P/REFERENCES OF DESIGN

(DE)COLONIZING OUTER SPACE: SPECULATIVE FRONTIERS OF OUTER SPACE EXPLORATION IN VIDEO GAMES.

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ABSTRACT | The narratives around the new frontiers of space exploration promise a future in which humans could become a multi-planetary species that will benefit from the exploitation of extraplanetary resources. Economic opportunities are driving large private investments in the space industry, assuming the role that once was of public institutions in the development of technologies for space exploration and raising concern around legal, ethical and sustainability issues. In this paper video games are interpreted as speculative media that can blend boundaries between the fictional and the actual. Science fiction video games are analyzed as media artifacts that are both representative of neoliberal and colonialist approaches to outer space exploration but, in virtue of their speculative potential, can also promote critical and alternative perspectives. The concepts that allow us to situate games, game worlds, and game mechanics in the context of anticipatory and critical design practices are discussed. It is argued that the acknowledgement and adoption of concepts, ideas, methodologies, approaches, and practices that can resonate both in design and game cultures addresses the need to confront the complexity of contemporary challenges, of which space exploration is a paradigmatic example, from multiple perspectives.

1. Introduction: Trajectories and Narratives of the Space Economy

On February 6, 2018, at 15.45 EST, the Falcon Heavy FH-001 was launched from Launch Complex 29A at Kennedy Space Center in Florida (Uri, 2023). The launch, like the other SpaceX missions, is live streamed, offering the audience an informative yet entertaining overview of all the salient characteristics of the new rocket being tested. In fact, the Falcon Heavy is one of the most powerful super heavy-lift launch vehicles ever built, capable of delivering nearly 64 metric tons to low Earth orbit (SpaceX, 2021). SpaceX's Falcon Heavy and the Starship, which is currently under development, address the growing market demand for reliable and cost-effective launchers capable of carrying materials, satellites, and humans to orbit. It has been estimated that the satellite payload market size will reach 24.51 billion USD by 2029 (Satellite Payload Market Size Report, 2024), demonstrating private interest in the commercial opportunities of the space economy. During the streaming, every stage of the startup sequence that is successfully completed is cheered by the crowd of SpaceX engineers attending the launch from the mission control room. The broadcasting conveys the excitement and the tension of the moment. During the minutes leading to the launch, the mission profile is presented in detail by representatives of the company's departments. Finally, when the countdown reaches zero, the Falcon Heavy rocket successfully lifts off from the launch pad with a deep, powerful roar. The crowd cheers and shouts loudly with joy. Cameras alternate views from the ground and from the rocket itself, offering dramatic perspectives of the rocket lifting from Earth. After reaching an altitude of 60 km, 2 minutes, and 38 seconds into the flight, the side busters shut down and separated from the main rocket. They will successfully perform a choreographic synchronous vertical landing on Landing Zone 1 and 2 in the famous Cape Canaveral Space Force Station. A few seconds later, the central core engine is turned off and dethatched from the upper stage of the rocket that contains the payload. Cheers of celebration. The onboard camera shows the upper stage's engine glowing while the Earth profile moves in the background. After 3 minutes and 45 seconds of flight, the crowd's cheering and the mission control audio is suddenly drowned out by the sound of an electric guitar and by the lyrics of David Bowie's song *Life of Mars*. The camera is now framing Starman, an astronaut mannequin comfortably and boldly sitting at the wheel of Elon Musk's own red Tesla Roadster mounted on a support system inside of the upper stage fairing, the protective shell that contains the material to be shipped to orbit. The fairing is finally deployed, revealing a spectacular view of Starman riding his supercar into the universe with the Earth in the background.

In the described mission, Musk's Tesla has been used as a dummy payload, a nonfunctional mass that simulates the loading capacity of a spacecraft during test launches. Dummy payloads are used to evaluate the spacecraft's behavior when loaded with material's, equipment's, and crew's weight. Dummy payloads are generally used during test flights since the high chance of failures. Although any object with comparable size and weight would have effectively served as a dummy payload, using a Tesla Roadster offered an unprecedented marketing opportunity for both Elon Musk's companies, SpaceX and Tesla.

The new frontiers of space exploration promise a future in which humans could become a multi-planetary species that will benefit from exploiting extraplanetary resources. This vision and the economic opportunities it prospects are driving large private capital investments in the space industry, assuming the role that once was of national institutions in the development of technologies for space exploration. The growth of private capital flows in such a strategic industry is raising concerns around legal, ethical, and sustainability issues (Iliopoulos & Esteban, 2020). The dramatization of outer space operations offers a spectacle of private companies' technological achievements underplaying the complex issues of power and control that derive from the private ownership of such technologies. Moreover, such a spectacle contributes to the construction of the contemporary narrative about human space endeavor that shows to gather impulse from neo-colonialism modes of approaching space exploration (Mitchell et al., 2020). A narrative that exposes the utilitarian and neoliberal perspective of private interest in developing human access to outer space.

