.00721

Holmes, N. P. (2012). Does tool use extend peripersonal space? A review and reanalysis. *Experimental Brain Research*, *218*(2), 273–282. https://doi.org/10.1007/s00221-012-3042-7

Howard-Jones, P. A., Jay, T., Mason, A., & Jones, H. (2016). Gamification of Learning Deactivates the Default Mode Network. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.01891

Humphrey, J. D., & Delange, S. L. (2004). An introduction to biomechanics. *Solids and Fluids, Analysis and Design. Springer, Heidelberg*.

Janacsek, K., Shattuck, K. F., Tagarelli, K. M., Lum, J. A. G., Turkeltaub, P. E., & Ullman, M. T. (2020). Sequence learning in the human brain: A functional neuroanatomical meta-analysis of serial reaction time studies. *NeuroImage*, *207*, 116387. https://doi.org/10.1016/j.neuroimage.2019.116387

Johnson-Glenberg, M. C., Birchfield, D. A., Tolentino, L., & Koziupa, T. (2014). Collaborative embodied learning in mixed reality motion-capture environments: Two science studies. *Journal of Educational Psychology*, *106*(1), 86–104. https://doi.org/10.1037/a0034008

Johnson-Glenberg, M. C., & Megowan-Romanowicz, C. (2017). Embodied science and mixed reality: How gesture and motion capture affect physics education. *Cognitive Research: Principles and Implications*, *2*, 1–28.

Kan, K., Schweizer, T. A., Tam, F., & Graham, S. J. (2013). Methodology for functional MRI of simulated driving. *Medical Physics*, *40*(1), 012301. https://doi.org/10.1118/1.4769107

Keele, S. W., Ivry, R., Mayr, U., Hazeltine, E., & Heuer, H. (2003). The cognitive and neural architecture of sequence representation. *Psychological Review*, *110*(2), 316–339. https://doi.org/10.1037/0033-295X.110.2.316

Keogh, J. W. L., & Hume, P. A. (2012). Evidence for biomechanics and motor learning research improving golf performance. *Sports Biomechanics*, *11*(2), 288–309. https://doi.org/10.1080/14763141.2012.671354

Kilteni, K., Groten, R., & Slater, M. (2012). The sense of embodiment in virtual reality. *Presence: Teleoperators and Virtual Environments*, *21*(4), 373–387.

Kingstone, A., Smilek, D., & Eastwood, J. D. (2008). Cognitive ethology: A new approach for studying human cognition. *British Journal of Psychology*, *99*(3), 317–340. https://doi.org/10.1348/000712607X251243

Klasen, M., Weber, R., Kircher, T. T. J., Mathiak, K. A., & Mathiak, K. (2012). Neural contributions to flow experience during video game playing. *Social Cognitive and Affective Neuroscience*, *7*(4), 485–495. https://doi.org/10.1093/scan/nsr021

Klingner, J., Kumar, R., & Hanrahan, P. (2008). Measuring the task-evoked pupillary response with a remote eye tracker. *Proceedings of the 2008 Symposium on Eye Tracking Research & Applications*, 69–72. https://doi.org/10.1145/1344471.1344489

Koepp, M. J., Gunn, R. N., Lawrence, A. D., Cunningham, V. J., Dagher, A., Jones, T., Brooks, D. J., Bench, C. J., & Grasby, P. M. (1998). Evidence for striatal dopamine release during a video game. *Nature*, *393*(6682), 266–268. https://doi.org/10.1038/30498

Krejtz, K., Duchowski, A. T., Niedzielska, A., Biele, C., & Krejtz, I. (2018). Eye tracking cognitive load using pupil diameter and microsaccades with fixed gaze. *PLOS ONE*, *13*(9), e0203629. https://doi.org/10.1371/journal.pone.0203629

Kühn, S., Gleich, T., Lorenz, R. C., Lindenberger, U., & Gallinat, J. (2014). Playing Super Mario induces structural brain plasticity: Gray matter changes resulting

from training with a commercial video game. *Molecular Psychiatry*, *19*(2), 265–271.

Lam, W. W. T., Tang, Y. M., & Fong, K. N. K. (2023). A systematic review of the applications of markerless motion capture (MMC) technology for clinical measurement in rehabilitation. *Journal of Neuroengineering and Rehabilitation*, *20*(1), 57. https://doi.org/10.1186/s12984-023-01186-9

Lappi, O. (2016). Eye movements in the wild: Oculomotor control, gaze behavior & frames of reference. *Neuroscience & Biobehavioral Reviews*, *69*, 49–68. https://doi.org/10.1016/j.neubiorev.2016.06.006

Lappi, O. (2022). Gaze Strategies in Driving–An Ecological Approach. *Frontiers in Psychology*, *13*, 821440. https://doi.org/10.3389/fpsyg.2022.821440

Li, L., Chen, R., & Chen, J. (2016). Playing action video games improves visuomotor control. *Psychological Science*, *27*(8), 1092–1108. https://doi.org/10.1177/0956797616650300

Loonen, A. J. M., & Ivanova, S. A. (2015). Circuits regulating pleasure and happiness: The evolution of reward-seeking and misery-fleeing behavioral mechanisms in vertebrates. *Frontiers in Neuroscience*, *9*. https://doi.org/10.3389/fnins.2015.00394

Lumsden, J., Edwards, E. A., Lawrence, N. S., Coyle, D., & Munafò, M. R. (2016). Gamification of Cognitive Assessment and Cognitive Training: A Systematic Review of Applications and Efficacy. *JMIR Serious Games*, *4*(2), e11. https://doi.org/10.2196/games.5888

Mandrick, K., Peysakhovich, V., Rémy, F., Lepron, E., & Causse, M. (2016). Neural and psychophysiological correlates of human performance under stress and high mental workload. *Biological Psychology*, *121*, 62–73.

Maravita, A., & Iriki, A. (2004). Tools for the body (schema). *Trends in Cognitive Sciences*, *8*(2), 79–86. https://doi.org/10.1016/j.tics.2003.12.008

Mathiak, K., & Weber, R. (2006). Toward brain correlates of natural behavior: fMRI during violent video games. *Human Brain Mapping*, *27*(12), 948–956. https://doi.org/10.1002/hbm.20234

Maziero, D., Rondinoni, C., Marins, T., Stenger, V. A., & Ernst, T. (2020). Prospective motion correction of fMRI: Improving the quality of resting state data affected by large head motion. *NeuroImage*, *212*, 116594. https://doi.org/10.1016/j.neuroimage.2020.116594

Mishra, J., Anguera, J. A., & Gazzaley, A. (2016). Video Games for Neuro-Cognitive Optimization. *Neuron*, *90*(2), 214–218. https://doi.org/10.1016/j.neuron.2016.04.010

Oei, A. C., & Patterson, M. D. (2013). Enhancing Cognition with Video Games: A Multiple Game Training Study. *PLOS ONE*, *8*(3), e58546. https://doi.org/10.1371/journal.pone.0058546

Palaus, M., Marron, E. M., Viejo-Sobera, R., & Redolar-Ripoll, D. (2017). Neural Basis of Video Gaming: A Systematic Review. *Frontiers in Human Neuroscience*, *11*, 248. https://doi.org/10.3389/fnhum.2017.00248

Pallavicini, F., Ferrari, A., & Mantovani, F. (2018). Video games for well-being: A systematic review on the application of computer games for cognitive and emotional training in the adult population. *Frontiers in Psychology*, *9*, 407892.

Parsons, T. D. (2015). Virtual Reality for Enhanced Ecological Validity and Experimental Control in the Clinical, Affective and Social Neurosciences. *Frontiers in Human Neuroscience*, *9*. https://doi.org/10.3389/fnhum.2015.00660

Pinti, P., Tachtsidis, I., Hamilton, A., Hirsch, J., Aichelburg, C., Gilbert, S., & Burgess, P. W. (2020). The present and future use of functional near-infrared spectroscopy (fNIRS) for cognitive neuroscience. *Annals of the New York Academy of Sciences*, *1464*(1), 5–29.

Powers, K. L., Brooks, P. J., Aldrich, N. J., Palladino, M. A., & Alfieri, L. (2013). Effects of video-game play on information processing: A meta-analytic investigation. *Psychonomic Bulletin & Review*, *20*(6), 1055–1079. https://doi.org/10.3758-/s13423-013-0418-z

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, *14*(2), 154–166. https://doi.org/10.1037/a0019440

Rao, R. P. N., & Ballard, D. H. (1999). Predictive coding in the visual cortex: A functional interpretation of some extra-classical receptive-field effects. *Nature Neuroscience*, *2*(1), 79–87. https://doi.org/10.1038/4580

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion*, *30*, 344–360.

Sánchez-Reolid, R., López de la Rosa, F., Sánchez-Reolid, D., López, M. T., & Fernández-Caballero, A. (2022). Machine Learning Techniques for Arousal Classification from Electrodermal Activity: A Systematic Review. *Sensors*, *22*(22), Article 22. https://doi.org/10.3390/s22228886

Schrum, J., & Miikkulainen, R. (2016). Discovering Multimodal Behavior in Ms. Pac-Man through Evolution of Modular Neural Networks. *IEEE Transactions on Computational Intelligence and AI in Games*, *8*(1), 67–81. https://doi.org/10.1-109/TCIAIG.2015.2390615

Schultz, W. (2017). Reward prediction error. *Current Biology*, *27*(10), R369–R371. https://doi.org/10.1016/j.cub.2017.02.064

Schweizer, T. A., Kan, K., Hung, Y., Tam, F., Naglie, G., & Graham, S. J. (2013). Brain activity during driving with distraction: An immersive fMRI study. *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00053

Serino, A. (2019). Peripersonal space (PPS) as a multisensory interface between the individual and the environment, defining the space of the self. *Neuroscience &*

Biobehavioral Reviews, *99*, 138–159. https://doi.org/10.1016/j.neubiorev.2019-.01.016

Seth, A. K. (2013). Interoceptive inference, emotion, and the embodied self. *Trends in Cognitive Sciences*, *17*(11), 565–573. https://doi.org/10.1016/j.tics.2013.09.007

Shamay-Tsoory, S. G., & Mendelsohn, A. (2019). Real-life neuroscience: An ecological approach to brain and behavior research. *Perspectives on Psychological Science*, *14*(5), 841–859.

Thompson, J. J., Blair, M. R., Chen, L., & Henrey, A. J. (2013). Video game telemetry as a critical tool in the study of complex skill learning. *PloS One*, *8*(9), e75129.

Thompson, J. J., Blair, M. R., & Henrey, A. J. (2014). Over the hill at 24: Persistent age-related cognitive-motor decline in reaction times in an ecologically valid video game task begins in early adulthood. *PloS One*, *9*(4), e94215.

Thompson, J. J., McColeman, C., Stepanova, E. R., & Blair, M. R. (2017). Using video game telemetry data to research motor chunking, action latencies, and complex cognitive-motor skill learning. *Topics in Cognitive Science*, *9*(2), 467–484.

Ulrich, M., Keller, J., & Grön, G. (2016). Neural signatures of experimentally induced flow experiences identified in a typical fMRI block design with BOLD imaging. *Social Cognitive and Affective Neuroscience*, *11*(3), 496–507. https://doi.org-/10.1093/scan/nsv133

Van der Wel, P., & Van Steenbergen, H. (2018). Pupil dilation as an index of effort in cognitive control tasks: A review. *Psychonomic Bulletin & Review*, *25*, 2005–2015.

Varela, F. J., Thompson, E., & Rosch, E. (2017). *The embodied mind. Cognitive science and human experience*. MIT Press.

Wade, L., Needham, L., McGuigan, P., & Bilzon, J. (2022). Applications and limitations of current markerless motion capture methods for clinical gait biomechanics. *PeerJ*, *10*, e12995.

Walter, H., Vetter, S. C., Grothe, J., Wunderlich, A. P., Hahn, S., & Spitzer, M. (2001). The neural correlates of driving: *Neuroreport*, *12*(8), 1763–1767. https://doi.-org/10.1097/00001756-200106130-00049

Washburn, D. A. (2003). The games psychologists play (and the data they provide). *Behavior Research Methods, Instruments, & Computers*, *35*(2), 185–193. https://doi.org/10.3758/BF03202541

Wasserman, J. A., & Banks, J. (2017). Details and dynamics: Mental models of complex systems in game-based learning. *Simulation & Gaming*, *48*(5), 603–624. https://doi.org/10.1177/1046878117715056

Whitford, M., & Klimley, A. P. (2019). An overview of behavioral, physiological, and environmental sensors used in animal biotelemetry and biologging studies. *Animal Biotelemetry*, *7*(1), 1–24.

Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin & Review*, *9*(4), 625–636. https://doi.org/10.3758/BF03196322

Yannakakis, G. N., & Togelius, J. (2018). *Artificial Intelligence and Games*. Springer International Publishing. https://doi.org/10.1007/978-3-319-63519-4

Olgierd Borowiecki is a cognitive scientist at the University of Białystok, Faculty of Philosophy and Cognitive Science. His research bridges ecological psychology and neuroscience, focusing on how neural architecture shapes organism-specific action possibilities. He received the Diamond Grant for fMRI research on sensorimotor acquisition within a custom-designed game and the Perzanowski Award for the best cognitive science master's thesis in Poland. His current work develops mechanistic accounts of how the brain balances familiar and novel action strategies.

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Bury Me, My Love: An Introduction to Social Impact Games

Damian Gałuszka
AGH University of Kraków, Poland
dagal@agh.edu.pl

Received 2025-06-08; accepted 2025-12-18; published Online First 2025-12-30.

Abstract

Bury Me, My Love (2017, Playdius Entertainment) is an intriguing project addressing a significant social issue: the phenomenon of displacement and refugees. This game serves as an example to illustrate the potential of digital games as a medium for commenting on and interpreting existing realities, showcasing their critical, educational, and even transformative value—concepts collectively described as "social impact gaming". This game, along with other titles mentioned in the article, represents a production that is relatively simple to implement: inexpensive, straightforward, and not demanding in terms of hardware requirements. Yet it simultaneously offers insights into the mechanisms underlying the emergence of significant social issues, thereby holding an advantage over both AAA games and traditional media. A detailed examination of specific elements of this game (case study) will help identify possible strategies for its application in contexts beyond entertainment, which is a critical aspect of "social impact gaming".

Keywords: video games, refugees, social impact games, serious games

1. Introduction

Bury me, my Love is a multiplatform narrative video game that can be classified as a serious game. This production illustrates one of the most vital contemporary social issues—the phenomenon of forced migration—which constitutes the foundation of socially engaged games, also referred to as social impact games. Originally released in 2017 for mobile devices running Android and iOS, the game is a collaborative work by The Pixel Hunt, Figs, and ARTE France. In

2019, editions for the Nintendo Switch handheld console and personal computers were introduced to the market—the latter being available via the digital distribution platforms Steam and itch.io.

Bury me, my Love exemplifies a relatively accessible game due to its low price point (averaging approximately $5) and broad availability across various hardware platforms. It is also user-friendly, due to its simplified mechanics and the use of a touch-based interface. At the same time, the production offers insight into complex and nuanced social mechanisms. This juxtaposition of simplicity and depth of message distinguishes the title both in comparison to other major AAA (Triple-A) games and to traditional media.

Although *Bury me, my Love* does not introduce a novel subject, it stands out through its form and approach to the central theme. It is also a game in which the developers employ rarely used design solutions, such as the integration of interfaces (hardware and software) and notification mechanics that extend beyond the game world. These features—mentioned here and discussed in detail below—are valuable from the perspective of practical implementations and educational interventions. Therefore, this title merits in-depth analysis in the form of a case study.

2. Literature review

The origin for the creation of *Bury me, my Love* was the encounter between the game's author, Florent Maurin, and Dana—a Syrian refugee who survived the journey from Damascus to Europe. Through a series of meetings, the core design principle was developed: to faithfully recreate the way refugees use mobile messaging apps on their smartphones to stay in touch with friends and family (GDC, 2018). This approach to gameplay aligns with the type of play that French philosopher and sociologist Roger Caillois termed as *mimicry*, in which players imitate and assume roles, co-creating a virtual world and thereby shaping their attitudes based on observation and a sense of immersion (Słomczyński, 2014).

According to the developers, *Bury me, my Love* is a reality-inspired game, based on actual events (GDC, 2018). It is one of many games that originate from a reflection on social issues. This entanglement with social themes and the attempt to influence audiences are characteristic of socially engaged games (Ruggiero, 2013), which, in a broader context, are reflected in initiatives such as *Games for Change* or *Games for Impact* (Ashton, 2007). The starting point for such projects is usually the personal views or experiences of authors, which are then elaborated upon using collected materials and transformed into the form of a digital game. This approach is typical of serious games—productions in which the primary aim is not entertainment, but rather education and awareness-raising through gameplay (Michael, Chen, 2005, p. 21; Charsky, 2010, p. 179). In this context, "social impact games" may be understood as at least

partially overlapping with serious games, as they are titles that address social challenges by fostering empathy, influencing behaviour, or promoting collective change (Grace, 2023). The sense of engagement (immersion) in the observed or reenacted events can enhance the educational potential of a given production (Gee, 2003; Charsky, 2010).

Depending on the type of serious game, this educational component may affect the player in different ways. It may involve an attempt to provoke a reaction or reflection through a high-quality aesthetic experience (art games), a critical commentary on current events (news games), a disruption of the boundary between the game world and the physical world (pervasive games), a mechanism of empathic identification (empathy games), or even shock (radical games). What is particularly interesting is that *Bury me, my Love* incorporates elements of several of these subtypes of serious games, which contributes to the uniqueness of this title. At the same time, adopting such a perspective entails the risk of an imbalance between entertainment and serious aspects, which in some cases results in games that fail to provide satisfying gameplay; this will be noted with regard to *Bury Me, My Love* later in the article.

3. Methodology

The following description of *Bury me, my Love,* is based on the mobile version of the game and, in order to avoid spoilers, does not include specific details about its narrative. The choice of this edition is primarily motivated by the developers' recommendation who suggest on the official website (www.burymemylove.arte.tv), that the game should be played on a smartphone as it offers the most immersive experience. The following analysis is based on the ontological model of game analysis developed by Espen Aarseth and Paweł Grabarczyk, which consists of four layers: physical, structural, communicational, and mental, each subdivided into three sublayers. The physical layer concerns the material aspects of the game; the structural layer addresses its mechanics, code, and economic model; the communicational layer pertains to the ways information is conveyed (including the interface); and the mental layer relates to the player's experiences and perceptions (Aarseth, Grabarczyk, 2018). The choice of mobile version is directly linked to the game's communicational layer, which—across its presentational (appearance, graphics, and sounds), semantic (all conveyed meanings and information, from simple commands to full narratives), and interface (non-diegetic information directed solely at the player) dimensions—is built around the metaphor of a smartphone and simulates information exchange via a mobile messaging app, which is a core design principle. In practice, this means the player performs simple operations on a touchscreen interface, such as receiving and sending messages in various forms—primarily textual, and less frequently symbolic (emoticons) or graphical (photos).

4. Results

A distinctive feature that sets the discussed game apart from others is its "desktop"-style interface. Based on the fundamental division into hardware and software interfaces, as well as input (which determines the scope and nature of information the user can transmit to the device) and output (which governs the form of feedback from the device to the user) interfaces (Celiński, 2011; Bomba, 2014, p. 82), we can assert that in this case, the software output interface presented in the game fully corresponds to the hardware input interface when using the Android or iOS version of *Bury me, my Love* that in a result "maps the temporal structures of refugee experience onto the lives of its players" (Nijdam, 2022). This is a highly uncommon situation, as interaction within virtual environments is typically mediated through hardware controllers (usually a keyboard, mouse, or a gamepad), which indirectly translate the player's physical actions into the game world. Certain exceptions include steering wheels or joysticks, which allow for more direct manipulation of vehicles in racing games or flight simulators.

It is also important to consider the software layer of the interface, which generally includes abstract elements superimposed on the represented world. These are typically various non-diegetic textual or visual messages accessible only to the player, such as HUDs displaying item attributes, maps, or health indicators (Iacovides et al. 2015, p. 13). In contrast, diegetic elements are those that constitute the game world and narrative, therefore are accessible to both the player and the character they control (ibid.). Launching *Bury me, my Love* on a smartphone creates a rare scenario in which the hardware interface (the smartphone) is identical to the communicative layer of the game—both in terms of diegetic and non-diegetic elements. In other words, the player observes the game world through the hardware output interface, i.e., the screen of their device, on which messages exchanged between the two main characters—Nour, fleeing Syria for Europe, and her husband Majd, who is forced to stay behind—are displayed.

Other productions, such as *Her Story* (2015, Sam Barlow) or *SUPERHOT VR* (2016, SUPERHOT Team), also simulate fragments of the hardware input interface within the game world. In *Her Story*, this is a computer, while in *SUPERHOT VR*, it is a virtual reality (VR) headset. Choosing to play these games on the hardware platform suggested by the game's design unifies the gaming experience not only at the level of the game system, its rules, and the player's impressions and mental imagery, but also in terms of the specific physical actions required to continue gameplay (Nitsche, 2008, p. 15). Such game design can enhance the sense of sensory immersion in the observed virtual reality (Heim, 1993, pp. 154–155)—which reduces the cognitive distance between the displayed image and its viewer, between the virtual and physical worlds (Maj, 2015, p. 372). In *Bury me, my Love*, this results from the exceptionally strong

embedding of the game's communicative layer in the interface metaphor, making the player feel as though they are genuinely (almost physically) participating in the events. The player knows from the description and narrative that they are assuming the role of someone communicating via mobile phone—and they are indeed doing so, both in the game world and on their own device.

This phenomenon does not occur when *Bury me, my Love* is played on a personal computer or even on a Nintendo Switch console, which may reduce the enjoyment of gameplay for some users and, in extreme cases, lead to the opposite of immersion–emersion, which weakens the sense of direct participation in the game's events (Kubiński, 2016, pp. 69–70). Therefore, the developers' encouragement to experience their game on a mobile device is understandable. The impression of deepened engagement is further enhanced by the audiovisual design, which, while not extensive, has been crafted with attention to detail. The developers paid close attention to elements such as message reception animations and intricately drawn graphics that imitate photographs. In addition to the main view of the messaging interface, the game also features a menu, a map, and an integrated journal in which certain content—such as images received during the virtual conversation—is saved. At the same time, the game's sound layer has been reduced to a minimum, consisting of a notification sound, a few short recordings, and a single musical theme that plays at specific moments, such as when transitioning to the next day of the journey. Vibrations signalling incoming messages also contribute positively to the impression of participating in an authentic conversation.

Educational content can be embedded in the narrative, descriptions (of characters, tasks, or the game world), but also in the game mechanics themselves. The latter—an approach unique to games—is often referred to as procedural rhetoric (Bogost, 2007). In the case of the discussed production, the game teaches through its core mechanics, raising awareness of the challenges involved in helping a loved one from a distance, particularly in a complex situation such as attempting to cross into another country. This stems from the fact that not every decision that seems appropriate from Majd's perspective—the main character controlled by the player—leads to a positive outcome for Nour, his partner and a refugee navigating a dangerous route to Europe, who is located in an entirely different place. For instance, suggesting that she hides money in her underwear results in a favourable outcome, as Nour avoids losing her funds during a search. However, encouraging her to apply for asylum proves detrimental, as it leads to her being stuck in a refugee camp for many months. As a result, the player is confronted with the consequences of their decisions—they are no longer passive observers of events but actively co-create them through the procedures (algorithms, mechanics) embedded in the game. Importantly, due to the ergodic nature of this medium, the player can restart the game multiple times and enact different versions of Nour and Majd's story, thereby gaining a completely different (holistic) perspective on the entire issue.

Bury me, my Love also serves as a specific commentary on the existing socio-political situation. Admittedly, the game lacks the temporal immediacy characteristic of typical news games, which are usually released shortly after the events they aim to comment on. However, the inspiration behind the game lies in the ongoing Syrian civil war, which has persisted since 2011, and the broader issue of migration—particularly forced displacement—remains highly relevant. The game engages with this ongoing discourse in a highly specific and previously unexplored manner. This is not merely a matter of addressing the topic itself. In the past, several serious games have tackled similar issues. What distinguishes *Bury me, my Love* from those earlier titles, however, is the unique form it adopts, as previously described, as well as the mechanics that will be discussed further.

Of course, this game is not merely a straightforward, informative depiction of the relationship between two individuals gradually becoming geographically separated. While it does contain factual information—for instance, descriptions of cities visited by Nour, including population figures or explanations of why a given metropolis constitutes a key point along the refugee route—it also reveals the everyday struggles of a displaced person. These include lack of access to Wi-Fi or electricity, communication difficulties, harsh camp conditions, confusion over local legal intricacies, uncertainty about choosing the right route, and a range of fears concerning both personal safety and the fate of family members left behind in Syria. The game also incorporates elements designed to evoke a sense of empathy or emotional resonance in the player: illustrations of the protagonists' war-torn hometown streets, reports of the death of another acquaintance, or narrative fragments that portray the sorrow of the couple's separation. Together, these components create an authentic message that allows for a deeper understanding of stories familiar from TV screens—yet without the sensationalism often characteristic of televised representations.

This approach is also linked to the fact that *Bury me, my Love* offers the player multiple possible endings. As a result, Nour does not necessarily reach Germany; she may, for example, become stranded in a Bulgarian refugee camp. There are many such scenarios, and the final outcome depends on the suggestions the player sends to Nour through the "fingers" of her husband, Majd. Interestingly, Nour possesses her own independent and strong-willed personality and does not always follow the player's advice, which enhances the credibility of the experience and reinforces the realism of this unconventional gameplay.

However, this commentary is not always neutral and contains an ideological dimension that is not immediately apparent. As the player becomes immersed in the relationship between the two protagonists and learns more about it, a perspective on the refugee crisis—embedded by the developers—gradually emerges. For example, in the description of Berlin, the developers reference

Angela Merkel's famous 2015 statement about Europe's "wide opening" to refugees (Deja 2015). This directly informs Nour's destination: Germany. Furthermore, in the couple's conversations, certain expressions appear that convey not only evaluations of the events depicted in the game but also of exclusionary attitudes held by some Europeans. One illustrative example is a moment when Nour encounters difficulties crossing yet another border, prompting a dialogue with Majd in which two contrasting European attitudes toward refugees are juxtaposed: a negatively framed hostility and a more ambiguous, difficult-to-judge fear.

One element of *Bury me, my Love* that merits discussion, is the implementation of certain game mechanics. In this respect, too, the game is not particularly complex; however, one especially noteworthy feature is the notification system for unread messages. If the player grants the game the appropriate permissions on the mobile device, they will periodically receive notifications directly from the game. In this way, the production does not merely break the so-called "magic circle" of gameplay—it actively "intrudes" into the player's everyday life. Whether or not this is a deliberate design choice, the game reproduces contemporary models of communication, in which various actors—both human and non-human—compete for the limited attention of mobile device users (Hoffman, Novak, 1996, p. 53), sometimes resulting in the problem of information overload (Andrejevic, 2013, pp. 14–15). However, the point here is not simply to replicate this dynamic, but rather to offer a striking, even physical (measured in minutes or hours) reminder that not everything is within the player's control—especially when Nour's status is marked in red, indicating she is offline.

This unusual displacement of the player from the "pedestal" of agency is also present in another serious game, *That Dragon, Cancer* (2016, Numinous Games), in which players are deprived of any real influence over the fate of a dying child. In *Bury me, my Love,* waiting for the next notification produces unexpected effects: the player may feel impatience, anxiety over the lack of a response, or even fear of having missed something—an experience sometimes described as FOMO (Fear of Missing Out). Yet above all, what the player experiences is a profound sense of helplessness, which powerfully conveys the drama faced by fleeing refugees and their families—one of the declared aims of the discussed production (GDC 2018).

However, the reported reception of *Bury Me, My Love* is mixed. Some critics and players raised concerns that led to negative reviews. Based on public opinions on platforms such as itch.io (2025), Steam (2025), and Metacritic (2025), criticism centres on:

- Poor socio-cultural representation and lack of authenticity: misrepresentation of the refugee experience, trivialization of suffering, and perceived Western bias.

- Ethical and political issues: accusations of exploiting the subject matter, claims that the game undermines the appropriateness of games for addressing social issues, and oversimplification of the Syrian refugee crisis.
- Simplified characterization and storytelling: unrealistic behaviour attributeed to Nour and an emotional distance in the narrative.
- Gameplay and design limitations: absence of meaningful choices, low replayability, text overload, and bugs or errors (notably in some ports).

These observations suggest that *Bury Me, My Love* may not suit players expecting fast-paced, more dynamic gameplay, complex storytelling or vivid audiovisuals. At the same time, players with biographical or cultural ties to the subject matter may react less positive. Thus, such challenges should be addressed before exposing these groups to the game.

5. Discussion

Bury Me, My Love serves as a compelling example of a serious video game with significant potential for social impact. This title offers a distinctive interface, immersive experience, procedural structure, and core mechanics that effectively simulate complex social phenomena, such as the refugee crisis. Furthermore, the game is accessible due to its low cost and minimal hardware requirements, and it remains intuitive and user-friendly, even for individuals with limited gaming experience. These characteristics make it a potentially valuable tool in various educational settings and as an instrument for social intervention—particularly in contexts constrained by limited resources, such as insufficient educators' skills, tight budgets, or time restrictions.

The game exhibits features that are essential for any social impact game: assisting or guiding others (in this case, not other human players but an in-game companion), engaging with moral and ethical dilemmas (arising from the advice given and choices made), learning about societal issues (such as tensions between local populations and refugees), and gaining insight into broader social challenges (including civil wars and humanitarian crises) (Ruggiero, 2013). Therefore, potential applications include, but are not limited to:

- Self-education: tangential learning through gameplay and extension to other media (films, articles, etc.).
- Learning by doing: interactive messaging with a (virtual) refugee rather than passive watching or reading their stories.
- Collective discussion: conversations about the different paths Nour takes on her journey to Europe.

- Comparative analysis: examining varying European responses to refugees as depicted in the game.
- Peer assessment: evaluating alternative in-game decisions made by players.
- Retrospective learning: assessing historical circumstances depicted in the game by their real-world consequences (e.g., migration policies in the EU).
- Cross-curricular learning: integrating knowledge from different domains (e.g., culture with geography, law, or ethics).
- Empathy and perspective-taking: emotional processing of gameplay combined with reflection to foster understanding of people affected by migration crises.

Educators can also adopt a mixed approach. For example, raise awareness about the migration crisis by using the game as an interactive story and combining it with methods such as creative writing or journaling. Players might propose alternative endings, suggest upgraded mechanics, or write a journal from the protagonist's perspective.

At the same time, it is important to note that the proposed applications should be directed toward individuals with sufficient emotional maturity and sensitivity. This is necessary to avoid exposing younger audiences or those unprepared—due to personal trauma or difficult experiences—to the game's challenging content. The game is recommended for audiences between 15 and 18 years old (Gaming4skills, 2022). This is a potential limitation in the game's broader applicability. Anyone who intends to introduce *Bury Me, My Love* in any context should also consider the arguments of critically attituded players, especially when the game will be presented to people culturally or biographically related to its main theme.

Another limitation is the lack of robust empirical data regarding its actual effectiveness in educational interventions, which underscores the need for further research among player populations.

6. Conclusions

Digital games have become a significant medium in contemporary societies, particularly (but not only) among younger generations. This medium not only offers a comprehensible form of communication but, more importantly, provides an engaging and attractive mode of expression. As such, it holds the potential for more effective influence, especially when compared to traditional media. Within this framework, *Bury Me, My Love* emerges as a potentially valuable tool for shaping attitudes toward refugees.

Consequently, future initiatives and educational interventions addressing the broadly defined migration and refugee crisis should consider incorporating this—and similar–production. Their capacity to combine emotional engagement with experiential learning makes them promising assets in fostering empathy, critical reflection, and social awareness.

References

Aarseth, E., & Grabarczyk, P. (2018). *An ontological meta-model for game research*. https://pure.itu.dk/ws/portalfiles/portal/85540747/4.19_An_Ontological_Meta_Model_for_Game_Resea.pdf

Andrejevic, M. (2013). *Infoglut: How too much information is changing the way we think and know*. Routledge.

Ashton, D. (2007, July). G*ames for change: A cultural studies and social impact gaming dialogue*. Paper presented at the Cultural Studies Now Conference, London, UK. https://culturalstudiesresearch.org/wp-content/uploads/2012/-10/AshtonGames4Change.pdf Bogost, I. (2007). *Persuasive games: The expressive power of videogames*. MIT Press.

Bomba, R. (2014). *Gry komputerowe w perspektywie antropologii codzienności*. Adam Marszałek.

Celiński, P. (2011). W poszukiwaniu interfejsu idealnego. *Kultura i Historia*, *19*.

Charsky, D. (2010). From edutainment to serious games: A change in the use of game characteristics. *Games and Culture, 5*(2), 177–198. https://doi.org/-10.1177/15554-12009354727

Deja, M. (2015, September 8). Ramiona Angeli Merkel szeroko otwarte na imigrantów. *GP24*. https://gp24.pl/ramiona-angeli-merkel-szeroko-otwarte-na-imigrantow/ar/7352853

Gaming4skills. (2022). Bury Me, My Love. https://www.gaming4skills.eu/wp-content/uploads/2022/03/Singleplayer8_EN.pdf

GDC. (2018, March 21). Exploring helplessness in games with Bury Me, My Love [Video]. *YouTube*. https://www.youtube.com/watch?v=yDzsSvFZhJ8

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. Palgrave Macmillan.

Grace, L. D. (2023). Social impact games, a probable future illuminated by looking back. *ACM Games: Research and Practice, 1*(1), 1–3. https://dl.acm.org/-doi/10.-1145/3583986

Heim, M. (1993). *The metaphysics of virtual reality*. Oxford University Press.

Hoffman, D. L., & Novak, T. P. (1996). Marketing in hypermedia computer-mediated environments: Conceptual foundations. *Journal of Marketing, 60*(3), 50–68. https://doi.org/10.1177/002224299606000304

Iacovides, I., Cox, A., Kennedy, R., Cairns, P., & Jennett, C. (2015). *Removing the HUD: The impact of non-diegetic game elements and expertise on player involvement*. In Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play (pp. 13–22). ACM. https://doi.org/10.1145/2793107-.2793120

itch.io. (2025). *Bury me, my Love*. https://dearvillagers.itch.io/bury-me-my-love/comments

Kubiński, P. (2016). *Gry wideo. Zarys poetyki*. Universitas.

Maj, M. K. (2015). Czas światoodczucia. Imersja jako nowa poetyka odbioru. *Teksty Drugie, 3*, 368–394.

Metacritic. (2025). *Bury me, my Love.* https://www.metacritic.com/game/bury-me-my-love/user-reviews/

Michael, D., & Chen, S. (2005). *Serious games: Games that educate, train, and inform*. Course Technology PTR.

Nijdam, E. B. (2022) Playing against real time: Queer (ing) temporalities in Bury Me, My Love. *Game Studies, 22(1)*.

Nitsche, M. (2008). *Video game spaces: Image, play, and structure in 3D worlds*. MIT Press.

Ruggiero, D. (2013). *The four keys of social impact games*. Paper presented at the Foundations of Digital Games Conference (FDG2013), Chania, Greece. http://www.fdg2013.org/program/workshops/papers/IDGEI2013/idgei2013_2.pdf

Słomczyński, M. (2014). Dydaktyczne aspekty projektowania gier. *Homo Ludens, 1*(6), 141–152.

Steam. (2025). *Bury me, my Love*. https://store.steampowered.com/app/808090-/Bury_Me_My_Love/#app_reviews_hash

Damian Gałuszka is a sociologist specializing in socio-technological dynamics, with a focus on digital ecosystems including video games, virtual reality, and artificial intelligence. He serves as an assistant professor at the AGH University of Science and Technology and collaborates with EduVRGameLab on research related to immersive media. Author of several publications and active participant in international academic networks, he supports public, private, and NGO partners in designing research, producing analyses, and delivering expert lectures and workshops. He integrates practical gaming experience with scientific inquiry in both research and teaching. His personal website: www.grywrodzinie.pl

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Integrating Generative AI into Narrative-Based Educational Games for Moral Development: A Conceptual Approach

Stanisław Kumor
Department of Information Technology,
Poznań University of Economics and Business, Poland
Stanislaw.Kumor@ue.poznan.pl

Received 2025-05-30; accepted 2025-12-18; published Online First 2025-12-30.

Abstract

This paper presents a conceptual approach for integrating artificial intelligence (AI) into the mechanics of narrative-based educational games. Drawing on theoretical analysis and a comprehensive literature review, the proposed model emphasizes the use of generative artificial intelligence (GenAI) to personalize game worlds, adapt storylines dynamically, and simulate the consequences of players' moral decisions. Rather than offering static scenarios, the system enables real-time narrative adaptation based on decision patterns and player profiles, promoting deeper engagement and ethical reflection. The core contribution lies in demonstrating how AI can support the development of critical thinking and moral sensitivity through interactive storytelling. The proposed solutions may inform the design of educational games and training environments that foster moral development in a socially responsible and pedagogically grounded manner.

Keywords: generative artificial intelligence (GenAI), narrative-based learning, moral education, interactive storytelling, ethical decision-making in games

1. Introduction

Traditional approaches to ethics education, often grounded in transmissive (behaviorist) models of instruction, frequently struggle to engage learners or translate abstract principles into practical decision-making skills applicable in complex real-life situations. These methods often lack elements of personaliza-

tion and experiential learning, both of which are essential for fostering a deeper understanding of moral norms.

In response to these challenges, educational games—particularly those based on interactive storytelling—are gaining traction as tools capable of simulating moral dilemmas in engaging and immersive ways. This potential can be significantly enhanced through the integration of artificial intelligence (AI), which opens new possibilities for delivering deeply personalized and adaptive educational experiences. Unlike static scenarios, AI allows for dynamic, player-specific content that evolves in response to individual gameplay trajectories.

Accordingly, the aim of this article is to present a theoretical model that integrates AI mechanisms with the design of narrative-based educational games. The proposed model focuses on the use of AI to track players' decision-making patterns and dynamically adapt the narrative, enabling users to experience the consequences of their moral choices and thereby support the development of critical thinking and ethical sensitivity. The solutions presented here are conceptual in nature and grounded in theoretical analysis and a review of relevant literature.

The article is structured into several key sections. It begins with a literature review covering educational games, moral psychology, and applications of AI in education and interactive narratives. This is followed by a detailed description of the proposed system architecture, with emphasis on the roles of specific AI components in achieving educational goals. The subsequent sections discuss the potential applications and broader implications of the model. The paper concludes with a critical discussion of its strengths and limitations, along with suggested directions for future research in this field.

2. Literature Review

Educational games, often referred to as serious games, are designed for instructional purposes while preserving the engaging mechanics of entertainment-focused games (Girard et al., 2013; Hookham & Nesbitt, 2019). A growing body of research confirms their ability to enhance student motivation and engagement (Arias-Calderón et al., 2022; Landers, 2015). Meta-analyses suggest a positive effect on learning outcomes, although overall effectiveness is closely tied to the quality of game design (Wouters et al., 2013; Riopel et al., 2019).

In the context of STEM education, prototype-based approaches to 3D educational games demonstrate how thoughtful integration of design, accessibility, and pedagogical collaboration may foster scalable and engaging learning environments—even if such systems are not yet widely deployed in classroom settings (Ranosz et al., 2023). These initiatives emphasize multi-platform

accessibility, cross-functional teamwork between developers and teachers, and game-based learning tailored to individual student needs.

Beyond foundational skills, games—especially narrative ones—hold promise for more complex educational goals, such as attitude formation and ethical reflection. Narrative games leverage compelling storylines to promote narrative transportation, encouraging players to reflect on moral choices and real-world analogs. Identification with characters and the cultivation of empathy deepen immersion and foster emotional engagement (Felnhofer et al., 2023; Cummings et al., 2022). A key element in such experiences is player agency—the ability to make meaningful decisions and observe their consequences (Mekler & Iacovides, 2018; Nguyen et al., 2018). Empirical studies confirm that narrative-based games can lead to measurable attitude change (Kolek et al., 2023; Iten, Steinemann & Opwis, 2018).

The pedagogical potential of such games aligns with established psychological frameworks of moral development. Foundational theories—such as Piaget's and Kohlberg's stages of moral reasoning (Killen & Smetana, 2015), Bandura's social learning theory (Bandura, 2002), and Haidt's moral intuitionist model (Haidt, 2008)—emphasize the role of experience, modeling, and emotion. Integrative models, like those by Narvaez and Lapsley (2009), synthesize these perspectives. Within this context, moral dilemmas serve as critical tools for fostering ethical reasoning, particularly when delivered through the pedagogically validated "+1 model" (Schlaefli, Rest, & Thoma, 1985). However, traditional moral education often struggles with learner passivity and lack of context (Balakrishnan, 2009).

Artificial Intelligence in Education (AIED) offers novel tools to address these limitations. Intelligent tutoring systems (ITS), adaptive learning environments, and learning analytics platforms support personalized learning paths, adjustable pacing, targeted feedback, and learner modeling (Al-Kfairy et al., 2025; Jian, 2023; Kumor et al., 2025). Generative AI, in particular, introduces new capabilities in customizing content and simulating dynamic educational scenarios—benefits especially relevant in moral and narrative-based games. As Walczak and Cellary (2023) highlight, such technologies require higher education institutions to rethink their curricula, placing new emphasis on digital literacy, ethical use of AI, and the development of metacognitive skills.

Applications of AI in educational contexts are not limited to textual or narrative domains. Recent experimental research demonstrates that AI can assist in visual recognition tasks relevant to hands-on learning. For instance, GPT-4 has been shown to successfully identify and describe electronic components—such as Arduino modules—based on visual input. This capability enables dynamic feedback, technical explanations, and suggestions for potential applications, provided that image quality and labeling are sufficient (Śliwicki, Rykowski,

& Gnusowski, 2024). These findings point to the broader value of AI as a tool supporting experiential learning in technical and engineering education.

At the implementation level, AI also transforms digital games by enabling believable, adaptive non-player characters (NPCs) that respond to player behavior (Lim et al., 2012; Wittmann & Morschheuser, 2022). AI-driven plot generation systems, such as Directors and planning algorithms, orchestrate branching narratives and emergent storylines (Roberts & Isbell, 2008; Young et al., 2013). Procedural content generation (PCG) further enables dynamic game environments, while player modeling techniques—powered by machine learning and natural language processing—support the simulation of morally relevant consequences (Yannakakis et al., 2013; Wang et al., 2017; Tato & Nkambou, 2022).

However, these advancements raise critical ethical questions. AI systems in education must be designed with fairness and transparency in mind. Algorithmic bias can lead to discriminatory outcomes (Kandregula, 2024), highlighting the need for fairness-oriented design principles (Mehra et al., 2025). Explainable AI (XAI) approaches are essential for fostering trust in AI-driven educational tools (Dwivedi et al., 2023). Moreover, systems that analyze moral reasoning or emotional responses must safeguard sensitive learner data, raising concerns about privacy, accountability, and ethical system design (Kundu & Bardhan, 2025; Tiribelli et al., 2024).

3. System Concept

The system is designed to create personalized, interactive narratives that allow players to experience the consequences of their moral decisions and reflect on them. A central role is played by generative artificial intelligence (GenAI), which is responsible for personalization, scenario generation, and integrating the outcomes of player choices into the ongoing narrative. The system is built around three core principles:

- **Personalized experience**—GenAI constructs the game world and initial narrative scenarios based on player-provided input.
- **Dynamic storytelling**—GenAI continuously generates new events and moral dilemmas during gameplay.
- **Consequences of decisions**—the player's earlier choices are analyzed and influence the progression of the game.

Complementary to these elements are **evaluation mechanisms** (e.g., community opinion) that strengthen engagement and support reflection on the long-term consequences of actions. The goal is not to "win" in the traditional sense, but to foster moral development, with diverse narrative paths forming a personalized summary of the player's ethical journey.

The system is structured in a modular way, allowing for scalability and further development. The main components include:

- **Initial questionnaire**—the player completes a short form specifying their values, goals, and preferences, which serve as input for gameplay personalization.
- **World generator**—based on the player's profile, GenAI creates a unique narrative setting, including atmosphere, central themes, characters, and initial conditions.
- **Narrative engine**—the GenAI component responsible for generating moral scenarios and decision points throughout gameplay.
- **Decision history database**—records the player's decisions and context, optionally including metadata such as reaction time.
- **Analysis and interpretation module**—an AI component that examines decision history, detects behavioral patterns, infers direct and delayed consequences, and tracks moral progression.
- **Consequence integration module**—ensures that new narrative events reflect the player's previous actions and current standing in social and moral evaluation systems.
- **Game interface**—allows the player to interact with the system by exploring scenarios, making decisions, and observing the evolving game world.

Personalizing the Game World Based on Player Input: Personalization begins with the initial questionnaire completed by the player before starting the game. The form gathers data across four key areas:

- **Moral values and attitudes**—e.g., importance of honesty and loyalty, ethical orientation (deontological, utilitarian, care ethics), views on moral trade-offs, reactions to injustice.
- **Decision-making style**—e.g., intuition vs. analysis, conformity vs. independence, pragmatism vs. idealism, avoidance vs. engagement in conflict.
- **Educational preferences**—e.g., topics of moral interest, desire for feedback, openness to value change.
- **Self-perception and reflection**—e.g., personal definition of a "good person," previous experiences with moral dilemmas.

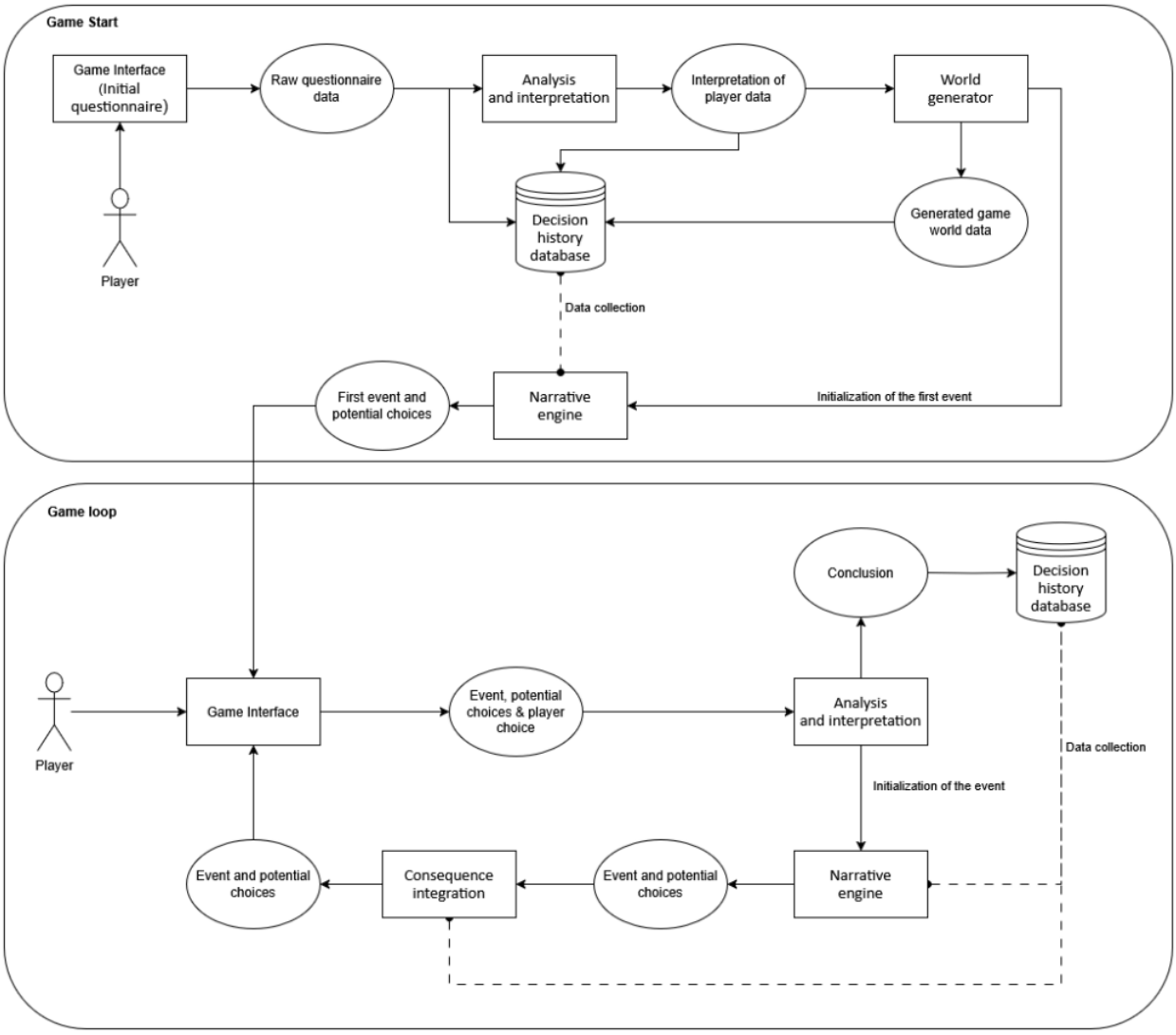

Figure 1. System architecture. Source: own elaboration.

Using this input, GenAI constructs a unique game world. The player's declared values may become central narrative themes or sources of moral tension—for instance, a player who values honesty may find themselves in a world of intrigue that constantly challenges their principles. Decision-making style influences how scenarios are presented—analytical players encounter complex, multi-variable challenges, while intuitive players face emotionally charged, time-sensitive dilemmas. Thematic preferences shape the narrative arc (e.g., social justice, interpersonal dynamics), and elements of self-identification can be subtly woven into the story, deepening immersion and encouraging early reflection.

Personalization Dimension	Example Data	Influence on Narrative Elements
Moral values and attitudes	Honesty, loyalty, deontological vs. utilitarian ethics, sensitivity to injustice	Core themes of the story; moral tensions; dilemmas challenging declared values
Decision-making style	Intuitive vs. analytical, conformist vs. independent	Scenario presentation style: emotional/time-limited vs. logical/complex dilemmas
Educational preferences	Openness to value change, interest in feedback, thematic preferences	Emphasis on reflective moments; alignment with moral topics of interest; tailored feedback
Self-perception and reflection	Definition of a "good person," past moral dilemmas, identity themes	Deeper narrative immersion; symbolic representation of self; enhanced personalization of scenarios

Table 1. Personalization Dimensions and Their Influence on Narrative Elements. Source: own elaboration.

User Interface: The user interface (UI) consists of dynamically generated text describing the scenario, supported by simple AI-generated visuals and clearly presented decision options. Interaction is facilitated through the selection of one of several choices, similar to dialogue trees in narrative games. The interface is designed to maximize immersion and focus the player's attention on the moral dimensions of their decisions.

Narrative Event Generation: Once the personalized world is created, GenAI is responsible for continuously generating short narrative events that pose moral dilemmas. Each event ends with a choice between three options. These scenarios are adapted dynamically based on both the initial questionnaire and the evolving decision history. To ensure variety and avoid repetitiveness, GenAI employs several strategies:

- Thematic variation—dilemmas span different moral domains (e.g., justice, honesty, compassion), regardless of initial player preferences.
- Complexity scaling—as the game progresses, dilemmas become more nuanced, ambiguous, and involve more people.
- Perspective shifting—similar situations may be presented from different viewpoints or within new contextual frames.
- Randomization within narrative consistency—to maintain novelty and appropriately balance the consequences of decisions.

This approach enables the generation of compelling and diverse experiences that encourage both immersion and moral reflection.

Artificial Intelligence: At the core of the system is the ongoing analysis of the player's decisions and the dynamic integration of their consequences—alongside moral progression—into the evolving narrative. The AI detects behavioral patterns, compares them with declared values, and evaluates their impact on internal moral indicators. This analysis informs the generation of future events, ensuring they are meaningfully connected to the player's prior actions and reflect their evolving status within the game world.

The AI may subtly steer the narrative toward various outcomes—not as "wins" or "failures" but as meaningful reflections of the player's moral development. The world responds to the player's choices through changes in environment, character behavior, and social dynamics—for example, becoming more harmonious or conflict-ridden based on prior decisions. Crucially, consequences are designed to feel coherent and justified, even if they emerge with a delay.

The system may also offer **reflection prompts**—personalized questions encouraging the player to think about their decisions (e.g., "How did you feel when making choice X?"). These moments of reflection can be tailored to player preferences and triggered after major decisions or on request, maintaining a sense of agency and voluntary introspection.

4. Example Use Case

To illustrate the functioning of the system, the following scenario presents a sample interaction between a player—Anna—and the AI-driven educational narrative game. This use case demonstrates how the proposed model—through dynamic personalization, consistent integration of consequences, and support for reflection—can fulfill educational, motivational, and immersive goals. Rather than offering a static storyline or point-based evaluation, the game provides a morally meaningful narrative in which the player co-creates and experiences a world shaped by their own decisions.

Initial Questionnaire and World Personalization: Anna begins the game by completing an initial questionnaire, in which she declares honesty as her core value, while also revealing a strong fear of social rejection and confrontation. Based on this input, the **World Generator** (a GenAI component) creates a personalized narrative setting: a small, isolated community where trust, reputation, and adherence to shared rules are essential to survival. In this society, even minor transgressions can lead to serious consequences.

First Narrative Scenario: Once introduced to the game world, Anna faces her first moral dilemma. Her close friend Marek confesses that he violated community rules by using more than his allotted share of a scarce resource for personal—though understandable—reasons. He asks Anna to keep it a secret, fearing harsh judgment from the elders. Anna is presented with three options:

- Keep Marek's secret, out of loyalty to a friend.
- Encourage Marek to admit his wrongdoing.
- Discreetly inform the elders, prioritizing the community's rules over personal loyalty.

Anna chooses the first option. The **Narrative Engine** logs her decision and passes it to the **Analysis Module**, which updates her **moral profile**—noting the tension between her stated value of honesty and her desire to avoid rejection. **Progression indicators** are also updated: she gains Marek's trust, but her reputation in the community becomes potentially compromised.

Consequence Integration and Story Progression: As the game continues, the system generates additional scenarios not directly linked to Anna's earlier choice. Eventually, however, a narrative event emerges that represents the **consequence** of that decision.

A shortage of the same resource that Marek misused triggers an investigation by the community elders. Anna witnesses how suspicion falls on an innocent individual. Marek remains silent, and subtle narrative cues (e.g., dialogue from non-player characters) suggest that some community members begin to distrust Anna, having seen her near the scene of the incident.

Anna now faces a new moral dilemma: should she continue to protect Marek, risking the escalation of the crisis and further damage to her own reputation, or reveal the truth, accepting the consequences for both herself and her friend but possibly restoring justice?

Narrative Reflection: After this scene, the system introduces a moment of reflection—a personalized internal monologue or prompt encouraging self-examination, such as: *"Remaining silent about Marek's actions has led to escalating conflict and compromised your standing in the community. How do you now assess your initial decision? Did loyalty outweigh honesty?".* The

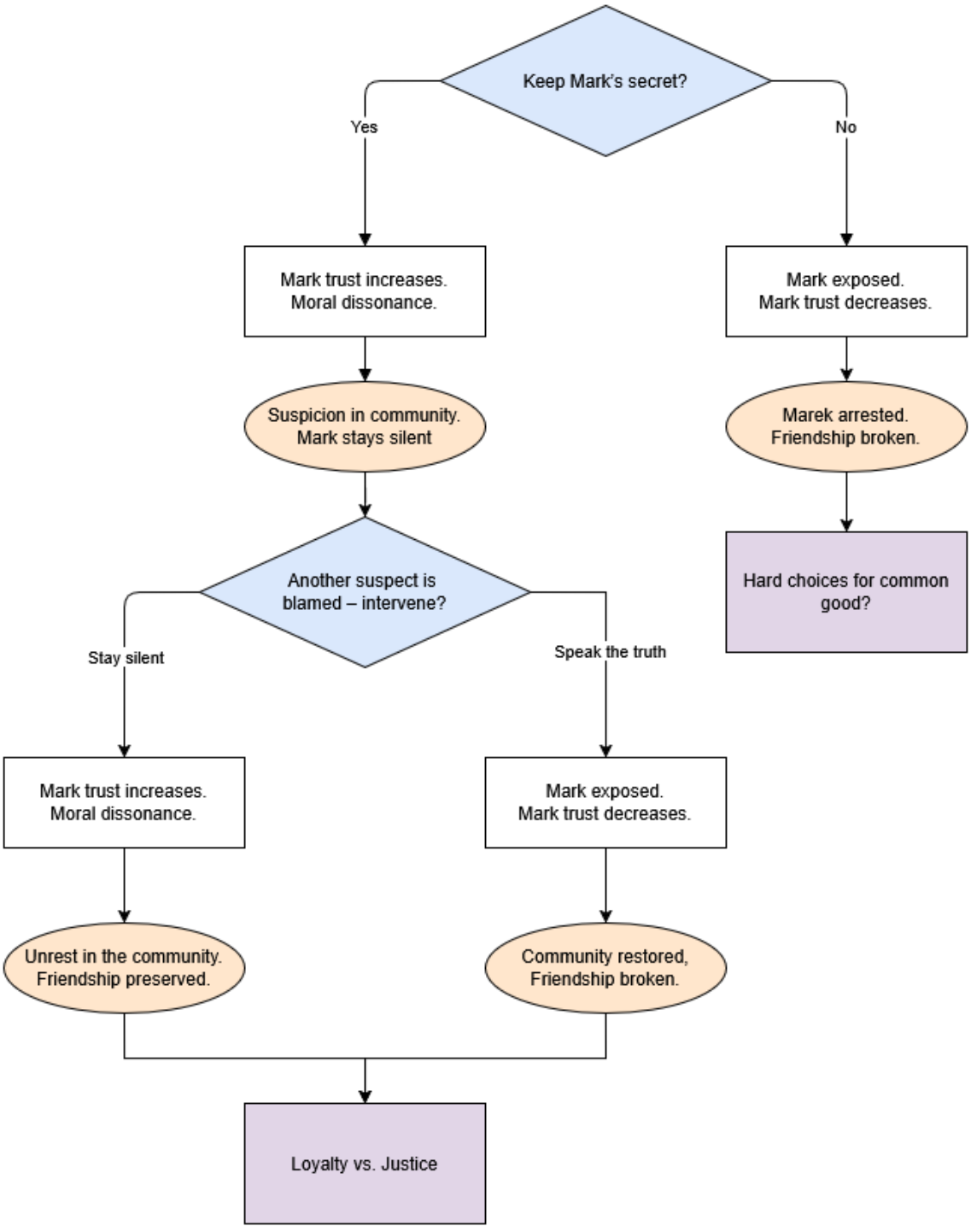

Figure 2. Moral progression pathways. Source: own elaboration.

Continued Gameplay and Moral Progression: The system continues its cycle: new dilemmas are generated by the **Narrative Engine**, and previous decisions—processed by the **Analysis and Integration Modules**—shape the unfolding storyline, character relationships, and narrative outcomes. Anna experiences the consequences of her choices both directly and indirectly, and the evolving game world becomes a mirror of her unique moral journey.

Figure 2 illustrates the moral decision pathways available to Anna in the use case scenario, along with exemplary narrative consequences resulting from each choice. The diagram presents a simplified yet representative segment of the possible moral trajectories within the game. Each shape in the diagram conveys a distinct aspect of the player's experience—from critical choices, through direct outcomes, to evolving world states and moments of ethical reflection.

5. Potential Applications and Implications of the Proposed Model

The proposed system model, based on GenAI and a mechanism for experiencing the consequences of moral choices, offers a wide range of applications and significant implications. With its deep personalization, dynamically generated scenarios, and narrative moral progression, it serves as a valuable tool across multiple contexts.

In **formal education**—from primary schools to universities—the system can support ethics instruction and values education by adapting the complexity of dilemmas to the learner's age and field of study (e.g., law, medicine, education). This fosters empathy and encourages meaningful discussion. In **professional training**, it enables the simulation of ethically relevant dilemmas specific to various sectors—including business, healthcare, public service, and technology—thereby enhancing awareness of professional responsibility.

In **informal learning and self-directed education**, the system can serve as a tool for personal reflection on moral values. It may also be used by **non-governmental organizations** as an interactive component in civic education and human rights programs. Additionally, it holds potential for use in **rehabilitation and resocialization programs** for individuals in the criminal justice system.

For **learners**, the system offers increased engagement, personalized narratives, and deeper comprehension of moral dilemmas through experiential learning. It promotes the development of empathy, perspective-taking, critical thinking, and moral self-awareness—competencies that translate into better preparation for real-world challenges.

For **educators**, the model provides an innovative didactic tool capable of delivering personalized instruction at scale. It may also generate aggregated insights into moral reasoning patterns, thereby supporting the refinement of educational curricula—provided ethical safeguards are maintained.

In a **broader societal context**, the model promotes prosocial attitudes, civic responsibility, and a culture of ethical dialogue and reflection. It highlights the interdisciplinary nature of modern educational innovations, merging psychology, pedagogy, computer science, and ethics. As a system that fuses GenAI with interactive moral storytelling, it has the potential to contribute to a new generation of education—one that is more engaging, personal, and reflective, and better aligned with the demands of a complex contemporary world.

6. Discussion

The previous sections have established the need for new approaches to moral education and introduced a conceptual model of an educational game system powered by generative AI (GenAI). This model leverages personalized, interactive narratives and a mechanism for experiencing the consequences of moral decisions, supported by progression systems. The present section discusses the model's key strengths, limitations, broader implications, and future research directions.

The model addresses a gap in the literature by integrating GenAI with interactive storytelling to support ethical development. GenAI enables dynamic personalization of the game world and the generation of tangible, multidimensional consequences based on the player's decisions. The experience is further enhanced by progression systems (e.g., "Moral Path," reputation, "World State," and "Milestones") designed to reinforce engagement and reflective thinking.

Key Advantages:

- Deep personalization—GenAI adapts the game world and scenarios to the player's values, decision-making style, and self-reflection.
- Experiential learning—players not only learn about moral principles but directly experience the outcomes of their actions, fostering value internalization.
- Integration of progression mechanics—educational goals are aligned with familiar game mechanics, promoting sustained engagement.
- Reflective feedback—GenAI can generate personalized feedback, enhancing moral self-awareness and ethical reasoning.

- Addressing limitations of traditional moral education—the model reduces learner passivity and bridges the gap between theory and practical application.

Key Challenges:

- Technical complexity—difficulties include ensuring narrative coherence, logical and morally relevant consequences, and maintaining content quality.
- Modeling morality—risks include oversimplifying or misinterpreting player behavior and difficulty in assessing genuine moral development.
- Ethical concerns—potential for algorithmic bias, lack of transparency in AI-driven decisions, privacy issues, and the need to preserve player autonomy.
- Resource intensity and scalability—high technological and organizational demands may limit broad implementation.

Research Potential:

- Despite these challenges, the model opens several promising avenues for research:
- The use of GenAI in designing adaptive educational narratives.
- Evaluation of the effectiveness of personalized moral learning interventions.
- Exploration of human–AI interaction in ethically sensitive contexts.
- Development of tools to assess the moral impact of gameplay experiences.

From the perspective of educational practice and game design, the model signals a new direction: the creation of immersive learning tools that foster moral reflection.

Future Research Directions:

- Prototyping—designing and testing a functional version of the system.
- Empirical studies—assessing the game's influence on moral attitudes, empathy, and engagement.
- GenAI algorithm development—refining AI to generate coherent, morally meaningful narratives and build accurate moral profiles.
- Ethical safeguards—establishing clear guidelines and safety standards for educational AI systems.
- Moral progression metrics—creating reliable methods for measuring moral development in virtual environments.

Advancing these research areas can not only improve the model itself but also contribute to the broader field of AI-enhanced education and the development of essential moral competencies.

7. Conclusion

This study set out to address the growing need for innovative methods of fostering moral development, particularly in the context of rapidly evolving digital technologies. Its primary aim was to present a theoretical model that integrates artificial intelligence mechanisms—specifically generative AI (GenAI)—with interactive storytelling in educational games. The proposed model emphasizes the creation of a deeply personalized experience, in which the player not only makes ethically significant decisions but also experiences their multidimensional consequences in a dynamic, narrative-driven format.

The core contribution of this work is the conceptualization of a system architecture in which GenAI is responsible for generating a unique game world and scenarios based on player input, continuously analyzing decisions, and adaptively embedding their consequences into the evolving narrative. A key element of the model is the implementation of narrative-based progression systems (such as a "Moral Path," reputation indicators, or "Milestones") that aim to enhance player engagement and motivation while supporting educational objectives and leading to narratively meaningful outcomes. This approach allows players not only to grasp abstract ethical principles but to internalize values through personal experience and reflection, all within a safe, simulated environment.

The model responds to a gap identified in the literature: the lack of comprehensive frameworks for leveraging AI in designing games that support moral development beyond basic decision-tree scenarios. While the implementation of such a system presents substantial technological challenges—particularly regarding content coherence and control in GenAI-generated outputs—as well as ethical concerns (e.g., bias, transparency, player autonomy, and data privacy), the proposed approach opens promising pathways. It holds the potential to transform how we approach moral education, making it more personal, engaging, and effective.

Future work should focus on empirically validating the model's assumptions through prototype development, user studies, and in-depth exploration of AI algorithms and ethical frameworks specific to this application. Nonetheless, the proposed concept outlines a promising direction for the development of educational tools that can meaningfully support the cultivation of moral maturity and ethical sensitivity—competencies that are increasingly vital in today's complex world.

References

Al-Kfairy, M., Alfandi, O., Sharma, R. S., & Alrabaee, S. (2025). Digital Transformation of Education: An Integrated Framework for Metaverse, Blockchain, and AI-Driven Learning. In *17th International Conference on Computer Supported Education, CSEDU 2025* (pp. 865-873). Science and Technology Publications, Lda. Retrieved from: https://www.scitepress.org/Papers/2025/134994/134994.pdf, 27.05.2025

Arias-Calderón, M., Castro, J., & Gayol, S. (2022). Serious games as a method for enhancing learning engagement: Student perception on online higher education during COVID-19. *Frontiers in Psychology*, *13*, 889975. Retrieved from: https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2022.889975/full, 27.05.2025

Ashby, T., Webb, B. K., Knapp, G., Searle, J., & Fulda, N. (2023, April). Personalized quest and dialogue generation in role-playing games: A knowledge graph-and language model-based approach. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (pp. 1-20). Retrieved from: https://dl.acm.org/doi/abs/10.1145/3544548.3581441, 27.05.2025

Balakrishnan, V. (2009). *Teaching moral education in secondary schools using real-life dilemmas* (Doctoral dissertation, Open Access Te Herenga Waka-Victoria University of Wellington). Retrieved from: https://openaccess.wgtn.ac.nz/articles/thesis/Teaching_Moral_Education_in_Secondary_Schools_Using_Real-Life_Dilemmas/16967287?file=31386973, 27.05.2025

Bandura, A. (2002). Selective moral disengagement in the exercise of moral agency. *Journal of moral education*, *31*(2), 101-119. Retrieved from: https://doi.org/10.1080/0305724022014322, 27.05.2025

Cummings, J. J., Tsay-Vogel, M., Cahill, T. J., & Zhang, L. (2022). Effects of immersive storytelling on affective, cognitive, and associative empathy: The mediating role of presence. *new media & society*, *24*(9), 2003-2026. Retrieved from: https://doi.org/10.1177/1461444820986816, 27.05.2025

Dwivedi, R., Dave, D., Naik, H., Singhal, S., Omer, R., Patel, P., ... & Ranjan, R. (2023). Explainable AI (XAI): Core ideas, techniques, and solutions. *ACM Computing Surveys*, *55*(9), 1-33. Retrieved from: https://doi.org/10.1145/3561048, 27.05.2025

Felnhofer, A., Wittmann, L., Reichmann, A., König-Teshnizi, D., & Kothgassner, O. D. (2023). Character identification is predicted by narrative transportation, immersive tendencies, and interactivity. *Current Psychology*, *42*(22), 18567-18577. Retrieved from: https://doi.org/10.1007/s12144-022-03048-4, 27.05.2025

Girard, C., Ecalle, J., & Magnan, A. (2013). Serious games as new educational tools: how effective are they? A meta-analysis of recent studies. *Journal of computer assisted learning*, *29*(3), 207-219. Retrieved from: https://doi.org/10.1111/j.1365-2729.2012.00489.x, 27.05.2025

Haidt, J. (2008). Morality. *Perspectives on psychological science*, *3*(1), 65-72. Retrieved from: https://doi.org/10.1111/j.1745-6916.2008.00063.x, 27.05.2025

Hookham, G., & Nesbitt, K. (2019, January). A systematic review of the definition and measurement of engagement in serious games. In *Proceedings of the australasian computer science week multiconference* (pp. 1-10). Retrieved from: https://doi.org/10.1145/3290688.3290747, 27.05.2025

Iten, G. H., Steinemann, S. T., & Opwis, K. (2018, April). Choosing to help monsters: A mixed-method examination of meaningful choices in narrative-rich games and interactive narratives. In Proceedings of the 2018 CHI conference on human factors in computing systems (pp. 1-13). Retrieved from: https://doi.org/10.1145/3173574.3173915, 27.05.2025

Jian, M. J. K. O. (2023). Personalized learning through AI. *Advances in Engineering Innovation*, *5*, 16-19. Retrieved from: https://doi.org/10.54254/2977-3903/5/20230-39, 27.05.2025

Kandregula, N. (2024). Revolutionizing Healthcare with Artificial Intelligence-A Machine Learning-Driven Approach to Precision Medicine, Predictive Analytics, and Automated Clinical Decision Support. Retrieved from: https://philarchive.org/rec/KANRHW, 27.05.2025

Killen, M., & Smetana, J. G. (2015). Origins and development of morality. *Handbook of child psychology and developmental science*, *3*(7), 701-749. Retrieved from: https://www.sas.rochester.edu/psy/people/faculty/smetana_judith/assets/pdf/KillenSmetana_2015_Origins.pdf, 27.05.2025

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Retrieved from: https://www.researchgate.net/publication-/235701029_Experiential_Learning_Experience_As_The_Source_Of_Learning_And_Development, 27.05.2025

Kolek, L., Ropovik, I., Šisler, V., van Oostendorp, H., & Brom, C. (2023). Video games and attitude change: A meta-analysis. *Contemporary Educational Psychology*, *75*, 102225. Retrieved from: https://doi.org/10.1016/j.cedpsych.2023.102225, 27.05.2025

Kumor, S., Maik, M., & Walczak, K. (in press). AI-driven video avatar for academic support. In K. Węcel (Ed.), *Business Information Systems: 25th International Conference, BIS 2025, Poznan, Poland, June 25–27, 2025, Proceedings* (Lecture Notes in Business Information Processing, Vol. 14448). Springer.

Kundu, T., & Bardhan, M. (2025). Artificial intelligence in neurology, ethics, recent guideline, and law-an Indian perspective. *Frontiers in Neurology*, *16*, 1515041. Retrieved from: https://doi.org/10.3389/fneur.2025.1515041, 27.05.2025

Landers, R. N. (2014). Developing a theory of gamified learning: Linking serious games and gamification of learning. *Simulation & gaming*, *45*(6), 752-768. Retrieved from: https://doi.org/10.1177/1046878114563660, 27.05.2025

Lim, M. Y., Dias, J., Aylett, R., & Paiva, A. (2012). Creating adaptive affective autonomous NPCs. *Autonomous Agents and Multi-Agent Systems*, *24*, 287-311. Retrieved from: https://doi.org/10.1007/s10458-010-9161-2, 27.05.2025

Mehra, S., Jhunjhunwala, A., Chopra, J. S., Dave, A., & Kukreja, G. (2025). A Ticking Time Bomb: Bias in Machine Learning and Artificial Intelligence. In *Emerging Multisector Applications of AI and IoT* (pp. 1-34). IGI Global Scientific Publishing. Retrieved from: https://doi.org/10.4018/979-8-3373-4332-7.ch001, 27.05.2025

Mekler, E. D., Iacovides, I., & Bopp, J. A. (2018, October). " A Game that Makes You Question..." Exploring the Role of Reflection for the Player Experience. In *Proceedings of the 2018 annual symposium on computer-human interaction in play* (pp. 315-327). Retrieved from: https://doi.org/10.1145/3242671.3242691, 27.05.2025

Narvaez, D., & Lapsley, D. K. (2009). Moral identity, moral functioning, and the development of moral character. *Psychology of learning and motivation*, *50*, 237-274. Retrieved from: https://doi.org/10.1016/S0079-7421(08)00408-8, 27.05.2025

Nguyen, H., Harpstead, E., Wang, Y., & McLaren, B. M. (2018). Student agency and game-based learning: A study comparing low and high agency. In *Artificial Intelligence in Education: 19th International Conference, AIED 2018, London, UK, June 27–30, 2018, Proceedings, Part I 19* (pp. 338-351). Springer International Publishing. Retrieved from: https://doi.org/10.1007/978-3-319-93843-1_25, 27.05.2025

Ranosz, J., Leszczyński, C., Kumor, S., Popiel, A., Głowaczewska, J., Garwol, P., ... & Maik, M. (2023, October). Advancing stem education in primary schools with an integrated system of 3d games. In Proceedings of the 28th International ACM Conference on 3D Web Technology (pp. 1-5). Retrieved from: https://doi.org/10.1145/3611314.3615919, 27.05.2025

Riopel, M., Nenciovici, L., Potvin, P., Chastenay, P., Charland, P., Sarrasin, J. B., & Masson, S. (2019). Impact of serious games on science learning achievement compared with more conventional instruction: an overview and a meta-analysis. *Studies in Science Education*, *55*(2), 169-214. Retrieved from: https://doi.org/10.1080/03057267.2019.1722420, 27.05.2025

Roberts, D. L., & Isbell, C. L. (2008). A survey and qualitative analysis of recent advances in drama management. *International Transactions on Systems Science and Applications, Special Issue on Agent Based Systems for Human Learning*, *4*(2), 61-75. Retrieved from: https://www.researchgate.net/publication/2289267-72_A_survey_and_qualitative_analysis_of_recent_advances_in_drama_management, 27.05.2025

Schlaefli, A., Rest, J. R., & Thoma, S. J. (1985). Does moral education improve moral judgment? A meta-analysis of intervention studies using the Defining Issues Test. *Review of educational research*, *55*(3), 319-352. Retrieved from: https://doi.org/10.3102/00346543055003319, 27.05.2025

Śliwicki, M., Rykowski, J., & Gnusowski, A. (2024). Wykorzystanie sztucznej inteligencji w wizualnym wykrywaniu modułów elektronicznych do celów edukacyjnych. W I. Mołdoch-Mendoń & M. Świtalski (red.), *Nowe horyzonty sztucznej inteligencji i uczenia maszynowego—trendy, wyzwania i perspektywy* (s. 101–115). Retrieved from https://bc.wydawnictwo-tygiel.pl/publikacja/8D63D-77C-BB67-12F0-A2B9-A7C733F703EE, 27.05.2025

Tato, A., & Nkambou, R. (2022). Infusing expert knowledge into a deep neural network using attention mechanism for personalized learning environments. *Frontiers in Artificial Intelligence*, *5*, 921476. Retrieved from: https://doi.org/1-0.3389/frai.2022.921476, 27.05.2025

Tiribelli, S., Giovanola, B., Pietrini, R., Frontoni, E., & Paolanti, M. (2024). Embedding AI ethics into the design and use of computer vision technology for consumer's behaviour understanding. *Computer Vision and Image Understanding*, *248*, 104142. Retrieved from: https://doi.org/10.1016/j.cviu.2024.104142, 27.05.2025

Walczak, K., & Cellary, W. (2023). *Challenges for higher education in the era of widespread access to Generative AI*. Economics and Business Review, 9(2), 71–100. Retrieved from: https://doi.org/10.18559/ebr.2023.2.743, 27.05.2025

Wald, H. S. (2015). Professional identity (trans) formation in medical education: reflection, relationship, resilience. *Academic medicine*, *90*(6), 701-706. Retrieved from: https://doi.org/10.1097/ACM.0000000000000731, 27.05.2025

Wang, P., Rowe, J. P., Min, W., Mott, B. W., & Lester, J. C. (2017, August). Interactive Narrative Personalization with Deep Reinforcement Learning. In *IJCAI* (pp. 3852-3858). Retrieved from: https://www.ijcai.org/proceedings/2017/0538.pdf, 27.05.2025

Wittmann, M., & Morschheuser, B. (2022). What do games teach us about designing effective human-AI cooperation?-A systematic literature review and thematic synthesis on design patterns of non-player characters. *GamiFIN*, 95-104. Retrieved from: https://www.researchgate.net/publication/361740956_What_do_games_teach_us_about_designing_effective_human-AI_cooperation_-A_systematic_literature_review_and_thematic_synthesis_on_design_patterns_of_non-player_characters, 27.05.2025

Wouters, P., Van Nimwegen, C., Van Oostendorp, H., & Van Der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of educational psychology*, *105*(2), 249. Retrieved from: https://doi.org/10.1037/-a0031311, 27.05.2025

Yannakakis, G. N., Spronck, P., Loi, C. L., & Raffe, W. L. (2013). *Player Modeling.* Retrieved from: https://www.um.edu.mt/library/oar//handle/123456789/29725, 27.05.2025

Young, R. M., Ware, S. G., Cassell, B. A., & Robertson, J. (2013). Plans and planning in narrative generation: a review of plan-based approaches to the generation of story, discourse and interactivity in narratives. *Sprache und Datenverarbeitung, Special Issue on Formal and Computational Models of Narrative*, *37*(1-2), 41-64. Retrieved from: https://www.justusrobertson.com/papers/Young%20Ware-%20Cassell%20and%20Robertson%202013%20-%20Plans%20and%20Planning-%20in%20Narrativ-e%20Generation.pdf, 27.05.2025

Stanisław Kumor is a researcher and lecturer at the Poznań University of Economics and Business. He received his bachelor's degree in Informatics and Econometrics and his master's degree in Industry 4.0 from the Poznań University of Economics and Business. His research interests focus on the application of artificial intelligence in education and on the use of computer games to support teaching and learning processes.

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Framework for Gamifying Production Management Principles in Education with Commercial-Off-The-Shelf Games

Cyryl Leszczyński
Poznan University of Economics and Business, Poland
cyryl.leszczynski@ue.poznan.pl

Received 2025-06-07; accepted 2025-12-18; published Online First 2025-12-31.

Abstract

This paper introduces a framework for integrating gamification principles into production management education and production via commercial-off-the-shelf (COTS) software. It synthesizes multidisciplinary insights from management science (logistics), psychology, and computer science to demonstrate how gamified interactions can effectively represent complex management concepts such as lean manufacturing, workflow optimization, TOC, and resource allocation. The framework emphasizes factors like motivation, engagement, and cognitive retention, as well as computational considerations, realistic simulation, adaptive feedback, and comparisons to mathematically optimal solutions. The goal of the study is to outline these games can be repurposed as effective, low-barrier and relatively low-cost tools for teaching complex production systems and developing practical decision-making skills in both academic and professional settings.

Keywords: interactive learning, production management, gamification, supply chain simulation

1. Introduction

As the complexity of production chains in the modern world continues to increase, so does the demand for production managers equipped with both a solid grasp of (Deterding et al., 2011) theory and practical problem-solving skills. These professionals need to navigate dynamic production environments, optimize resource flows and respond to uncertainty with informed decision-

making, grounded in the theory behind production management principles, making traditional education and simulation key components in their training.

In this paper, commercial-off-the-shelf (COTS) video games, originally designed with entertainment as their primary focus, can be repurposed and implemented to support the education of future production managers. A structured framework is proposed, laying out the specifics of how a selection of production-oriented video games (*Factorio, Minecraft)* could be integrated into a class on production management, with a focus on *Minecraft* due to its extensive, community-driven mod support. Applying game-design elements in non-game context (like education) is an effective way of enhancing engagement with the material (Deterding et al., 2011), and has been shown to increase information retention and subject understanding (Clark et al., 2016; Deterding et al., 2011). Within this context commercial-off-the-shelf games present a unique opportunity— unlike custom-developed software, COTS games are readily available, cost-effective, and often feature sophisticated production chain simulations that mirror real-world production scenarios. Professional production management software, though offering a much greater degree of simulation accuracy, remains expensive, inaccessible, and generally much more complex.

Integrating COTS video games into production management curricula aligns with experiential learning theories, which emphasize learning through reflection on doing (Kolb, 1984). Immersing students in simulated environments facilitates the development of critical thinking and problem-solving skills relevant to production management, such as decision-making under uncertainty or job scheduling. Despite those potential benefits, the adoption of COTS games in production management education remains limited, and there is a lack of structured frameworks guiding their implementation, which is a gap this paper aims to address, especially for games which have been modified for this specific purpose. The goals of the presented framework are to:

- Analyze the applicability of selected COTS as a means to teach production management principles.
- Demonstrate an example structured framework for integrating those COTS games into a limited curriculum.
- Identify good practices, drawbacks and potential challenges in implementing (and expanding) gamification in production management curricula.

The relative popularity of production-chain oriented video games is a favorable factor in adapting them in educational settings. According to the data aggregated by SteamDB, *Factorio* reached a peak of 118 674 concurrent players during the launch of its latest DLC expansion *Space Age* in October of 2024, which shows a significant increase when compared to the base-game's launch in August 2020, which held a count of 34 700 concurrent players (SteamDB, 2025). *Satisfactory,* another production management simulator, saw a concurrent its

peak concurrent player count in September of 2024, when the game left Steam's Early Access program and launched its 1.0 version (SteamDB, 2025). *Minecraft* is considered the single best-selling video game with over 350 million copies sold as of April 2025 (Mojang AB, 2025), though the game in its original, unmodified version offers limited capabilities for production management simulation; more extensive logistics features are added into *Minecraft* via player-made game modifications. Despite not having an official modding API, *Minecraft's* most popular mod-loader *Forge* (CurseForge, 2025) (which provides its own API to create game modifications) allows for implementing new and complex features into the base game of *Minecraft*[1]. The website *CurseForge* (and its accompanying launcher) lists over 10 000 different mods available for download. Out of those, nearly one thousand is under the category of "Energy, Fluid and Item Transport" which implement production-chain features. Game modifications such as *Applied Energistics 2* (175 million downloads), *Mekanism* (131 million downloads), *Logistics Pipes* (13 million downloads), *ComputerCraft* (66 million downloads), *Integrated Dynamics* (90 million downloads) all provide highly flexible and in-depth logistics features that can be used to model real-world production systems; in addition, the modifications are well-documented, open-source, and also highly popular (as indicated by their download statistics), which positively impacts their viability as teaching environments. Game modifications for *Minecraft* are also (mostly) not conflicting and designed to be used together; programmers often iterate on each other's code and design addons and compatibility features to allow for seamless integration with other mods. This approach has enabled the creation of "mod packs", which are pre-constructed instances of *Minecraft* that include many mods as a single executable, often tweaked and further modified to ensure compatibility and performance.

2. Literature Review

Abt's Serious Games (Abt, 1970) first argued that rule-based play could achieve non-trivial learning objectives and has laid out the conceptual foundation for the field. Digital game-based learning emphasizes the motivational pull of fast feedback loops provided by gameplay (Prensky, 2001). Since then, large scale syntheses have confirmed consistent gains in knowledge retention and new skill acquisition: a meta-analysis of over 50 controlled studies (Clark et al., 2016) found a statistically significant mean effect size in favor of digital games over

[1] An important note regarding *Minecraft* modding is that it relates only to the *Java Edition* of the game— on November 18, 2016 Microsoft (which has by that point acquired Mojang*,* the initial developer of *Minecraft)* released the *Bedrock Edition* of *Minecraft* which supported cross-platform play and was written in C++. Although the *Bedrock Edition* of the game provides limited support for game modifications in the form of "data packs", they provide less flexibility than Java-based modifications written for the *Java Edition* of the game— as such, the *Java Edition* is the version of *Minecraft* which is being described in this paper (unless stated otherwise).

conventional instruction (when conventionally viable). A systemic review of more than 40 studies shown links between gamified education elements and an increase in student engagement and assessment performance (Subhash & Cudney, 2018).

Production management teaching has also seen success when combined with game-based learning. The "Beer Distribution Game" (Sterman, 1989) remains a popular example of how even simple, tabletop simulations reveal intricate supply chain dynamics, such as the bullwhip effect. Customer-off-the-shelf games have also been used in teaching: Squire (Squire, 2004) has used *Sid Meier's Civilization* to frame the series as a set of "epistemic frames" that allowed learners to inhabit different roles. Despite the momentum within the field, studies focus mostly on qualitative impressions and systemic mappings of course outcomes onto in-game results remain sparse, motivating the simple structured alignment method proposed in Section 3.