Together with the cinematic commercials of private companies, contemporary media artifacts concur to the construction of the space culture narrative, both dramatizing the real events of past and contemporary

space exploration and using fiction to project the future speculative frontiers of space travel. Considering works of fiction, in fact, the conquest of space colonies, the visions of space tourism, and the story of intergalactic wars for resources and territory control are widely depicted in numerous sci-fi novels, movies, and video games. Science fiction novels have largely contributed to inspire scientists and engineers in the development of new technologies. The influence of science fiction novels on real-world space artifacts has been discussed in the analysis of the design for future space habitats (Ceylan, 2018, 2022), new technologies and interfaces (Figueiredo et al., 2015; Kendrick, 2002), and new forms of outer space commercial travels (Ceuterick & Johnson, 2019).

In this context, however, alternative and diverse ways of approaching space exploration are being discussed to challenge the dominant spaceflight culture and narrative to acknowledge diverse and underrepresented perspectives (Schwartz et al., 2023). Fictional representations of space exploration, and science fiction in particular, play a significant role in the diffusion of space culture and shaping people's opinions on emerging technologies. Isaac Asimov, considered one of the seminal authors of the genre, considers science fiction novels a form of response to the transformations happening in technology and society (Asimov, 1982). From a critical design point of view, the analysis of future-oriented narrative artifacts offers the opportunity to reflect on emerging attitudes toward technological and cultural transformations. In particular, examining contemporary science fiction media, it can be observed which political and economic values are emerging as drivers that motivate the future human presence outside Earth's boundaries. This paper discusses how video games, and science fiction video games in particular, can be understood as interactive forms of design fiction that speculate on the future of outer space exploration. It is argued that, despite the dominance of a neo-colonialist and exploitative rhetoric, video games can advocate for a critical perspective on the future of human space presence in outer space that is driven by values alternative to that of neoliberal capitalism. Play is a form of expression of ideas and values, a creative form of production, and not a mere form of consumption (Sicart, 2014). A critical perspective towards future scenarios can be developed through the experience of play, and video games solicit such an attitude through the distinctive qualities of the medium that will be discussed in the next paragraphs.

1.1 Methodology

The introduction of this paper reports a specific SpaceX's mission streaming as a representative example of the current dominant narrative on human endeavor for outer space exploration. Being a highly experimental field, it requires powerful and evocative depictions to drive investors' interest to the space economy. Such representations not only serve this purpose but also shape the dominant narrative on space exploration in Western countries. This paper aims to analyze science fiction video games as media artifacts that are both representative of neoliberal and colonialist approaches to outer space exploration but, in virtue of their speculative potential, can also promote critical and alternative perspectives. For doing so, literature on games and play has been reviewed to bring out the concepts that allows to situate games, game worlds, and game mechanics in the context of anticipatory and critical design practices. The identified defining ideas of speculative design are confronted with related concepts specific to the medium of video games. The discussion is presented in paragraph 2. It constitutes the theoretical premise that allows to observe science fiction video games as materialization of actual and future perspectives on outer space exploration, which is discussed in paragraph 3. Paragraph 4 uses two case studies to exemplify the ways video game can address science fiction scenarios without adopting narrative and visual clichés. The two games have been chosen as case studies to exemplify how both commercial and non-commercial games can offer alternative perspectives on the discussed topic of outer space exploration. Moreover, unlike the other games mentioned which are products developed by established game companies, the selected games are representative of two bottom-up design processes: a workshop activity and a thesis project that developed in a successful commercial product.

2. Video Games as Speculative Media

In contemporary technocultural society, the specificities of video games bear an "aesthetic potential which allows for speculation over the very structure of knowledge and contemporary technology" (Luersen & Paula, 2023). In this paper, video games are interpreted as speculative media that can blend boundaries between the fictional and the actual. Several scholars have addressed the multiple connections between video games and speculative practices, discussing how worldbuilding and diegetic elements intertwine with the mechanics of play themselves and the effect on player experience and critical reaction.