The two games selected as a basis for a case study in this paper have both been used as teaching platforms: *Minecraft* includes mechanics that allow for the construction of logic gates and has been used to teach Boolean algebra, as well as digital circuit design (Prayaga et al., 2016). A 2025 systematic review of more than 100 studies found that *Minecraft* consistently enhances cognitive and motivational outcomes when aligned with clearly stated curricular goals (García-Álvarez & Acevedo-Borrega, 2025). *Minecraft*'s publisher, Microsoft, has tried to capitalize on the game's educational capabilities by releasing *Minecraft: Educational Edition* which hosts a number of lessons, including ones on logic gates (*Introduction to Logic Gates— Minecraft Education Lesson Library*, n.d.). *Factorio* has been used to demonstrate lean flow, kanban, bottleneck alleviation and other concepts that directly transfer to industrial engineering contexts (Boardman & Krejci, 2021).

Across literature, arises a need for a simple, replicable, and theory-driven method that can help educators connect production management principles to specific mechanics that form the gameplay loop of COTS games, detailed in Section 3.

3. Methodology for Framework Development

A core idea of serious games and gaming in education is that the gameplay not only provides entertainment, but also purposefully aligns with the pedagogical goals of a given curriculum (here: key production management principles). The process of mapping curriculum concepts starts with the identification of said concepts; this is highly dependent on the course and class being taught (e.g., a general introductory 101 course on logistics would include only the broad fundamentals, while an advanced course could build upon prior knowledge and focus on highly specific topics). Afterwards, relevant game mechanics need

to be extracted— relevant, here meaning capable of simulating (and preferably visualizing) the previously identified concepts. Bridging the two (game mechanics and their corresponding concepts) is done by designing a learning task (scenario) that requires the players (students) to engage with the mechanic in a controlled way, where successfully completing it necessitates an understanding of the corresponding concept. This "triangulated" approach to concept-game mapping reinforces principles of constructive alignment (Biggs, 1996), to ensure that learning outcomes, in-game tasks and assessments are integrated in a cohesive way. This section includes several concept-game mappings that teach production management principles with gameplay mechanics of *Factorio* and *Minecraft*. Though the presented framework could be used by a wider variety of games, *Factorio* and *Minecraft* have been chosen as examples due to two factors: their popularity (discussed in Section 1) and availability of tools that allow for their modification ('moddability'). *Factorio* is an example of a very popular (estimated by player count; see Section 1) automation-focused game that implements a number of features that relate to production management by default, while also offering ways to further customize the user experience, which is very useful for designing lesson scenarios. To help with modifying the game, *Factorio* provides an official, extensively documented modding API which uses Lua— a relatively beginner-friendly programming language often used in game development (Ierusalimschy et al., 2007). Though its modding community is not as large as *Minecraft's*, game modifications have been an important part of *Factorio's* development, with its lead developer quoting *IndustrialCraft 2* (a *Minecraft* mod) and other mods similar to it as a direct source of inspiration when designing *Factorio* (Kovařík, 2013). Since *Minecraft* is a sandbox and exploration-based game, rather than one with automation and production management at the core of its gameplay loop (like *Factorio*), it requires multiple game modifications running in parallel to be used effectively as a teaching tool under the proposed framework. This means a potential educator would have to go through additional steps when setting up a lesson scenario— due to this increase in complexity, the case using *Minecraft* has been discussed in more detail.

3.1 Case 1: Bottleneck Identification and Resolution in Factorio

A bottleneck (constraint) is any point in a production system where the capacity of a resource or operation is less than the demand placed upon it, thereby limiting the throughput of the entire system. Commonly referred to as "the weakest link", it consists of a single unit (e.g., a machine with a relatively high processing time, an inefficient policy, a worker experiencing a disproportionate workload) that causes work-in-process inventory to build up and an increase in production cycle times, leading to a lowered throughput. Resolving bottlenecks requires their identification— methods include value stream mapping (Liker & Meier, 2005), process cycle-time analysis, and queuing-analysis

metrics, which help in spotting and quantifying constraints. Resolving bottlenecks include capacity elevation, buffering upstream work, and preventative measures. The theoretical foundation is laid out in Goldratt's Theory of Constraints (Şimşit et al., 2014) where constraints are the system's primary improvement lever, as well as in the waste-minimizing principles of Lean Manufacturing (Nicholas, 2018).

The continuous recognition and elimination of bottlenecks is a core part of the gameplay loop in production-management oriented video games, and as such, can be used to demonstrate it in an educational setting. *Factorio* includes UI elements that can be used to see production graphs, and other statistics that can be used to identify bottlenecks in complex systems. Though the game itself provides top-down 2D visuals, with a sufficiently large production change, identification of constraints at a glance becomes difficult, which is accurate to the real world— utilizing data visualization to extract valuable information from a system in order to eliminate bottlenecks is key in Value Stream Mapping. In less elaborate systems, bottlenecks in *Factorio* may be quickly visually identified as clogged-up conveyor belts or under-supplied machines with a blinking indicator. *Factorio* offers several ways to alleviate bottlenecks after they have been spotted, and which ones are available to students should depend on the course contents. Designing a task that effectively teaches the student course material and assesses their understanding of it involves preparing: the initial game state, the desired game state, and a scenario description outlining clear goals.

Unlike during usual gameplay, where manually gathering resources to kickstart a production line is a necessary, and often lengthy step, a well-designed task should present students with a pre-constructed environment, where player interaction is limited to mechanics that are relevant to the lesson. In *Factorio* this is represented as a save file (alternatively, a game server). Removing certain gameplay elements, despite restricting the player's freedom from a gameplay point of view, is almost certainly necessary when adapting COTS games to educational settings. Features that normally make gameplay more varied, unpredictable and entertaining can detract from the educational aspect. It is important to note, that there is no "one size fits all" set of guidelines on which gameplay features should be limited in teaching: for example, during a module intended to teach capacity planning and line balancing, PvE (player versus environment, i.e. combatting naturally occurring in-game enemies) mechanics do not add any value to the lesson, and are likely to only distract and frustrate students. The same set of mechanics, however, may be useful in another module that aims to teach decision-making under uncertainty and calculated loss management— in *Factorio* enemies are denizens of the planet that the player character is turning into a factory, and they react aggressively the pollution generated by the numerous processing lines the player builds over the course of the game. Finding an optimal set-up that minimizes generated

pollution while also maximizing production throughput, as well as accounting for potential loss due to enemy interference are a mapping of several important production management and operations research principles that are possible only when the lesson scenario involves game mechanics that may initially seem counterproductive to learning. All gameplay elements should be carefully considered when designing the initial game state.

The desired game state is the state of the game world that fulfills all the task criteria presented during the lesson. Where the initial game state given to a student is a literal one (a save file, world generation seed value or a server), the desired game state can be represented as a well-structured list of requirements that constitute a successfully executed task. An example of trivial desired game state could be "a throughput of at least 25 gears per second[2] on the top-most assembly line", which provides a goal for the student when paired with the initial game state. The desired game state should be seen as a frame of reference through which the teacher can assess a student's familiarity with the lesson contents. The previously mentioned example is binary (the student has either managed to achieve the goal or not) but could be expanded into a point range using different throughput values as references (e.g., 25 gears per second is 5 points, 20 per second is 4, and so on). When deciding on what constitutes a satisfactory solution, a bottom-up approach is recommended— this means finding the optimal (or sufficient) solution should be done by playing the game from its initial state until one is reached, rather than adjusting the initial state to fit a specific value. The desired game state can also be represented more literally (just like the initial state), with a save file that fulfills all task criteria.

Getting from the initial state to the desired state within the scope of play (allowed set of gameplay interactions) is the goal of a single unit lesson. In Case 1, the player uses UI elements and in-game analytics to accomplish the goal: those systems are already present as a part of the base game, and do not have to be implemented by the teacher manually.

[2] Due to hardware differences, production-management focused games like *Factorio*, *Satisfactory* and especially *Minecraft* can run at different speeds. To keep game mechanics consistent, the aforementioned games use a tick system, where the game states progress in discrete steps called "ticks", which occur multiple times a second. For example, in *Minecraft* ticks are programmed to occur at a fixed rate of 20 per second (Minecraft Wiki, 2025), but may occur less frequently on less powerful hardware— this means that the number of seconds a process takes up can vary from computer to computer, but the amount of executed ticks remains consistent. As such, game ticks are the fairest unit by which to measure timespan. Under the assumption that lessons are taught on similar hardware, and for the sake of simplicity, the framework described here uses seconds as the base unit.

3.2 Case 2: Just-in-Time production in modded Minecraft

Just-in-time (abbreviated to JIT) is a lean scheduling philosophy that aims to produce or deliver each unit in a production chain at the exact moment it is needed, reducing in-process inventory and consequently, the cost of carrying stock (Nicholas, 2018). JIT has formalized inside Toyota manufacturing plants between the late-1940s and 1970s (Nicholas, 2018), as a way to synchronize individual operations with the actual downstream consumptions. This approach helps alleviate waste and shortens lead time. Reducing work-in-process inventory helps slash costs in real-life manufacturing and is also a critical gameplay component of many production management simulation games. Modded instances of *Minecraft* offer a very customizable environment that could be used to demonstrate and teach JIT and its related methodologies— during a normal, non-educational play session the player is likely to "discover" JIT principles by themselves by noticing that creating unnecessary buffers for products often incurs some sort of cost. For example, storage compartments in *Minecraft* require the player to first collect necessary resources and then craft the storage containers (which uses up said resources in the process). Larger buffers may require more resources, which may be better spent elsewhere by the player.

Using modded *Minecraft* as the educational game base requires more input from the teacher than a game that revolves around optimizing production chains by default. In addition to the steps described in Case 1 (designing an initial and desired game state, as well as task specification), it also necessitates a careful selection of gameplay modifications to expand on the production simulation features natively offered by *Minecraft*. This process is similar to how a more education-friendly environment has been created in *Factorio* by removing certain features (e.g., player-versus-world interactions), but additive in its nature, rather than subtractive. This way, *Minecraft* becomes almost like a game engine that can be used to design very elaborate and specific lessons. The flexibility offered by *Minecaft's* numerous modding APIs makes it an attractive teaching platform. The freedom and customizability offered by modifying *Minecraft* to better suit teaching needs, however, presents additional challenges: selecting gameplay elements that are meant to be added, rather than removed, requires in-depth knowledge of how many (often very complex) game modifications work. It also requires a greater amount of technical know-how: though bundling game modifications together into one instance is relatively simple, they may not always work in tandem "out of the box" and could require additional customization (e.g., due to versioning issues, compatibility or obtuse interactions). Using modified game instances as teaching environments also opens up the possibility of designing said modifications for the specific purposes of a curriculum from scratch— this requires programming knowledge (Java) but enables even more control over how individual gameplay elements work. Case 2 uses only three gameplay mods and a single programming utility mod bundled together on the 1.21 version of *Minecraft* to simulate

JIT principles: *Mekanism, Applied Energistics 2* and *ComputerCraft* as well as *KubeJS* (enabling small compatibility tweaks to be implemented into the game with a much simpler, less advanced framework that relies on JavaScript).

The initial game state, much like in Case 1, should be a literal save (or server) for *Minecraft*. The student is presented with a small, pre-built and pre-powered[3] production line: a sink (chest), some number of always-on processing machines that convert raw materials (e.g., iron ore) into intermediate components (e.g., iron ingots) to deposit them into buffer storage, an automation network (automating product requests) and culminates in a single processor that assembles the final product (e.g., iron pickaxes). Pre-programmed display panels show current work-in-process inventory (large number of components) and a calculated average order lead-time (high, despite the sizable inventory). The student should see and identify a push system with high inventory and unsatisfactory service times. Though adding gameplay features is what makes modded *Minecraft* so appealing as a learning environment, some gameplay elements may also be removed to keep the player away from distractions, just like with *Factorio*. For example, in Case 2 the player should not be able to leave the boundaries of their factory and explore the world to obtain additional raw-material sources or processing machines.

This scenario asks the student to convert the small factory into a JIT (pull) oriented system that builds products only when an order is placed, while also maintaining a slim buffer of components in a simulation that lasts for a set amount of time with no stock-outs. The desired game state could be presented as a simple rubric, demonstrated below, including example starting metrics.

Assuming initial values of 1000 WIP components, 15 s request to delivery time, 4 processors

Grade points	Component WIP	Order lead-time
5	≤ 128 components	≤ 5 s
4	≤ 256 components	≤ 7 s
3	≤ 384 components	≤ 10 s
2	≤ 512 components	≤ 12 s
1	Any reduction from initial	Any reduction from initial

Table 1 Example desired game state rubric. Source: own work

[3] Most processors in modded *Minecraft* and *Factorio* are usually hard coded to require a constant power supply. During usual gameplay, managing the power grid is an additional gameplay challenge, but may add undesired complexity to a teaching scenario, and its inclusion in lessons should be carefully considered. For both Case 1 and Case 2, we don't take power consumption into account.

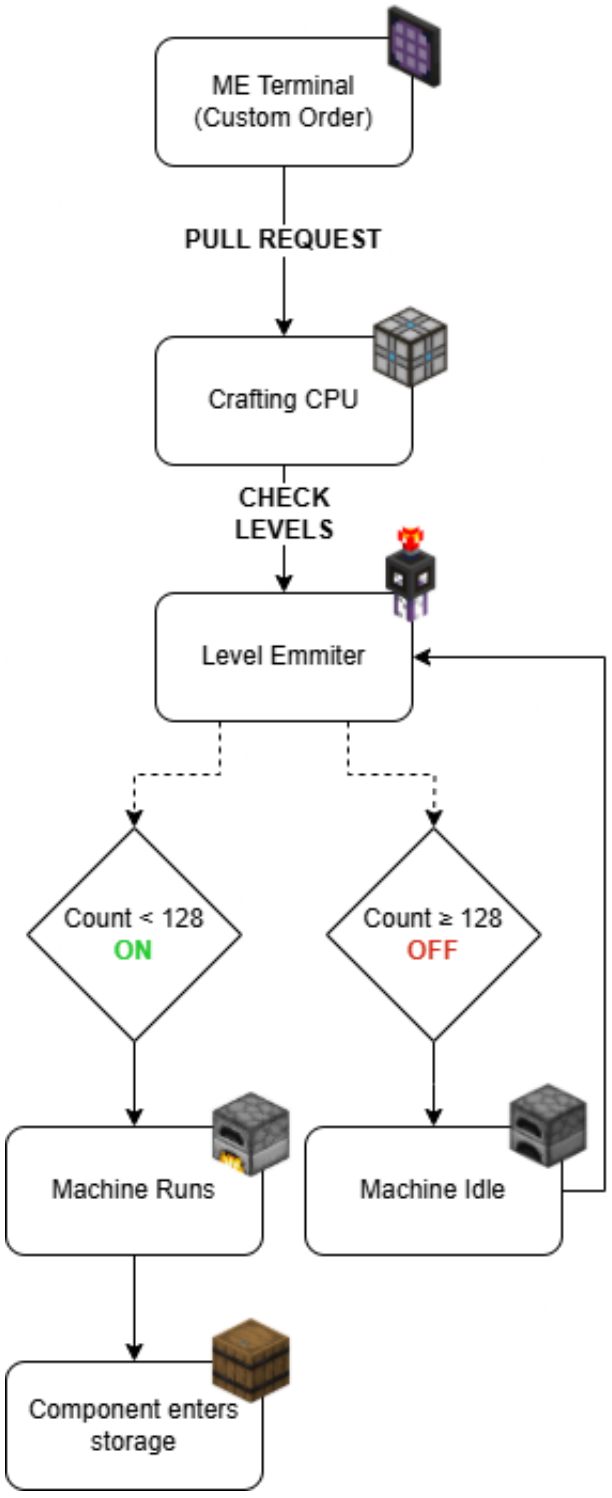

Figure 1. Viable solution chart for Case 2

The minimal viable solution requires the player to automate the assembly of the final component and installing a “kanban card” for the component storage that allows the machines to operate only when it drops below a set threshold of items. After setting up on-demand crafting, the student should notice how components only get processed as needed and everything stops afterwards. Doing this requires the student to have an understanding of pull systems and specific modded Minecraft mechanics, both of which should be supplemented by the instructor. Figure 1. Viable solution chart for Case 2 is a flowchart that demonstrates the kind of system a student should be able to achieve by the end of the lesson, working under the same initial value assumptions as the ones presented in Table 1 (example values only— could be adjusted by instructor). A similar flowchart could be a part of the scenario description, helping the students reach the desired game state, while also not providing exact answers.

4. Discussion, Future Work and Conclusions

The framework presented in this paper illustrates that COTS games can be aligned with well-established production management constructs through a structured *initial-state to scenario to desired state* task design. The two demonstrated case studies utilize popular, critically acclaimed video games as teaching platforms, and demonstrate how constraints, as well as modded features, can channel learners towards a single concept at a time, while also providing a transparent grading scheme for the teacher. From a pedagogical perspective, this approach helps address student engagement, visualization of highly abstract ideas, and encourages safe experimentation in a more constructive learning environment. Kolb’s experiential-learning cycle (Kolb, 1984) predicts that iterative problem solving inside a low-consequence “sandbox” type of environment helps facilitate the conceptual transfer from theory to practice. (Akella, 2010) COTS software can deliver many affordances that were traditionally reserved for costly and complex discrete-event simulators at a lesser organizational overhead and in a more entertaining way.

Adopting COTS games in this way is not without its caveats, however. Hardware requirements and differences may deter teachers from adopting this approach. Additionally, unless the instructors are already familiar with the games used, the teacher workload may be much greater than when using well-documented DES systems. Designing balanced save files or ensuring mod cross-compatibility also requires a degree of technical know-how. Lastly, there is the issue of scope creep: due to the open world nature of most production-centered COTS games, instructors will need to spend time carefully selecting which features to keep, and which to discard, so that the scenarios assess the students understanding of the curriculum material, rather than their prior gaming skills.

Further developing the framework and designing a set of teaching materials would require additional work, the most important of which are empirical efficacy studies conducted in controlled classroom environments. Comparisons of COTS games as teaching aid to traditional lectures or spreadsheet simulations could quantify the gain differentials and long-term knowledge retention, helping to justify (or reject) the workload required to prepare learning scenarios and materials.

The framework described in this paper is mostly theoretical, and as such elaborate technical solutions have not been discussed in detail— however, COTS games include many features that could be integrated into e-learning systems (e.g., Moodle) and help with save file distribution, telemetric data capture, automate rubric scoring and significantly reduce the required instructor overhead, while also providing rich analytics. Both cases described in the study were focused on individual production chains, assuming a distribution of one per student, but this does not have to be the case: the games used in the Methodology section have robust multiplayer features and allow hosting servers. This could be used to create a multiplayer environment where students can work in groups, rather than individually, and better illustrate how complex production chains rely on many smaller ones. Another potential avenue for further development is the co-creation of specific, bespoke game modifications between educators: with the numerous modding APIs available for games like *Minecraft* and *Factorio*, teachers could work together with mod developers to create purpose-built mechanics (e.g., visual Andon boards, SMED mini-games, etc.) that more faithfully mirror real industrial practice, while also maintaining the motivational and entertainment-related pull of mainstream game titles. Lastly, used COTS titles should be considered through the lens of accessibility— since games require a degree of mechanical skills to pilot (small as it may be), the ones used in teaching should include a set of accessibility features that ensure that a student's performance is not hindered by gameplay elements outside of their control: for example, mechanics that may unfairly disadvantage students with limited motor skills or color vision deficiency, but also those without access to high-spec hardware.

References

Abt, C. C. (1970). *Serious Games*. Viking.

Akella, D. (2010). Learning together: Kolb's experiential theory and its application. *Journal of Management & Organization - J MANAG ORGAN*, *16*, 100–112. https://doi.org/10.5172/jmo.16.1.100

Biggs, J. B. (1996). Enhancing Teaching Through Constructive Alignment. *Higher Education*, *32*(3), 347–364. https://doi.org/10.1007/BF00138871

Boardman, B. S., & Krejci, C. C. (2021). Simulation of Production and Inventory Control Using the Computer Game Factorio. *ASEE Gulf-Southwest Section Annual Conference*.

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital Games, Design, and Learning: A Systematic Review and Meta-Analysis. *Review of Educational Research*, *86*(1), 79–125. https://doi.org/10.3102/0034654315582065

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification." *Proceedings of the 15th International Academic MindTrek Conference*, 9–15.

García-Álvarez, J., & Acevedo-Borrega, J. (2025). Minecraft as a Pedagogical Tool: A Systematic Literature Review (2014–2024). *Games and Culture*, 15554120251-341034. https://doi.org/10.1177/15554120251341034

Ierusalimschy, R., Figueiredo, L., & Celes, W. (2007). *The evolution of Lua*. https://doi.org/10.1145/1238844.1238846

Introduction to Logic Gates - Minecraft Education Lesson Library. (n.d.). https://education.minecraft.net/en-us/resources/introduction-logic-gates

Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.

Kovařík, M. (2013, February 1). *"Factorio" Forum thread linking Factorio's crowdfunding page*. IC^2 Forum. https://forum.industrial-craft.net/thread/8845-factorio/

Liker, J. K., & Meier, D. (2005). *The Toyota Way Fieldbook*. McGraw-Hill.

Nicholas, J. (2018). *Lean Production for Competitive Advantage*. CRC Press.

Prayaga, L., Davis, J., Whiteside, A., & Riffle, A. (2016). An Exploration in the Use of Minecraft to Teach Digital Logic to Secondary School Students. *International Journal of Computer Science, Information Technology and Management 2*(2).

Prensky, M. (2001). *Digital Game-Based Learning*. McGraw-Hill.

Şimşit, Z. T., Günay, N. S., & Vayvay, Ö. (2014). Theory of Constraints: A Literature Review. *Procedia - Social and Behavioral Sciences*, *150*, 930–936. https://doi.org/10.1016/j.sbspro.2014.09.104

Squire, K. (2004). Replaying History: Learning World History Through Simulation Games. *International Conference of the Learning Sciences (ICLS)*. https://doi.dx.org/10.22318/icls2004.505

Sterman, J. D. (1989). Modeling Managerial Behavior: Misperceptions of Feedback in a Dynamic Decision-Making Experiment. *Management Science*, *35*(3), 321–339. https://doi.org/10.1287/mnsc.35.3.321

Subhash, S., & Cudney, E. A. (2018). Gamified Learning in Higher Education: A Systematic Review of the Literature. *Computers in Human Behavior*, *87*, 192–206. https://doi.org/10.1016/j.chb.2018.05.028

Tick. (2025, June 7). Minecraft Wiki. https://minecraft.fandom.com/wiki/Tick

CurseForge. (2025). *Minecraft Forge Documentation.* Retrieved from the Forge API documentation: https://docs.minecraftforge.net/en/latest/

Mojang, AB. (2025). *Minecraft Annual 2026.* Farshore.

Steam, DB. (2025, 06). *Steam Database*. Retrieved from URL: https://steamdb.info/

Cyryl Leszczyński is a researcher and teacher at the Department of Information Technology, Institute of Informatics and Quantitative Economics of the Poznań University of Economics and Business. Research interests include virtual and augmented reality, artificial intelligence, and educational technology, with a focus on the design and evaluation of interactive learning systems and applied digital learning tools.

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

From Archaeological Museum Showcase to Gamedev—The Missing Links of Creative Collaboration. A Case Study of the Game Numiares—A Dark Tale

Anna Molter[1], Artur Karwatka[2], Joanna Adamik-Proksa[3], & Joanna Ligoda[3]
[1]University of Information Technology and Management in Rzeszow, The Regional Museum in Rzeszów, Poland
[2]iNFORMERS AG, Warsaw Management University, Poland; corresponding author *ak@informers.pl*
[3]Archaeological Department, The Regional Museum in Rzeszów, Poland

Received 2025-06-24; accepted 2025-12-18; published Online First 2025-12-30.

Abstract

This study examines collaboration between museums and video game developers through value co-creation processes, identifying factors that support and limit cross-sector partnerships. Using a mixed-method approach combining literature review with case study analysis of the game "Numiares—A Dark Tale," the research reveals significant tensions between museums' authenticity priorities and developers' entertainment focus. The study finds that museums possess vast untapped potential, with archaeological collections offering cultural artifacts that could enhance game credibility and historical accuracy. Key barriers include institutional isolationism, digital immaturity, and intellectual property concerns. The research develops an open innovation model for creative partnerships, demonstrating how museums can commercialize knowledge while maintaining educational integrity. With gaming reaching 41% of the global population, this collaboration represents a critical pathway for cultural institutions to engage digital audiences and strengthen institutional sustainability. The findings provide practical recommendations for building museum-developer partnerships and contribute to understanding digital transformation in cultural heritage management.

Keywords: digitization, museum, archaeological collections, video game development, value co-creation, video games

1. Introduction

Until the 20th century, museums performed two basic functions: conservation and interpretation (Hatton 2012). The social role of museums has become multilayered, and the way museums interpret cultural heritage and engage their audiences has also changed. Museums in the "post-digital era," alongside static exhibitions, increasingly use digital solutions to create interactive and immersive experiences (Pastore, 2020; Mihura-López et al., 2023). As part of the digital turn initiated by the Internet era, video games have emerged from the margins and been recognized as a form of cultural practice, a sophisticated medium that has permanently entered the fabric of everyday life, also affecting cultural heritage resources and education (Connor, 2024).

Video games, like works of contemporary cinematography, are complex works. Unlike other cultural content carriers, besides the audiovisual layer, they offer users a certain degree of interactivity with the work, using a range of intermedial means of expression, which intensifies their culture-creating function (Zawada 2018). Following the criterion of utility, the authors adopted a broad definition of classically understood games focused on entertainment: "A video game or computer game is an electronic game that involves interaction with a user interface or input device (such as a joystick, controller, keyboard, or motion sensing device) to generate visual feedback from a display device, most commonly shown in a video format on a television set, computer monitor, flat-panel display or touchscreen on handheld devices, or a virtual reality headset." (Wikipedia, 2025; cf. Jensen et al., 2016).

Video games, like museums' cultural offerings, reflect the current condition of society and culture, needs and expectations, shape cultural frameworks, and push technological boundaries (Connor ,2024). Although games gained the status of cultural artifacts in the 1990s, entering the collection of the Game Museum in Berlin (1997, Connor, 2024), their pejorative perception still persists in public discourse, including within museum walls. The interaction between museums and video games is certainly intensifying. Two main evolution paths can be identified for games in the museum context—as collectible objects worthy of preservation (MoMA's first purchase of a game collection in 2012) and as part of exhibitions, installed as interactive elements supporting collection interpretation and enriching visitor experiences (Bakun, 2017). An emerging path is deeper integration of collaboration, transitioning from museums that exhibit and collect games to museums that actively co-create games as a medium for building engaging experiences, education, and knowledge dissemination. Game co-creation most often takes the form of designing games for museums, with limited museum engagement of their knowledge and digital resources in supporting commercial game projects.

It should be emphasized that cultural heritage entities, including museums, like the game industry, according to the classification presented in Regulation 2024/1689 for the Creative Europe program, are classified as belonging to the culture and creative sector (CCI). This proximity results from the nature of work outcomes (goods and services), based on talent, knowledge, and creativity of individuals. Additionally fueled by a clear preference for participation in

non-institutional culture in Poland (NCK, 2024) and changing patterns of audience perception, the development of new forms of participation in digital culture. Deep digital transformation of society additionally strengthens the convergence of CCI activity areas, competing in the leisure time market, the experience market. Pressure related to digitization in recent decades has significantly contributed to bringing both sectors closer through knowledge diffusion and integration of technology and art. From video games—like museum exhibitions—sophisticated artistic content and technologically advanced forms of perception and interaction with the audience are expected (Baeza-Gonzales 2021; Belyaeva et al., 2022; cited in Klimas et al., 2025). The need for cooperation and integration of museums with the game industry is clear, supported at many levels of cultural policy formation: global—UNESCO (2022), ICOM (2024), European—European Commission (2022, 2024; OECD-ICOM 2019) and national (CRPK).

The public value perspective helps explain challenges related to cooperation at the intersection of industries and sectors (Ćwiklicki 2017). Public value in a broad sense "is what society values" at a given time (Blaug et al., 2006, cited in Ćwiklicki, 2023). As Ćwiklicki emphasizes, "public goods are limited to products and services, while public value is not only the result of an organization's activity, but also the impact, effect that enjoys society's recognition (Alford and O'Flynn, 2008, cited in Ćwiklicki, 2023)". For cultural heritage to be utilized for society's benefit, it requires interpretation and creativity from employees (Hausner 2013) and content delivery forms adequate to expectations. A condition for achieving the desired social resonance is identifying different needs and expectations of a diverse group of stakeholders. Determining factors forming values is important for understanding the sources of their creation and the possibilities of their realization by museums (Ćwiklicki, 2023).

The article focuses on understanding cooperation between video game creators and museums through identifying the process of co-creating value based on innovation, whose result is a video game (value carrier). The aim of the considerations is to identify factors supporting and limiting cooperation, areas of tension and contradictions in the area of values and goals. Special emphasis was placed on value co-creation, a term that means a joint, iterative process of conceptualization, design, and development (Klimas, Czakon, 2022a; 2022b). Co-creation assumes deeper cooperation in which partners combine resources, achieving a synergy effect. The value co-creation relationship takes the form of creative partnership (CP). Bringing a game from concept to market always takes the form of a project (Klimas et al., 2025; Klimas, Czakon, 2022a; Klimas, 2019a).

According to Ilczuk et al. (2011), the purpose of CP is "producing innovative content and transferring creative capabilities from culture to other areas of economy and social life." The subject of the research insight is therefore this kind of cultural activity by museums, which expresses itself through the public value provided by cultural resources—capital and intellectual property—using the output of cultural activities as input for the creation of video games. The prerequisite for collaboration is openness and the availability of resources, held by the partners.

The game is a carrier of created value. As Klimas and Czakon note, "video game design leads to innovation resulting from creative processes, such as insight or inspiration, or from a form of creativity that combines different concepts in a novel way through their adaptation, addition, combination" (2022a). The conducted reflection fits into the emerging cognitive trend in management sciences devoted to different types of innovation ecosystems (Klimas, Czakon, 2022b). This approach also justifies the challenges accentuated in the pages of professional journals in terms of integrating immersive technologies for the benefit of cultural heritage, such as participatory innovations in cultural heritage and efforts to increase museum openness and promote cooperation with the outside world (Wang, 2025; Chaitas, 2024). Creative partnerships play an important role in the video game innovation ecosystem (VGIE)—knowledge-based and highly creative, due to the potential for generating knowledge spillovers that result from access to museum collections and employee knowledge (more in Klimas, 2019b; Klimas, Czakon, 2022a).

The basis for value co-creation by CP is innovation in an open model (following Klimas, Czakon, 2022a; more in Molter, 2023). According to the theory, open innovation expresses the strategy of organizations that deliberately use flows of knowledge, competencies and resources, cooperating in an open innovation environment (Chesbrought, 2003; Li, Ghirardi, 2019; Klimas, 2019b; 2025). Key importance lies in CP cooperation aimed at co-creating innovation, delivered to the market in the form of a game with diverse value and socio-cultural impact (Wronka-Pośpiech 2015; Klimas, Czakon, 2022a; Klimas et al., 2025). Innovations generated from cultural content take the form of a process in which roles, forms and stages engaging partners' resources and activities can be distinguished. Following the above criteria and the approach of H. Bakhshi and D. Throsby (2010), special attention was focused on the supporting and expert role of museum employees (knowledge brokers), new possibilities for using museum knowledge (innovations) and ways of commercializing it. Museum engagement may involve co-creating symbolic content, aesthetics or narratives based on sources of knowledge and cultural artifacts (Li, Ghirardi, 2019). In this sense, innovations are characterized by communicative value (transmission of knowledge about cultural heritage), aesthetic value (Alcaide-Marzal, Tortajada-Esparza, 2007), and content value (Handke, 2004). This leads to the key issue of cooperation and co-creation between museums and video game creators.

CCI cooperation assumes partners' activities toward a common goal (Sopińska, Dziurski, 2018). A relationship based on co-creating innovation does not have to be symmetrical in terms of achieving partners' overriding goal, that is—the value proposition offered and delivered to players—emotionally and cognitively engaging game experience (game creators) and generating long-term impact through delivering knowledge about cultural heritage, deepening its understanding through contextualization of content and giving meaning (museums). The contribution of museologists may include reconstruction of socio-cultural contexts through co-creating intermedial transmission of symbolic content (plot, narrative) and interactive elements, such as digital representa-

tions of cultural artifacts or intangible manifestations of cultural practices (rituals and ceremonies). Museums ensure the authenticity and credibility of games' cultural message. Transferring knowledge about cultural heritage to games can also be a form of protection and dissemination. Cooperation with the video game industry is not only an opportunity for institutional development, but may be necessary for survival in a leisure market increasingly dominated by digital audiences (Dalle Nogare, Murzyn-Kupisz, 2021; Klimas et al., 2025; Klimas, Czakon, 2022a).

A review of existing literature and the authors' experience suggests that cooperation is a common phenomenon in the museum sector (NIM statistics; Nogare, Murzyn-Kupisz 2021). Museums show noticeable polarization, with intensive cooperation within the museum and educational sector (Sawczuk 2019) and limited cooperation with the technology and services sector (Li, Ghirardi, 2019). According to the authors' knowledge, the area of cooperation between museums and video game creators remains partially studied in the literature. It is also difficult to establish a complete picture of this cooperation in the context of the Polish Game Innovation Ecosystem, as quantitative data on cooperation with CCI presented by NIM in the Museum Statistics project does not directly refer to game creators (NIM 2024; Dalle Nogare, Murzyn-Kupisz 2021).

Additionally, the lack of case studies marks a clear empirical gap (Klimas et al., 2025). Examples of cooperation between museums and game creators, also in the Polish context, document museum workers' engagement mainly in the context of serious games, educational applications and digital experiences using game elements in exhibition or virtual space to build engaging visitor experiences (Charr, 2025). This does not exhaust the possible forms of cooperation. Value co-creation in the open innovation model can have different levels of openness and degrees of cooperation intensity (de Pourbaix, Warzybok, 2018). The authors' intention is to point out the missing links in value co-creation, where the game is the carrier. According to the suggestion of Klimas et al. (2025), an integrative approach was applied in the research process, combining literature review with qualitative research using the case study method. Empirical data allowed for the identification of factors supporting and disrupting cooperation from the perspective of people involved in designing the game "Numiares—a Dark Tale". In accordance with theoretical findings, these factors were sought in three areas of exploration: motives; practices, resources and experiences; and sources of knowledge (Klimas et al., 2025; Sopińska, Mierzejewska, 2016).

In the analyzed case, the authors' many years of experience in cross-industry cooperation and participant observation allowed for the identification of knowledge commercialization paths (databases, licenses, external financial resources). The developed model of value co-creation based on CP can serve as a kind of map supporting the video game creation process. The article concludes with reflection on ways to mitigate identified inhibitors of cooperation.

2. Literature Review

In the literature, the mainstream consideration of video games in the context of museums is mainly conducted in three contexts. The first refers to the game as a cultural artifact placed in the museum exhibition space—a collectible object (physical medium—carrier, along with design documentation), the second—games as an element of installation accompanying the exhibition, enriching/expanding the experience during a museum visit (Connor, 2024). The last is related to the use of games as an element of museum education. A negligible part of publications in scientific discourse, especially those developed in the field of digital humanities, game studies or strategic management, addresses the issue of the co-creation relationship of games at the intersection of the museum sector/industry and games (more in Klimas, 2019b; Klimas et al., 2025).

Given that game design is an interdisciplinary area of exploration, to narrow the cognitive perspective and clarity of argument, an ecosystem approach within strategic management was adopted as the reference theory. The *differentia specifica* approach of museums additionally required support with the concept of creating public value (Ćwiklicki 2023). The basis for determining the current state of research was the desk research method (Babbie 2004).

This article focuses on recognizing the value co-creation relationship in the video game innovation ecosystem (VGIE), as the basic unit of analysis of the culture and creative sector (CCI). Focusing the lens on this particular type of innovation ecosystem results from several premises: (1) insufficiency of theory and empirical research, in this sense implementing research postulates emphasized by Polish researchers P. Klimas (2019b; 2025 et al., 2025) and W. Czakon (2019; 2022a); (2) task proximity as a result of deep digital transformation of society and economy (change in preferred forms of perception based on sound and image at the expense of textuality of message); (3) potential for co-creating creative content in cultural circulation (innovations); (4) result of work based on knowledge, creativity and talent (cultural goods and services); (5) importance of innovation for organizational development and success; (6) necessity of crossing sectoral boundaries; (7) specialization in managing projects based on creators' intellectual capital.

As a starting point, cognitive assumptions were adopted according to categories identified by Klimas and Czakon (2022a), serving to analyze the process of co-creating innovation, such as role and stages of engagement in the value co-creation process. According to the authors' findings, partners can play four characteristic roles: direct value creation, supporting value creation, encouraging entrepreneurship, and leadership. Five common stages can be distinguished in the co-creation process: discovering, developing, implementing, delivering, and disseminating. Due to the complexity and interdisciplinarity of game projects, partner engagement has different scope and intensity depending on the process stage. In the studied context, focus was placed on concept creation and idea generation as well as gathering intellectual, cognitive, and physical resource support (Klimas, Czakon, 2022a). Answers were sought to research questions: what skills and knowledge does a museum possess that can be used in a game

project? How can archaeological resources strengthen the attractiveness and cultural message of a game? What public value does a game deliver, both for creators and players?

Answering the first question allowed for identification of motives underlying the establishment of creative partnerships (de Pourbaix, Warzybok, 2018). According to Sopińska and Dziurski (2018), these motives can be divided into internal, such as: better use of own potential, acquiring new knowledge and technology, possibility of acquiring new audiences and improving competitiveness, and external—financial motives. Museums can be characterized as knowledge-rich organizations (Krzyworzeka, 2010), that is, those whose core consists of "professional services" in the field of intangible goods (Alvesson, 2004). A key role is played by specialists, characterized by diverse, often broad and difficult to describe spectrum of competencies, especially tacit knowledge directly related to the collection. Museum workers are perceived as a source of expert knowledge. Museums also play the role of "aesthetic gatekeepers." For game creators, museums can be places of exhibition, dissemination or production, as well as sources of creative content and suppliers of inspiration for such content (Dalle Nogare, Murzyn-Kupisz, 2021).

The current state of knowledge and participant observation by the authors allows us to state that game co-creation relationships are rather rare, involving a one-on-one relationship between a central entity and its partner (museum—commissioner, creator—exploring the relationship), emerging bottom-up, often ad hoc informally based on social relationships (Klimas, Czakon, 2022a). The lack of strong connections between museums and game creators noticed by researchers should be interpreted from dichotomous perspectives. The first, socio-cultural perspective indicates the disjoint specificity of cultural activity of museums vs game creators, which is based on goals and methods of their implementation (transmission of symbolic content) (Strycharz, 2013; Kasprzak, 2013). The second—economic-political, focuses on creating public value, i.e., the implementation of cultural goods and services in the strict administrative-legal regime, regulated through financial intervention of decision-makers vs the flexibility of the free market. Industry discourse confirms the belief about mutual incommensurability of culture vs business, from fear of pauperization of museum functions (attraction for visitors), threat of appropriation of cultural value and its improper use (Eid, 2016).

The degree of openness of museums to cooperation with game creators is also largely a consequence of the pejorative perception of games, and moreover, of relational short-sightedness. Game creators are not perceived as potential partners and/or competitors, even though a significant part of cultural participation takes place in non-institutional spaces, and games can be considered such a form alongside film or books, in which they compete in the leisure time market. For game creators, cooperation with museums is marked by a series of difficulties in accessing resources and expert knowledge. The main reasons can be considered institutional isolationism, digital immaturity, and asymmetric positioning of power in the curator-layperson relationship. This hermetization

of the museum environment toward game creators may result from the tradition-grounded institutional isolation and the imperative of realizing intangible goals (Eid, 2016).

Research conducted in the field of game studies clearly indicates that digital representations of cultural artifacts are not used in games, which often rely on stereotypes and topoi of mass culture (Sołtysiak, 2015, 2017; Yap et al., 2024; Muñoz et al., 2025). Game creators prioritize gameplay attractiveness at the expense of message credibility. Considering that one of the main functions of contemporary museums is educational activity, this constitutes the main source of tensions (Haczewska, 2002; Skowron, 2002; Radecki, 2015; Pater, 2016; Cabała, 2019). Museum archaeological collections become inspiration for a wide educational offer (cf. Czopek 2016; Ligoda 2023). The potential of museum institutions in popularizing archaeology still remains not fully recognized, overshadowed by exhibitions, lectures, workshops or festivals. Popularization activities constitute only the surface of advanced research and scientific work, sources of knowledge. Digital representations of archaeological artifacts become a valuable, though insufficiently utilized resource for the dynamically developing video game sector. In this sense, museums constitute valuable repositories of material and spiritual heritage of prehistoric and medieval communities (in the discussed case, Slavs). Archaeological collections offer game creators authenticity and historical credibility. The image of past epochs reconstructed based on archaeological sources relies on factual and symbolic knowledge, which generates potential for creative content. It provides inspiration for designing the game universe (props, locations, cultural worldview), character appearance and gameplay mechanics. It allows enriching the narrative and plot of games while enhancing their educational value.

Deconstruction of the status quo also required theoretical identification of contradictions arising from the separateness of material vs. immaterial goals, operating models and professional culture. Public museums function in a very complex space created by: "ethics—politics—law—economics" (Zeidler, 2011). Each area determines conflicting goals, whose realization requires balancing priorities and competing values that guide the museum (Davies et al., 2013). The specific system of goals and values, orientation toward realizing intangible goals creates a broad context of challenges for museums, such as: securing public interest (mission); institutional development; image protection; adopting consumer orientation; managing relationships with internal and external stakeholders (competency potential); digital transformation of the institution. In this light, the need for developing entrepreneurial orientation of museums is evident, in three dimensions: proactivity, innovation, acceptance of risk accompanying experimentation, exploitation and commercialization of knowledge (Wójcik-Karpacz, 2016).

In summary, over two decades of digitization of museum collections have certainly contributed to the evolution of museums toward "hybrid spaces," in which digital cultural data coexist alongside physical artifacts, thereby increasing the accessibility of cultural content (Türkmen, Savasta, 2024). The traditional museum model, which is based on isolationism and focus on the

collection without considering multidirectional relationships engaging various stakeholders, remains a dysfunctional anachronism (Eid, 2016).

3. Methodology

The adopted cognitive strategy consisted of several stages. The first stage was exploratory in nature. In terms of achieving cognitive goals, the method of critical analysis of literature and existing sources was used. The literature review was subordinated to achieving the adopted goal. Based on it, the current state of knowledge and research was established. Identified cognitive gaps allowed for determining specific exploratory-explanatory goals maintained in a mixed deductive-inductive approach. Research conclusions took the form of abduction (Glinka, Czakon, 2021).

To obtain greater detail and accuracy of conclusions, the case of creating a video game prototype titled "Numiares—A Dark Tale" was analyzed, which is an example of cooperation between actors from outside the gaming circle. To provide some context, the characteristics of the game are outlined. “Numiares—A Dark Tale” is a narrative type of 3D game driven by horror, with a story conceptualized as a visual novel, told by means of environmental storytelling. The story of the game is deeply rooted in a brutal and unforgiving fantasy world inspired by a grim and dark early medieval middle Europe fairytales and folklore with its gritty and bloody reality. Players take on the role of a holy warrior and witch doctor, going against a blood-chilling menagerie of creatures of various origins, tasked with negotiating treaties with the supernatural. The player acts as a judge, jury and an executioner of Nature laws, permeating the fabric of reality. Every stage of a game is a decision between stealth and combat, solvable by both. Players learn the secrets of the World by seeing it through the eyes of nature. The choice of game was purposeful, as the authors were directly involved in its implementation. The game allowed insight into a different type of games than serious games which are designed with clear educational, interpretive or social goals that go beyond entertainment, and games co-created to interpret museum collections and increase visitor engagement (Djaouti et al., 2011).

In accordance with the national programme for the support of video games creators (PWGW) organised by CRPK, under which the prototype was realised, the game was to combine elements and inspirations related to Polish culture with cultural codes potentially understandable and attractive to a global audience. The game draws inspiration from many different European cultures, including Slavic. It is an action adventure game with puzzle-solving elements, with high-quality, stylized 3D graphics. The team structure by specialization criterion with role division used in gamedev presents: 1. Design—story & narrative design; cultural research; gameplay design; combat design; 2. Graphics and animation—art direction; concept artist; 2D graphics artist; environmental

3D modelling artist; character 3D modelling artist; mo-cap and 3D animator; 3. Programming—gameplay/generalist programmer; 4. Production—producer; 5. Sound—sound design; 6. Quality assurance—game tester. The implementation time was about five months for designing the concept and iterative implementation, which resulted in creating a playable prototype with strong focus on the visual aspects.

For an in-depth analysis of the game co-creation relationship, conceptual frameworks and conclusions from participant observation by the authors were used. Focus was placed on elements that were considered important from a theoretical point of view (Strumińska-Kutra, 2012). The game allowed for a better understanding of mutual relationships of value co-creation based on video games (Dondajewska 2016; Yin 2015; Ćwiklicki, Pilch, 2018). The cooperation was established at the game's conceptual stage and was based on the findings of a museologist/researcher of magical cultures, in terms of reconstructing the worldview and structure of magical thinking appropriate to early forms of culture and the symbolism of individual linguistic, behavioral and material artifacts used in the game (totem, ritual, clan).

To understand the scope and form of engagement in game co-creation, game layers and its elements were first distinguished. They also allowed further identification of areas of tension and contradictions in mutual relationships. For analysis purposes, K. Gonciarz's division was adopted (201, cited in Zmuda, 2018), which distinguishes game planes: (1) content—all substantive and audiovisual content of the work, i.e., all text elements, images, sound recordings, three-dimensional models. In the case of video games, content is all artistic design, as well as the game's plot (if present) and all narrative structures related to it; (2) gameplay—the set of solutions and elements that constitute the mutual interaction between player and game. Gameplay consists of infinitely many manifestations of possible interactions between them, enabled by programmed game mechanics; (3) technology—the factor ensuring the game's operation as a computer program. Consequently, through this combination, the viewer is able to read the other two factors as the interface and the creators' designed audiovisual representation of the virtual world.

It should be emphasised that “all three planes are inextricably linked, and the quality of this bond determines a game's artistic and commercial success” (Zmuda, 2018). For game developers, the overarching layer remains the mechanics of gameplay, which is the essence of the phenomenon of the medium (Zmuda, 2018). For museum professionals, on the other hand, the key layer consists of story and narrative, artistic and aesthetic content. The two sides of the relationship are thus divided by the interest guiding cognition (Habermas, 1971)—authenticity vs utilitarianism. The case study was analysed in this dimension. Answers were also sought to the questions: what potential for games does an archaeological collection have? What types of artefacts can be placed in the game as assets? What digital barriers can be identified from digitisation

to the use of digital assets, further the commercialisation of knowledge about the collection. The answers made it possible to identify the competence potential of the partners.

4. Results

Cooperation between game creators and museologists poses a series of challenges in the context of understanding mutual needs and expectations. Museologists are specialists characterized by a diverse, often broad and difficult to describe spectrum of competencies and abilities (Ingram, 2016). The area of professional activity of museologists often remains within the boundaries of substantive specialization, which deepens through accumulating knowledge and experience and numerous relationships with the professional environment. Knowledge about museum collections often has the character of tacit, personalized and highly contextual knowledge, which makes it difficult to imitate on one hand, and difficult to commercialize on the other. Importantly, cooperation requires maintaining a balance between audience expectations (attractiveness of message) and the social role played by museums (guardian, researcher, educator, mediator).

The game “Numiares—A Dark Tale”, whose action is set in the early medieval period, like others, raises the most tensions in the area of priorities of gameplay attractiveness vs. credibility of message. The Middle Ages is perceived not only as (another) historical period—for many reasons closer to contemporary audiences than ancient times (e.g., Stone or Bronze Age), but also as a kind of cultural myth that defines an area of certain convention for game creators (cf. Sołtysiak 2017, 219). Games are carriers of cultural messages, often also sources of knowledge. A challenge for 21st-century archaeology—as Sołtysiak (2017) emphasizes "is the lack of interest in its achievements and a peculiar petrification of the popular state of knowledge, in which many concepts long since refuted still function," as well as cultural topoi that infantilize the image of the archaeologist.

The studied case revealed the enormous potential of museums, which are depositories of often huge series of artifacts. The chronologically and typologically diverse collection of archaeological materials of the Regional Museum in Rzeszów (MOR) as of April 30, 2025, amounted to 2,979 inventory items, which when converted to artifacts gives us over half a million (!) cultural artifacts. The vast majority of them are so-called mass material, but nevertheless a significant group consists of exhibits that can serve as models for replicas and historical reconstructions. The source potential in the context of the analyzed game and the usefulness or attractiveness of artifacts for game creators from the early medieval period is defined by militaria. MOR has an interesting collection of this group of artifacts, which include iron, double-edged swords and axes. Properly digitized, these objects could serve as models for the armament of the hero, virtual warrior—protagonist or other characters appearing in the game. Besides militaria, archaeological reconstructions of locations have great potential, presenting the layout of residential settlements, defensive strongholds, or lifestyle and work, such as craft activities (pottery, blacksmithing, weaving,

etc.). Tangible traces of this information are sources of material culture discovered during archaeological research, in the form of a series of ceramics, tools and everyday objects, as well as ornaments in the form of glass bracelets and beads or silver temple rings and rings.

The goal of archaeologists is to convey reliable, evidence-based knowledge about cultural heritage. Archaeology is a science that uses the achievements of other disciplines and is constantly developing. At the same time, the state of knowledge about human life in prehistory is currently so extensive that existing factual material allows for precise reconstruction of almost any time period, providing inspiring information for game creators. This can concern economic, social, as well as spiritual or symbolic issues, allowing for the reconstruction of interactive elements and representations in the game world. The ease and preference for choosing stereotypical forms of message additionally supports the discrepancy in the area of partner cooperation. The dissonance is deepened by the fact that a huge resource of authentic archaeological artifacts lies in museum warehouses, and its potential is not used for the benefit of the gaming community.

Ultimately, expert support from museologists allows building the added value of the game through the credibility of elements of the presented world. It also allows for the realization of museums' social role, revision of stereotypical simplifications and erroneous, repeatedly reproduced beliefs that in mass culture circulation become carriers of information, creating historical realities in the eyes of recipients. Games constitute a cultural medium (Crogan, 2018). A game as a carrier of value for players can and should shape the proper imagination of past worlds, alongside fictionalization measures affecting the immersiveness of the game itself, which can be achieved at another level of emotional immersion (Jacko F.M, Jacko M., 2020). The tension identified in priorities is therefore apparent. Co-creation based on the cooperative relationship between museums and game creators enables the creation of high-quality products and delivery of a more comprehensive range of cultural experiences. The studied case confirms the significance of a series of barriers indicated in the literature. Among the more important ones are issues of intellectual property protection and the lack of frameworks regulating digital artifact licensing, allowing for the necessity of maintaining balance between public access and commercial interests of the game industry (Klimas et al., 2025; Wang, 2025). Emphasis should also be placed on the dissemination of museum knowledge through game projects, which are aimed at different audiences. In the discussed case, the problem of "reasonable popularization" of knowledge was revealed. The necessity of maintaining a "delicate balance between information and entertainment" (Bahn, 1997, cited in Czopek, 2000) also allows for better understanding of digital creators' motives and identification of common interests. Basing a game on historical sources is a major challenge for game creators. It requires both easy access to comprehensive expert support and significant time commitment from partners for consultations, which can additionally limit the free creative process (example of the mobile game "Zaginiona partytura Moniuszki" [The Lost Score Of Moniuszko]). Additionally, it is difficult to measure the extent to which content and elements based on evidence affect the game's attractiveness (i.e. number of downloads). M. Bauchmann and O. Gawlik (2025), referring to the results

of a study conducted by PIN in 2022, note that the Internet and computer games can be considered the most important or one of the most important sources of historical knowledge, especially among high school youth. The inclination of game content is the result of the project, type of game and adopted goals, including educational ones. It was assumed that through cooperation it is possible to maintain the authenticity and accuracy of cultural messages, enrich its interpretation with plot threads, without violating the integrity of cur rent knowledge.

Team collaboration was marked by certain difficulties: barriers related to the use of game-specific jargon; focusing more attention on gameplay, i.e., the game itself and implemented mechanics in the game than the factual layer; seeking inspiration in popular science sources while resigning from relying on expert knowledge (Slavic Mythology Museum) and the achievements of archaeologists (MOR). Conclusions from participant observation are confirmed by the literature (Zmuda, 2018; du Vall, Majorek, 2014; Jacko J.F, Jacko M., 2020)—game creators, focusing on player needs, mostly focus on: gameplay (interaction with the game) at the expense of its artistic values; consistency of gameplay elements—to maintain player engagement, achieve deep immersion of the player in the virtual world (immersion) and maintain adopted conventions, at the expense of novelty and exploitation of expert knowledge in the creative process; use of intermedial means, such as sound, image, text, iconography to build mood—immersion, hedonistic experience at the expense of cognitive engagement, cognitive aspects of participation in the game; game rules that build player engagement, evoke strong emotions, affect the sense of effectiveness, success, ultimately the realization of individual needs; reproducing cultural motifs and tropes ingrained in popular culture at the expense of interpreting reliable facts into game language.

These elements define areas of tension and contradictions in the game co-creation process. Museums are characterized by focus on the object vs. audience (cognitive and participatory dimension of experience). Game creators focus on experience, its fetishization (hedonistic dimension) (Sangamuang et al., 2025), sensory immersion (sense of world reality) vs. emotional (stimulation, absorption, flow) (Jacko F.M, Jacko M., 2020). The parties to the relationship differ in interpretive strategy (facts vs. fiction) and communication with the audience (hierarchical vs. direct). Often the inspiration for game creators are historical events, archaeological discoveries, reinterpreted and enriched with fantastic elements, blurring the boundaries between fact and fiction. For specialists in a given field, such "caricatural representations of reality" are highly harmful to the recipient, for whom the game may be the main source of knowledge on a given topic. Sołtysiak (2017) identifies stereotypes, simplifications, misrepresentations, medievalisms and neomedievalisms reproduced in games, which reflect mass imaginations from which the state of historical knowledge of contemporary society is built. It should be agreed with M. Wawrzak-Chodaczek (2012) that games can serve to transmit knowledge from many fields. Archaeological knowledge is particularly affected by stereotypes and misrepresentations. The studied case is also not free from mass borrowings, which was pointed out by female archaeologists, also emphasizing the need to revise the game to maintain the authenticity of the message.

The identified difficulties are confirmed by literature and conclusions from the GameHearts project, of which the authors were participants (03.2025). In a systematic literature review (177 publications), Wang et al. (2025) emphasizes the inherent difficulties in combining different professional languages, methodologies and expectations. Effective co-creation depends on successful communication and cooperation between different groups: museum professionals (curators, researchers, educators, conservators), game creators (designers, programmers, artists), scientists (from humanities, social sciences and computer science), and often also community members engaged in game development.

Cooperation between the sectors was exploratory in nature. The game developers sought inspiration in museum ethnographic and archaeological sources. The scope and nature of activities related to the development of the game, which were supported financially by the CRPK, severely limited the possibilities for co-creation that would go beyond the stage of consultation and identification of common areas of cooperation. Ultimately, inspiring material was identified in archaeology. The cooperation established was an early stage in the process of co-creating the game. It mainly concerned the identification of source material in the form of artefacts collected in the museum and curatorial interpretation, as well as other research materials. This stage was not without tensions and contradictions related to differences in knowledge and perspectives (so-called information diversity), a lack of mutual understanding of expectations and needs, which resulted from both hermetic language, different work logic and professional orientation (profit vs. social mission). This stage can be described as the 'Innoversity Paradox' (Justesen, 2001). Despite the information diversity related to the role and purpose—the overriding value—diversity supported the creative energy of the team from the very beginning, leading to inspiring motifs and ideas to be used in the game.

The success of the collaboration lay in attracting game developers who recognised the potential of museum collections. The case of the game Numiares—A Dark Tale demonstrates the potential for co-creation between two sectors that have largely operated separately until now. It also reveals the structure of dynamic relationships and forms of partner engagement, opening up new opportunities for the museum to popularise knowledge. This partnership is an excellent example of how collaboration can use pop culture to promote historical and archaeological literacy among the public, help build the image of museums as brokers of knowledge, and in turn contribute to the development of institutions.

The analysis of the case study allowed us to identify key areas of cooperation and the scope of partner involvement. The ideation and conceptualisation stage of the game project and its joint development, based on the exploration of mutual relations (support, expert advice, feedback), were considered particularly important. The authors' findings emphasise the importance of the various roles that museums can play in their cooperation with game developers: expert advice, a repository of knowledge and resources, and a channel for promotion and communication with the audience. Cooperation with the gaming industry

also allows museums to increase their influence on other fields, expanding the role of the museum as a guardian of cultural heritage and an active participant in social transformation (Chaitas et al., 2024). Based on a non-systematic literature review, the roles and scope of partner involvement in the game co-creation process were identified (Chaitas et al., 2024; Kosti et al., 2025; Klimas et al., 2025): (1) co-creation of the game from concept to dissemination. Co-authorship may include the game's narrative, character design, development of visual and audio resources, and even the basic game mechanics that shape player interaction (e.g., Mini Melbourne, Carmen Funes); (2) design methodologies focused on building an immersive cognitive experience; (3) joint research and development in the field of inclusive game design, democratisation of access to innovative tools, and deeper links between technology and heritage (EU i-Game project, as cited in Kosti et al., 2025).

These diverse forms of engagement are rarely mutually exclusive. The prerequisite is cooperation based on flexibility and mutual trust between partners (Klimas et al., 2025). Transdisciplinary competences, broad knowledge and the ability to navigate the complexity of game projects, both interpersonal and digital, are of key importance.

5. Discussion

The article contributes cognitively and empirically to understanding the process of value co-creation by CCI, whose carrier is a video game. The basis for research conclusions is the perspective of people engaged in the process of value co-creation based on video games, that is, game creators and museologists. The case study served for detailed analysis, which took into account the characteristics of entities (who?), roles played in the context of mutual benefits (what?), diverse engagement of partners (how?) at different stages of the process (when?) (Klimas, Czakon, 2022b). The research insight allowed for identification of areas of tension and contradictions and factors mitigating them, indicating mutual benefits. It should be emphasized that the studied case confirmed literature findings identifying factors supporting and limiting CCI cooperation. It also allowed for determining common interests and factors allowing for reaching compromise in the area of priorities. Also future directions for development of joint initiatives based on CP, mainly related to knowledge diffusion and cooperation based on the open innovation model, through which partners combine complementary resources and achieve their own goals. The case study helped fill the empirical gap emphasized by researchers. Research conclusions served to develop an open innovation model based on CP (Fig 1). The proposed value co-creation model captures in a theoretical framework, identifying factors supporting cooperation between museums and game creators. The assumptions at its base are supported by three related concepts: open innovation strategy, entrepreneurial orientation, and

cultural innovations (compare Eid, 2016). Each of these concepts was a separate subject of research conducted by A. Molter (2020; 2021; 2023), and was also observed in the studied case.

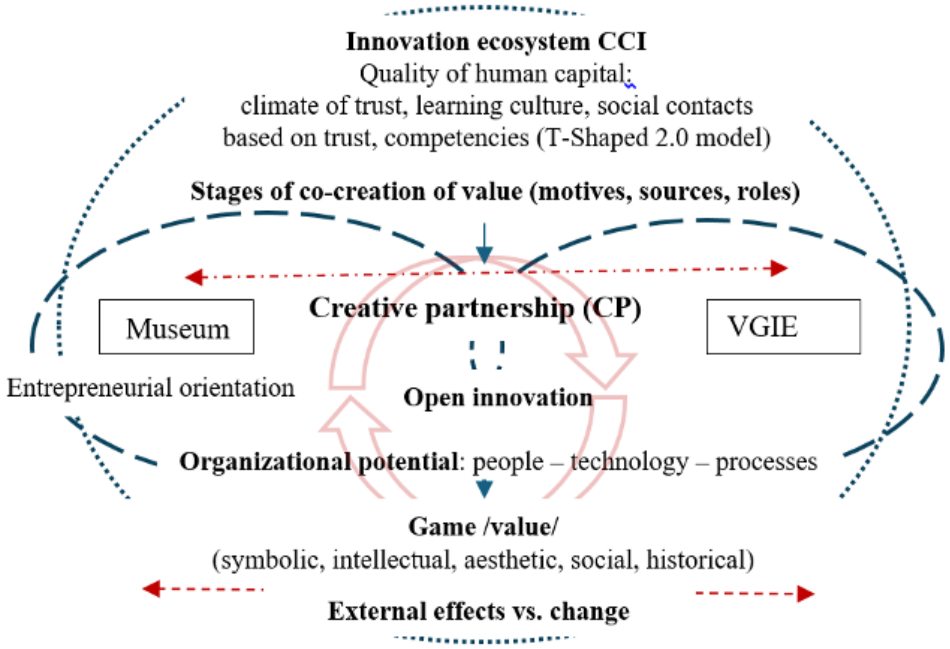

Figure 1. The Creative Partnerships open innovation model. Source: own contribution (Kasprzak 2013; Klimas et al., 2025, 2019; Juchnowicz 2018)

The developed model has utilitarian purpose and can serve as a kind of map for CP whose cooperation focuses on co-creating video games. Additionally, it allows building financial resilience of museums through identifying paths of knowledge commercialization (databases, licenses, external financial resources). Given that museums are largely characterized by low innovation and organizational flexibility, and more broadly low entrepreneurial orientation—despite high proactivity of employees (Molter, 2020; 2021; 2023)—which is a consequence of limitations tied by tight administrative-legal corset. This engagement of museologists is important in the pre-production phase: developing concepts and working on the prototype, expert support in the development phase and embedding cultural content. In this sense, game creators can derive a series of benefits from the direct and supportive contribution of museologists in designing concepts and developing games (consulting, creating aesthetic and artistic impressions, supporting narrative elements with reliable sources of knowledge, providing 3D models of objects and locations in appropriate format,

with the possibility of further processing (high-poly models). Mutual benefits resulting from commercialization of knowledge and use and processing of digital representations of cultural artifacts by game creators are clear. Despite examples of good practices related to digitization, there are still a number of barriers related to the openness of cultural data. This results from two critical limitations, hedging resulting from the perceived threat to intellectual property by museologists, the problematic "reciprocity between commercialization and institutional ethics" (Lorenc, 2024). Also concerns about the possibility of improper use of objects and lack of implementation of unified digitization standards for access to cultural data, especially on open license terms. Museums' digital lag, manifested by a gap in digital competencies, lack of adequate ICT infrastructure and abandonment of technology due to high operating costs, constitutes an additional inhibitor of cooperation and establishing creative partnerships between museums and game creators. This translates into a series of barriers in access to cultural resources, defines a gap between creators' needs for access to digital artifacts (3D models, location maps) and the possibility of their further processing for various applications, including commercial ones (Rattanarungrot et al., 2025).

In the authors' opinion, cooperation between museums and game creators is a natural path for developing a museum's digital strategy. Despite significant involvement of European funds in building infrastructure, open platforms and methodologies dedicated to designing games devoted to cultural heritage (i-Game, Digital Heritage, Digital Games Research Association—DiGRA; ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play—CHI PLAY), journals devoted to research at the intersection of technology-culture-games[1], cooperation between museums and game creators can hardly be considered mature. In the authors' opinion, it is marked by a series of barriers and contradictions that were identified in the research process.

6. Conclusions

The need for inter-organizational cooperation usually appears when organizations are unable to independently provide services, deliver certain goods or meet the needs of recipients (Czernek-Marszałek et al., 2023). Understanding the needs and expectations of game creators is important in the context of society's deep digital transformation. According to the Newzoo report (2024), at the end of 2024 the number of players was estimated at 3.422 billion, which is about 41.73% of the world's population. According to estimates, in 2027 this value will reach 45% of players, and by 2030, 50.5% of players. As D. Gałuszka

[1] Journal on Computing and Cultural Heritage (JOCCH); Museum International issued by ICOM and Taylor & Francis (2025); Journal of Museum Management and Curatorship (2024); Digital Applications in Archaeology and Cultural Heritage (2024).

(2020) notes, games constitute one of the leading pieces of evidence of progressing ludification (Raessens, 2012), the growth in the importance of play in different domains of life. Games are becoming an alternative form of participation in culture and spending free time, which can be realized in many different ways (Gałuszka, 2020; Polacyn, 2018). The success of museums is not only the quality of presented content, but also obtaining the desired social resonance through appropriately developed interpretive and exhibition strategies supporting and enriching the experiences of digital audiences. The development of digital society requires museums to redefine institutional development strategies, increase openness and take advantage of opportunities from the environment that will allow them to tune into the needs of cultural content recipients.

Cultural data has particular value for generating spillover effects (Kasprzak 2013). For the survival, growth and development of the Polish game industry, which struggles with innovation pressure, access to cultural data can be a source of inspiration and competitive advantage (Klimas, 2019b; Klimas et al., 2025). Cooperation in an open innovation environment can be an alternative form of knowledge commercialization for museums, building image and promoting the institution. However, it requires developing recommendations and good practices that allow balancing commercialization with institutional ethics without compromising the integrity of collections (Lorenc 2024; Chaitas et al., 2024). The authors indicated possible ways to mitigate tensions and contradictions. It should be emphasized that the proactivity of museologists (Molter 2020) is a good predictor of CP development, but inflexible work environments in museums remain a serious inhibitor.

The case study method is subject to criticism of low acceptability of results due to difficulty in defining true statistical generalizations and the charge of researcher subjectivity. To limit researcher subjectivity, data and researcher triangulation was used (Glinka, Czakon, 2021). The study provides insight into a small fragment of the complex game co-creation process, identifying only a few possible paths of cooperation based on CP. It allowed for determining future research directions related to developing a competency profile of a digital curator; recommendations and support mechanisms in shaping the entrepreneurial orientation of museums.

References

Alvesson, M. (2004). *Knowledge work and knowledge-intensive firms*. Oxford: Oxford University Press.

Bacon, EC., William MD. (2021). Deconstructing the ivory tower: identifying challenges of university industry ecosystem partnerships. *RMS.* https://doi.org/10-.1007/s11846-020-00436-7

Bakun, M. (2017). Niechcący zrobiłam Dark Souls – gry wideo w instytucjach kultury z perspektywy twórcy i groznawcy. *Replay,* 1(4). https://doi.org/10.18778/2391-8551.04.01

Bakhshi, H., Throsby, D. (2010). *Culture of innovation: an economic analysis of innovation in arts and cultural organisations.* London: NESTA.

Buijsman, M. et al. (2024), *Global Games Market Report 2024.* Newzoo.

Baumann, M., Gawlik O. (2025). W jaki sposób gry z elementami historycznymi mogą kształtować świadomość historyczną graczy? In: M. Blacha, D. Szczepański (ed.). *Ogrywanie historii. Rola i miejsce gier w historiografii.* Łódź: ArchaeGraph.

Cabała, A. (2019). Edukacja muzealna w praktyce szkolnej – wyzwania dydaktyczne. *Kultura i Wychowanie* (15), pp. 57-68.

Chaitas, C., Chipangura, N., Meparishvili, N. (2024). Expanding museums' horizons through partnerships and collaboration. *Museum International,* 76(3-4), pp. vi-xi. https://doi.org/10.1080/13500775.2024.2473192

Charr, M., (2025). *Game On: The Playful Revolution Transforming Museums,* Retrieved from: https://www.museumnext.com/article/game-on-the-playful-revolution-transforming-museums/ [Accessed: 06.05.2025].

Connor, A. 2025. In Real Life: Gaming Community Engagement in Museums. *Curator: The Museum Journal,* 68 (1), pp. 9-22. https://doi.org/10.1111/cura.12622.

Crogan, P. (2018). Indie Dreams: Video Games, Creative Economy, and the Hyperindustrial Epoch. *Games and Culture, Special Issue: Ludic Economies,* 13(7), pp. 671–689. https://doi.org/10.1177/15554120187567

Czernek-Marszałek, K., Klimas, P., Wójcik, D. (2023). The dark side of social relationships – the context of the video game industry. *International Journal of Management and Economics* 59(4), pp. 1-19. DOI: 10.2478/ijme-2023-0025

Czopek, S. (2000). *Wstęp do muzealnictwa,* Rzeszów: Wydawnictwo WSP.

Czopek, S. (2016). Muzea i zbiory archeologiczne – uwagi o misji i funkcjonowaniu. In: S. Czopek, J. Górski (ed.). *Między nauką a popularyzacją. Muzea i parki archeologiczne* (pp. 11-33). Kraków: Towarzystwo Autorów i Wydawców Prac Naukowych UNIVERSITAS.

Ćwiklicki, M. (2023). Tworzenie wartości publicznej jako cel zarządzania publicznego. In: A. Frączkiewicz-Wronka, M. Ćwiklicki (ed.). *Zarządzanie publiczne. Perspektywa teorii i praktyki* (pp. 64-85). Katowice: Wyd. UE w Katowicach.

Ćwiklicki, M., Pilch, K. (2018). Rygor Metodologiczny Wielokrotnego Studium Przypadku w badaniach marketingu miejsc. *Studia Ekonomiczne. ZN Uniwersytetu Ekonomicznego w Katowicach* (376). DOI: 10.2139/ssrn.3214126.

Ćwiklicki, M. (2017). Zdolność operacyjna w koncepcji wartości publicznej. *Management Forum* 5(2), pp. 8-13.

Davies, S.M., Paton, R., O'Sullivan, T.J. (2013). The museum values framework: a framework for understanding organisational culture in museums. *Museum Management and Curatorship,* 28(4), pp. 345–361. https://doi.org/10.1080/09647775.2013.831247

Delpont, É., Fascialé, R., Ivo, A., Guillard, A. (2024). When a Museum and a Game Developer Team Up: Interview with the Institut du Monde Arabe and Ubisoft regarding the exhibit Baghdad: A Journey Back to Madinat al -Salam with Assassin's Creed ® Mirage. *Museum International* (76/3-4), pp. 120–131. https://doi.org/10.1080/13500775.2024.2473209

de Pourbaix, P., Warzybok, A. (2018). Otwarte innowacje – istota, uwarunkowania, aktywność przedsiębiorstw. *Studia Oeconomica Posnaniensia 6(6).*

du Vall, M., Majorek M. (2014), W stronę nowej kultury gier komputerowych – od komputeryzacji do smartfonizacji. *Replay. The Polish Journal of Game Studies* (1), pp. 96-106. Retrieved from: https://repozytorium.uni.lodz.pl/bitstream/handle/11089/8882/10%20du%20Vall_Majorek.pdf [Accessed: 23.05.2025].

Djaouti, D., Alvarez, J., Jessel, J-P. (2011). Classifying Serious Games: the G/P/S model. In: *Handbook of Research on Improving Learning and Motivation through Educational Games: Multidisciplinary Approaches.* DOI: 10.4018/978-1-60960-495-0.ch006

Dondajewska, A. (2016). Studia przypadków w badaniach nauk o zarządzaniu w świetle rygoru metodologicznego. *Zeszyty Naukowe Politechniki Poznańskiej. Organizacja i Zarządzanie* (70), pp.39-50. https://doi.org/10.21008/j.0239-9415.2016.070.03

Eid, H. (2016). *The Museum Innovation Model: A museum perspective on innovation. The annual conference of Museums and the Web. April 6 -9.2016. Los Angeles, CA, USA.* Retrieved from: https://www.researchgate.net/publication/329884894_The_Museum_Innovation_Model_A_museum_perspective_on_innovation

Gałuszka, D. (2020). Społeczno-kulturowy potencjał gier cyfrowych. Ujęcie syntetyczne. *Studia z Teorii Wychowania (4)33.*

Glinka, B., Czakon, W. (2021). *Podstawy badań jakościowych.* Warszawa: PWE.

Habermas, J. (1971). *Knowledge and Human Interests.* London: Heineman.

Haczewska, B. (2002). Rola muzeów w edukacji. In: W. Kawiorski (ed.). *Edukacja w muzeum. Materiały z seminarium „Polacy i Słowacy – przygraniczni przyjaciele. Wspólne karpackie dziedzictwo kulturowe",* pp. 29-34. Nowy Sącz: Muzeum Okręgowe w Nowym Sączu.

Hatton, A. (2012). The conceptual roots of modern museum management dilemmas. *Museum Management and Curatorship,* 27(2).

Hausner, J. (2013). Kultura i polityka rozwoju. In: J. Hausner, A. Karwińska, J. Purchla (ed.) *Kultura i rozwój (pp. 93-119).* Kraków: NCK.

Gonciarz, K. (2011). *Wybuchające Beczki – zrozumieć gry wideo.* Kraków: KG Tofu Media.

Ilczuk, D., Krzysztofek, K., Bender, E., Nowak, M., Wójcik, A. (2011). *Partnerstwa kreatywne w Polsce. Raport z badań.* Warszawa: Wyd. NCK.

Ingram, T. (2016). Zarządzanie talentami w kulturze i sztuce. *Studia Ekonomiczne* (256)*, pp. 46-55.*

Jacko, J.F, Jacko, M. (2020). Czy zaangażowanie w grę jest racjonalne? Imersja emocjonalna w zabawie, zarządzaniu i sporcie. *Homo Ludens 1(13).* https://doi.org-/10.14746/HL.2020.13.1

Jensen, L.J., Barreto D., Duncan Valentine K. (2016). Toward Broader Definitions of "Video Games": Shifts in Narrative, Player Goals, Subject Matter, and Digital Play Environments. In: K. Duncan Valentine, L. J. Jensen (ed.) *Examining the Evolution of Gaming and Its Impact on Social, Cultural, and Political Perspectives*. DOI: 10.4018/978-1-5225-0261-6.ch001

Juchnowicz, M., Sienkiewicz, Ł. (2016). *Kultura organizacyjna kreatorem kapitału ludzkiego.* Prace Naukowe UE we Wrocławiu (422).

Kasprzak, R. (2013). *Przemysły kreatywne w Polsce. Uwarunkowania i perspektywy.* Warszawa: Kamon Consulting.

Klimas, P. (2019a). A cultural fit in cooperation – recognition of the cultural facet of game developers. *Nauki o Zarządzaniu,* 24(1), pp.3-10.

Klimas, P. (2019b). *Relacje współtworzenia innowacji w ekosystemach Kontekst ekosystemu gamingowego.* Warszawa: Wydawnictwo C.H. Beck.

Klimas P., Czakon W. (2022a). Gaming innovation ecosystem: actors, roles and co-innovation processes. *Review of Managerial Science* (16), pp. 2213-2259. https://doi.org/10.1007/s11846-022-00518-8

Klimas, P., Czakon W. (2022b). Species in the wild: a typology of innovation ecosystems. *Review of Managerial Science* (16), pp 249–282. https://doi.org/10.1007-/s11846-020-00439-4

Klimas P., Radomska J., Kościewicz D., Strzelec G., Wrona S. (2025). What are the Drivers, Barriers, Mechanisms, and Anchors of cross-industry cooperation? The Perspective of the Video Game Industry Ecosystem. *Games and Culture*. DOI: 10.1177/15554120251317276

Kosti M.V., Diplaris S., Georgakopoulou N., Runnel P., Marini C., Rovatsos N., Barakli A., de Lera E., Vrochidis S., Kompatsiaris I. (2025). I-Game: Redefining Cultural Heritage Through Inclusive Game Design and Advanced Technologies. *Electronics* (14). https://doi.org/10.3390/electronics14061141

Krzyworzeka, P. (2010). Wiedzochłonne organizacje. *E-mentor* (3), pp. 59-62.

Lamdahl Justesen, S. (2001). *Innoversity: A study of the dynamics inherent in the relationship between innovation and diversity.*

Li, C., Ghirardi, S. (2019). The role of collaboration in innovation at cultural and creative organisations. The case of the museum. *Museum Management and Curatorship* 34(3).

Ligoda, J. (2023). Europejskie Dni Archeologii w Regionalnej Składnicy Zabytków Archeologicznych w Zgłobniu. *Materiały i Sprawozdania Rzeszowskiego Ośrodka Archeologicznego* (44)*, pp. 185-187.* DOI: 10.15584/misroa.2023.44.12

Lorenc, N., Schadt, M. (2024). *Tensions in Transition – Identifying Barriers to Cross-Sectoral Collaboration Towards Circular Economy in Plastics.* Retrieved from: https://www.diva-portal.org/smash/get/diva2:1863768/FULLTEXT02

Mihura-López, R., Seoane, A., Nolasco, Otero, T.P. (2023). The introduction of video games in the museum content. Human Review. *International Humanities Review (19).* pp. 1-14. DOI.10.37467/revhuman.v19.4927

Molter, A. (2021). Mikrofundamenty orientacji przedsiębiorczej muzeów publicznych. Między proaktywnością a reaktywnością. *In: Przedsiębiorczość w dobie kryzysu COVID-19 lekcja na przyszłość, A. Barwińska-Małajowicz, M. Grzebyk (ed.). Łódź: Wyd. SIZ*.

Molter, A. (2020). *Zarządzanie profesjonalistami – orientacja na job crafting w praktyce muzealnej. Raport z badań.* Retrieved from: https://www.researchgate.net/publication/348077102_Zarzadzanie_profesjonalistami_-_orientacja_na_job_crafting_w_praktyce_muzealnej

Molter, A. (2023), Znaczenie sieci relacji zawodowych dla otwartych innowacji w muzeach publicznych. L. Mierzwińska, B. Ujda-Dyńka (ed.). *Zeszyty Naukowe PANS w Krośnie.*

Muñoz, A., Climent-Ferrer, J.J., Martí-Testón, A., Solanes, J.E., Gracia, L. (2025). Enhancing Cultural Heritage Engagement with Novel Interactive Extended-Reality Multisensory System. *Electronics* (14), 2039. https://doi.org/10.3390/electronics14102039

Dalle Nogare, C., Murzyn-Kupisz, M. (2021). Do museums foster innovation through engagement with the cultural and creative industries? *Journal of Cultural Economics* 45(2).

Pater, R. (2016). *Edukacja muzealna – muzea dla dzieci i młodzieży.* Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.

Piecuch T., Molter A. (2014). Metody jakościowe w badaniu przedsiębiorczości. *Problemy Zarządzania. Przedsiębiorczość i small business – badania jakościowe (3),* p. 248-268.

Polacyn, S. (2018). Ewolucja czasu wolnego na przestrzeni dziejów. Gry komputerowe jako współczesna forma wolnoczasowa. *Biuletyn Historii Wychowania,* (38), pp.187-200. https://doi.org/10.14746/bhw.2018.38.12

Radecki, G. (2015). Obszar wydzielony czy nowe otwarcie? Edukacja muzealna jako muzeologia. In: *ABC edukacji w muzeum. Muzea sztuki współczesnej, rezydencjonalne, wielooddziałowe i interdyscyplinarne* (pp. 6-23). Warszawa: Wyd. NIMoZ.

Raessens, J. (2006). Playful Identities, or the Ludification of Culture. Games and Culture, 1(1), pp. 52-57. https://doi.org/10.1177/1555412005281779.

Rattanarungrot, S., White, M., Chairungsee, S. (2025). Enhancing Cultural Heritage Accessibility Through Three-Dimensional Artifact Visualization on Web-Based Open Frameworks. *Informatics* (12/37). https://doi.org/10.3390/informatics12020037

Pastore S. (2020). Beyond the Modern Museum. A theoretical framework for a museal landscape analysis. *ICOFOM Study Series,* pp. 48-2. https://doi.org/10.4000/iss.2720

Rutkowski, R., Marszałkowski, J., Biedermann S. (2023). *The game industry of Poland – report 2023.* Warszawa: Wyd. PARP. Retrieved from: https://www.parp.gov.pl/publications/publication/the-game-industry-of-poland-report-2023

Sangamuang, S., Wongwan, N., Intawong, K., Khanchai, S., Puritat, K. (2025). Gamification in Virtual Reality Museums: Effects on Hedonic and Eudaimonic Experiences in Cultural Heritage Learning. *Informatics,* 12(1). https://doi.org/10.3390/informatics12010027

Sawczuk, M. (2019). Kształtowanie relacji wspomagających innowacyjność muzeum*. Zeszyty Naukowe UE w Katowicach* (381).

Skowron, R. (2002). Muzea i edukacja. Między przeszłością a przyszłością. In: W. Kawiorski (red.) *Edukacja w muzeum. Materiały z seminarium „Polacy i Słowacy – przygraniczni przyjaciele. Wspólne karpackie dziedzictwo kulturowe"* (pp.17-21). Nowy Sącz: Muzeum Okręgowe w Nowym Sączu.

Sołtysiak, M. (2017). Mediewalizmy, neomediewalizm i rola archeologii w badaniu gier. *Homo Ludens (1), pp. 217-238*.

Sołtysiak, M. (2015). Rogate hełmy sprzedają się lepiej? O nieprzystawalności współczesnego stanu wiedzy historycznej do potrzeb projektantów gier. *Homo Ludens* 1(7), pp. 191-208.

Sopińska, A., Dziurski, P. (2020). Przesłanki tworzenia innowacji w modelu otwartym a skala zjawiska otwartych innowacji – wyniki badań. In: L. Bohdanowicz, P. Dziurski (ed.). *Innowacje i marketing we współczesnych organizacjach: wybrane zagadnienia.* Warszawa: Oficyna Wydawnicza SGH.

Sopińska, A., Mierzejewska, W. (2016). Zasobowe uwarunkowania otwartych innowacji. *Prace Naukowe UE we Wrocławiu* (444).

Strumińska-Kutra, M. (2012). Rola badań społecznych w refleksyjnych procesach metarządzenia. *Zarządzanie Publiczne* 4(22). *Zarys perspektywy teoretycznej i metodologicznej.* pp.17-29. Retrieved from: https://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-fe5c2718-6ffa-44f5-a4d3-c4bc0bef0940

Strycharz, J. (2013). *Organizacje sektora kultury a rozwój.* In: J. Hausner, A. Karwińska, J. Purchla (ed.), *Kultura a rozwój.* Warszawa: Wyd. NCK, pp.*175-192*.

Türkmen, D., Savasta, D. (2024). Cultural Heritage Manifestation in Computer Role-Playing Games for Enhancing Museum Experience: A Model Proposal. *Journal of Museum Education*. DOI: 10.1080/10598650.2024.2391718.

Wang, H., Du, J., Li, Y., Zhang, L., Li, X. (2025). Grand Challenges in Immersive Technologies for Cultural Heritage. *International Journal of Human-Computer Interaction.* https://doi.org/10.1080/10447318.2025.2475996

Wawrzak-Chodaczek, M. (2012). Rola gier komputerowych w czasie wolnym młodzieży w wieku adolescencji. *Problemy edukacji w społeczeństwie wiedzy*, 1(39), pp. 237-252. Retrieved from: https://journals.us.edu.pl/index.php/CHOWANNA/article/view/20672/16170

Wójcik-Karpacz, A. (2016). Orientacja przedsiębiorcza a przedsiębiorstwa. Ustalenia literaturowe. *Zarządzanie i Finanse,*14(2), pp. 483-496.

Yap, J. Q. H., Kamble, Z., Kuah, A. T. H., Tolkach, D. (2024). The impact of digitalisation and digitisation in museums on memory-making. *Current Issues in Tourism,* 27(16), pp. 2538-2560. https://doi.org/10.1080/13683500.2024.2317912.

Zeidler K. (2011). Muzeum i komercja. Prawo, etyka, misja, rynek. In: D. Folga-Januszewska, B. Gutowski (ed.). *Ekonomia muzeum* (pp. 125–136*).* Warszawa: Wydawnictwo Universitas.

Zmuda, B. (2018). Znaczenie intermedialnych środków wyrazu w grach wideo a recepcja ich treści i formy. *Ars Educandi* (15), pp. 111-125. https://doi.org.10.26881-/ae.2018.15.09

Netography

McKinsey Global Institute (2024). The next big arenas of competition. Report. Retrieved from: https://www.mckinsey.com/mgi/our-research/the-next-big-arenas-of-competition

Video Game: https://en.wikipedia.org/wiki/Video_game

Numiares – A Dark Tale game website: https://www.numiares.com

2024 Global Games Market Report (2024). https://best-of-gaming.be/wp-content/uploads/2024/09/2024_Newzoo_Global_Games_Market_Report.pdf. NEWZOO report source page https://newzoo.com/resources/trend-reports/newzoos-global-games-market-report-2024-free-version

NCK (2024). Uczestnictwo w kulturze i polityka kulturalna jakiej potrzebujemy. https://nck.pl/projekty-kulturalne/kongres-kultury-/-materialy-kongresowe (Accessed: 30.05.2025)

Anna Molter, PhD in Management and Quality Sciences, Assistant Professor at the University of Information Technology and Management in Rzeszów. Areas of scientific and research interest: co-creation of innovation, creative partnerships, cross-sector cooperation, shaping a culture and organisational climate that supports development and learning. Researcher of digital culture and digital society. For years, she has been involved in building bridges of cooperation between cultural institutions and the gaming and technology industry, the diffusion of knowledge between sectors, and co-creation of value. Author of educational materials on "Digital society and open data" (Smart Cities for Young Generations: Safe, Green, Digital). Expert in international cross-sector projects, academic lecturer.