Games have reflected the cultural and ideological values of society since ancient times. Video games represent the interaction and the conflicts of social and technological transformations. They are both cultural objects (Dovey & Kennedy, 2006; Schrank, 2014), materialization of the commodity from (Celaschi, 2000) in the contemporary market exchange system (Jagoda, 2020), and products of a complex industrial system (Dyer-Witheford & De Peuter, 2009; Woodcock, 2019). Through the practice of appropriation and re-functionalization, ludic artifacts can suggest and invite critical reflections on social, ethical, and political issues. The manipulation of the game structures and affordances in avant-garde games (Schrank, 2014), the adoption of "radical" (Flanagan, 2009/2013) and critical (Grace, 2014) approaches to game design, and the appropriation and re-functionalization of the medium, such as in the case of machinima and game mods (Joseph DeLappe, 2018), are some of the methodologies and practices that have been adopted to address political and social issues through games.

As a medium, it can be argued that video games can be considered an interactive form of design fiction. Despite being commercial products (whereas design fiction and speculative artifacts generally are not), games are inherently speculative. The in-game decisions players are continuously faced with and the layering of slight interactions that add up during the gaming experience force a constant speculation on the possible outcomes of one's decision (Kunzelman, 2022). With a particular focus on science fiction games, Kunzelman describes the "mechanics of speculation" as the "ways that games specifically ask us to engage in speculative practices while playing them" (Kunzelman, 2022, p. 22). As presented by Kunzelman, those mechanics are specific to the medium and can produce several effects on the players, from Brechtian estrangement to the stage of the differences between the actual and the fictional world, between one ideology or the other. In design fiction, the narrative is functional to the representation, in the form of prototypes, of the transformed or alternate world (Sterling, 2013). In game worlds, mechanics can be considered narrative devices that produce real-time events and responses to player action (Dubbelman, 2016). Game mechanics determine the limits of the action and the type of affordances accessible in the game world but also activate mechanics of speculation within it.

Compared to linear media, games are defined by rules within a system in which players engage (Salen & Zimmerman, 2004). Such a system constitutes a possibility space that is discovered and interpreted by players through their performance (Squire, 2008). The frame of rules and objectives that regulates the game world combine with the possibility and the indeterminacy of play, characterizing video games as experimental artifacts (Jagoda, 2020). As argued by Jagoda, games are experimental both in formalist terms for their capability to model alternative forms of reality and for offering players a possibility space (Squire, 2008) where the uncertainty of play can encourage the emergence of difference and unpredicted outcomes. Games offer a space for experiencing an alternative vision of the world and exploring the dynamics of alternative control and power structures. In their book on fictional games, Gualeni and Fassone (2022) explore the role of fictional ludic artifacts that only exist in narrative worlds. Fictional games lack complete game rules or can function only through technological or magical elements that make them impossible to play in the real world. It can be argued that fictional games act as forms of diegetic prototypes (Kirby, 2010), that are contextualized as real functioning (playable) artifacts within the narrative. They emerge as the materialization of social and cultural values or, by contrast, as ludic forms of reaction to the established dominant powers. In fact, fictional games can act as transformative tools, questioning the socio-political environment depicted in the fictional world and becoming utopian tools. They can transform, through the indeterminacy of game dynamics, dystopian narratives into acts of

critique (Gualeni, 2021). Even within the grim and undesirable characters of a dystopian narrative, critical dystopias open a space of contestation and propose the hope of a positive alternative, if not within the narrative itself, at least outside of it (Baccolini & Moylan, 2003).

Besides its capability to address social conflicts and issues through the materiality of design, design fiction is a design practice that can be adapted to support the development of new real-world technologies. The diegetic prototypes of design fiction conceptualize and enable reasoning about the impact and possible applications of new technologies (Bleecker, 2009). The artifacts of science fiction prototyping (Johnson, 2011) represent the design concept of the things that one day will be possible to build. Games artifacts materialize such prototypes situating them both as functional and interactive means, and as technocultural expression of the fictional world.

Effective speculative design needs to build "perceptual bridges" between the observer's reality and the speculative future (Auger, 2013). Auger suggests that such perceptual bridges can be inspired by different fields, such as psychology and comedy, that offer insights into the way the human mind works. In games, these perceptual bridges are constantly built through the complex combination of aesthetic, kinesthetic, and sensorial experiences of game feel (Swink, 2009). The sensation deriving from the feeling of directly and precisely controlling the avatar, from the physical interaction with the simulated world, and from the effects that polish and enhance the interactions, act on players' nonconscious cognition as affective experiences (Jagoda, 2020, p. 116), and constitute the medium-specific perceptual bridges to the speculation.