Artur Karwatka, interdisciplinary researcher with a master's degree in computer science. Lecturer teaching classes for computer engineering and management students. Graduate of postgraduate studies in IT project management, Executive MBA, marketing strategy, and digital marketing. Co-creator of video games, R&D project manager in the areas of IoT, AI, CGI, among others.

Joanna Adamik-Proksa is a doctor of humanities in the field of archaeology, employed at the District Museum in Rzeszów. Her research interests focus on the Bronze Age and early Iron Age, particularly communities developing in the 2nd millennium BC, settlement and funerary archaeology, and the Scythians.

Joanna Ligoda, archeologist, museologist; research interests revolve around the archaeology of the Bronze Age and the early Iron Age, with particular emphasis on settlement issues, as well as issues related to museology and the protection and promotion of archaeological cultural heritage.

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Gamification Marketing—Essence, Types of Activities, Examples of Application

Aleksandra A. Olejarz
University of Warmia and Mazury in Olsztyn, Poland
aleksandra.olejarz@uwm.edu.pl

Received 2025-05-30; accepted 2025-12-18; published Online First 2025-12-31.

Abstract

The increasing popularity of digital games has also led to a concomitant rise in the popularity of gamification-based marketing strategies. The integration of gamification into marketing strategies has emerged as a potent method to engage both existing and prospective customers, thereby exerting a transformative influence on brand identity. Despite the expanding role of gamification, a lacuna persists in the extant academic literature concerning gamification in marketing, particularly with regard to the forms of gamification employed and their efficacy in influencing customer purchase intentions. This article expounds on the merits of employing marketing games and the categories of games that are utilized to enhance customer interaction with a brand. The text provides concrete examples to illustrate the various types of games, along with detailed descriptions of the game mechanics and their respective purposes. Polish brands have demonstrated a marked inclination to employ advergames, which are predominantly characterized as games of chance and lotteries. The primary objectives of advergames are typically to augment the number of users of dedicated mobile applications, enhance brand recognition and loyalty, and escalate the frequency and value of purchases.

Keywords: advergames, gamification, marketing games

1. Introduction

Play, which exerts a profound influence on such developmental processes as growth, education, socialization, and culture, is a fundamental element of human life. It encompasses cognitive, social, and emotional aspects, thereby becoming the cornerstone of human existence. The promotion of play at all

stages of human development has been demonstrated to result in more fulfilling and significant experiences (Ross, 2013; Detering, Zagal, 2018; Thorsted, 2016). Games represent an integral component of play. While play is associated with pleasure and creativity, it is a form of spontaneous and voluntary activity driven by internal motivation (Cummins, Zamani, 2018; Vartiainen et al., 2024), "a game is perceived as something played by human beings. Its mathematical analysis is human-centered, explores the structures of particular games, economic or social environments, and tries to model supposedly 'rational' human behavior in search of appropriate 'winning strategies'" (Faigle, 2022).

Games have played an important role in culture and the development of societies for centuries. These tools functioned as both entertainment and an educational apparatus. In ancient Egypt, Senet was played (although the rules of this game are still unknown), and 5,000 years ago in Mesopotamia, The Royal Game of Ur was played (Pfeiffer, Sedlecky, 2020), which is considered the precursor to backgammon. Chess, a widely recognized game that traces its origins to the 5th century CE, has historically served not only as a form of entertainment but also as a strategic war game that has been utilized to train players in the art of planning military operations (Pizło, Mazurkiewicz-Pizło, 2023). Games underwent an evolution and adaptation to the social norms of the countries where they gained popularity. An example of this phenomenon is the case of chess in Muslim countries (Sáez, 2022). With the advent of new technologies, games became increasingly widespread, more accessible (e.g., through the advent of printing) and advanced. In the contemporary epoch of electronic media, the digital games industry is undergoing a period of substantial growth and expansion, with its applications disseminating throughout nearly all domains and facets of human existence.

Scientific literature contains a plethora of publications that address the utilization of games in educational settings, the promotion of pro-ecological and pro-health attitudes, and their application in business contexts. The integration of games within the marketing paradigm merits particular consideration. However, extant literature predominantly focuses on the experiences of users of marketing games and the assessment of the effectiveness of games on customer engagement (Xiaolin et al., 2025). A paucity of publications exists that address the types of games utilized by brands for marketing purposes. The present article aims to address this lacuna by presenting a definition of gamification, the benefits of using games to promote a brand, and the types of marketing games used, along with examples from the Polish market.

2. Gamification

Gamification is defined as the process of engaging individuals in problem-solving activities across various domains through the medium of games. This practice has a long historical precedent, dating back hundreds of years to the realm of strategic war games, which involve meticulously planned military operations. The term "gamification" is widely attributed to Nick Pelling, aBritish game designer and computer programmer. It is believed that “the first use of gamification in its current sense apparently occurred in 2003, when Nick Pelling, a British game developer, established a short-lived consultancy to create game-like interfaces for electronic devices” (Werbach, Hunter, 2020).In the text, the following citation style should be used (Wahyudi, 2020) or (Deephouse, Carter, 2005; Bromley, 2000). In the case of more than three authors, write the surname of the first of them and add the abbreviation “et al.” (Akintoye et al., 2022).

In the age of electronic media and the growth of the digital gaming industry, gamification has taken on a new meaning. Gamification is defined as the integration of game-design elements into non-game contexts, such as education, health promotion, environmental protection, marketing, and management. Through the use of techniques such as scoring, badges, levels, and competition, people are motivated to take action to bring about lasting behavioral change and increase engagement and motivation in various areas (Stefoska-Needham, Goldman, 2025). Gamification is also understood as the use of game elements for purposes other than entertainment (Gao, 2024). It is also worth mentioning here that gamification mainly refers to bringing about positive (desired) changes in behavior and habits through game elements and can be confused with the term “gambification,” which is understood as "the (increased) presence of gambling (or gambling-related content) in non-gambling contexts in order to realize desired outcomes. It incorporates two main aspects: affective (employing cultural values/signifiers of gambling); and effective, (employing gambling games and activities)" (Macey, Hamari, 2022). The term "gambification" is used to describe the process of incorporating elements of gambling, such as monetary incentives and emotional stimulation, into video games. This practice carries the potential risk of leading to excessive user engagement, which could result in addiction. Activities employed in the gamification process may bear resemblance to gambling, yet they are predominantly utilized as a form of incentive for positive behaviors. For instance, virtual coins are awarded for cycling in applications that promote a healthy lifestyle, for completing tasks correctly in educational applications, or for purchases. These coins, representing virtual currency, can be exchanged for additional game elements, virtual rewards, or discounts in the context of shopping applications.

Gamification, regardless of the field in which it is used, is (Sawarkar, et al., 2024; Persada, 2023; Larson, 2020; Bawa, 2023; Cechanowicz et al., 2013; Triantafyllou et al. 2025):

- enables permanent change of negative habits into positive ones,
- teaches regularity,
- facilitates the achievement of goals,
- increases commitment,
- develops competencies and skills,
- improves performance and goal achievement,
- increases motivation,
- facilitates learning and memorization,
- builds loyalty and retention,
- increases satisfaction and positive experiences,
- supports innovative activities and creativity.

The aforementioned benefits of gamification are subject to variation depending on the field in which it is employed.

3. Marketing Games

The saturation of marketing with traditional media has prompted a search for new forms of interaction with the recipient. Conventional advertising strategies frequently entailed the reiteration of a persuasive message, a practice that often led to recipients experiencing feelings of irritation and fatigue. This shift led to a decline in the perceived credibility and effectiveness of the activities (Bailôn, 2008) and, concurrently, spurred the exploration of novel methods for consumer communication that would facilitate interaction (Fidalgo et al., 2017). This development signaled the dawn of a new era in transmedia campaigns, giving rise to a "discursive hybridity" in which the recipient assumes an active role, engaging with the brand and following the discourse it fosters (Felici, Ripollés, 2017).

The evolution of marketing concepts and existing paradigms has been driven by changes in the dynamics of social communication. This evolution can be represented by four distinct stages: Marketing 1.0, which prioritizes the product and is characterized by one-way communication; Marketing 2.0, which places the customer at the forefront and facilitates two-way communication; Marketing 3.0, which emphasizes values and emotional connection; and Marketing 4.0, which integrates online and offline activities through technological advancements and the analysis of large data sets (Kartajaya et al. 2019).

A component of Marketing 4.0 is gamification, which is defined as the incorporation of game elements into marketing strategies. Marketing games, also referred to as advergames, are a form of interactive media used to promote brands. The integration of advertising content with entertainment elements in these games has been shown to engage users and promote the brand, thereby increasing brand awareness and shaping consumer perceptions.

The spectrum of marketing games is extensive. These games can take the form of traditional offline games or online games (on a website or in a mobile app), and include: games of chance, scratch and win games, instant win games, knowledge games, platform games, tapping games, puzzles, hidden object games, strategy games, gamified landing pages, product recommender games, social interactive content games, seasonal holiday games, hourly games, and hourly games (Figure 1).

Figure 1. Types of marketing games

Games of chance are defined as those in which the outcome is primarily determined by chance rather than the abilities of the players. The randomness inherent in the game is a critical factor in this context, as it limits the ability to influence the outcome. Consequently, these types of games are often perceived from a psychological perspective as gambling. Games of chance encompass a wide array of activities, including roulette, dice, lotteries, and slot machines.

Roulette, a game traditionally classified as a game of chance, is a popular pastime in casinos. Players place wagers on various outcomes, including specific numbers, colors, or combinations of these elements. The outcome is determined by the spinning of a wheel (Minakuchi, 2018). In the context of marketing, roulette frequently manifests as a "wheel of fortune," wherein participants do not engage in wagering activities; rather, they initiate the spinning of the wheel, with the potential to accrue discounts on purchases, access to products at reduced rates, or promotional gadgets. The act of spinning the wheel can entail additional forms of interaction, such as serving as a reward following a purchase, or offering a single opportunity to spin the wheel on a daily basis within the application, among other scenarios. In Poland, this game has been utilized by brands such as:

- Rossmann—online version—the wheel was spun in a mobile application as part of the "Klub Rossmann" loyalty program. Players had the opportunity to win discounts or complimentary products. The objective of introducing this game was to enhance the activity of Rossmann application users and the frequency of purchases.

- Lidl's online version has been incorporated into seasonal campaigns. Following a purchase in the store, an individual has the opportunity to engage in a virtual wheel spinning activity, with the potential to win products or discounts. The objective of introducing the game was to encourage repeat purchases and increase brand loyalty.

- The online version of Żabka allows customers using the mobile application to accrue additional loyalty points, referred to as "żappsy," which can be redeemed for products or discounts. Additionally, the "Koło Promocji" (eng. Promotion Wheel) feature offers discounts to customers. The objective of this initiative was to promote the application and thereby increase the frequency of purchases.

- Hebe—online version—periodically organizes a “Zakręć Kołem Rabatów) (eng. Spin the Discount Wheel) promotional event. This event offers discount codes and complimentary delivery as prizes. The objective of this initiative was to enhance the frequency of online purchases.

- Decathlon Polska has implemented an offline version of a Wheel of Fortune-type game at sporting events it organizes. Participants have the opportunity to win gadgets, discounts, and beverages. The objective of this initiative is to cultivate customer relationships and promote the brand.

- Empik, an online retailer, employed a game during a promotional campaign on Black Friday. To promote increased sales in the online store, individual discounts were made available.

Craps is also traditionally considered a game of chance and gambling, where players make bets on the outcome of rolling two dice. In the context of marketing, this concept can manifest in a similar manner, wherein the outcome of the dice roll dictates the financial rewards. Additionally, the dice may feature imagery representing prizes that can be won, with rolling two of the same number resulting in a win. This game is not as prevalent in marketing as roulette, yet it has been utilized by prominent brands such as:

- Żabka—the game was called “Zbij kostki” (eng. Knock the dice) and was an online version available in the Żappka app. The user initiated the process by casting or striking the dice, which resulted in the awarding of loyalty points, known as "żappsy" or prizes. The objective of the initiative was to enhance user engagement with the application and cultivate brand loyalty.
- T-Mobile—SMS game—network users received an SMS invitation to “roll the dice.” In response to the roll of the dice, participants were presented with the opportunity to win discounts or additional GB of Internet. The objective of the exercise was to promote supplementary services and foster interaction with the brand.

Slot machines, also known as one-armed bandits, are games of chance that are primarily associated with casinos. Nevertheless, these games are frequently utilized in marketing campaigns due to their straightforward and engaging mechanics, the swift satisfaction they provide, and their strong association with success. In Poland, the game has been utilized in various contexts, including but not limited to:

- CCC—The "Zakręć i Wygraj” (ang. Spin and Win) game, as part of the mobile application CCC, required users to "pull the lever" in order to win discounts, points, or free delivery. The objective of the game was to motivate users to install the application and make online purchases.
- Allegro—this auction platform offered slot machine-like games in which, after meeting certain conditions (e.g., purchasing above a certain amount), users could win products or coupons. The objective of the game was to activate users and increase the value of their shopping carts.
- eobuwie—this brand's game was available on the store's website. Customers visiting the site could play a simple slot game by spinning the reel and winning a discount or free delivery. The objective of the initiative was to enhance conversion rates within the online store.
- Auchan, Carrefour—slot machines were set up in selected brick-and-mortar stores. Participation in the game was contingent upon prior purchase of an item from the store, which could be validated through the scanning of a receipt, for example. The prizes offered in exchange for participation

were coupons or products. The objective of this initiative was to enhance the store's visibility and attract more customers.

Scratch cards represent a particularly prevalent marketing strategy. These forms are utilized in both traditional, paper-based formats and digital, web-based or app-based formats. The user/customer scratches off a field (traditionally on paper or with a finger on the screen) to reveal a prize. The game's mechanics are characterized by their simplicity and rapid execution, incorporating an element of surprise and "suspense." The implementation of this system is both straightforward and versatile, with the capacity to be executed in both physical and digital domains. This approach has been demonstrated to be effective in increasing sales and fostering customer loyalty. In Poland, it has been utilized by the following brands:

- Biedronka, Lidl—scratch cards were available in paper form and were received after making purchases for a certain amount. You could win discounts, products, and prizes, including bicycles and audio/video equipment. The aim of the game was to encourage larger purchases and return visits to the store.

- Rossmann has introduced digital scratch cards within the Rossmann Club application. Discount coupons for select cosmetics were available for acquisition. The objective of the initiative was to promote the application and certain product categories.

- BP implemented a “Zdrap i Wygraj” (ang. Scratch and Win) game, which was paper-based. Customers received scratch cards when they replenished their vehicle's fuel. These cards could be exchanged for coffee, car wash discounts, Payback points, or prizes. The objective of this initiative was to promote the loyalty program and encourage more frequent visits to the station.

- Żabka—intermittent scratch card games within the Żappka application, wherein participants have the opportunity to accrue loyalty points or prizes.

Lottery is the most prevalent marketing strategy. Pursuant to the fulfillment of specific criteria, such as the completion of a purchase, the registration of a receipt, or the enrollment in a loyalty program, customers are entitled to receive prizes, which are randomly assigned and take the form of tickets. The utilization of lotteries in marketing strategies is predicated on their capacity to profoundly motivate customers to make purchases, thereby enhancing brand loyalty, promoting specific products, and fostering excitement and engagement. In Poland, lotteries have been utilized by various entities, including:

- Biedronka's "Codziennie do wygrania 500 zł na zakupy” (eng. Win PLN 500 for Shopping Every Day) campaign provided customers with the opportunity to participate in a daily drawing for gift cards by registering their receipt online. In addition to gift cards, products were available for acquisition, and in more extensive campaigns, automobiles. The objective of the campaign was to promote increased frequency and magnitude of purchases. The probability of winning increased with each additional receipt registered.

- Lidl has implemented two promotional campaigns: the „Loteria paragonowa” (eng. Receipt lottery” and „Loteria z aplikacją Lidl Plus” (eng. Lidl Plus app lottery). Tickets for these campaigns are received by customers who have made purchases using the Lidl app. The prizes encompassed various items, including shopping vouchers, automobiles, and household appliances. The objective of the campaign was to promote the app and cultivate brand loyalty.

- The "Miliony Żappsów” (eng. Million Żapps) campaign, orchestrated by Żabka, offered consumers the opportunity to participate in a lottery by purchasing select products and scanning the app. The prizes in the daily draw included loyalty points (Żapps), phones, scooters, and vouchers. The objective of the campaign was twofold: to increase sales of select products and to enhance the popularity of the app.

- The Orlen Lottery, also referred to as the "Scent of Victory," is a promotional initiative offered by Orlen, a prominent oil and gas company. This initiative provided customers with the opportunity to participate in a lottery upon purchasing goods or services at its gas stations. The prizes offered include cars, fuel vouchers, and other amenities.

- Lotos, a promotional campaign, offered a prize of PLN 500 to customers who completed a designated task at designated intervals. To qualify for the promotion, participants were required to purchase a minimum of 25 liters of fuel or a minimum of PLN 10 worth of products. Subsequently, they were required to collect a coupon from the seller and submit an SMS message to the designated number.

- InPost has established a program through which senders and recipients of parcels delivered by InPost can collect InCoin points. These points can be exchanged for InBoxes, which offer a chance to win an instant prize or a ticket in a monthly lottery with a chance to win a car, airline tickets, or a hotel stay.

- A substantial number of food companies, including Coca-Cola, Wedel, and Nestlé, have historically engaged in seasonal lotteries, particularly during periods such as holidays or Christmas.

Instant win games are a type of game or contest in which participants have the chance to win prizes immediately. Examples include roulette, dice, scratch cards, and slot machines. These games can also take other forms derived from lotteries, such as a marker under a drink cap indicating a prize (Coca-Cola, Pepsi, Tymbark). Prizes can include discounts, products at bargain prices, or products and material rewards. An interesting variation of this activity is, for example, “Shakeomat” or “Shakomarka”, introduced in the Biedronka chain store app, where shaking your phone gives you a special commercial offer. A similar Shakeomat functioned on the website and in the app of the Allegro auction site. The InPost campaign, in which you can find prizes and vouchers for purchases at partner companies in your InBox, is also a form of instant game. The aim of instant win games is to engage customers, build a community around a promotion, promote specific products or brands, and increase the number of participants in the promotion and the level of sales.

"*Knowledge games*" are interactive activities that evaluate and cultivate participants' knowledge. The objective of such games is threefold: to be enjoyable, to serve as a medium for education, and to cultivate a favorable brand image and heightened brand awareness. Additionally, they are designed to enhance user engagement and cultivate brand loyalty, thereby fortifying the expert status of the brand. These activities are frequently associated with social, environmental, or health campaigns. One example is the quizzes organized by the Biedronka chain of stores: a quiz available in the app, containing questions about the products sold in the chain's stores and the organization of the store. In exchange for their participation, the subjects received additional points that could be redeemed for plush toys or books. In addition, knowledge competitions were orchestrated by Orlen, which featured online inquiries regarding road safety for both customers and employees; PKO BP, which administered an educational quiz on financial topics; and Coca-Cola, which offered a quiz on the history of the company, with prizes provided by the companies themselves.

Platform games are simple 2D games available on websites, in which players explore a specific environment by moving characters around. The objective of the game is to maneuver the character through a series of challenges, including jumping, climbing, and navigating obstacles, with the goal of collecting items. Such games are frequently components of seasonal marketing strategies. Examples of notable games of this type include Pepsimen, developed by Pepsi, in which the player assumes the role of a superhero tasked with collecting cans, and Sneak King, created by Burger King, in which the player utilizes the company's mascot to deliver meals. Platform games have also been utilized by MacDonalds, Lego, and Tymbark. The marketing campaign initiated by the Żabka chain merits particular consideration in this context, particularly the game known as "Żabu." This game, which featured advanced graphics and was available on the Żappka app, required players to control a frog that jumped and caught falling objects (coins, products, or other symbols).

Puzzles are images that have been meticulously divided into smaller pieces and subsequently mixed together. The objective of the activity is to reassemble the image into its constituent parts. In the context of marketing, these puzzles are frequently employed in two distinct forms: offline, as physically existing puzzles, and online, as visual representations of brand products. Puzzles have been utilized by prominent brands such as Lidl, PZU, Biedronka, Reserved, and Kaufland (the online version was available in Poland). In Romania, for instance, individual puzzle pieces could be obtained after purchasing a certain amount, and the entire puzzle could be obtained after increasing the number of purchases in the store.

The category of *hidden object games* encompasses games that require players to locate concealed objects within a visual display. These games can be subdivided into two primary classifications: those that employ a "find and point" mechanic and those that follow a "three cups" paradigm. This strategy has been employed by prominent brands such as Carrefour and Biedronka. The popular shopping platform TEMU employs a similar strategy, wherein users are prompted to select one of three eggs, with the potential to win prizes such as discounts and products at reduced rates.

Strategy games are characterized by the active choices and influence that participants have on the outcome of the game. Furthermore, these individuals require a significantly higher level of engagement. The game can manifest in the form of a series of daily activities. An exemplar of this phenomenon is the game Żabu, in which players were tasked with nurturing a virtual character by providing it with sustenance and engaging in recreational activities on a daily basis.

A gamified landing page is a website that incorporates game elements, such as challenges, rewards, and points, with the objective of ensuring user enjoyment, encouraging frequent visits to the website, and increasing user engagement.

Product Recommender Games are a category of games that are dedicated to specific products. Players can identify products that align with their preferences by responding to a series of questions or by engaging in interactive scenarios. In accordance with the responses and selections provided by the participants, the game subsequently recommends products from the company's range. Games incorporating product recommendation elements included "Oreo," accessible via a QR code scan on a packet of crisps, and McDonald's.

Social Interactive Content Games are a category of games that are available on social media platforms. These activities may include quizzes, team games, or challenges designed to generate content, disseminate it, and thereby expand the brand's reach.

Seasonal holidays games, and *hourly games* refer to marketing games that are made available at particular times. For instance, these games may be offered during the holiday season or on specific days.

Metaverse games represent a distinct category within the broader realm of marketing strategies. These games are characterized by their advanced and immersive nature, which is facilitated by digital platforms. In these platforms, users collaborate to create a virtual world. The most prevalent games of this category include Minecraft, Roblox, and Fortnite. These games experienced a notable surge in popularity, particularly among younger demographics, during the period of the SARS-CoV-2 pandemic. In response to the restrictions imposed due to the pandemic, educational institutions resorted to the creation of virtual spaces where students could convene through their avatars, facilitating social interaction in a remote setting. Numerous brands and institutions (e.g., city halls) have established virtual worlds in popular platforms such as Minecraft and Roblox. Among the brands, the following distinctions can be observed: MacDonalds, ING Bank, PKO SA, Biedronka, Lego, and Nike.

The array of games presented is not mutually exclusive. A single marketing game may exhibit characteristics of several types. For example, Christmas Roulette is a game of chance and, at the same time, a seasonal game available at a specific time. It is imperative to acknowledge that marketing games represent a comprehensive category of games that are designed to achieve specific marketing objectives. These objectives include, but are not limited to, increasing sales, enhancing customer engagement, building brand awareness, strengthening customer loyalty, improving customer relations, fostering a customer community, and achieving expert status. A subcategory of marketing games is that of promotional games, which focus on promoting a specific product or service and encourage purchases. Consequently, it can be concluded that while every promotional game is a marketing game, not every marketing game is a promotional game.

4. Discussion and Conclusions

Marketing games have seen a marked increase in their utilization within the domain of marketing strategies, with their scope undergoing consistent expansion. These games frequently serve as the focal point of scientific inquiry, with research concentrating predominantly on four aspects: the impact of advertising games on children's health, purchase intent, brand narrative, and brand loyalty (Sanz, de la Hera, 2023). Scientific research has demonstrated that the incorporation of games into marketing strategies can positively influence customer experience and brand engagement, which, in turn, can lead to enhanced brand loyalty and increased sales (Elshoubashy et al., 2023; Pour et al., 2021). Educational advertising games have been demonstrated to promote positive dietary habits among children (Englund et al., 2020). The

implementation of promotional games has been demonstrated to result in an augmentation of sales, both in terms of value and quantity. However, as van Berlo et al. (2023) have noted, studies are most often conducted without paying adequate attention to the context in which the games are played. Moreover, research has scarcely addressed the evolution of advertising games themselves in relation to the emergence of new technologies or to the nomenclature of advertising games (Catalán et al., 2019). The present article focuses on the latter issue. In an effort to identify and showcase marketing games, a review was conducted of the available games utilized by the most prominent brands in Poland. Due to the absence of archives on brand websites and in mobile applications where previously available games could be checked, popular information available on the Internet (forums, search engines) was utilized. The games mentioned were intended to present the game's operation and its purpose. An analysis of the most prevalent marketing games utilized on the Polish market reveals a preponderance of promotional games, in which participants stand to win discounts, products, or material prizes. The most common goals of the games were:

- increasing the value of purchases,
- increasing the frequency of purchases,
- increasing the number of brand-dedicated apps installed.

The article presents 15 types of marketing games, which are not mutually exclusive. It is noteworthy that a single game may exhibit characteristics of multiple other games. The most prevalent categories encompass games of chance offering instantaneous wins and seasonal games, such as those initiated as part of a limited-time promotional campaign or holiday season.

The popularity of marketing games is increasing, and it is probable that this trend will persist. These interactions are characterized by their appeal, engagement, and mutual benefits for both parties (Makki et al., 2025). However, it is imperative to consider the repercussions of these practices, particularly the ethical considerations (Gupra et al., 2024). The initial issue to be addressed is the association of gamification with gambling and exposure to gambling. This association is particularly problematic in the case of children and individuals with problematic consumer behavior, such as compulsive shopping. Secondly, the processing of game user data. In the context of gaming and software installation, users are routinely prompted to register, furnish personal information, and consent to stipulated terms and conditions. A significant proportion of individuals may not be cognizant of the utilization and dissemination of the data they provide, nor may they be aware of the parties to whom this data is disclosed. It is imperative to recognize that consumers may be unaware that the act of scanning receipts or club cards to obtain a discount, enter a lottery, or similar activities is effectively divulging their purchase history and unveiling their consumer behavior. Thirdly, the topic of digital

accessibility and media addiction is addressed. Marketing games frequently necessitate daily engagement, which can potentially result in dependency. These games are becoming increasingly unavailable in their traditional form, such as paper, potentially excluding older adults as active users. Digital accessibility also impacts business owners who intend to incorporate games into their development strategies. The substantial expenses associated with the development, implementation, and continual operation of marketing games, in conjunction with the requisite competencies, might prove to be a significant hindrance for smaller business enterprises. Consequently, prominent and big brand names are the primary beneficiaries of games. This provides a foundation for future research on the readiness of smaller businesses to adopt marketing games, particularly digital ones.

References

Bailón, M. A. N. (2008) La integración de la comunicación: análisis de su implicación para el consumidor y el capital de marca (Doctoral dissertation, Universidad de Murcia). https://dialnet.unirioja.es/servlet/tesis?codigo=169692

Bawa, S.S. (2023) Implement Gamification to Improve Enterprise Performance. *International Journal of Intelligent Systems and Applications in Engineering,* 11 (2), 784—788.

Catalán, S., Martínez, E., Wallace, E. (2019). Analysing mobile advergaming effectiveness: the role of flow, game repetition and brand familiarity. *Journal of Product & Brand Management,* No. 28, 502–514. https://doi.org/10.1108/JPBM-07-2018-1929

Cechanowicz, J., Gutwin, C., Brownell, B., Goodfellow, L. (2013) Effects of gamification on participation and data quality in a real-world market research domain. *ACM International Conference Proceeding Series* (pp. 58—65). https://-doi.org/10.1145/2583008.2583016

Cummins, E., Zamani, Z. (2017) Play Environments and Affordances. In: E. Cummins, Z. Zamani (Eds.) *How to Grow a Playspace: Development and Design* (pp. 37—47). Taylor and Francis. https://do.org/10.4324/9781315695198-ch4

Deterding, S., Zagal, J.P. (2018) THE MANY FACES OF ROLE-PLAYING GAME STUDIES. In: S. Deterding, J.P. Zagal (Eds.) *Role-Playing Game Studies: Transmedia Foundations* (pp. 1—16). Routledge. https://doi.org/10.4324-/9781315637532-1

Elshoubashy, H., Elkader H.A.B.D., Khalifa N.(2023) Empirical Study On Gamification Effect On Brand Engagement. *Journal Of Organizational Behavior Research*, 8 (1), pp. 297—318. https://doi.org/10.51847/sAorvxedSs

Englund, T.R., Zhou, M., Hedrick, V.E., Kraak, V.I. (2020) How Branded Marketing and Media Campaigns Can Support a Healthy Diet and Food Well-Being for Americans: Evidence for 13 Campaigns in the United States. *Journal of Nutrition Education and Behavior*, 52 (1), 87—95. https://doi.org/10.1016/j.jneb.2019.-09.018

Faigle, U. (2022) *Mathematcal Game Theory*. World Scientific. http://dx.doi.org/-10.1142/12540

Felici, J. M., Ripollés, A. C. (2017) El discurso publicitario: Núcleo de la comunicación transmedia. *AdComunica. Revista Científica de Estrategias, Tendencias e Innovación En Comunicación 14,* 11-19. https://doi.org/10.6035/2174-0992.2017.-14.1.

Fidalgo, M. I. R., Ambrosio, A. P., Paz, Y. R, Iglesias, L. J. (2017) Cambios en los modelos persuasivos: La nueva publicidad en tiempo real a través de estrategias narrativas transmedia. Estudio de caso de la campaña publicitaria de Tous, Tender Stories. *AdComunica. Revista Científica de Estrategias, Tendencias e Innovación En Comunicación, 14,* 27-50. https://doi.org/0.6035/2174-0992.

Frame, K. K. (2024) Gamify Utility. In: Jim, J. (Eds.) *The UnNoticed Entrepreneur: How Entrepreneurs Can Leverage their Authenticity to Build Brands. Book 3* (pp. 155–159). https://doi.org/ 10.1002/9781907312731.ch26

Gao, F. (2024) Advancing Gamification Research and Practice with Three Underexplored Ideas in Self-Determination Theory. *TechTrends 68*, 661-671. https://doi.org/10.1007/s11528-024-00968-9

Gupta, S., Nagina, R., Paruthi, M., Gupta, G. (2024) *Marketing and Gamification: Applications, Challenges, and Ethics.* Routledge. https://doi.org/10.4324/9781032-694238

Ilhan, O.A. (2021) The rise of digitalization in the tourism industry during COVID-19: cyber space, destinations, and tourist experiences. In M. Demir, A. Dalgic, F.D. Ergen (Eds.), *Handbook of Research on the Impacts and Implications of COVID-19 on the Tourism Industry* (pp. 843-862). IGI Global, Hershey, PA.

Kartajaya, H., Kotler Ph., Hooi, D. H. (2019) "Marketing 4.0: Moving From Traditional To Digital," World Scientific Book, In: Ph. Kotler, H. Kartajaya, D.H. Hooi (Eds.), *Asian Competitors Marketing for Competitiveness in the Age of Digital Consumers* (pp. 99-123). World Scientific Publishing Co. Pte. Ltd.

Larson, K. (2020) Serious Games and Gamification in the Corporate Training Environment: a Literature Review*. TechTrends*, 64 (2), pp. 319—328. https://doi.org-/10.1007/s11528-019-00446-7

Macey, J., Hamari, J. (2022). Gamblification: A definition. *New Media & Society, 26(4)*, 2046-2065. https://doi.org/10.1177/14614448221083903

Makki, M., Jafari, M., Parsanejad, M. (2025) Marketing strategies and dynamics in online mobile gaming: a diffusion model*. Internet Research*. https://doi.org/10.1-108/INTR-04-2024-0643

Minakuchi, M. (2018) Roulette++: Integrating physical lottery process with digital effects. In. E. Bertiono, W. Gao, B. Steffen, M. Yung (Eds.) *Lecture Notes in Computer Science, 10714 LNCS* (pp. 601—607). Springer. https://doi.org/10.1007/978-3-319-76270-8_41

Persada, A.G. (2023) Impact of Gamification on User Experience: An Empirical Review. *Proceeding—ELTICOM 2023: 7th International Conference on Electrical, Telecommunication and Computer Engineering: Sustainable and Resilient Communities with Smart Technologies*, 43—47. https://doi.org/10.1109/ELTICOM61905.2023.10443134

Pfeiffer, A., Sedlecky, G. (2020). An introduction to gambling in the context of game studies. In. E. Bektic, D. Bruns, S. Gabriel, F. Kelle, G. Pölsterl, F. Schniz (Eds.) *Mixed Reality and Games: Theoretical and Practical Approaches in Game Studies and Education* (pp. 281-294). Media Studios. https://doi.org/10.1515/97838-39453292-026

Pizło, W., Mazurkiewicz-Pizło, A. (2023). Gamification—Use in Tourism Business Management. *European Research Studies Journal*, vol. XXVI, issue 2, 390-409. https://doi.org/10.35808/ersj/3177

Pour, M.J., Rafiei, K., Khani, M., Sabrirazm, A. (2021) Gamification and customer experience: the mediating role of brand engagement in online grocery retailing. *Nankai Business Review International*, July 2021. https://doi.org/10.1108/nbri-07-2020-0041

Ross, D. (2013) Ambiguity and possibility: Cognitive and educational grounds for play. *International Journal of Play, 2 (1)*: 22—31, https://do.org/10.1080/215-94937.2013.771604

Sáez, N.M. (2022) Translatio ludorum. La recepción del ajedrez musulmán en el reino de Alfonso X. *Patristica et Mediaevalia, 43 (2)*.https://doi.org/10.340-96/petm.v43.n2.10966

Sanz, L.C., De La Hera, T. (2023) What we do not know about advergames: a literature review. *Frontiers in Communication*, Volume 8. https://doi.org/10.3389/fc-omm.2023.1155899

Sawarkar, D., Agrawal, P., Mandal, R.K., Pinjarkar, L., Agrawal, P., Kaur, G. (2024) The Impact of Gamification Across Different Educational Contexts. *4th International Conference on Innovative Practices in Technology and Management 2024, ICIPTM 2024.* https://doi.org/10.1109/ICIPTM59628.2024.10563427

Stefoska-Needham, A., Goldman, A.L. (2025) Perspectives of Australian healthcare professionals towards gamification in practice. *Nutrition and Dietetics, 82 (2)*, 206—217. https://doi.org/10.1111/1747-0080.12911

Thorsted, A.C (2016) Communities of play–a collective unfolding. *International Journal of Play*, 5 (1), 28—46. https://doi.org/10.1080/21594937.2016.1147292

Triantafyllou, S.A., Georgiadis, C., Sapounidis, T. (2025) Gamification in education and training: A literature review. *International Review of Education*. https://doi.org/10.1007/s11159-024-10111-8

van Berlo, Z.M.C., van Reijmersdal, E.A., Waiguny, M.K.J. (2023). wenty years of research on gamified advertising: a systematic overview of theories and variables. International Journal of Advertising, Volume 42, 171–180. https://doi.org/10.-1080/02650487.2022.2143098

Vartiainen, J., Sormunen, K., Kangas J. (2024) Relationality of play and playfulness in early childhood sustainability education. *Learning and Instruction,* 93, art. no. 101963. https://doi.org/10.1016/j.learninstruc.2024.101963

Werbach, K., Dan Hunter, D. (2020). *For the Win, Revised and Updated Edition: The Power of Gamification and Game Thinking in Business, Education, Government, and Social Impact.* Wharton School Press. https://doi.org/10.2307/j.ctv2hdrfsm

Xiaolin, L., Yilun, X., Guofeng, D., Qianwei, X., Weichun, X. (2025) The role of user participation and psychological distance in consumer brand attitudes in gamified marketing. *Scientific Reports*, volume 15, Article number: 582 (2025). https://doi.org/10.1038/s41598-024-84268-5

Aleksandra A. Olejarz is a Doctor of Economics employed at the University of Warmia and Mazury in Olsztyn. Her research interests include market research and using quantitative methods to predict economic phenomena.

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

The Educational Potential of Video Games: The Case of *This War of Mine* in the Polish Context

Joanna Pigulak[1,2] **& Marcin Pigulak**[1]
[1]Adam Mickiewicz University in Poznań, Poland
[2]corresponding author *joanna.pigulak@amu.edu.pl*

Received 2025-06-15; accepted 2025-12-18; published Online First 2025-12-31.

Abstract

This article examines the educational potential of digital games through a case study of *This War of Mine* in the Polish institutional context. The analysis argues that game mechanics, interpreted within the framework of procedural rhetoric, generate experiences of didactic value by fostering empathy, critical reflection, and civic awareness. Methodologically, the study combines a genological perspective with selected analytical tools of game design theory, focusing on how rules, challenges, and fairness shape the player's experience. In addition, the article presents three original lesson plans for Polish language and literature, civics, and ethics, developed by the authors, which illustrate how the game can be effectively integrated into interdisciplinary teaching. The findings emphasize both the unique potential of digital games to support humanistic and civic education and the challenges of implementation, including digital exclusion, institutional constraints, and the necessity of careful pedagogical planning.

Keywords: digital games in education, *This War of Mine*, lessons plans, game-based learning, serious games

1. Introduction

In recent decades, video games have increasingly attracted the attention of researchers as a medium with significant educational, developmental, and competence-building potential. Findings from psychological, pedagogical, and neurological studies indicate that playing games can foster the development of

cognitive functions, including supporting decision-making and strategic processes (Reynaldo et al., 2021), enhancing reaction time (Ziv, Lidor, Levin, 2022) and more precise implicit temporal processing (Foerster et al., 2022), as well as stimulating creative thinking and neural plasticity (Ganter-Argast et al., 2023). Given that digital games contribute to significant and beneficial improvements in the efficiency of various cognitive processes—including working memory and task-switching abilities—they may emerge as an important tool in formal education, with studies indicating that children who play video games regularly achieve higher scores on tests assessing working memory and impulse control (Słupczewski, Gut, 2020). The demonstrated positive effects of gameplay also point to its therapeutic applications, particularly in work with children with perceptual-motor disorders (Ahn, 2020). Furthermore, games can serve as both educational and formative tools, teaching perseverance, cooperation, and coping with failure (Hefkaluk, Linehan, Trace, 2024).

From the perspective of contemporary digital humanities, it is therefore worthwhile to move beyond the reductionist perception of games as merely a source of addiction or a "waste of time". This is all the more important given that the positive dimensions of digital gameplay—particularly its educational, cognitive, and social functions—are increasingly recognized, including at the institutional level. A particularly notable example comes from Poland: the domestically produced *This War of Mine* (11 bit studios, 2014)—a mainstream game that addresses serious themes—was added to the list of optional readings in upper secondary schools, illustrating the growing institutional acceptance of games as educational tools. This gesture carries both symbolic and practical significance: it acknowledges games as a legitimate cultural medium and highlights their didactic potential, paving the way for their treatment as instruments for shaping humanistic and civic values within formal education.

Although *This War of Mine* remains an exception in this regard—no other video game has yet achieved a comparable status within the education system—it simultaneously reflects a broader trend of recognizing the educational value of games, even when they were not explicitly designed with didactic purposes in mind. As James Paul Gee (2003) observes, many commercial games naturally support learning through systems of challenges, rewards, and progression that foster the development of strategic and critical thinking. Kurt Squire (2004), in turn, emphasizes that simulation games such as *Civilization* (Sid Meier, Firaxis Games, 1991–2025) enable students to explore complex historical and cultural processes, thereby functioning as tools of experiential learning. Research by Constance Steinkuehler and Dmitri Williams (2006) demonstrates that online games promote social and communicative competencies, while Jane McGonigal (2011) highlights their potential in cultivating cooperation and perseverance. Even in the realm of movement- and music-based games, such as the *Dance Dance Revolution* series (Konami, 1999–2014), scholars have identified oppor-

tunities for developing coordination and motor skills (Gee, 2003). Taken together, these examples demonstrate that diverse game genres, although not necessarily designed as didactic instruments, nonetheless find educational applications in practice and are increasingly subject to academic reflection concerning their formative and competence-building potential.

Particular attention from researchers and educators has been directed toward serious games—productions whose implicit purpose extends beyond entertainment. These games primarily serve educational, training, therapeutic, or developmental functions, while also engaging critically with socio-political discourses. As Ian Bogost (2007) argues, serious games address weighty issues in order to provoke discussion, raise doubts, or foster specific attitudes. Their credibility is established by embedding narrative and gameplay mechanics in contexts that resonate with players' real-world experiences. Such projects are increasingly employed both within formal education and in broader cultural spaces. Notable examples include *PeaceMaker* (Impact Games, 2007), which simulates the Israeli–Palestinian conflict in the context of civic education; *Darfur is Dying* (Susana Ruiz, TAKE ACTION Games, 2006), designed to raise awareness about the humanitarian crisis in Sudan; and *September 12th* (News-gaming.com, 2003), which invites reflection on the consequences of the war on terror.

Closely related to serious games is the category of empathy games, which has developed primarily within the independent scene and aims to foster empathy toward real social issues. As Martyna Bakun (2016) observes, the creators of such games abandon escapist conventions in favor of difficult themes rooted in real-world and everyday experiences. The purpose of empathy games is not only to tell a story but also to create conditions for emotional or cognitive empathy through gameplay mechanics and modes of immersion. Representative titles include *Depression Quest* (Zoë Quinn & Patrick Lindsey, 2013), *Gone Home* (The Fullbright Company, 2013), and *That Dragon, Cancer* (Numinous Games, 2016). Each of these engages the player in distinct ways: through ergodic, hypertextual storytelling, environmental exploration, or the fusion of autobiographical narrative with metaphorical imagery.

From the perspective of the present discussion, what is particularly significant is that both serious games and empathy games derive their educational, social, formative, and therapeutic value not primarily from narrative or visual ornamentation, but from the very grammar of gameplay. In this sense, they confirm Ian Bogost's (2007) intuition that the rhetoric of games does not emerge from narrative commentary but from procedures, rules, and interactions—from what the game compels players to do, rather than from what it tells them. Within this framework, *This War of Mine* presents itself as a particularly compelling case. Although formally part of the commercial sector, from the moment it was included in the canon of school readings and released in a free

version by the Polish government, it has also functioned as a didactic tool, generating meanings akin to those typically attributed to serious games. The rules and procedures of this game, operating as a subtle mechanism of persuasion, construct an experience of empathy that is not imposed by a narrative moral but emerges directly through the act of participation. In other words, it is the ludic layer—rather than the narrative one—that shapes player reflection and opens an educational space in which attitudes, values, and critical thinking skills can take form.

In the following sections of this article, we seek to capture this potential in a systematic manner. We will first examine how the mechanics of *This War of Mine*—including resource balancing, the dynamics of moral decision-making, and the role of failure—generate experiences of a didactic nature, prompting reflection on the human condition in situations of extremity. This analysis will be grounded in the framework of procedural rhetoric and a genological perspective. We will then demonstrate how the game can be integrated into school practice by presenting lesson plan proposals developed in our educational handbook for *This War of Mine* (Pigulak, Pigulak, 2020).

2. From Rules to Reflection: The Pedagogical Dimension of Game Mechanics

This War of Mine stands out against the dominant representations of war in digital game culture. Unlike classical war games—and, more broadly, the war genre—which center on the experience of the soldier, a combatant who is armed and exerts tangible influence over the course of the conflict, this game shifts the focus to an entirely different perspective: that of the civilian trapped in a besieged city, whose experience it seeks to simulate. Such an approach has been largely marginalized within interactive war narratives (Bomba, 2015), and it distinguishes *This War of Mine* thematically as well as ludically from other simulation-survival titles addressing the experience of war. The narrative revolves around a group of random individuals who must struggle together to survive in a world torn apart by civil conflict. There are no heroic battles, spectacular victories, or storylines that glorify military strength. Instead, the player confronts a daily existence marked by hunger, illness, fear, and the relentless scarcity of resources.

The aesthetics of *This War of Mine* serve as an integral complement to its procedural message. The stark color palette, dominated by muted, almost monochromatic tones, does not merely function decoratively but actively co-constitutes the experience of perpetual crisis and unspoken despair. The game's visual layer—evoking at once the qualities of a documentary report and of a testimonial graphic novel—aligns with aesthetic traditions in which a reduction of expressive means amplifies semantic intensity. The accompanying music, sparse and melancholic, does not illustrate so much as underscore the

ludic situation, enabling the player to feel the weight of the characters' fate rather than merely describing it. The universality of the depicted world, stripped of place names and unequivocal locations, does not, however, result in abstraction. The developers drew direct inspiration from civilian accounts of the siege of Sarajevo during the Yugoslav wars (Warr, 2014), thereby granting the game the character of a quasi-archival testimony—anchored in real history yet simultaneously open to resonating with any context of armed conflict.

What is particularly significant from the perspective of the educational potential of *This War of Mine* is its decidedly anti-war stance, which radically undermines the dominant model of heroic agency characteristic of military games. Instead of triumph and victory-driven narratives, the player is confronted with helplessness, ethical dilemmas, and the inevitability of failure. In this way, the game reveals that war is not a stage for heroism but a space of suffering, where the subjects are those deprived of both voice and visibility. *This War of Mine* thus aligns with a broader current of critical representations of war, which, rather than glorifying violence, activate reflection, empathy, and an experience of tragedy as a mode of knowledge. Comparable tendencies can be observed in works such as *Spec Ops: The Line* (Yager Development, 2012), which deconstructs the conventions of the military shooter; *Valiant Hearts: The Great War* (Ubisoft Montpellier, 2014), which highlights the human costs of World War I through puzzle-adventure mechanics; or *11-11: Memories Retold* (DigixArt & Aardman Animations, 2018), which combines painterly aesthetics with narrative strategies to foreground the civilian and emotional dimensions of conflict. Together, these titles testify to the growing importance of anti-heroic and empathetic approaches to war in contemporary game culture.

At the same time, the broader metacontext of *This War of Mine*—namely, the fact that it was the first video game in the history of the Polish education system to be included in the canon of supplementary school readings—further extends the scope of its impact. This institutional gesture not only symbolically affirms games as a legitimate cultural medium but also opens up an entirely new field of questions: about pedagogical techniques, didactic strategies, and modes of working with young people in a space where knowledge is not a linear transmission but an immersive practice of experience. Indeed, *This War of Mine* does not provide a factual compendium—it is neither a textbook nor an archive of events—but instead operates through mechanics that model attitudes, cultivate empathy, and foster critical reflection, thereby expanding the repertoire of humanistic and civic education.

Although the game has already been the subject of extensive analysis within academic discourse—Radosław Bomba (2015) interpreted it through the lens of procedural rhetoric, demonstrating how the ludic layer models experiences of community and resistance to war; Stephanie de Smale, Martijin Kors and Alyea Sandovar (2017) emphasized its ethical potential; and Levent Durdu (2021) described its capacity to cultivate empathy—relatively little attention has so far

been devoted to the question of how *This War of Mine* functions in an educational context and what specific competencies it may foster. To capture this dimension, it is necessary to situate the game within a broader genological framework. As a simulator, it belongs to a tradition of games that, as research suggests, possess a distinctive didactic potential: they become laboratories of social experience in which learning occurs through action and reflection on the consequences of one's decisions (Gee, 2003). *This War of Mine* not only simulates the daily existence of civilians entangled in the realities of war but also creates a space for empathetic understanding, shifting the emphasis from "playability" to "reflectivity" (Bogost, 2007).

The distinctly reflective character of *This War of Mine* becomes evident in its mechanics. The day–night cycle compels players to make decisions under conditions of perpetual scarcity: during the day, characters must tend to the shelter and care for one another, while at night they must risk their lives in search of food, medicine, or fuel. The simulation of imbalance between needs and resources teaches the management of limited supplies but also enables players to experience the psychological weight of responsibility for the group. Additional mechanics—such as the possibility of suffering negative physiological and psychological consequences, including illness, hunger, or depression—demonstrate that in wartime it is not enough to satisfy biological needs; morale and social bonds must also be maintained. Another element that diversifies each playthrough is randomness (e.g., unexpected raids or encounters with strangers seeking help), which prevents full control and underscores the fragility of daily existence in a besieged city. These mechanics, structured around unpredictable iterations of scenarios, force the player to reflect on the fate of those deprived of influence over the course of war. In this way, *This War of Mine* functions as a kind of ethical laboratory in which students can perform attitudes related to crisis management, solidarity, and responsibility for others.

To deepen the analysis of *This War of Mine's* gameplay mechanics in the context of their educational potential, we draw on Jesse Schell's framework from *The Art of Game Design* (2008), in which he proposes a series of so-called "lenses" for examining game design. One of these is the lens of fairness, according to which a well-designed game treats all playable characters in a balanced way, without favoring any particular side. In *This War of Mine*, this principle is realized through the analogous construction of its characters: all playable figures—defined by a handful of leading traits and a limited yet evocative backstory—share largely similar capacities and needs. The differences among them are reduced to minor nuances: one may be a better cook, another moves more quickly, yet another struggles with nicotine addiction or requires aesthetic stimulation. This structuring of characters significantly affects the balance of gameplay, ensuring that the player cannot "hide" behind a stronger avatar, as is often the case in classical war games. On the contrary, every character is

equally vulnerable to suffering and death, and survival depends on cooperation and the equitable distribution of burdens across the group.

From a didactic perspective, this balance of gameplay functions as a lesson in justice and solidarity. The game demonstrates that war affects everyone—regardless of age, gender, or social status (cf. Bomba, 2015)—and that survival is possible only through cooperation rather than competition. This mechanic not only enhances realism but, more importantly, operates as a tool for shaping social sensitivity, teaching egalitarianism, a sense of community, and responsibility for others. *This War of Mine* can therefore be interpreted not only as a space of empathetic engagement with the fate of its characters (Durdu, 2021), resulting from the shift in perspective from the representation of the soldier to the performative role of the civilian, but also as a practical lesson in equality and co-responsibility—one that the player must undergo if they wish to see their characters (wards) through to the end of the war.

In contrast to many games that guide the player toward a satisfying state of flow—characterized by a sense of gratification resulting from the appropriate alignment of challenge difficulty with the player's skills and knowledge of the game's rules (Cowley et al., 2008)—*This War of Mine* deliberately operates through experiences of frustration and failure. Jesse Schell (2008), in his analysis of games through the "lens of challenge," emphasizes that balancing difficulty is fundamental to sustaining player engagement and thus can serve as a primary tool for fostering immersion. In the case of *This War of Mine*, however, the balance of challenges does not rely on harmoniously adjusting difficulty to the player's situation and abilities, but rather on gradually depriving the player of any sense of control. Resources run out faster than they can be replenished; characters' illnesses and injuries erode the group's strength; and the onset of winter further raises the stakes. As a result, nearly every decision carries significant risk and very often culminates in failure.

Jesper Juul (2013), in his analysis of the specificity of failure in games, emphasizes that games possess a unique capacity to teach through failure, with failure itself serving as a carrier of ludic meaning. The player experiences the painful sensation of defeat but simultaneously gains the opportunity to try again and to analyze previous choices in order to succeed. *This War of Mine* radically reverses this mechanism: repeated failures are not the result of insufficient skill but constitute an immanent part of gameplay, reflecting the hopelessness of civilians' circumstances in a besieged city. This structuring of difficulty—where challenges rarely end in success due to the characters' limited capacities—aligns with Ian Bogost's (2007) concept of the rhetoric of failure, which he frames as an important complement to procedural rhetoric. Bogost, analyzing games such as *September 12th* (Newsgaming.com, 2003), notes that failure in such titles is not the outcome of the player's individual mistakes but rather the deliberate consequence of a system of rules that precludes complete victory.

Games, in this sense, may be consciously designed to prevent success, with failure itself becoming a crucial meaning-making, persuasive, and rhetorical device. *This War of Mine* employs this mechanism in a radical way: repeated failures are not the result of a lack of dexterity but are built into the very fabric of play, mirroring the despair of civilians trapped in a city under siege. As Radosław Bomba (2015) observes, the game systematically confronts the player with the consequences of selfishness, isolation, and violence, underscoring the importance of solidarity and collective action.

From an educational perspective, frustration and the constant risk of failure carry particular significance. They allow the player to experience emotions such as loss of control, anxiety about the future, and a sense of helplessness states that accompany civilians in real armed conflicts. As Kurt Squire (2004) notes, historical games achieve their greatest didactic potential not when they merely reproduce facts, but when they enable students to assume roles and encounter cognitive conflicts that compel critical reflection. In this sense, *This War of Mine* does not perform a didactic function by transmitting a body of factual knowledge, but rather through the simulation of wartime experience and the emotions bound up with it. The omnipresent specter of failure—carefully designed at the level of game rules and emerging from specific gameplay mechanics (event randomness, limited resource pools, the diverse needs of characters)—fosters empathetic reflection on the consequences of armed conflict.

In the didactics of history and ethics, this translates into the possibility of introducing students to situations that cannot be fully conveyed in a classroom or textbook: extreme circumstances in which every decision carries both moral weight and the tangible risk of losing one's life. As David Shaffer (2006) emphasizes, the educational power of games lies in their capacity to create "epistemic frames" that allow learners to think and act as participants in particular social practices. Frustration and failure in *This War of Mine* perform precisely this function: they teach humility, reflection on the consequences of one's choices, and sensitivity to the suffering of civilians during wartime. Consequently, the game shapes a specific habitus—a set of dispositions that guide the understanding of social practice and enable meaningful, intuitive action (Bourdieu, 1977). In this case, the habitus is associated with the perspective of civilian participation in war, marked by an awareness of the fragility of life, empathy for the suffering of others, and the capacity to recognize the ethical dimension of everyday decisions. Through this process, players internalize experiences that go beyond the mechanics of survival and become an exercise in practical ethics: they learn to think in terms of responsibility, solidarity, and the moral costs of actions taken in situations of extremity.

As Stephanie de Smale, Martijin Kors and Alyea Sandovar (2017) emphasizes, *This War of Mine* activates an affective–ethical dynamic not at the level of linear narrative but through the materiality of gameplay itself—by inscribing the

player into a virtual network of decisions and consequences. An act of theft, refusal of help, or use of violence is not a purely symbolic gesture but a node within a web of feedback loops in which affect (empathy, guilt, disgust) intertwines with the mechanical structure of the game (loss of morale, diminished control over the avatar, illness, or self-destruction). It is precisely at this intersection—between affect and mechanics—that ethical reflexivity emerges. What is at stake here is not a narrative, moralizing instance instructing the player, but a processual pedagogy in which ethics arises as the outcome of participation in a system where every decision is existentially weighted and performatively consequential.

From a didactic perspective, the crucial element here is not so much the mechanism of "learning through choice" as the individual map of affective–decisional actions, in which choice is constituted as an irreversible event that generates difference within the field of experience. In pedagogical literature, this practice is described as "learning through experience" (Dewey, 1938/1997; Kolb, 1983), yet in the case of digital games it assumes the form of a distinctive generator of critical experiences: a mechanism that does not simply replicate the process of cognition but rather destabilizes it, opening up new, unexpected interpretive perspectives for the participant. As research on the didactics of games and simulations suggests (Gee, 2003; Shaffer, 2006; Squire, 2004), decisions imbued with moral and social consequences do not lead to straightforward problem-solving but instead produce cognitive ruptures—moments of undecidability that catalyze critical reflection. When the player–learner is forced to make a choice with irreversible consequences—for instance, saving their own community at the expense of strangers—an intense affective tension is activated, one that cannot be dispersed through rational calculation. It is precisely this tension that serves an initiatory function: it becomes the ignition point of transformative learning (Mezirow, 1991), in which not only strategies of action but also the very frames of perception, matrices of value, and the ontology of the participant's identity undergo transformation.

Analyzed in this context, *This War of Mine* does not so much teach "correct" moral answers as it creates a simulated ethical laboratory in which every solution carries its own cost. Theft may enable survival, yet it undermines social bonds and damages the characters' psychological well-being; refusal to use violence preserves moral integrity but often results in death. In this way, the game's mechanics illustrate a fundamental feature of moral choices—their tragic nature and irreducible ambivalence. In educational practice, such an experience can be interpreted as an exercise in situational ethics, where clear-cut notions of good and evil do not exist, and the meaning of decisions emerges only in light of their consequences.

Extending the analysis, it is worth noting that *This War of Mine* also challenges the typical game conventions of "good" and "bad" endings. Instead of clear rewards and punishments, the game presents an open spectrum of consequences: a character who has survived through theft may struggle with depression until the end of the war, while a group that refused to help others may endure at the cost of persistent guilt. This is not a lesson in morality in the traditional, normative sense, but rather a practice of reflection on the ethics of survival. Students entering this space become participants in a kind of thought experiment that is difficult to reproduce in classroom settings through other didactic methods. The game functions here as a system of differences and interrelations, where ethical meanings emerge not from predetermined rules but from the immanent relations between decision and its affective resonance. In this way, *This War of Mine* fosters a process in which the player's identity and values are continuously negotiated and reconfigured.

The didactic potential of the game under analysis is revealed not so much through narrative moral dilemmas as through its very procedural structure, which continually stages experience as a field of differences, tensions, and uncertainties. Resource scarcity, chronic imbalance between playable and non-playable characters (e.g., armed looters), spirals of psychophysical consequences, and the variability of living conditions function here not as mere ludological components but as simulation operators that compel the player to enter into the logic of permanent negotiation at the limits of survival (Gee, 2003; Shaffer, 2006; Squire, 2004). As a result, gameplay emerges as a kind of laboratory of experience in which knowledge is not transmitted linearly but performatively produced in the very act of participation within a machinery of procedural rules (Dewey, 1938/1997; Kolb, 1984). It is precisely this specificity of mechanics—rather than narrative commentary—that makes *This War of Mine* a medium of humanistic and social pedagogy: a tool that initiates in the player a liminal experience where tensions between individual and community, safety and risk, responsibility and the necessity of survival are enacted. Incorporating the game into educational practice is therefore not merely a gesture legitimizing games as a cultural medium but an act of deterritorializing didactics, opening a space in which learning arises through immersion in simulated processes and negotiation with uncertainty as a condition of knowledge. For this reason, *This War of Mine* became the foundation of the educational handbook we developed: we approached the game as a tool whose didactic potential was captured and amplified through lesson scenarios, presented in detail in the following section. In this part, we also reflect on the conditions, opportunities, and challenges of implementing the game within the school environment.

3. Opportunities and Challenges of Using *This War of* Mine in Education

Ongoing technological transformations, which render digitality an integral sphere of contemporary social life, make it more than a truism today to describe digital games as a significant aspect of culture—comparable to literature, music, or cinema. By treating video games, encompassing diverse forms, genres, and themes, as an important element of our lives, we naturally ascribe to them meanings that extend beyond their original (and often only seemingly) purely entertainment-oriented character. In short, once a game becomes a cultural text, it simultaneously acquires the status of an educational tool.

In the publication *The Impact of Console Games in the Classroom: Evidence from Schools in Scotland*, cited in the report *Using Video Games in School. Guidelines for Successful Learning Outcomes* (Bray & Hosein, 2023), Jennifer S. Groff, Cathrin Howells, and Sue Cranmer point to a number of conditions related to the implementation of digital games in education systems. According to the researchers, game-based learning:

1) "approaches present an excellent opportunity to engage students in activeities that can enhance learning and produce a range of educational benefits;
2) approaches need to be well planned and classrooms carefully organised to engage all students in learning and produce appropriate outcomes;
3) approaches build on many children's existing interests, skills and knowledge and can narrow the gap between children's home and school cultures;
4) approaches can increase communication between parents, teachers and school leaders and enhance parental engagement in children's learning;
5) approaches have the capacity to increase teacher motivation."

Among the additional aspects identified, it was noted that teachers often have to overcome various prejudices and barriers related to game-based teaching methods. At the same time, the article emphasizes the "need support from peers, school leadership and outside resources to use games well for learning and integrate them effectivelyn." (Groff, Howells, Cranmer, 2010, as cited in Bray & Hosein, 2023).

Although the above factors were presented from the perspective of experiences within the Scottish educational system, their inclusion in a publication prepared at the European Union level clearly attests to their universal character. It is equally significant that these observations align with the findings of scholars analyzing the Polish context, who point to similar barriers in introducing digital games into educational practice. For instance, Danuta Smołucha highlights the low level of implementation of gamification systems in Polish universities, the very limited experience of secondary school graduates with educa-

tional games, the lack of necessary competencies among teaching staff (stemming from the shortage of specialized training in the use of new media and technologies), as well as the difficulties associated with reliably assessing the outcomes of their incorporation into didactic practice (Smołucha, 2016). Although these observations date back nearly a decade, it remains fully justified to take them into account when planning educational initiatives that integrate digital games into curricula.

An important manifestation of overcoming barriers to the implementation of digital games in school practice is our development of original lesson plans, which constitute the central component of the handbook designed for working with *This War of Mine*. A lesson plan—understood as "plan that the teacher prepares to create effective learning in the students" and as a "regular and organized framework for educational events" (Aghazadeh, 2014, as cited in Farhang, Hashemi & Ghorianfar, 2023)—functions as a didactic map, defining objectives, methods, and modes of evaluation. The lesson plan is thus a cornerstone of education and plays a crucial role in shaping the learning process (Farhang, Hashemi & Ghorianfar, 2023). Accordingly, ready-made teaching scenarios not only facilitate the integration of the game into the didactic process but also enhance the coherence and effectiveness of instruction.

The preparation of lesson plans was preceded by consideration of key assumptions aimed at mitigating two fundamental problems of a technical and economic nature: the time required to become familiar with the game and to conduct effective lessons (a particular challenge in the context of the overloaded curriculum in Polish schools), as well as the costs associated with access to game copies. In the first case, the solution was to assign students the task of playing short, individualized sessions as homework (not exceeding one hour, sufficient for implementing a sample lesson plan). In the second, a significant advantage remains the possibility of downloading the game free of charge via the government website as part of the *Games in Education* program (Ministry of Education and Science, n.d. [online] https://www.gov.pl/web/grywedukacji/this-war-of-mine [Accessed: 15 June 2025]).

It should be emphasized, however, that the adopted solutions do not eliminate problems arising from digital exclusion, related above all to the lack of access to appropriate equipment in students' homes. The relatively low technical requirements of *This War of Mine*, however, make it possible to conduct classes using computers available in school IT laboratories (for instance, through cooperation between the teacher implementing the lesson plan and the IT instructor). In extreme cases, all lesson scenarios can also be carried out on the basis of gameplay recordings available on the YouTube platform.

A separate issue, inherently embedded in the concept and content of the lesson plans, was the attempt to counteract the still widespread stereotypes surrounding digital games. Although—as argued in the introduction to this section—the perception of this medium is undergoing constant change, its educational role may still be hindered by approaches that frame games exclusively in terms of low-level entertainment, addiction, or violence (Matusiak, 2016). Given the weight of meanings inscribed in the character of *This War of Mine* as an example of a serious game, it was particularly important to target the recommended age group of the final years of secondary school, as well as to closely align the game's message with the cultural and scholarly representations of war and social threats present in the curricula of three subjects: Polish language, civics, and ethics.

The developed lesson plans demonstrate how *This War of Mine* can be creatively adapted across different subjects. The Polish language lesson focuses on a comparative analysis of the game and literature, highlighting the narrative specificities of both media. The civics lesson foregrounds issues of human rights, enabling students to reflect on their protection within different political systems. The ethics lesson, in turn, is aimed at cultivating empathetic and solidarity-oriented attitudes through the analysis of moral dilemmas encountered during gameplay.

The first of the developed lesson plans—titled *War from the Civilian's Perspective: A Comparative Analysis of "This War of Mine" and "Memoir of the Warsaw Uprising" in the Context of Hero Construction*—is a Polish language class designed to juxtapose a digital game with a literary work. The comparative analysis of the fictional city of Pogoren, marked by the experience of war inspired by the siege of Sarajevo (1992–1996), and the occupied Warsaw of 1944 provides an opportunity to discuss the narrative dimensions of both cultural texts. Particular emphasis is placed on the perspective of the individual (considered through the categories of the "everyman," the "anti-hero," or the "civilian"), as well as on the narrative specificities of literature and video games. Nonlinearity, interactivity, variability, and the simulation-based character of the digital medium are here accorded the status of significant didactic categories. In this way, This War of Mine becomes a tool that supports the interpretative process, enabling students not only to develop a deeper understanding of the realist convention and the category of tragedy but also to identify the universal values present in the analyzed cultural texts. Outlined in the scenario, the detailed objectives, core methodologies, and expected learning outcomes of this lesson are set out in the following table (Table 1).

Table 1. Learning Objectives, Teaching Methods, and Expected Outcomes of the Polish Language Lesson Plan *War from the Civilian's Perspective: A Comparative Analysis of "This War of Mine" and "Memoir of the Warsaw Uprising"*

Didactic Map of the Polish Language Lesson		
Learning Objectives	Teaching Methods	Expected Outcomes
1. Analysis and interpretation of literary and interactive texts. 2. Comparison of character construction in the game and in literature. 3. Recognition of the realist convention and the category of tragedy. 4. Analysis of the represented world and civilian characters. 5. Consideration of historical, cultural, and biographical contexts. 6. Identification of universal values in cultural texts.	1. Brainstorming. 2. Problem-based discussion. 3. Individual and group work. 4. Textual analysis. 5. Associative method.	1. Interprets literary and interactive texts at the level of meaning. 2. Identifies modes of constructing the represented world and characters. 3. Compares cultural texts in the context of character construction. 4. Recognizes the realist convention and its transformations in video games. 5. Analyzes the notion of tragedy and its means of expression. 6. Identifies the thematic dimensions of works in social, historical, and existential contexts. 7. Distinguishes between memoir and recollections as genres of applied literature. 8. Takes into account historical, cultural, and biographical contexts in interpretation. 9. Recognizes universal values present in texts.

Source: Own elaboration based on the educational handbook for *This War of Mine* (Pigulak, Pigulak, 2020)

The second lesson plan concerns a civics class entitled *Perceiving "This War of Mine" as a Basis for Discussing Human Rights in the Context of Armed Conflicts*. Its principal educational value lies in the possibility of directly employing the experiences derived from gameplay. Students' confrontation with the fate of characters deprived of basic guarantees of security, medical care, or even the right to life enables not only the identification of cases involving violations of fundamental human rights but also reflection on their significance and scope. In this approach, gameplay becomes a point of departure for working with legal documents—most notably the *Universal Declaration of Human Rights*—and for analyzing differences in the protection of individual rights in democratic versus non-democratic states. By applying activating teaching methods such as brainstorming, problem-based discussion, and individual and group work, students gain the opportunity not only to deepen their understanding of the importance of humanitarian law but also to cultivate social sensitivity, critical thinking, and the ability to argue for the universality of human rights. The detailed learning objectives, principal teaching methods, and expected outcomes for this lesson are presented in the table below (Table 2).

Table 2. Learning Objectives, Teaching Methods, and Expected Outcomes of the Civic Class Lesson Plan *Perceiving "This War of Mine" as a Basis for Discussing Human Rights in the Context of Armed Conflicts*

Didactic Map of the Civic Class Lesson		
Learning Objectives	Teaching Methods	Expected Outcomes
1. Understanding the significance of human rights and humanitarian law during wartime. 2. Analyzing examples of human rights violations in armed conflicts. 3. Comprehending differences between democratic and non-democratic states in the context of human rights protection. 4. Reflecting on the universality of human	1. Brainstorming. 2. Individual work with the game. 3. Group work with the text. 4. Problem-based discussion. 5. Analysis of a cultural text.	1. Explains the concept of human rights and establishes their hierarchy. 2. Develops sensitivity to violations of rights and freedoms. 3. Discusses examples of human rights violations in wartime conditions. 4. Identifies differences in the protection of rights in democratic and non-democratic systems. 5. Argues for the universality of human rights

rights and the necessity of their protection.		and the necessity of their protection. 6. Enhances skills of logical reasoning and argumentation.

Source: Own elaboration based on the educational handbook for *This War of Mine* (Pigulak, Pigulak, 2020)

The third lesson plan, designed for ethics classes (*Solidarity Regardless of Circumstances: The Video Game as a Space for Shaping Empathetic Attitudes*), focuses on the themes of empathy and solidarity in the context of wartime experiences depicted in *This War of Mine*. The practical aspects of the game—including the necessity of making difficult moral choices regarding the distribution of resources, providing aid to others, or sacrificing one's own needs for the good of the community—serve here as a stimulus for reflection on altruistic and empathetic attitudes. The analysis of the characters' decisions enables students to identify ethical dilemmas and relate them to their own daily lives, thereby fostering self-awareness and self-reflection. The applied didactic methods (brainstorming, group work, and problem-based discussion) promote the exchange of perspectives, the cultivation of dialogical skills, and the strengthening of capacities for self-knowledge. As a result, gameplay is transformed into an educational tool that supports not only cultural analysis but also the formation of attitudes grounded in empathy and moral responsibility. The learning objectives, teaching methods, and expected outcomes are presented in Table 3.

Table 3. Learning Objectives, Teaching Methods, and Expected Outcomes of the Ethics Classes Lesson Plan *Solidarity Regardless of Circumstances: The Video Game as a Space for Shaping Empathetic Attitudes*

Didactic Map of the Ethics Classes Lesson		
Learning Objectives	Teaching Methods	Expected Outcomes
1. Understanding the concept of empathy and empathetic attitudes. 2. Reflecting on emotional identification and	1. Brainstorming. 2. Problem-based discussion. 3. Group work. 4. Textual analysis.	1. Explains what empathy is. 2. Understands and interprets human behavior.

solidarity in everyday life and in cultural texts. 3. Analyzing the attitudes of the game's characters in the context of moral community. 4. Developing self-awareness and empathetic self-reflection.		3. Analyzes and evaluates attitudes in cultural texts. 4. Identifies ethical dilemmas (using *This War of Mine* as an example).

Source: Own elaboration based on the educational handbook for *This War of Mine* (Pigulak, Pigulak, 2020)

The analysis of the three lesson plans confirms that *This War of Mine* can serve as an interdisciplinary didactic tool. The game fosters not only literary analysis, reflection on human rights, and the cultivation of empathy, but it can also be applied in other subjects such as history or civic education. Its particular value lies in combining emotional engagement with the development of critical thinking, empathy, and social competencies—an approach that, as highlighted in the report *Using Video Games in School...* (Bray & Hosein, 2023) cited in the introduction to this section, constitutes the key to effective game-based learning.

4. Conclusions

The analysis of the educational potential of *This War of Mine* allows us to formulate several conclusions of both practical and theoretical significance. From the perspective of humanistic didactics, this game proves to be an exceptional tool, since it does not convey knowledge in a linear or encyclopedic manner but constructs an experience in which the student becomes a participant in a liminal situation. This situation—marked by scarcity of resources, a sense of helplessness, and the constant risk of failure—is not merely a ludological mechanism but also a vehicle of values. It is within the procedures of the game, rather than in its narrative commentary, that the possibility for reflection on the human condition is embedded: on the relationship between the individual and the community, on responsibility and solidarity.

The lesson plans presented in this article demonstrate that *This War of Mine* can be effectively integrated into the school curriculum at various levels and across different subjects—ranging from Polish language and literature to civics

and ethics. In each of these cases, the game functions as a laboratory of attitudes, in which young people not only analyze a cultural text but also confront existential and moral questions. The game's ability to combine emotional engagement with critical reflection constitutes its greatest didactic value, enabling the transcendence of traditional models of education based on transmission and opening up a space for learning through experience.

On a theoretical level, *This War of Mine* demonstrates that digital games—even when produced within a commercial framework—can operate as instruments of humanistic education. It belongs to a broader process of institutional recognition of games as a cultural medium, comparable to literature or film, and challenges both scholars and practitioners of education to consider new forms of a pedagogy of experience. What is at stake here is not merely the adoption of innovative methods to activate students, but a profound rethinking of knowledge itself: knowledge is no longer a resource to be assimilated, but a process in which meanings emerge through immersion in simulation, through action, and through reflection on its consequences.

From this perspective, *This War of Mine* may be regarded as a kind of humanistic experiment: a game that does not provide simple answers but opens up a field of constant negotiation between the individual and the collective, between survival and ethics, between historical memory and present experience. In this sense, education through digital games is no longer a marginal element of the school system but its future—a future in which what matters most is not only what we teach, but how we teach, and what kinds of attitudes we cultivate in the process.

References

Ahn, S. (2021). Combined Effects of Virtual Reality and Computer Game-Based Cognitive Therapy on the Development of Visual-Motor Integration in Children with Intellectual Disabilities: A Pilot Study. *Occup Ther Int.*, *1*, pages 1—8. https://doi.org/10.1155/2021/6696779

Bakun, M. (2016). Nurt *empathy games* w niezależnych grach wideo. In D. Gałuszka, G. Ptaszek, D. Żuchowska-Skiba (Eds.), *Technokultura: transhumanizm i sztuka cyfrowa* (pages 173—188). Libron. Retrieved from: https://open.icm.edu.pl/handle/123456789/11056.

Bogost, I. (2007). *Persuasive Games: The Expressive Power of Videogames*. The MIT Press. https://doi.org/10.7551/mitpress/5334.001.0001

Bomba, R. (2015). Simowie na wspak. Gra *This War of Mine* w perspektywie retoryki proceduralnej. *Wielogłos*, *3* (25), pages 87—95. https://doi.org/10.4467/2084395XWI.15.023.4803

Bray, O., Hosein, A. (2023). *Using Video Games in School. Guidelines for soccessful learning outcomes*. European Schoolnet. ISBN: 9789464595093.

Bourdieu, P. (1977). *Outline of a Theory of Practice*. Cambridge University Press. ISBN: 0521211786. Źródło: https://openlibrary.org/books/OL4882306M/Outline_of_a_theory_of_practice

de Smale, S., Kors, M., Sandovar, A. (2017). The Case of *This War of Mine*: A Production Studies Perspective on Moral Game Design. *Games and Culture*, *14* (4), pages 387—409. https://doi.org/10.1177/1555412017725

Cowley, B. U., Charles, D. K., Black, M. M., Hickey, R. J. (2008). Toward an understanding of flow in video games. *Computers in Entertainment*, *6* (2), pages 1—27. https://doi.org/10.1145/1371216.137122

Dewey, J. (1938). *Experience and Education*. Macmillan. Reprint: Touchstone, 1997. ISBN: 0684838281. Źródło: https://www.amazon.com/Experience-Education-John-Dewey/dp/0684838281

Durdu, L. (2021). Digital Games for Peace Education. In M. Khosrow-Pour (Ed.), *Research Anthology on Developments in Gamification and Game-Based Learning* (pages 1300-1323). Information Resources Management Association. https://doi.org/10.4018/978-1-6684-3710-0

Farhang, Q., Hashemi, S.S.A., Ghorianfar, S.M. (2023). Lesson Plan and Its Importance in Teaching Process. *International Journal of Current Science Research and Review*, *6* (8), pages 5901—5913. https://doi.org/10.47191/ijcsrr/V6-i8-57

Forester, F. R., Chidharom, M., Bonnefond, A., Giersch, A. (2022). Neurocognitive analyses reveal that video game players exhibit enhanced implicit temporal processing. *Communications Biology*, *5*, pages 1—10. https://doi.org/10.1038/s42003-022-04033-0

Ganter-Argast, Ch., Schipper, M., Shamsrizi, M., Stein, Ch., Khalil, R. (2023). The light side of gaming: creativity and brain plasticity. *Front. Hum. Neurosci.*, *17*, pages 1—12. https://doi.org/10.3389/fnhum.2023.1280989

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. Palgrave Macmillan. ISBN-10: 1403961697.

Hefkaluk, N., Linehan, C., Trace, A., Fail, fail again, fail better: How players who enjoy challenging games persist after failure in “Celeste”. *International Journal of Human-Computer Studies*, *183*. https://doi.org/10.1016/j.ijhcs.2023.103199. Retrieved from: https://www.sciencedirect.com/science/article/pii/S1071581923002082.

Juul, J. (2009). Fear of Failing? The Many Meanings of Difficulty in Video Games. In M. J. P. Wolf, B. Perron (Eds.), *The Video Game Theory Reader 2* (pages 237—252). Routledge. Retrieved from: https://jesperjuul.net/text/fearoffailing/.

Kolb, D. A. (1983). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall. ISBN: 0132952610.

Matusiak, R. (2016). Gry jako źródło zachowań niepożądanych wśród młodzieży. *Nauczyciel i Szkoła*, *1* (61), pages 97—109.

McGonigal, J., (2011). *Reality is Broken. Why Games Make Us Better and How They Can Change the World*. The Penguin Press. Retrieved from: https://educacaofisicaaefcps.wordpress.com/wp-content/uploads/2018/07/reality_is_broken.pdf?utm.

Mezirow, J. (1991). *Transformative Dimensions of Adult Learning*. Jossey-Bass. ISBN: 978-1-555-42339-1. Źródło: https://www.wiley.com/en-us/Transformative+Dimensions+of+Adult+Learning-p-9781555423391

Pigulak, J., Pigulak, M. (2020). *This War of Mine*. Broszura edukacyjna. Retrieved from: https://www.gov.pl/attachment/a84a9811-1579-4c7e-a815-0cfbd08b7fc2.

Reynaldo, Ch., Christian, R., Hosea, H., Gunawan, A. (2021). Using Video Games to Improve Capabilities in Decision Making and Cognitive Skill: A Literature Review. *Procedia Computer Science*, *179*, pages 211—221. https://doi.org/10.1016/j.procs.2020.12.027

Schell, J. (2008). *The Art of Game Design. A Book of Lenses*. Elsevier. ISBN: 978-0-12-369496-6.

Shaffer, D. W. (2006). Epistemic frames for epistemic games. *Computers & Education*, *46* (3), pages 223—234. https://doi.org/10.1016/j.compedu.2005.11.003

Słupczewski, J., Gut, M. (2020). Wykorzystanie gier komputerowych w rozwijaniu zdolności poznawczych—zastosowanie w edukacji i terapii. In M. Trojan, M. Gut (Eds.), *Nowe technologie i metody w psychologii* (pages 79—98). Liberi Libri, https://doi.org/10.47943/lib.9788363487430

Smołucha, D. (2016). Gry i systemy grywalizacyjne jako nowoczesne narzędzia w edukacji uniwersyteckiej. *Horyzonty Wychowania*, *15* (34), pages 231—244. https://doi.org/10.17399/HW.2016.153413

Squire, K. D. (2004). Replaying history: Learning world history through playing *Civilization III*. PhD dissertation, Indiana University, 2004. Retrieved from: https://www.academia.edu/1317076/Replaying_history_Learning_world_history_through_playing_Civilization_III.

Steinkuehler, C. A., Williams, D.. (2006). Where Everybody Knows Your (Screen) Name: Online Games as “Third Places”. *Journal of Computer-Mediated Communication*, *11* (4), pages 885—909. https://doi.org/10.1111/j.1083-6101.2006.00300.x

Warr, P. (2014). Interview: Warzone Survival In *This War Of Mine*. A war game with a civilian focus. *Rock Paper Shotgun*. https://www.rockpapershotgun.com/this-war-of-mine-interview

Ziv, G., Lidor, R., Levin, O. (2022). Reaction time and working memory in gamers and non-gamers. *Scientific Reports*, *12*, pages 1—12. https://doi.org/10.1038/s41598-022-10986-3

Joanna Pigulak – PhD, assistant professor at the Institute of Film, Media, and Audiovisual Arts at Adam Mickiewicz University in Poznań, Poland. She co-founded game studies at AMU and is the author of Filmplaying: Relationships Between Film and Video Games (Cracow, 2022). For some time now, she has been exploring the issue of game inclusivity, with particular emphasis on their accessibility for people with disabilities. In addition to her research, she is a media educator and an advocate for digital game education.

Marcin Pigulak – PhD. Historian, film scholar, and digital games researcher. Assistant Professor at the Institute of Film, Media, and Audiovisual Arts at Adam Mickiewicz University in Poznań. His research interests include the history of film and digital games, audiovisual and digital manifestations of historical culture, philosophy of history in cinema, historical themes in video games, and methods of constructing discourse on collective memory.

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Towards a Cybernetic Game Design Framework

Aleksandr Polin
Polish-Japanese Academy of Information Technology
alex.polin@pjwstk.edu.pl

Received 2025-07-27; accepted 2025-12-18; published Online First 2025-12-31.

Abstract

Established game design frameworks, often adapted from linear engineering disciplines, are fundamentally misaligned with the non-linear, unpredictable, and collaborative reality of game development. This paper diagnoses this misalignment by framing game design as a "wicked problem," a class of challenges that resist traditional, top-down planning. It argues that a more robust foundation can be found in the principles of second-order cybernetics. The paper's contribution is not a rigid new framework, but a foundational rubric of five core principles intended to guide the creation of future design tools. These principles: Systemic Legibility, Emergence Cultivation, Conversational Framing, Authorial Intent as a First-Class Constraint, and Designing for the Player-as-System. Aimed at changing the conceptual understanding of a designer's role from a director of experience to a cultivator of a possibility space. By introducing design concepts rooted in cybernetics and systems thinking, this paper lays the theoretical groundwork for tools that can better support the discovery-driven and emergent nature of game design.

Keywords: Game Design, Game Design Frameworks, Game Development, Design Cybernetics, Design Frameworks, Player Experience, Interaction Design, Emergence

1. Introduction

Video games industry has emerged as one of the dominant cultural and economic forces in 21st century. In the recent years it has grown to become a massive powerhouse with the total industry-wise revenue projected to reach US$522.46bn in 2025 [1]. Yet, despite this commercial success, the creative process at the heart of the industry remains notoriously difficult to formalize and

manage. Video games are complex, costly sociotechnical products (Tschang, 2007), and empirical studies consistently reveal their development to be a non-linear, unpredictable, and highly collaborative process that resists traditional, top-down planning (Marklund et al., 2019). The final design is often *discovered* through iteration and playtesting, rather than being executed from an initial blueprint.

In an attempt to manage this complexity, numerous game design frameworks have been proposed. However, these frameworks, often adapted from more linear engineering disciplines, are frequently deemed not suitable in real-life scenarios. They attempt to impose a systematic, goal-oriented structure onto what is fundamentally an emergent and discovery-driven practice. By treating game design as a conventional, solvable problem, they often fail to adequately address its inherent "wickedness" (Rittel & Webber, 1973; Buchanan, 1992), creating a tension that can stifle the very creativity they are meant to support.

This paper argues that a more robust foundation for game design frameworks can be found in the principles of second-order cybernetics. By reframing game design not as a linear process of problem-solving but as a conversational and constraint-oriented practice of navigating complexity (Fischer & Richards, 2017; Dubberly & Pangaro, 2019), we can synthesize a new set of guiding principles for the creation of design tools. These principles, including systemic legibility, emergence cultivation, and the preservation of authorial intent, can lay the groundwork for a future generation of frameworks that empower, rather than confine, the designer's creative act. To build this argument, this paper will first establish the wicked nature of the game design problem space, then introduce key concepts from cybernetics, before finally synthesizing these insights into a set of foundational principles.

2. The Wicked Nature of Game Design

Prior to attempting to propose a new framework for game design, it is essential to define the nature of the activity it aims to support. A common approach in many design frameworks is to treat the process as a systematic, phased progression from idea to product, focusing on the structured development of components. (Maxim & Arnedo, 2025) However, a deep look into the empirical reality of game development reveals a process that is fundamentally at odds with such linear and predictive models. This chapter will argue that game design is not a conventional engineering task but a "wicked problem", a class of challenges that cannot be solved by traditional, systematic means. This inherent wickedness explains the limitations of current frameworks and establishes the necessary criteria for any new approach.

Empirical research into the daily practices of game development paints a picture of a process that is non-linear, highly iterative, and discovery oriented.

Marklund et al. (2019), in a comprehensive review of 48 papers on the topic, found that it is "almost impossible to plan a development project in detail". And this is not due to a lack of discipline but is seemingly inherent to the creative act itself. Creativity in game development is described not as the top-down vision of a single *auteur* but as a "subtle alchemy" emerging from the collaboration between diverse communities of scriptwriters, artists, programmers, and testers.

This collaborative and creative process is fundamentally non-linear. Ideas are not confined to an initial "ideation" phase but can appear at all stages and originate from any of the involved actors. (Marklund et al., 2019) The process is driven by continuous testing and refinement. As one developer noted: "You can plan for a large number of things, but ultimately the final decision is made when actual players try out the idea" (Kasurinen et al., (2014), as cited in Marklund et al., (2019)). The common four-stage structure: ideation, pre-production, production, and post-production, serves more as a loose guide than a rigid process, as the results from testing can have a major impact irrespective of the stage. The game is, in effect, *discovered* during its own creation.

Given this dynamic and unpredictable process, the tools used for design and communication become critically important. The traditional central artifact of game design, the Game Design Document (GDD), is a static, textual blueprint. However, its utility in a fluid development environment is highly questionable. Almeida & da Silva (2013) note that the static nature of the GDD creates a "gap between the conception of game ideas and the experimentation process" (Almeida & da Silva, 2013). They found that production teams, in real circumstances, are often unmotivated to read long, rapidly outdated documents. This finding is reinforced by Marklund et al. (2019), who observed a consistently low focus on formal documentation in favor of a strong focus on playable prototypes.

This inadequacy has led to a recognized need for more expressive and compact visual languages. (Almeida & da Silva, 2013) Designers have intuitively turned to tools like mind maps, flowcharts, UML diagrams, and other visual models to communicate the systemic and dynamic relationships within their designs that a linear document cannot adequately capture. The failure of the GDD is a clear symptom of a deeper misalignment: the tools of a predictable, linear process are being applied to an unpredictable, systemic one.

This collection of characteristics, the unpredictability, the co-evolution of problem and solution, the focus on subjective values, and the inadequacy of linear methods, has been identified and described before. It is the definitive signature of what design theorists Horst Rittel and Richard Buchanan have named a "**wicked problem**" (Rittel & Webber, 1973; Buchanan, 1992). Applying the ten attributes of wicked problems, as refined over decades of research (Chan & Xiang, 2022), reveals a near-perfect mapping to the challenges inherent in game design:

1. **No definitive formulation**. The formulation of the problem is inseparable from the formulation of the solution. This is clearly represented in the findings of Marklund et al. (2019) that the final design of a game is discovered during the development process. The initial design brief is only a hypothesis. The true problem of "what this game should be" is only defined through the iterative creation and testing of its solution.

2. **No stopping rule.** This manifests in game design as the constant need for balancing, patching, and the ever-present risk of "feature creep". The design process does not have a natural, logical endpoint where the game is definitively "solved" or "finished". It stops when external constraints (running out of budget, hitting a market deadline, etc.) are imposed. For modern "live service" games, the process seemingly never stops at all.

3. **Solutions are good-or-bad, not true-or-false.** This is evident in the industry's focus on subjective, "soft values" such as "user experience" and "fun" over objective metrics like "efficiency" (Marklund et al., 2019). There is no "correct" solution in game design, only solutions that are judged by various stakeholders (players, designers, publishers) as being more or less satisfying, engaging, or profitable.

4. **No immediate and no ultimate test of a solution.** While playtesting is essential, it cannot provide definitive proof of a solution's quality. Each playtest is a data point, an observation of a complex interaction at a single moment in time. Designers can only use this information to form better hypotheses about how the final design will be perceived by a much larger and more diverse audience over a longer period.

5. **Solutions trigger ripple effects.** Every significant game design decision has cascading consequences that affect the entire system. A seemingly minor change to a character's movement speed can impact level design, combat balance, the viability of certain strategies, and the overall "feel" of play. Once implemented and experienced, these decisions become part of the project's history and the team's collective memory. They are also not easily reversible, as the design is a path-dependent process.

6. **No clear solution or set of solutions.** As research by Kultima (2010) indicates, ideas in game design transform, evolve, and can originate from any source at any time. It is difficult to imagine a significant design problem, such as "the combat feels stale", that could be solved by a single definitive change. The solution is almost always a complex interplay of adjustments to animations, sound design, control responsiveness, enemy AI, and player feedback.

7. **Every wicked problem is essentially unique.** While genres provide conventions, every game development project is unique. The specific combination of creative vision, team dynamics, chosen technology, target audience, and market timing creates a unique context for every problem that arises.

A solution that worked for one game may be entirely inappropriate for another, even within the same genre.

8. **Every wicked problem can Be a symptom of another.** Due to the deep interconnectivity of a game's systems, the most elegant design solutions often address problems indirectly by treating them as symptoms of a deeper issue. For example, the problem “players are not using the crafting system” might not be a failure of the crafting UI, but a symptom of a flawed game economy that makes buying items easier than crafting them.

9. **The choice of explanation determines the nature of the resolution.** This principle highlights the power of framing. A designer who frames a problem as “players are bored” will seek solutions that add more content or spectacle. A designer who frames the same problem as “players don't understand the core mechanic” will seek solutions that improve tutorials and feedback. The way the problem is explained defines the entire space of possible solutions.

10. **The designer has no right to be wrong.** Game design is not a purely theoretical exercise. It results in the production of a cultural and commercial artifact. A flawed design decision is not a hypothetical “what if”, it is an intervention with real-world consequences, impacting the player experience, the team's morale, and the financial viability of the project. Every solution implemented in the final game will be experienced and judged by its players.

Recognizing game design as a wicked problem is not a critique, it is a crucial diagnosis. It explains why traditional frameworks fail and clarifies that what is needed is not a more rigid process, but a fundamentally different way of thinking about the design process itself.

3. A Cybernetic Language for Design

As I have previously established that game design is not a tame, structured process but a wicked problem, characterized by ambiguity, emergence, and subjectivity. Traditional design frameworks, with their linear and goal-oriented assumptions, are therefore less suitable for this reality. If game design is a problem of navigating complex, dynamic systems with unpredictable outcomes, then we must turn to a discipline that specializes in these very concepts. This chapter introduces cybernetics not as a rigid methodology, but as a foundational language for understanding and engaging with the wicked nature of game design.

At its core, cybernetics is the science of “goals, feedback, and learning” in any system (Dubberly & Pangaro, 2007; Dubberly & Pangaro, 2019). Its principles offer a powerful lens for describing the fundamental interactions of gameplay. A digital game is not simply a piece of software, it is a **complex regulatory system of communication** bounded by rules (Hollins, 2011). The player

and the game software together form a single, dynamic system where actions and reactions flow continuously. The core mechanism of this system is the **feedback loop**.

Feedback loops are the engine of play. They come in two primary forms:

Negative (Balancing) Feedback: This type of loop seeks stability and equilibrium. It works to close a gap between a current state and a desired state. In game terms, losing health is a balancing loop. The system signals a deviation from the desired state of "full health", prompting the player to disengage and take corrective action (seek cover, use a med-kit, etc.) to stabilize their condition.

Positive (Reinforcing) Feedback: This type of loop amplifies change, leading to exponential growth or collapse. In a game, a "snowballing" effect, where a player who gets an early advantage can leverage it to become exponentially more powerful, is a classic reinforcing loop.

A key cybernetic principle for designers is Ashby's Law of **Requisite Variety**. In essence, for a system to be stable, the number of states its control mechanism can adopt must be at least as great as the number of states in the system it is controlling (Ashby, 1956). In game design terms, this means the game's systems must have enough interesting responses (mechanics, AI behaviors, content variations) to match the variety of actions and strategies a player might try. A game with low variety feels brittle, "solvable", and quickly becomes boring. It cannot adequately regulate the player's experience.

While this first-order view of games as systems of feedback and variety is useful, it is insufficient. It still frames the designer as an objective engineer standing outside the system, tuning its loops and variables. However, as established in the context of wicked problems, the designer's own values, biases, and framing of the problem are inextricably part of the process itself.

This is the domain of **second-order cybernetics**, the "cybernetics of observing systems" (von Foerster, 2003). It recognizes that the designer is not a detached operator but a subjective participant in the conversation of creation. As Dubberly and Pangaro (2019) argue, this shifts the understanding of design from an act of engineering to an act of conversation. Design becomes a process of argumentation, negotiation, and the co-creation of meaning among the design team, stakeholders, and ultimately, the players.

This second-order perspective provides the necessary epistemology for wicked problems. It acknowledges that the designer's *Weltanschauung* (their worldview and explanation for the problem) is a central, not peripheral, element of the design process. The act of designing is an act of framing, and that framing is an inherently political and rhetorical act of persuasion (Buchanan, 1992; Dubberly & Pangaro, 2019).

If design is a second-order, conversational practice for navigating wicked problems, what does that mean for the designer's day-to-day actions? A purely goal-oriented approach becomes highly problematic. When the problem itself is misdiagnosed, a rigidly defined goal is often a fiction that locks the designer into a solution space that may be entirely wrong.

Fischer and Richards (2017) propose a powerful alternative: a shift from **goal-oriented to constraint-oriented design**.

> **Goal-Oriented Design** treats constraints as obstacles, the barriers to be overcome on the path to a predetermined goal. It seeks to narrow possibilities to find the "one right path".
>
> **Constraint-Oriented Design**, conversely, treats constraints as the primary creative tool. Constraints are not obstacles, they are the very elements that define the boundaries of the possibility space, giving it shape and direction.

This cybernetic approach is perfectly suited to the empirical reality of game development. Instead of defining the goal of "fun" directly, a designer defines the constraints of the system: the rules of the world, the scarcity of resources, the limitations of the player's abilities. Desirable, emergent gameplay, the "fun", arises from the player's creative exploration of the possibility space defined by those constraints. This approach embraces the non-linearity and unpredictability of the design process, making it a tool for discovery rather than a plan for execution. It is the practical, operational consequence of adopting a second-order cybernetic stance.

4. Defining the Principles for a Future Cybernetic Game Design Framework

I have now established two fundamental points: first, that game design is a wicked problem, incompatible with linear, predictive frameworks, and second, that second-order cybernetics provides a language and a conceptual lens for understanding and navigating this complexity. The critical questions remain: What does this mean in practice? If we reject the traditional model of a framework as a rigid, step-by-step process, what should take its place?

This chapter synthesizes these insights into a set of five core principles. These principles are not a blueprint for a specific tool but rather a foundational rubric, a set of criteria that any future cybernetic game design framework must embody to be effective. They shift the purpose of a framework from a tool for managing production to a tool for facilitating *conversation* and cultivating *emergence*.

Principle 1: Systemic Legibility. A cybernetic game design framework must make the systemic structure of the game legible and manipulable. As the empirical evidence shows, static, linear documents like the GDD fail because they

cannot represent the dynamic, interconnected nature of a game's systems (Almeida & da Silva, 2013; Marklund et al., 2019). A cybernetic framework must therefore favor visual and interactive representations that make explicit the "invisible" structures of gameplay, the feedback loops, resource flows, and causal relationships. By modeling the game as a network of interacting components rather than a list of features, the framework allows designers to reason about the system as a whole and understand the potential ripple effects of their decisions.

Principle 2: Emergence Cultivation. A cybernetic framework must shift the designer's focus from authoring specific, predetermined outcomes to cultivating the conditions for emergent behavior. The wicked nature of game design means the final experience is discovered, not created (Marklund et al., 2019). Therefore, the framework should operationalize a constraint-oriented approach (Fischer & Richards, 2017). Instead of defining a goal like "fun", the designer should be encouraged to define the system's core constraints: its rules, the scarcity of its resources, the limits of its agents' abilities. The framework's role is to help the designer understand how these simple, interconnected constraints can generate complex, surprising, and meaningful gameplay. It is a tool for designing the seeds of the system, not for engineering the entire forest.

Principle 3: Conversational Framing. A cybernetic framework must be a tool for conversation, not just for documentation. Second-order cybernetics teaches us that the designer is not a detached observer but a subjective participant whose framing of the problem defines the solution space (Dubberly & Pangaro, 2019). A framework must support this conversational and argumentative process. It should act as a Socratic partner, a "Cybernetic Compass and Sketchbook", that prompts designers to make their assumptions explicit, to question their own framing of the problem, and to facilitate a shared understanding within a multidisciplinary team. It should be an environment for asking "what if?" rather than a repository for declaring "what is".

Principle 4: Authorial Intent as a First-Class Constraint. Because solutions to wicked problems are judged as "good-or-bad" based on values, not "true-or-false" (Rittel & Webber, 1973), a cybernetic framework must treat the designer's artistic and thematic goals as first-class constraints. A game is not just a product to be optimized for engagement, it is a piece of art, an expression of ideas (Tschang, 2007). A framework must provide an explicit mechanism for designers to define these "irrational" but essential goals (such as "the player should feel a sense of dread" or "the mechanics should be intentionally frustrating to serve the narrative"). By treating these intentions as primary constraints, the framework can help protect the artistic vision from being eroded by purely utilitarian or market-driven pressures, ensuring that even "bad" design decisions can be made intentionally and for good reason.

Principle 5: Designing for the Player-as-System. Finally, a cybernetic framework must explicitly model the game and the player as two distinct but co-evolving systems within a broader environment. It must move beyond simple player personas to a systemic view of the player. This means providing tools to reason about the player's feedback loops of learning, their capacity for adaptation, and the requisite variety of their motivations (Hollins, 2011). The framework should constantly prompt the designer to consider the interaction between the two systems: How does this game mechanic afford learning? How does this feedback loop shape player behavior over time? How do the systems of the game and the systems of the player interact to co-create the experience?

5. Conclusion and Future Directions

These five principles, taken together, form a coherent foundation for a new approach to game design tools. They reject the notion of a framework as a rigid, prescriptive process and instead propose it as an interactive, reflective, and systemic environment for thought. They provide a language that is native to the wicked, complex, and creative reality of game development.

This study is, by design, theoretical. It lays the conceptual groundwork, but it does not provide the finished artifact. The principles outlined here are not an endpoint, but a beginning, a call to action for a new research agenda focused on creating tools that are as dynamic, adaptive, and reflective as the designers who will use them.

Future work must now move from the theoretical to the practical. The most direct and exciting path forward is the design and prototyping of an interactive tool that explicitly embodies these principles. I envision a Cybernetic Design Engine (CDE): a visual, interactive environment where designers can cultivate their game systems. Such a tool would not be a mere documentation aid, but an active collaborator that asks Socratic questions about player choice, visualizes the feedback loops that lead to emergence, and helps teams maintain thematic coherence by treating artistic goals as inviolable constraints. The development of the CDE would be a major research undertaking, blending human-computer interaction, systems modeling, and potentially AI-driven conversational agents.

References

Almeida, M.S.O., da Silva, F.S.C. (2013). A Systematic Review of Game Design Methods and Tools. In: Anacleto, J.C., Clua, E.W.G., da Silva, F.S.C., Fels, S., Yang, H.S. (eds) Entertainment Computing—ICEC 2013. ICEC 2013. Lecture Notes in Computer Science, vol 8215. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-41106-9_3

Ashby, W. R. (1956). An Introduction to Cybernetics. Chapman & Hall.

Buchanan, R. (1992). Wicked Problems in Design Thinking. Design Issues, 8(2), 5–21. https://doi.org/10.2307/1511637

Chan, J.K.H., Xiang, WN. (2022). Fifty years after the wicked-problems conception: its practical and theoretical impacts on planning and design. Socio Ecol Pract Res 4, 1–6. https://doi.org/10.1007/s42532-022-00106-w

Dubberly, Hugh & Pangaro, Paul. (2007). Cybernetics and service-craft: Language for behavior-focused design. Kybernetes. 36. 1301-1317. https://doi.org/10.1108/03684920710827319

Dubberly, Hugh & Pangaro, Paul. (2019). Cybernetics and Design: Conversations for Action. https://doi.org/10.1007/978-3-030-18557-2_4

Fscher, T., & Richards, L. D. (2017). From Goal-Oriented to Constraint-Oriented Design: The Cybernetic Intersection of Design Theory and Systems Theory. Leonardo, 50(1), 36–41. https://www.jstor.org/stable/26808353

Freese, M., & Lukosch, H. (2024). The Funnel of Game Design—An Adaptive Game Design Approach for Complex Systems. Simulation & Gaming, 55(2), 323–341. https://doi.org/10.1177/10468781231222524

Hollins, P. (2011). Recognition of variety: considering learning with digital games as cybernetic systems. International Journal of Technology Enhanced Learning, 3(5), 456–467. https://doi.org/10.1504/IJTEL.2011.042098

Kasurinen, J., Maglyas, A., Smolander, K. (2014). Is Requirements Engineering Useless in Game Development?. In: Salinesi, C., van de Weerd, I. (eds) Requirements Engineering: Foundation for Software Quality. REFSQ 2014. Lecture Notes in Computer Science, vol 8396. Springer, Cham. https://doi.org/10.1007/978-3-319-05843-6_1

Kultima, A. (2010). The organic nature of game ideation: game ideas arise from solitude and mature by bouncing. In Proceedings of the International Academic Conference on the Future of Game Design and Technology (Futureplay '10). Association for Computing Machinery, New York, NY, USA, 33–39. https://doi.org/10.1145/1920778.1920784

Marklund, B., Engström, H., Hellkvist, M., Backlund, P. (2019). What Empirically Based Research Tells Us About Game Development. The Computer Games Journal. 8. 1-20. https://doi.org/10.1007/s40869-019-00085-1.

Maxim, R. I., & Arnedo-Moreno, J. (2025). Identifying Key Principles and Commonalities in Digital Serious Game Design Frameworks: Scoping Review. JMIR Serious Games, 13, e54075. https://games.jmir.org/2025/1/e54075

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4(2), 155–169. https://doi.org/10.1007/BF01405730

Tschang, F. T. (2007). Balancing the Tensions between Rationalization and Creativity in the Video Games Industry. Organization Science, 18(6), 989–1005. http://www.jstor.org/stable/25146154

von Foerster, H. (2003). Ethics and Second-Order Cybernetics. In: Understanding Understanding. Springer, New York, NY. https://doi.org/10.1007/0-387-21722-3_14

Links

https://www.statista.com/outlook/amo/media/games/worldwide

Aleksandr Polin is an Academic Teacher at the Polish-Japanese Academy of Information Technology and a researcher specializing in game design and management. With a background in Intercultural Communications and industry experience as the former Head of Studio at Chronospace, Alex has produced and designed mobile, PC, and VR games for international markets. His research explores the "maddening complexity" of games as artificial worlds and evolving communication systems. Captivated by storytelling through interconnected media, he works to bridge the gap between abstract theory and the emergent nature of player experiences.

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Metaverse—Virtual Worlds and Creating Brand Awareness and Customer Engagement—Examples from Poland

Łukasz Popławski[1], Marek Aljewicz[2,3] & Aleksandra A. Olejarz[1]
[1]Department of Market and Consumption, The Faculty of Economic Sciences, University of Warmia and Mazury in Olsztyn, Poland
[2]Department of Dairy Science and Quality Management, Faculty of Food Science, University of Warmia and Mazury in Olsztyn, Poland
[3]corresponding author *marek.aljewicz@uwm.edu.pl*

Received 2025-06-29; accepted 2025-12-18; published Online First 2025-12-30.

Abstract

The development of immersive digital environments has become a significant direction in contemporary information technologies, with the metaverse emerging as a key framework for integrating social interaction and commercial activity within interconnected virtual spaces. This study examines the role of metaverse-based environments in marketing communication and brand management, focusing on how immersive platforms are used to structure consumer engagement and brand experience. Drawing on an analysis of academic literature, industry reports and selected case studies, the article compares global patterns of metaverse adoption with practices observed among Polish brands operating on platforms such as Roblox and Fortnite. The findings indicate that while global implementations increasingly integrate experiential, transactional and data-driven mechanisms, Polish initiatives remain primarily engagement-oriented and exploratory. The analysis highlights key determinants shaping effective metaverse-based brand strategies and identifies structural, organizational and regulatory factors limiting wider adoption in the Polish market.

Keywords: brand communication, immersive marketing, digital consumer behavior, gamification, consumer attitudes

1. Introduction

The term metaverse, first introduced by Neal Stephenson in his novel Snow Crash, refers to an immersive 3D environment that integrates Internet of Things (IoT) technologies, artificial intelligence (AI), and Web3 concepts. Within this environment, all user activity, ranging from social interaction and participation in events to conducting transactions involving physical and digital goods is mediated exclusively through the user's avatar (Zakarneh et al., 2024).

This technological architecture supports the emergence of Brand Identity 2.0, in which digital artifacts and immersive experiences meet contemporary demands for personalization and co-creation, thereby fostering brand loyalty and a perception of authenticity in brand- customer interactions (Agarwal et al., 2024). IoT devices provide real-time environmental data; AI generates content and ensures security; and blockchain technologies (including NFTs) guarantee asset ownership and underpin token-based economic models (Islam et al., 2025; Kuznetsov et al., 2025).

However, the expansion of data volumes, the intensification of immersive experiences, and the potential for user manipulation pose significant ethical and regulatory challenges. The absence of coherent standards for data protection and digital asset governance increases the risk of copyright infringement and violations of user privacy, highlighting the need for transparency and informed consent (Mvondo, 2025; Jia & Mvondo, 2025).

Full commercialization of the metaverse depends on the spread of XR technology (virtual, augmented, and mixed reality). Poland, despite its investments in ICT, lags behind the United States, China, and Germany due to high costs, a deficit of specialists, and a lack of a transparent regulatory framework (Wiechetek & Gola, 2025; Lechman, 2018). Studies show that only 11% of Poles can correctly define the metaverse (24/7 Communication & Opinion-Way, 2023). Low awareness leads domestic brands to treat the environment mainly as an entertainment zone, although initial initiatives in other areas are also emerging.

Platforms for creating virtual worlds are widely used in the market, the most important being Fortnite and Roblox. Fortnite, developed by Epic Games on the Unreal Engine, offers high visual realism and carefully selected content, which lends itself to campaigns requiring controlled environments. Roblox, maintained by Roblox Corporation as an open scripting ecosystem, relies on community-created content, thereby obliging brands to actively co-create experiences. The differentiated profiles of the two platforms enable precise tool selection but, at the same time, require a consistent brand narrative. The absence of such consistency immediately undermines credibility in the eyes of the audience (Zanger et al., 2022).

High costs, digital competency gaps, and low market awareness underscore the need for in-depth research into audience engagement and the improvement of business models. An analysis of Polish implementations in Roblox and Fortnite will show to what extent local practices fit into global trends and take into account user needs. This study examines how metaverse-based environments are currently employed in marketing communication and brand management, with a particular focus on mechanisms of customer engagement and brand experience formation. The analysis concentrates on selected implementations within the Roblox and Fortnite ecosystems, which represent two dominant yet structurally distinct platforms for immersive brand interaction. By combining insights from academic literature with an examination of Polish market practices, the article assesses the extent to which local implementations reflect or diverge from globally observed patterns of metaverse adoption and identifies key determinants shaping their effectiveness.

The methodology of this review is based on a comprehensive analysis of foreign literature and publicly available industry reports published online. In the first phase, a search was performed in the Web of Science, Scopus, and Google Scholar databases, using keywords such as “metaverse,” “customer communication,” and “immersive marketing.” The selected items were reviewed for substantive relevance and the quality of the adopted research methods. At the same time, media reports and information posted on company websites were collected, which made it possible to reconstruct the national context of implementations. Subsequently, three main areas of analysis were highlighted: the communication tools used in the metaverse, the attitudes and behaviors of users, and the degree of adoption of this technology in marketing practice. The synthesis of the collected materials made it possible to identify dominant trends and research gaps, as well as to assess the potential and challenges of applying the metaverse in customer relations. The entire work concludes with a critical discussion of the key findings.

2. Brand Development in the Metaverse Era

The metaverse introduces a distinct environment for the creation and management of brand value, extending established branding logics into immersive, interactive spaces. According to the perspective of Brodie et al. (2017), a brand is shaped by the dynamic interaction between the organization, consumers, distribution channels and other stakeholders, and the virtual environment reinforces these relationships through increased levels of immersion and interactivity. While the metaverse is not yet a primary channel for branding, its properties allow for the construction of multi-layered narratives and the intensification of experiential engagement beyond the capabilities of traditional digital media, which has implications for the reconfiguration of customer relationship management practices. However, the effective use of

virtual spaces requires systematic research into their impact on brand perception and the course of consumer–brand interactions.

The experience of pioneers shows that the use of XR technologies allows for the design of immersive brand contact scenarios, which translates into higher customer recognition and loyalty. Empirical observations indicate that such environments facilitate longer interaction times and deeper cognitive involvement compared to conventional online formats. The examples of MetaFashion Inc., AutoDrive Innovations and CulinaryDelights Ltd. confirm that personalized online events and interactive product presentations are setting new standards for market communication (Yadav et al., 2024). Mechanisms such as virtual showrooms and gamification elements enable context-sensitive and user-adaptive interactions, strengthening long-term consumer relationships (Zandi, 2024).

The metaverse-based engagement model integrates technological advances with in-depth analysis of audience behavior. Bilgihan et al. (2024) demonstrate that the synergy of XR and AI builds consistent, multifaceted experiences that increase brand equity. In this context, immersive environments function not only as communication channels but also as data-rich ecosystems enabling continuous optimization of brand experiences. In parallel, the development of virtual economies based on digital assets and NFTs creates space for the implementation of innovative business models, intensifying brand visibility and audience interactions.

This potential comes with barriers. The high cost of 3D production, digital competency deficits, privacy concerns, and the pressure to continuously innovate can slow adoption (Bilgihan et al., 2024; Yadav et al., 2024). These constraints particularly affect small and medium-sized enterprises, for which the return on investment of immersive solutions remains uncertain. Managing the risks requires investing in infrastructure, the interoperability of AI systems, and developing procedures to ensure data security and the inclusivity of experiences. The Hadong-gun case study demonstrates that effective implementation of virtual technologies enables even local entities to scale narratives globally and reach audiences resistant to the constraints of time and space (Ryu, 2023).

The future development of brands in the metaverse depends on the right balance between exploration of new opportunities and responsible management of ethical issues. Sustainable brand strategies in immersive environments require alignment between technological innovation, user trust and clearly defined value propositions. The rapid evolution of the virtual ecosystem necessitates agile strategy updates and underscores the importance of in-depth research into the effectiveness and long-term implications of the solutions adopted.

3. Trends Determining the Metaverse

Recent literature and empirical studies indicate that the dynamics of the metaverse are increasingly influencing forms of brand communication with customers. Although market forecasts suggest rapid long-term growth of virtual worlds, their actual adoption in corporate strategies remains uneven and context-dependent. Projections indicate that by 2026 approximately 30% of enterprises may be ready to deploy metaverse solutions, while by 2030 the value of the global virtual worlds market could exceed $13 trillion (Gartner, 2025; Deloitte, 2025). At the same time, empirical evidence suggests a gradual and selective integration of these technologies. Over the next three years, the metaverse is expected to generate only around 4% of average corporate revenues, implying phased implementation and the need for realistic performance indicators (Accenture, 2025). Early deployments are therefore likely to focus on virtual training and digital twin projects, which are easier to integrate into existing business processes (PwC, 2023). The scaling of more complex initiatives remains constrained by shortages of XR and 3D specialists (EY, 2024) and limited budgets, as most technology, media and telecommunications companies allocate less than 5% of their IT expenditures to metaverse-related projects (KPMG, 2023).

User experience in virtual environments is primarily shaped by immersion. The perceived presence of an avatar in a luxury brand's virtual showroom has been shown to increase declared purchase propensity by over 20% (Gao et al., 2023). In the fashion sector, virtual fitting rooms reduce decision-making time, lower return rates and stimulate demand for digital counterparts of physical products (Alexandrova & Poddubnaya, 2023). These findings support the interpretation of immersive environments as functional extensions of e-commerce rather than experimental novelties (Gartner, 2025).

Another key trend is hyperpersonalization. The real-time integration of biometric, behavioral and transactional data can increase the likelihood of repeat purchases by approximately 28% (Sathish & Arun, 2024). Avatars that reflect users' identities have been shown to foster stronger loyalty than traditional loyalty programs (Bilgihan et al., 2024). However, effective personalization requires advanced analytics and clearly defined performance metrics; otherwise, the costs of customization may outweigh its benefits (Deloitte, 2025).

The development of the metaverse is also driven by the event economy. Analyses of transactions in platforms such as Decentraland indicate that a substantial share of turnover occurs during virtual festivals, premieres or fashion shows (Goldberg et al., 2023). Companies combining immersive events with immediate sales of digital products achieve significantly higher conversion rates, enabling relatively fast returns on investment even under budget constraints (Rane et al., 2023; KPMG, 2023).

Co-creation represents another important driver of engagement. User participation in designing avatars and virtual spaces extends interaction time and increases recommendation rates (Bilgihan et al., 2024). Nevertheless, the scalability of co-creation initiatives is limited by shortages of qualified designers and developers, prompting firms to invest in proprietary creation tools and training programs (EY, 2024). Finally, user trust and ease of use remain critical factors in metaverse adoption. Research shows that usability of XR devices strongly influences acceptance, while concerns related to privacy and biometric data processing continue to inhibit participation (Jha & Singh, 2024; Rathore, 2018). The absence of privacy-by-design solutions and regulatory compliance at early stages undermines user confidence and reduces the long-term economic viability of immersive initiatives (PwC, 2023).

4. Examples of Metaverse in the World

Although the metaverse is not yet a dominant brand-building channel, global market leaders have already begun to use its potential in direct communication with customers. These initiatives are typically exploratory in nature, yet they reveal recurring patterns of how immersive environments are incorporated into brand strategies. Nike's "Nikeland," created on the Roblox platform, illustrates how virtual spaces can enhance brand recognition and loyalty through interactive product-related experiences (Kaur et al., 2023). A similar logic underpins Gucci Garden, where the controlled scarcity and symbolic exclusivity of virtual goods are used to replicate the experiential dimension of luxury consumption.

Personalization of the user experience is largely driven by the analysis of behavioral data. Algorithms enable real-time customization of content and messaging (Levin, 2024), while luxury brands such as Louis Vuitton and Balenciaga use immersive environments to broadcast fashion shows and offer digital replicas of physical products (Kaur et al., 2023; Yadav et al., 2024). Such practices demonstrate how metaverse platforms can function as hybrid spaces that combine brand communication, experiential marketing and alternative revenue models, while simultaneously reducing geographical constraints.

Synthetic influencers represent another emerging mechanism of engagement in virtual environments. Digital characters such as Lil Miquela generate interaction rates up to 30% higher than traditional advertising formats (Yadav et al., 2024). Their programmable nature allows brands to maintain narrative consistency and respond rapidly to cultural trends at comparatively low production costs. Gamification further reinforces engagement: campaigns by Coca-Cola in Decentraland and McDonald's in Roblox employ reward-based mechanics to extend interaction time and strengthen brand associations (Payal & Dwivedi, 2024).

Live events transferred to three-dimensional environments constitute an additional dimension of immersive communication. Fashion shows by Balenciaga and Tommy Hilfiger in Decentraland, as well as the Travis Scott concert in Fortnite, illustrate how large-scale events can achieve global reach while enabling precise measurement of audience behavior (Mansoor et al., 2024; Yadav et al., 2024). Virtual trade fairs similarly reduce logistical costs and, supported by advanced 3D analytics, can translate directly into measurable sales outcomes (Kumar, 2024).

The adoption of metaverse-based branding strategies varies significantly across regions. In Asia, particularly in China, India and South Korea, development is supported by widespread 5G infrastructure and platforms integrating commerce with entertainment, such as Baidu XiRang (Jha & Singh, 2024). North American initiatives tend to focus on synergies with the gaming and music industries, whereas European implementations more often emphasize cultural projects and regulatory compliance, especially in relation to data protection. Across regions, empirical research consistently indicates that personalization and user co-creation contribute to higher retention and broader reach at relatively lower costs (Bilgihan et al., 2024; Payal & Dwivedi, 2024).

Despite this diversity of applications, metaverse development remains constrained by interoperability issues and privacy concerns (Jha & Singh, 2024). Hardware fragmentation complicates the scaling of experiences, while the absence of uniform regulatory frameworks hinders commercialization. Consequently, the broader diffusion of metaverse solutions depends on the adoption of open technological standards, such as OpenXR, and the systematic implementation of privacy-by-design principles, which together form the foundation for sustainable growth.

5. Metaverse in Poland

The intensification of Polish activity in immersive environments indicates that the metaverse is increasingly perceived as a functional extension of existing brand communication channels rather than a purely experimental space. In particular, initiatives implemented on Fortnite and Roblox demonstrate how game mechanics can be combined with data analytics to enable measur-able forms of engagement, including conversion rates, interaction time and user retention, especially among audiences socialized through digital gaming environments.

Fortnite Platform

PKO Bank Polski's Cash Empire Tycoon represents an early example of using the Fortnite ecosystem for financial education combined with brand positioning. The game develops financial competence among users aged 13–24 by integrating tycoon mechanics with a simulation of budget management. Participants begin in a virtual representation of PKO's Rotunda and gradually build their own economic structures, analysing the benefits and risks associated with savings accounts, deposits and loans. The project prioritises educational outcomes and long-term brand perception rather than direct sales objectives, with effectiveness measured through indicators such as the number of initiated sessions, achieved goals and time spent in the virtual environment, which together translate into sustained engagement and positive brand associations (Wardziak, 2025).

The Money Tycoon project developed by Bank Pekao S.A. illustrates a more commercially integrated approach to metaverse engagement. Targeted at users aged 13–24 and launched on Fortnite in December 2024, the initiative combined gameplay with a parallel campaign promoting youth-oriented banking products, including a payment card with a gaming theme. Players develop a virtual banking facility whose successive levels correspond to real financial services, while in-game tools allow experimentation with compound interest, loans and diversified income streams. Unlike PKO Bank Polski's initiative, this project explicitly linked immersive engagement with the bank's product and rewards ecosystem, enabling the assessment of effectiveness through metrics such as map visits, session recurrence, user-generated content reach and newly opened accounts (Unknow 1, 2025; Unknow 2, 2025). The later expansion into Money Island Tycoon further deepened the strategic dimension by introducing resource management and social infrastructure modules.

A different use of the Fortnite platform is illustrated by the Royale Festival — Alior Bank Map, developed by Alior Bank in cooperation with Mastercard for the nationwide Royale Festival. The project adopted a recreational mini battle royale format, incorporating brand-inspired items and competitive gameplay mechanics. Rather than focusing on education or product communication, the initiative aimed to enhance brand visibility and affinity through association with e-sports culture, with effectiveness evaluated in terms of campaign reach, player engagement levels and brand interactions across social media and gaming platforms (Unknow 3–4, 2025).

The Story Hunt: Poznań project launched by the Żabka retail chain in January 2024 represents an alternative application of Fortnite focused on edutainment and regional storytelling. Players navigate a virtual city, collecting "żapps" and encountering stores modelled on the chain's physical outlets. The game integrates elements of local heritage, including regional legends and products such as the świętomarciński croissant, while simultaneously reinforcing brand

visibility. This approach demonstrates how immersive environments can be used to embed brand communication within culturally contextualised narratives, strengthening the perception of the brand as modern and closely aligned with everyday consumer practices (Unknow 5; Kasperski, 2025).

In contrast to map-based implementations, JBB Bałdyga adopted a sponsorship-oriented strategy by supporting the JBB Bałdyga Cup feat. Fortnite! gameplay series. The initiative combined brand exposure for Polanka beverages with Twitch broadcasts and influencer-driven gamer experiences. This case illustrates that effective metaverse-related engagement does not necessarily require proprietary virtual environments, but can also be achieved through strategic integration with existing gaming communities, extending brand reach and fostering positive associations (Małkowska-Szozda, 2025).

Roblox Platform

ING Bank Śląski was the first Polish financial institution to enter the Roblox platform, launching ING City in March 2022 and explicitly targeting Generation Z. The project was designed as a long-term, non-transactional engagement environment, with a payment-free game focused on financial education and cyber hygiene. Users acquire and manage virtual financial resources while learning principles of budgeting, saving and data protection. In contrast to the tycoon-based mechanics employed by PKO Bank Polski and Bank Pekao S.A., ING City relies on narrative progression and repeated interaction, reinforcing the bank's image as an innovator and a trustworthy guide in the digital economy (Związek Pracodawców Branży Internetowej, 2025).

Trefl, a leading Polish manufacturer of puzzles and toys, entered the metaverse in November 2024 with the launch of Treflandia — Great Adventure on Roblox, positioning the project as a core component of the brand's broader digital expansion strategy. The gamification framework was designed to simultaneously support environmental, sales and image-related objectives. The initiative illustrates how a carefully constructed metaverse environment can integrate pro-environmental education with brand communication and performance indicators, aligning with broader trends that combine gamification, education and commercial goals within immersive platforms (Derewicz, 2025; Group One, 2025).

Biedronka, Poland's largest retail chain, debuted on Roblox in October 2024 with the store simulator You buy or you work. You decide, developed in cooperation with Gameset (Lifetube Group). Users assume the roles of customers or employees, gaining insight into retail operations while developing skills related to smart shopping and basic logistics. The presence of the digital guide Apka Biedronka structures the learning process and links gameplay mechanics with brand-specific narratives. Integration with the Gang of

Producers loyalty program enables the transfer of virtual achievements into the physical retail environment, strengthening customer loyalty and supporting sales. This case confirms that Roblox-based environments can effectively combine consumer education with both image-building and transactional objectives (AK, 2025; Mizerska, 2025).

Maspex implemented a different engagement strategy through the creation of Waterrrland, a branded game promoting Kubuś Waterrr beverages. Unlike projects centred on financial literacy or cyber security, this initiative prioritised emotional engagement and brand association through competition and entertainment. The case demonstrates that metaverse platforms can function as effective tools for building positive brand imagery and fostering loyalty among younger audiences by integrating playful virtual experiences with product promotion (Maspex, 2025; DK, 2025).

6. Customer Attitudes Towards Metaverse in a Global Perspective

Analyzing consumer attitudes toward the metaverse constitutes a critical prerequisite for designing effective immersive marketing strategies, as virtual environments reshape how users encounter brands, make purchasing decisions and construct identities in digital space (Bilgihan et al., 2024). Empirical studies indicate that high levels of immersion combined with active participation in brand-related activities foster stronger emotional attachment, which translates into increased trust and a higher likelihood of repeated interaction (Payal & Dwivedi, 2024). Real-time, interactive exploration of brand offerings is perceived by users as more engaging and informative than traditional, non-immersive forms of presentation (Chatterjee & Karmakar, 2024).

A central determinant of positive user attitudes toward virtual worlds is personalization, understood as the ability to configure avatars, spatial environments and interface elements according to individual preferences (Bilgihan et al., 2024). Such configurability enhances users' sense of agency and authenticity, which reinforces favourable perceptions of both the environment and the brands operating within it (Bilgihan et al., 2024). Consequently, the metaverse is frequently interpreted not merely as a transactional space but also as a medium for self-expression, which can deepen consumer–brand relationships and increase long-term engagement (Choubey & Tamrakar, 2024).

At the same time, a substantial share of users perceive immersive technologies as insufficiently transparent and potentially vulnerable to misuse, especially in the absence of uniform standards governing personal data protection and digital asset ownership. Ambiguity in regulatory frameworks related to NFTs increases the risk of copyright infringement and privacy violations, while immersive techniques may facilitate manipulation if not accompanied by

explicit transparency rules and robust informed-consent mechanisms. Perceived risk, particularly regarding unauthorized access to personal or behavioural data, remains a key barrier that limits willingness to participate in metaverse-based marketing activities (Lim et al., 2024).

User attitudes also vary systematically by age cohort and technological competence. Generation Z tends to treat the metaverse as a natural extension of existing digital contact points, valuing immediacy, interactivity and experiential richness (Crespo-Pereira et al., 2023). Older users are more likely to express scepticism toward the complexity and practical usefulness of virtual worlds, especially when brand initiatives appear superficial or inconsistent with established communication narratives (Hollensen et al., 2022). Hardware requirements and competency thresholds may intensify perceptions of exclusivity and exclusion among less digitally confident audiences; however, co-creation initiatives that enable users to participate in shaping virtual spaces can mitigate this barrier and strengthen brand dialogue (Buhalis et al., 2022).

Although the metaverse is an increasingly visible component of the digital brand ecosystem, its effective use requires strategic coherence across customer touchpoints, spanning physical and virtual interactions. A lack of integration between these spheres can generate confusion and erode trust (Zanger et al., 2022). Accordingly, brands should align metaverse initiatives with broader communication strategies, ensure transparency in data processing, adapt experiences to diverse levels of technological readiness, and support co-creation mechanisms in order to reduce adoption barriers and build durable, trust-based consumer relationships.

7. Polish Consumers' Attitudes Towards the Metaverse

In analyzing the transition from a global perspective to the realities of the Polish market, it should be noted that domestic consumers are still at a stage of conservative, preliminary familiarity with the metaverse concept. Only 11% of respondents are able to formulate a correct definition of the concept, while a further 13% recognize only the term itself (24/7 Communication & OpinionWay, 2023). Despite such limited knowledge, half of the respondents declare that they will start using the virtual environment in the next five years, driven primarily by the need to escape everyday routines and the opportunity to spend time together with other users. In the perception of Polish audiences, the metaverse is therefore expected to fulfil predominantly recreational and social functions.

Assessment of commercial potential remains mixed. A Santander Consumer Bank (2022) study shows that as many as 8% of e-consumers do not plan to make purchases in the metaverse, with only 9% reporting a real willingness to do so, a group composed mainly of young residents of large cities. A different

picture is drawn by the Mastercard Advisors report (2023): 60% of respondents accept the presence of brands in the metaverse, provided that a high-quality experience is delivered, and 65% express positive attitudes toward the prospect of using banking services in immersive environments. These findings suggest that adoption is more likely to be driven by high-value, experience-oriented services rather than by standard retail transactions.

The analysis also identifies three major barriers to development. First, the high cost of XR devices and infrastructure requirements limits the accessibility of the technology. Second, deficits in digital competencies hinder users' ability to navigate virtual environments with confidence. Third, the absence of clear regulations governing personal data protection and digital asset ownership raises concerns related to privacy and security. Research by Santander Consumer Bank and 24/7 Communication and OpinionWay (2023) confirms that hardware costs and regulatory uncertainty constitute the most significant factors inhibiting the wider opening of the Polish market to metaverse-based brand activities.

The report A New Era of Digital Development emphasizes that technological innovation alone does not directly translate into user readiness for the metaverse. The authors recommend a complementary approach involving hardware subsidies, extensive programs for developing digital competencies, open regulatory sandboxes, and cultural and educational pilot projects. Such a coordinated set of measures simultaneously supports trust-building, inclusion of less technologically advanced users, and the creation of innovative services with lower entry barriers (Związek Cyfrowa Polska & Komitet ds. Metawersum, 2024).

Although awareness of the metaverse in Poland remains limited, consumers declare a willingness to test solutions that offer tangible benefits. Parallel educational initiatives and carefully designed pilot projects targeting early adopters therefore appear crucial for translating initial curiosity into more regular and informed use of virtual environments, both in the areas of entertainment and social interaction, as well as shopping and financial services.

8. Conclusions

The metaverse is becoming a relevant, though still emergent, channel of marketing communication, with its strategic and commercial maturity in the Polish market remaining limited. Global developments point to a gradual expansion of immersive environments and a growing willingness of organizations to experiment with XR- and AI-based solutions, particularly in retail, entertainment and event-driven formats. However, the analysis indicates that effective metaverse deployment depends less on technological novelty and more on clearly articulated strategic objectives and measurable engagement outcomes.

In Poland, the metaverse is predominantly perceived as an entertainment-oriented space, yet the increasing number of initiatives combining gamification, education and transactional elements suggests a progressive development of user competencies and organizational learning. High implementation costs, shortages of specialized skills and regulatory uncertainty related to data protection and digital asset governance remain the key barriers to wider adoption. Further development of the Polish metaverse ecosystem requires coordinated efforts in user education, infrastructure development and the establishment of transparent governance standards. Marketing strategies in immersive environments should focus on experiential personalization, structured user co-creation and coherent integration with existing communication channels, enabling brands to build durable, trust-based relationships and sustainable competitive advantages in hybrid digital ecosystems.

Author Contributions

Conceptualization, L.P. and M.A.; methodology, L.P. and M.A.; formal analysis, L.P. and M.A.; resources, M.A.; data curation, L.P.; writing—original draft preparation, L.P. and M.A.; writing—review and editing, L.P., M.A. and A.O.; visualization, L.P.; supervision, M.A.; project administration, M.A.

References

24/7 Communication & OpinionWay. (2023). Metaraport: Analiza potrzeb, zachowań i przewidywań Polaków związanych z metawersum. https://247.com.pl/app/uploads/2023/02/metaraport.pdf

Accenture. (2025). More than hype—here's how to embrace the metaverse today [Raport]. Accenture. https://www.accenture.com/content/dam/accenture/final/accenture-com/document/Accenture-Metaverse-Evolution-Before-Revolution.pdf

Agarwal, S., Gupta, V., Varma, N., & Bansal, A. (2024) How is metaverse impacting consumers' behaviour? In: S. Inder, Sh. Dawra, K.L. Tennin, S. Sharma (Eds.) *New Business Frontiers in the Metaverse* (pp. 51—66) IGI Global. Scientific Publishing. https://doi.org/10.4018/9798369324226.ch004

AK. (2025.06.15) Biedronka otwiera wirtualny sklep. Pierwsza taka realizacja w historii firmy. https://www.dlahandlu.pl/detal-hurt/biedronka-otwiera-wirtualny-sklep-pierwsza-taka-realizacja-w-historii-firmy,151100.html

Alexandrova, E., & Poddubnaya, M. (2023). Metaverse in fashion industry development: applications and challenges. E3S Web of Conferences. https://doi.org/10.1051/e3sconf/202342006019

Bilgihan, A., Leong, A. M. W., Okumus, F., & Bai, J. (2024). *Proposing a metaverse engagement model for brand development. Journal of Retailing and Consumer Services, 78*, 103781.

Brodie, R.J., Hollebeek, L.D., Juric, B., & Ilic, A. (2017). Customer engagement: Conceptual domain, fundamental propositions, and implications for research. *Journal of Service Research, 14*(3), 252–271. https://doi.org/10.1177/109467051141170

Buhalis, D., Lin, M. S., & Leung, D. T. (2022). Metaverse as a driver for customer experience and value co-creation: implications for hospitality and tourism management and marketing. International Journal of Contemporary Hospitality Management, 35(2), 701–716. https://doi.org/10.1108/ijchm-05-2022-0631

Chatterjee, S., & Karmakar, B. (2024). Exploring Consumer Choices in the Metaverse: A New Digital Era. International Journal of Advanced Research in Science, Communication and Technology, 487–492. https://doi.org/10.48175/ijarsct-19275

Choubey, S. B., & Tamrakar, S. (2024). The Metaverse: An Uncharted Landscape for Virtual Marketing Focused on the Customer. International Journal Emerging Technology and Advanced Engineering, 14(2), 35–47. https://doi.org/10.46338/ijetae0224_05

Crespo-Pereira, V., Sánchez-Amboage, E., & Membiela-Pollán, M. (2023). Facing the challenges of metaverse: a systematic literature review from Social Sciences and Marketing and Communication. Profesional De La Informacion. https://doi.org/10.3145/epi.2023.ene.02

Deloitte. (2025). A whole new world? The metaverse and what it could mean for you [Raport]. Deloitte Insights. https://www2.deloitte.com/us/en/insights/industry/technology/what-does-the-metaverse-mean.html

Derewicz, K. (2025.06.28). Polski gigant growy debiutuje w Robloxie. Niespodziewany krok firmy. https://gra.pl/polski-gigant-growy-debiutuje-w-robloxie-niespodziewany-krok-firmy/ar/c12p2-27027985

DK. (2025.06.28) Wskakuj do Waterrrland i zgarnij nagrody. Waterrr z wirtualnym światem na Roblox. https://portalmedialny.pl/art/86329/wskakuj-do-waterrrland-i-zgarnij-nagrody-waterrr-z-wirtualnym-swiatem-na-roblox.html/

EY. (2024). Navigating beyond the hype: The metaverse, take two [Raport]. EY. https://www.ey.com/en_us/insights/metaverse/navigating-beyond-the-hype-the-metaverse-take-two

Gao, M., Xu, Y., & Yan, M. (2023). Marketing Mix Strategy in the Metaverse: The Luxury Brands Case Study. Advances in Economics, Management and Political Sciences. https://doi.org/10.54254/2754-1169/28/20231334

Gartner. (2025). Metaverse: Critical R&D business insights [Raport]. Gartner. https://www.gartner.com/en/innovation-strategy/trends/critical-insights-metaverse

Goldberg, M., Schär, F., & Thürkauf, D. (2023). Retailing and Customer Engagement in the Metaverse: An Empirical Analysis. Social Science Research Network. https://doi.org/10.2139/ssrn.4547100

Group one. (2025.06.28). Game Changer wpropwadza markę Trefl na platformę Roblox. https://www.signs.pl/game-changer-wpropwadza-marke-trefl-na-platforme-roblox,406610,artykul.html

Hollensen, S., Kotler, P., & Opresnik, M. O. (2022). Metaverse—the new marketing universe. Journal of Business Strategy, 44(3), 119–125. https://doi.org/10.1108/jbs-01-2022-0014

Islam, K.M.A., Khan, W., Bari, M.F., Mostafa, R., Anonthi, F., & Monira, N.A. (2025) Challenges of Artificial Intelligence for the Metaverse: A Scoping Review. *International Research Journal of Multidisciplinary Scope*, 6 (1), 1094—1101, https://doi.org/0.47857/irjms.2025.v06i01.02493

Jha, A., & Singh, S. R. (2024). Unveiling metaverse applications and challenges in Asia: Opportunities for innovation, marketing, and growth. Metaverse, 5(2), 2972. https://doi.org/10.54517/m2972

Jia, Y., & Mvondo, G.F.N. (2025) Exploring the adverse effects of the metaverse on users' psychological well-being and Self-Esteem: A mixed-methods study. Journal of Retailing and Consumer Services, 86, art. no. 104321. https://doi.org/10.1016/j.jretconser.2025.104321

Kasperski, M. (2025.06.28). Żabka wchodzi do świata Fortnite. Rywalizacja o „żappsy" na wirtualnej mapie Poznania, *Wprost*, https://biznes.wprost.pl/technologie/gry/11546605/zabka-wchodzi-do-gry-fortnite-wirtualna-mapa-poznania-i-rywalizacja-o-zappsy.html

Kaur, J., Mogaji, E., Paliwal, M., Jha, S., Agarwal, S., & Mogaji, S. A. (2023). Consumer behavior in the metaverse. *Journal of Consumer Behaviour*. https://doi.org/10.1002/cb.2298

KPMG. (2023). Understanding the value of the metaverse [Raport]. KPMG International. https://assets.kpmg.com/content/dam/kpmg/au/pdf/2023/understanding-the-value-of-the-metaverse-tmt-report.pdf

Kumar V. (2024). Real-time analytics in immersive commerce. *International Journal of Research in Marketing*, 41(2): 201–218.

Kuznetsov, O., Frontoni, E., Kuznetsova, K., Smirnov, O., & Kostenko, V. (2025). Blockchain applications in metaverse environments: New horizons. In: A.L. Imoize, W. Montlouis, H.H. Song (Eds.) *Advanced Metaverse Wireless Communication Systems* (pp. 255—293). https://doi.org/10.1049/PBTE112E_ch10

Lechman, E. (2018). Born Poland, gone global: The case of successful Polish ICT company Aiton Caldwell. In. D. Purg, A. Sauka, T. Mets (Eds.) *Entrepreneurship in Central and Eastern Europe: Development through Internationalization (pp. 112—126).* Routledge. London. https://doi.org/10.4324/9781315392387

Levin D. (2024). Dynamic ad-serving in 3D environments. *Digital Advertising Quarterly*, 12(1): 45–59.

Lim, W. M., Bansal, S., Nangia, P., & Singh, S. (2024). The bright and dark side of metaverse marketing. Global Business and Organizational Excellence. https://doi.org/10.1002/joe.22271

Małkowska-Szozda, A. (2025.06.28). "JBB Bałdyga Cup feat. Fortnite!" to kolejna odsłona gamingowej współpracy mark. https://www.press.pl/tresc/73901,_jbb-baldyga-cup-feat_-fortnite_----to--kolejna-odslona-gamingowej-wspolpracy-marki

Mansoor M., Rahman T., & Chen L. (2024). Virtual product launches: Best practices. *Journal of Marketing Management*, 40(5-6): 485–506.

Maspex. (2025.06.28). WSKAKUJ DO WATERRRLAND I ZGARNIAJ NAGRODY!. https://maspex.com/aktualnosci/wskakuj-do-waterrrland-i-zgarniaj-nagrody/

Mastercard Advisors. (2023). Poland meets Metaverse: Exploring the future of living and banking in a virtual world. https://www.mastercard.pl/content/dam/public/mastercardcom/eu/pl/pl/Biznes/MCA_Poland_meets_metaverse_vPublic.pdf

Mizerska, D. (2025.06.28). Biedronka otwiera wirtualny sklep na Robloxie. https://nowymarketing.pl/biedronka-otwiera-wirtualny-sklep-na-robloxie/

Mvondo, G.F.N. (2025) Why immersive experiences fall short: Exploring public resistance to metaverse adoption. *Technology in Society, 83, art. no. 102961*. https://doi.org/10.1016/j.techsoc.2025.102961

Payal R., & Dwivedi Y. K. (2024). Brand engagement antecedents in immersive worlds. *Electronic Commerce Research and Applications*, 65: 101381.

PwC. (2023). Demystifying the metaverse: Beyond the hype—six trends businesses can expect in 2023 [Raport]. PwC. https://www.pwc.com/us/en/tech-effect/emerging-tech/demystifying-the-metaverse.html

Rane, N., Choudhary, S., & Rane, J. (2023). Metaverse Marketing Strategies: Enhancing Customer Experience and Analysing Consumer Behaviour Through Leading-edge Metaverse Technologies, Platforms, and Models. Social Science Research Network. https://doi.org/10.2139/ssrn.4624199

Rathore, B. (2018). Metaverse Marketing: Novel Challenges, Opportunities, and Strategic Approaches. https://doi.org/10.56614/eiprmj.v7i2y18.344

Ryu, E. (2023). A Study on Hadong-gun City Brand Vitalization Plan Using Metaverse Platform: Focused on Hahadong Tea. *Association for International Tea Culture*, *60*, 23–54. https://doi.org/10.21483/qwoaud.60..202306.23

Santander Consumer Bank. (2022). Polaków portfel własny: Polacy na e-zakupach 2022.
https://www.santanderconsumer.pl/gfx/santander/userfiles/_public/20221220_raport_ppw_ecommerce_v1.pdf

Sathish, K., & Arun, M. (2024). A study on Rewriting and Redefining the Aspects of Marketing with Metaverse—A Brief Insight. South Asian Journal of Engineering and Technology, 14(4), 50–59. https://doi.org/10.26524/sajet.2024.14.19

Unknow 1. (2025.06.28). Pekao wprowadza nowości w grze Money Tycoon w Fortnite. https://media.pekao.com.pl/pr/848742/pekao-wprowadza-nowosci-w-grze-money-tycoon-w-fortnite

Unknow 2. (2025.06.28). Bank Pekao S.A. wkracza do metaverse. Gramy w Fortnite Money Tycoon. *Nowy marketing*, https://nowymarketing.pl/bank-pekao-s-a-wkracza-do-metaverse-gramy-w-fortnite-money-tycoon/

Unknow 3. (2025.06.28). Alior Bank z dedykowaną mapą w Fortnite na Royale Festival, https://aboutmarketing.pl/alior-bank-z-dedykowana-mapa-w-fortnite-na-royale-festival/

Unknow 4, (2025.06.28). Alior Bank x Gaming x Cosplay, https://www.aliorbank.pl/dodatkowe-informacje/informacje/alior-bank-gaming-cosplay.html

Unknow 5. (2025.06.28). Żabka wkracza do świata Fortnite, https://zabka-group.com/pl/zabka-wkracza-do-swiata-fortnite/

Wardziak, P. (2025.06.28). Edukacja finansowa, strategia i rywalizacja—teraz można zagrać na mapie PKO Banku Polskiego stworzonej w Fortnite. https://media.pkobp.pl/386098-edukacja-finansowa-strategia-i-rywalizacja-teraz-mozna-zagrac-na-mapie-pko-banku-polskiego-stworzonej-w-fortnite

Wiechetek, Ł., & Gola, A. (2025) Development of Polish ICT sector: Education, governmental policy, employment and future trends. In: E. Bukalska, T. Kijek, B.S. Sergi (Eds.) *Modeling Economic Growth in Contemporary Poland* (pp. 221—233). Emerald Publishing Limited. https://doi.org/10.1108/978-1-83753-654-220231017

Yadav, M., Bandyopadhyay, S., & Kumar, S. (2024). Virtual influencers in marketing: The next frontier. *International Journal of Advertising*, 43(1): 1–21.

Zakarneh, B., Annamalai, N., Alquqa, E.K., Mohamed, K.M. & Al Salhi, N.R. (2024) Virtual Reality and Alternate Realities in Neal Stephenson's "Snow Crash". *World Journal of English Language*, 14 (2), 244—252. https://doi.org/10.5430/wjel.v14n2p244

Zandi, A. (2024). Gamification in Retail: Enhancing Grocery Customer Experience with Location-Based Strategies. *International Journal of Serious Games, 11(2), 43-63. https://doi.org/10.17083/ijsg.v11i2.721*

Zanger, V., Meissner, M., & Rauschnabel, P. A. (2022). Beyond the gimmick: How affective responses drive brand attitudes and intentions in augmented reality marketing. Psychology & Marketing, 39(7), 1285–1301. https://doi.org/10.1002/mar.21641

Związek Cyfrowa Polska & Komitet ds. Metawersum. (2024). Nowa era cyfrowego rozwoju: Metawersum dla Polski. https://cyfrowapolska.org/wp-content/uploads/2024/05/raport-o-metawersum_PL.pdf

Związek Pracodawców Branży Internetowej. (2025.06.28). Miasto ING w Roblox. https://mixx-awards.pl/casebook-2022/consumer-experience/miasto-ing-w-roblox/

Beyond Entertainment:
Academic Approaches to Gamedev Industry
ISBN 978-83-969444-4-3, AVANT Anthologies

Design and Mechanical Challenges of Adapting the Tower Defense Genre Into 3d—A Case Study of the "Orcs Must Die!" Video Game Franchise

Hubert Tokar
DSW University of Lower Silesia, Wrocław, Poland
hubert.tokar@dsw.edu.pl

Received 2025-07-14; accepted 2025-12-18; published Online First 2025-12-30.

Abstract

Orcs Must Die! (Robot Entertainment, 2011–2025) Franchise presents interesting solutions to design challenges in combining the Tower Defense game genre, which traditionally uses a top-down perspective and long and short-term management of resources and defenses, with a 3rd person control scheme and a focus on individual interactions with enemies. This paper outlines mechanics and design principles core to the Tower Defense genre, and examines their modified and unaltered forms that exist in the *Orcs Must Die!* Games. These mechanics will be then compared to other similar games, as well as more traditional Tower Defense games. Critical examination of these design decisions is crucial in empowering game developers with useful insides into mixing genres, especially when making similar games.

Keywords: Tower Defense game, game design, video game mechanics, Robot Entertainment, Orcs Must Die!

1. Introduction

Within genres in video games, gamers learn to expect certain gameplay elements and conventions (Vahlo, J., 2018). These expectations inform choices made in the production of new titles, for which increasingly specialised audiences of gamers and academics tend to reach and discuss (Santos et al., 2019; Howell, 2016), especially when the similarity to other titles in that genre is often

explicitly advertised. The apetite for an increasingly novel or mechanicaly complex experience then drives developers to make use of elements outside of known conventions, paving the way towards new genres (Clearwater, 2011; Alexander et al., 2013), pushing the evolution of the established (Apperley, Thomas, 2006) or further categorizing genres emergent from such study (Arsenault, 2009), then looping all the way back to expectation formation (Clarke et al., 2015). With that recursive relation, it is no wonder that video game genre evolution is widely recognised (Arsenault, 2009). The concept of genre itself often lacks a clear definition or constraints (Arsenault, 2009; Clarke et al, 2015; Aarseth, 2004), so many authors propose arguments for its restructuring, either according to games' aesthetics, psychological effects, the ways they are controlled (Doherty et al., 2018), or proposing faci and facets based approaches (Lee et al., 2014). Having acknowledged that complexity, for the purpose of this article and in regards to the *Tower Defense* genre, specific gameplay elements outlined in articles (Asfarian et. al., 2019; Avery et. al., 2011; Leong et. al., 2013) and by video game related outlets (MobyGames, Steam) will be chosen as demonstrative. These gameplay elements include the defense of a territory or possesions from enemies, which usually come in waves, and construction of obstructions along the path of attack to impede their approach (Asfarian et. al., 2019; Avery et. al., 2011; Leong et. al., 2013). Most of these games use some form of a top-down 2D perspective—out of 742 games listed by video game database MobyGames in June 2025, more than 678 use it (adding Fixed Screen, Diagonal-Down, Top-Down, Side-view and 2D-Scrolling tags together in the Tower Defense genre search on MobyGames and subtracting titles tagged by two or more of these to exclude doubles from the final result). The subject of this article, however, uses a third-person perspective with third-person shooter mechanics. The purpose of this article is to investigate the gameplay implications of this choice, which introduces several design challenges in conveyance of gameplay elements, such as the need to relay state-of-the-game information to the player through means other than the user interface, as the focus of players is captured by a demanding moment-to-moment gameplay (Hernández-Sabaté et al., 2015). Comparisons to other games will be drawn, which is an established norm in writing on video games. As Clarke (2015) puts it, "the present utility of using games as their own symbolic language [...] eclipses even advanced genre labels because each token game name is often representative of several hours of firsthand experience" (p. 11).

2. Literature Overview

Tower defense is a sub-genre of strategy games that, according to video game database MobyGames, includes 742 titles as of writing of this article. According to Asfarian, "the tower defense genre is characterized by (1) the player build defensive towers to obstruct the enemies (or creeps) from reaching the player's base, (2) the enemies come in waves with increased difficulties, (3) by defeating

the enemies, the player will get resources corresponding to the difficulty of the enemy, that can be used to upgrade their towers, and (4) the tower can be bought, placed in the map, upgraded, and fire automatically on the enemy forces" (2019, p. 249). These characteristics are also outlined by Avery et al. (2011) and Leong et al. (2013), which both influenced Asfarian's characteristics. Tower Defense games seem to also be created for reasons outside of just providing entertainment—there are documented examples of bespoke titles created for the purpose of spreading health literacy during a pandemic (Sun et al., 2024) and as research tools for medical research (Brich et al., 2017), both of which focused mainly on the narrative aspects of a game in the context of serious games discussions and medical research respectively. Hernández-Sabaté et al. analyzes the utility of tower defense games in teaching mathematics (Hernández-Sabaté et al., 2015), while Liu et al. focus on technological application of specific game engine features in creating such games (Liu, et. al., 2019). These examples provide useful insights into design decisions made with information conveyance through gameplay or narrative in mind, especially when they seem to influence not just the human perception and experience, but also affect reinforcement learning research for artificial intelligence, specifficaly models trained to beat Tower Defense games (Bergdahl, et. al., 2024). This article is focused on the adaptation of specific gameplay elements necessitated by the change in player's perspective and navigation. Analysis of gameplay elements is informed by Schell's game design lenses (Schell, 2008), which outline numerous perspectives for game design process, and Ibrahim's exploration of state-of-play information conveyance in 3D games (Ibrahim et al., 2023), which focuses on level design features in competitive games. Framework of ludic knowledge put forward by Howell (2016) will be referenced, as the idea of "adapting" certain gameplay elements, which players and designers might be aware of through other games, overlaps heavily with the concept of transludic knowledge, which Howell defines as "knowledge relating to multiple other games that an individual may have played in the past" (p. 1).

3. Methodology

The ways in which gameplay elements are altered in the *Orcs Must Die!* (2011–2025) games will be analysed in comparison to how they appear in other games in the tower defense sub-genre. These games include *Sanctum* (2011), *Sanctum 2* (2013) *Bloons Tower Defense 6* (2018), *Infinitode 2* (2019), *Diplomacy is Not an Option* (2022), *Thronefall* (2023), *Emberward* (Steam Early Access, 2024). The *Orcs Must Die!* games will be considered as a whole, as most gameplay elements discussed appear in all titles unless specified otherwise. A "baseline" of how certain gameplay elements appear will be established by comparing them to similar elements in other titles in the sub-genre (Goddard and Muscat, 2017), while their adapted versions are considered with the alteration to the player camera perspective in mind. As established before, the 3D perspective that

these titles use is not the norm in the genre. This choice introduces many interesting design obstacles which the *Orcs Must Die!* Series, in my opinion, solves in a manner that warrants interrogation, so that the games' boldests decisions won't go unnoticed. Much weight will be placed on the Tower Defense genre conventions when considering gameplay elements in the series, which, I hope, will not be interpreted as a sugestion that the creative decisions were ready-made from the start as a mere byproduct of its genre constraints. The concept of the genre is used only as a taxonomical tool for discussion about players' pre-play expectations and post-play reflections (Howell et al., 2014), as well as a frame of reference for how the "baseline" gameplay element can be conjured in the first place.

4. Complexity in Strategy Games

A two-dimensional top-down view of the play area in strategy games grants the player easy access to information about the current state of the game (Donaldson, 2017). It allows the player to plan and execute strategies, and then constantly monitor the effectiveness of their approach (Donaldson, 2017). Games like those in the *Bloons Tower Defense* franchise, as well as *Emberward* and *Plants vs. Zombies* go so far as to fit the entirety of the game area on a single screen. Additionally, the player does not directly control a player character—their focus is directed exclusively on the placement of obstacles and managing in-game economy (Hernández-Sabaté et al., 2015; Alexander et al., 2013; Tekinbas and Zimmerman, 2003), which is usually assisted by the user interface containing relevant information on the current state of the game, such as the amount of money accumulated, remaining lives or what obstacles the player can create. These obstacles, usually referred to as *towers*, either directly damage the enemy, or restrict enemy movement. Some obstacles can be placed directly on the way of attackers, restricting their movement and facilitating the creation of long mazes, which the enemies navigate with added difficulty (Bergdahl, et. al., 2024). For example, in *Emberward*, the player is given access to building blocks, which, when placed on the path of the enemy, extend the way towards the player's base, affording more time for the towers to stop them.

On the other hand, *Thronefall* and *Mindustry* do have a player character on which the top-down camera is always focused, and in both of these titles the player character may be killed by approaching enemies, which adds moment-to-moment challenge to the purely strategy oriented gameplay. The King in *Thronefall* is frail by default, but capable of drawing aggresion, which enables a skillfull player to underinvest in their defenses by manipulating the pursuants into fruitless chases as they are gradually worn down by towers or friendly units.

Some games allow for additional ways of generating income for the in-game economy, such as Banana Farms in *Bloons Tower Defense* series, the Bounty Modifier in *Infinitode 2*, or windmills, goldmines and houses in *Thronefall*. These options do not stop the enemies from reaching the base, but conditionally generate wealth used to further enhance defences, making them a good, but risky investment, as the defenses are immediately underfunded. Using these methods might prove necessaryt, as usually costs of upgrading defences scale exponentially, which increases the feeling of skill progression (Tekinbas and Zimmerman, 2003). Usually, investing in these upgrades is crucial for survival, but involves taking additional risk, when saving up money requires defenses to be weakened in the short term. The cost of upgrading a tower in Infinitode 2 ranges from 20 coins for the first upgrade on a basic tower up to 1770 for the last. Such challenges require complex strategising, and create room for expert players to express their skills (Donaldson, 2017).

5. Third-Person Perspective and Conveyance

All of the gameplay elements intoduced above are built on the assumption that the player understands the state-of-the-play at any moment on the entire play area. The changed perspective from a top-down view to a third-person perspective in *Orcs Must Die!* introduces challenges in this regard. The player is no longer able to focus their attention purely on managing resources and defences comfortably from a bird's eye view—they get up and personal with the enemy while having to consistently aim, shoot and navigate the three-dimensional map. This change in player's perspective and player navigation require certain gameplay element changes to be implemented, as shooting and navigating in the third-person control scheme pulls more players' attention (Hernández-Sabaté et al., 2015). These kinds of alterations will be referred to as adaptations. It is a concept closely related to evolution (Apperley, Howard, 2006; Arsenault, 2009; Clearwater, 2011), but refers to when the implied motivation behind a change to one system is caused or forced by changes to another, such as, in this case, a change in perspective necessites either implementing additional ways of informing the player about the state of the map, or diminishing the importance of having that information.

One such change was made to better accomodate player built obstacles. Towers are replaced by traps, which can be placed on the floors, walls and ceilings in a grid. These traps spring to action as enemies walk into their range, which improves the conveyance of their effectiveness, as the player will often already be looking at them as they are activated. The changes made to a traditional upgrade system also happen to work great with the 3D perspective. All trap upgrades are only a part of meta progression, which is to say that advances happen outside the scope of level playthroughs, and apply to all subsequent sessions (Donaldson, 2017; Tekinbas and Zimmerman, 2003; Vahlo, J., 2018).

They are purchased with currency earned after each level, which removes the need to constantly evaluate the cost effectiveness of any particular upgrade. Since the traps do not upgrade during a playthrough, the effectiveness of players' defenses scales laterally instead; relying on a single, yet powerful trap is not possible, so they become a part of sets of traps, to which the game refers to as *killboxes*. Utilizing walls and low celings, powerful killboxes can be created, and their composition leaves space for player's expression of skill, as they can be arranged freely (Vahlo, J., 2018), which better visualise the deadly potential of the killboxes, which start to look more visually intimidating than a single fully upgraded tower might. To better facilitate the creation of such killboxes, the player might benefit from making use of additional ways of generating income, which, while sparse throughout the series, still include some interesting design choices in how they are implemented. *Orcs Must Die! 1*, *2* and *Unchained* include a Coinforge—a trap that takes up a 3x3 square of floor space and generates additional coins whenever enemies die on it. It does not hurt the orcs in any way and takes up valuable space, but in return reward skillful play by doubling the reward for anything killed there. *Orcs Must Die!: Unchained* also included a Power Generator, which is a wall trap that generates a limited amount of coins whenever enemies walk past it, and *Orcs Must Die! 2* has the Scavenger trinket, which causes all enemies to randomly drop coins upon dying. All of these methods take physical space in player's view, which helps them feel more impactful upon interaction.

Another way of passing information to the player is through audio. Conveyance through sound cues is present for whenever enemies cross specific checkpoints on the map—an event, which would otherwise be easy to miss. Certain types of enemies, such as flying enemies, hunters and sappers, emit characteristic sound cues whenever they enter the map or are slain. Directional sound is used throughout the series, which improves the player's awareness of the current state of currently fought enemy wave (Holloway et al., 2011; Ng and Nesbitt, 2013). Orcs also chatter amongs themselves, and as they make it past the player, that chatter will be increasilngly heard from the back. As the enemies reach their goal (the rift), a loud alarm sound is played and the number of remaining health points (rift points) positioned on top of the screen expands briefly to pull the player's attention (Ibrahim et al., 2023). That attention to sound design aids player's awareness greatly which vastly improves the game feel and the feeling of being in control of what's happening.

6. Map Design and Player Awareness

All playable levels in the *Orcs Must Die!* series are laid out on a grid, onto which traps are placed. These levels include geometry optimal for staging defenses, where the best spots have low hanging ceilings, walls on two sides and an un-

obstructed floor. In these spots, bottlenecks for enemy movement can be created easily and affordably. Player can place barricades, which make a spot on the map impassable to enemies and can be used for creating winding paths, as well as cutting off certain passages entirely. When placed strategically, barricades can increase value of other traps placed nearby—since multiple enemies can be struck by a single activation of a trap, forcing them to walk in a line allows for better utilisation of them, as more will be affected with each activation. This aspect of the design of traps is often seen in other Tower Defense games. In *Bloons Tower Defense 6* each tower (monkey) throws projectiles at enemies (bloons). A thrown projectile will not necessarily expire after popping a single bloon—it may also potentialy strike targets behind, if such projectile has enough pierce, which make areas of the map with long straight paths especially valuable for tower placement. Here though, instead of creating spots especially valuable for a single trap, this gameplay element is adapted to include an entire set of them into concideration.

Map turns and corners represent highly valuable spots, as they require very few barricades to force enemies into a single file march. These turns are often sorrounded by walls, on which wall traps can be placed. Such map utilisation is not uncomon in other games. In *Diplomacy is not an option*, mountain ranges and resource piles are strategically placed on a map, such that staging defense around them becomes more efficient. Mountains cannot be destroyed or passed by units, so building walls around them serves triple purpose, as less walls need to be built, manned, and maintained. The prohibitively high cost of barricades in *Orcs Must Die!* encourages the player to find spots on the map with pre-existing geometry to connect to. Stage hazards are also present, which pose danger both to the player character, as well as to enemies thrown into them. These hazards include bottomless pits, bodies of water and comically large meat grinders, all of which can be used to dispatch enemies, which encourages staging defences around them.

Many levels include multiple entry points and exits, which need to be managed at the same time. This gameplay element is especially challenging, as it requires a level of multitasking and map awareness as well as skillfull moment-to-moment interactions, which introduces similar challenges to many MOBA (Multiplayer Online Battle Arena) games, as they often also make use of this combined complexity in design (Donaldson, 2017). If a wave of enemies is not dispatched swiftly at one entry, the player will not be able to run to the second one in time. This challenge can be circumvented in multiple ways—either by overinvesting in the defenses near one exit and managing the defense of the other with the player character, or by routing enemies through a single area, which is not always possible. Such routing dilema can also be seen in *Tower Dominion*, in which player builds out the map themselves by placing randomly assigned routes, turns and splits further out of their base. Through clever utilisation of these routes (and a bit of luck), a single bottleneck can be created and more

easily defended. Creating such bottlenecks for the enemies creates a multiplicative advantage to players' defences and mitigates strategical challenge in managing multiple pathways at once.

7. Different Hammers, Different Nails

Different kinds of enemies necessitate diverse approaches, which in turn justify a wide arsenal of options available to the player. Both are intertwined, thus will be discussed in pairs, starting with the "regular" enemies—plain looking, following simple patterns and usually not difficult to dispatch. The core enjoyment found in *Orcs Must Die!* series is found in setting up combinations and exploding orcs mid-air. The most often recipients of such treatments are the light, medium and heavy orcs, which differ only by the amount of damage that is needed to take them down. As most enemies, they walk towards the rifts in the shortest path possible, and will only attempt to destroy barricades if all paths are blocked. They are also especially vulnerable to physics traps, which knock enemies up, back or all around. This makes them a solid stalling option and opening the floor to synergies with other types of traps, most notably physical, which consist of saws, spikes, arrows, maces, crushers and other straighforwardly painful instruments that deal massively increased damage to airborne enemies. Defences are best utilised while working together and supporting each other. A catapult in *Dyplomacy is not an option* can decimate whole packs of enemies with ease, especially when they are held in place, engaged in combat with knights and cavalry. A tack shooter in *Bloons Tower Defense 6* sprays nails in all directions, making short work of crowds of bloons, but becomes especially lethal when placed close to an alchemist, who can increase the damage of each individual nail. These synergies create multiplicative advantages that expert players can take advantage of. A similar interaction can be seen with freezing traps, as frozen enemies will also take massively increased damage from physical traps. Freezing is especially dangerous towards flying enemies, which are a part of all entries in *Orcs Must Die!* series since the second one. As their type name suggests, they fly above most floor and wall traps and cannot be stopped by barricades, but when frozen, will fall to the ground and shatter instantly. Acid damage, similarly to freezing, multiplies damage done by other physical sources, as well as apply damage over time.

Heavy enemies include ogres and trolls. With increased health pools and invulnerability to being thrown by most physics traps, most of the player's attention will be turned towards them. *Orcs Must Die! 3* and *Unchained* include arcane traps, which are especially effective against massive health pools, as multiple instances of arcane damage deal multiplicatively more damage. Ogres in *Thronefall* fill a similiar role—bulky, heavy hitting, somewhat easy to outsmart, but still take a lot of time and attention. Armored trolls and ogres in *Orcs Must Die!* are even more dangerous, as their health pools can get ridiculous. Arcane

damage is still effective against them, although the game encourages players to use electric traps, which ignore enemies' armored perks and cause them to explode, dealing damage to all around. Fast enemies, which include cobolds, are killed easily, but often run fast enough that they can outrun timers on some traps, leaving their area of damage before they spring to action. Fire is especially effective against them, as most fire traps fire continuously and apply a damage over time effect, making them most effective when placed near the entry.

Such synergies, I would argue, are the most important gameplay element of Tower Defense games. They facilitate the most space for players' skill expression out of all included elements, but also encourage moments of brilliance and discovery among casual playerbase, who might discover these interactions unexpectedly during regular gameplay (Vahlo, J., 2018). Countering designs, where certain enemy types are especially susceptible to specific types of defenses, have always been a staple of the genre, and the visual distinctiveness, as well as the use of verbal callouts by the announcer for certain types, make up for players limited perspective and succesfully adapt this aspect into the 3D control scheme of the series.

8. Discussion

In this article several gameplay elements were isolated and discussed in comparison to their counterparts in other games of the same sub-genre for the purpose of identyfing changes in their design necessitated by the change in player's perspective through multiple game studies lenses. Adaptations of many gameplay elements characteristic of the tower defense sub-genre, such as towers/traps, enemy variety, enemy routing and manipulating enemy aggression have been isolated and analysed. While using other games and genre conventions themselves as lenses of analysis is an established way of structuring a discussion, it is, arguably, affording undue credit to influences that game designers might not have even been aware of. To that point, the intention of this article is not to presume causality or inevitability of certain game design decisions, only to view them as solid answers to questions emergent from other design decisions. Another limitation of the perspective taken in this article is the presumption of causality with certain gameplay decisions. Such causality cannot be proven, unless with a written confession by the game designer, but it is also not necessary.

9. Conclusion

The perspective outlined in this article is a useful tool for experimentation with established genre conventions for future games, as well as a viable perspective through which genre evolution could be viewed in game design discourse. The

argument goes that viewing certain gameplay elements as adapted to other elements in the title in question allows a critical examination of these changes, which might provide useful observations for broader analysis of both the gameplay element itself, or the design structured around it. As a follow up to this article, analogous discussions on other genre-defying gameplay elements could follow, using the outlined methodology.

References

Aarseth, E. (2004). Genre Trouble. *Electronic Book Review.* Retrieved at https://electronicbookreview.com/publications/genre-trouble/, 01.06.2025

Alexander, J. T., Sear, J., Oikonomou, A. (2013). An investigation of the effects of game difficulty on player enjoyment. *Entertainment Computing* 4, 53-62. Retrieved at https://www.sciencedirect.com/science/article/abs/pii/S1875952112000134, 29.05.2025

Apperley, D., Thomas H. (2006). Genre and Game Studies: Toward a Critical Approach to Video Game Genres. *Simulation & Gaming* 37 (1): 6–23.

Arsenault, D. (2009). Video Game Genre, Evolution and Innovation. *Eludamos. Journal for Computer Game Culture* 3, 2. p. 149-176. Retrieved at https://www.researchgate.net/publication/288970477_Video_Game_Genre_Evolution_and_Innovation, 01.06.2025

Asfarian, A., Ramadhan, W., Putra, W. A., Raharjanto, G. M., Frisky, R. (2019). Creating a circular tower defense game: development and game experience measurement of orbital defense X. *Kinetik: Game Technology, Information System, Computer Network, Computing, Electronics, and Control* 4, 3, p. 249—258. Retrieved at https://www.researchgate.net/publication/334780971_Creating_a_Circular_Tower_Defense_Game_Development_and_Game_Experience_Measurement_of_Orbital_Defense_X, 31.05.2025

Bergdahl, J., Sestini, A., Gisslén, L. (2024). Reinforcement Learning for High-Level Strategic Control in Tower Defense Games, *2024 IEEE Conference on Games (CoG)*, Milan, Italy, 2024, pp. 1-8, doi: 10.1109/CoG60054.2024.10645621. Retrieved at https://ieeexplore.ieee.org/abstract/document/10645621, 26.05.2025

Brich, J., Rogers, K., Frommel, J., Weidhaas, M., Brückner, A., Mirabile, S., Dorn, T., Riemer, V., Schrader, C., Weber, M. (2017). LiverDefense: how to employ a tower defense game as a customisable research tool. *The Visual Computer* 33, p. 429–442. https://doi.org/10.1007/s00371-016-1314-0. Retrieved at: https://link.springer.com/article/10.1007/s00371-016-1314-0#citeas, 01.06.2025

Clarke, R. I., Lee, J. H., Clark, N. (2015). Why Video Game Genres Fail: A Classificatory Analysis. Games and Culture 1, 21. Retrieved at https://journals.sagepub.com/doi/abs/10.1177/1555412015591900, 02.06.2025

Clearwater, D. (2011). What Defines Video Game Genre? Thinking about Genre Study after the Great Divide. *Loading...* 5, 8. p. 29—49. Retrieved at https://journals.sfu.ca/loading/index.php/loading/article/view/67, 02.06.2025

Doherty, S. M., Keebler, J. J., Davidson, S. S., Palmer, E. M., Frederick, C. M. (2018). Recategorization of Video Game Genres. *Proceedings of the Human Factors and Ergonomics Society 2018 Annual Meeting* 62, 1. p. 2099—2103. Retrieved at https://journals.sagepub.com/doi/10.1177/1541931218621473, 27.05.2025

Donaldson, S. (2017). Mechanics and Metagame: Exploring Binary Expertise in League of Legends. Games and Culture 12, 5. p. 426—444. Retrieved at https://journals.sagepub.com/doi/abs/10.1177/1555412015590063, 26.05.2025

Goddard, W., Muscat, A. (2017). Towards Genre as a Game Design Research Approach. *Proceedings of Digital Games Research Association 2017 Conference*. Retrieved at https://dl.digra.org/index.php/dl/article/view/924 , 01.06.2025

Hernández-Sabaté, A., Joanpere, M., Gorgorió, N., Albarracín, L. (2015). Mathematics learning opportunities when playing a Tower Defense Game. *International Journal of Serious Games* 2, 4. p. 57—71. Retrieved at https://www.researchgate.net/publication/286913995_Mathematics_learning_opportunities_when_playing_a_Tower_Defense_Game , 24.05.2025

Holloway, A., DeArmond, R., Francoeur, M., Seagal, D., Zuill, A., Kurniawan, S. (2011). Visualising Audio in a First-Person Shooter With Directional Sound Display. Retrieved at https://www.researchgate.net/publication/228754584_Visualizing_Audio_in_a_First-Person_Shooter_With_Directional_Sound_Display, 02.06.2025

Howell, P., Stevens, B., & Eyles, M. (2014). Disrupting the Player's Schematised Knowledge of Game Components. *DiGRA 2014 Conference: <Verb that ends in 'ing'> the <noun> of Game <plural noun>.*

Howell, P. (2016). A Theoretical Framework of Ludic Knowledge: A Case Study in Disruption and Cognitive Engagement. *The Philosophy of Computer Games Conference*.

Ibrahim, A., Novela, A. X. A. (2023). Information Conveyance: An Examination of Using Level Design to Communicating the State of Play in a Competitive Video Game. *Blekinge Tekniska Högskola, Department of technology and aesthetics.* Retrieved at https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1777675&dswid=9888, 26.05.2025

Lee, J. H., Karlova, N., Clarke, R. I., Thornton, K., Perti, A. (2014). Facet Analysis of Video Game Genres. *iConference 2014 Proceedings*. Retrieved at https://www.researchgate.net/publication/266629200_Facet_Analysis_of_Video_Game_Genres, 26.05.2025

Liu, S., Chaoran, L., Yue, L., Heng, Ma., Xiao, H., Yiming, S., Licong, W., Ze, C., Xianghao, G., Hengtong, L., Yu, D., Qinting, T. (2019). Automatic generation of tower defense levels using PCG. *Foundations of Digital Games '19: The Fourteenth International Conference on the Foundations of Digital Games*, No.: 10, p. 1—9, https://doi.org/10.1145/3337722.3337723. Retrieved from: https://dl.acm-.org/doi/abs/10.1145/3337722.3337723, 01.06.2025

Ng, P., Nesbitt, K. (2013). Informative sound design in video games. *IE '13: Proceedings of The 9th Australasian Conference on Interactive Entertainment: Matters of Life and Death* 9, p. 1-9. Retrieved at https://dl.acm.org/doi/abs/10.1145/2513-002.2513015, 28.05.2025

Santos, T., Lemmerich, F., Strohmaier, M., Helic, D. (2019). What's in a Review: Discrepancies Between Expert and Amateur Reviews of Video Games on Metacritic. *Proceedings of the ACM on Human-Computer Interaction* 3, 140. Retrieved at https://dl.acm.org/doi/10.1145/3359242, 02.06.2025

Sun, X., Li, T., Miao, K., Zhang, M., Ren, X. (2025). InfecBlock: Investigating the Effects of a Tower-Defense Serious Game for Increasing Epidemic-Related Health Literacy. *International Journal of Human-Computer Interaction* 41, 10. Retrieved at https://www.tandfonline.com/doi/full/10.1080/10447318.2024.2375694, 02.06.-2025

Schell, J. (2008). The Art of Game Design: A Book of Lenses. Morgan Kaufmann Publishers.

Tekinbas, K. S., Zimmerman, E. (2003). Rules of Play: Game Design Fundamentals, The MIT Press, 2004.

Vahlo, J. (2018). In Gameplay—The Invariant Structures and Varieties of the Video Game Gameplay Experience. *University of Turku Faculty of Humanities.* Retrieved from: https://www.researchgate.net/publication/324390859_In_Gameplay_The_Invariant_Structures_and_Varieties_of_the_Video_Game_Gameplay_Experience, 01.06.2025.

Hubert Tokar is a 3D Animator born in Krotoszyn on the 3rd of November 1999. He finished Creative Media studies at the University of Lower Silesia DSW in 2023, where he teaches subjects related to 3D graphics, animation and rendering. His hobbies include running, swimming and biking, as well as media analysis, gaming and collecting pretty books.