The concepts that have been briefly discussed in this paragraph constitute a reference framework that situates games as a form of speculative media. The next paragraph introduces science fiction games as a genre that is particularly representative of the speculative qualities of video games and problematizes the dominance of colonialist themes that, it is argued, are representative of contemporary space endeavors.

3. Speculative Scenario of Outer Space Exploration in Sci-Fi Video Games

Science fiction and games have been sharing themes and visual iconography since the origin of the video game medium. From *Spacewar!* (Russell, 1962) and *Space Invaders* (Taito, 1978), to the *Halo* series (343 Industries et al., 2001-2021) and the recently published *Starfield* (Bethesda Game Studios, 2023), games have represented science fiction and space exploration narratives with increasing visual accuracy and technical sophistication. Science fiction games have developed in a wide variety of subgenres, among which space simulators are one the most representative because of the game mechanics it has introduced. Space simulations can be subdivided into two main categories of space combat simulation and space exploration simulations (Tringham, 2013, p. 413). As reported by Tringham, *Star Raiders* (Atari, 1979) can be considered one of the first examples of the space combat form that introduced the fundamental features, such as the presence of strategic mechanics and resource management systems, that characterize the genre still today. Regarding exploration games, *Elite* (Barben & Bell, 1984) is considered the first prototypical example of space exploration simulation presented as an open-ended large real-time 3D explorable universe where to collect, trade and fight for resources. The idea of procedurally generated game words introduced by *Elite* has developed in numerous game genres. A recent example of a science fiction game that largely uses procedural generation is *No Man's Sky* (Hello Games,2016) whose explorable universe is constituted of 18 quintillion planets, each characterized by a unique geology, flora, and fauna.

The peculiarity of science fiction video games, compared to other game genres and other mediums, has been observed in their capability to "convey a more active sense of futurity" (Frelik, 2014, p. 230). Moreover, as a medium, games reach a vast and diverse audience, making the ideas and concepts of science fiction more accessible. Frelik identifies four intersections between the medium of video games and the mode of science fiction. Video games "as narratives of space […]", "as integral elements of distributed narratives spanning multiple media and forms", "as instanced of visual science fictions invested in the pictorial portrayal of futurity", "as performative simulation, conveying a sense of malleability of the future" (Frelik, 2014, p. 230).

In discussing the argument of this paper, the spatiality of science fiction video games is particularly relevant. As suggested by Frelik, in science fiction games, spatiality emerges in two specific aspects. The first one is worldbuilding. Through the construction of coherent and complex fictional scenarios, players are confronted with visions of alien planets, extraterrestrial settlements, and advanced technologies. Compared to movies, which also provide strong and descriptive visual cues, games enable players to freely navigate such fictional universes, providing an "affective experience of the genre's sense of alterity" (Frelik, 2014, p. 231). Speculative practices heavily rely on worldbuilding and environmental narratives. Speculative cinematic narratives, such as *Planet City* (Young, 2021), guide observers through the architecture, the rituals, the technologies, and the identities of fictional future scenarios in which humanity addresses the environmental crisis in a radical way. In *Plane City* speculation, humanity gathers in a hyper-densely populated city, leaving the rest of the planet to nature. The project, in addition to a cinematic representation, uses essays and costumes to explore the technical, environmental, social, and cultural implications of such a scenario. The video game series *Mass Effects* (BioWare, 2007, 2010, 2012) offers a parallel to a similar speculation. In the game, the *Citadel* is a hyper-dense galactic settlement where humans and alien species coexist under the government of the *Citadel Council*. The massive galactic infrastructure resembles that of an O'Niell Cylinder, a conceptual outer space infrastructure proposed by Gerard K. O'Neill in the 1970s (O'Neill, 1977/2000) that generates artificial gravity through centrifugal acceleration. Compared to O'Niell design, the lateral surface structure of the *Citadel* is not continuous, but it is constituted by five 43.6 kilometers of arms (the Wards) that extend from a central pentagram-shaped ring with a diameter of 7.2 kilometers. The *Citadel* portrays the organizational structure of the social system that relies upon advanced technology. In the same way, *Plane City* suggests a critical reflection of how the political and social structure could operate in combination with technological infrastructures in a complex superorganism. The spatiality of games allows the exploration of such natural and artificial speculative environments, soliciting players to explore the architecture, the technologies, and the affordances offered by such artifacts and the dynamics of different social structures.

Another spatial-related mode, Frelik suggests, is represented by the narratives of conquer and exploitation of extraterrestrial worlds and living beings. Such trait, as already discussed, is recursive in both fictional media, but also suggested by the commercial narratives of the space industry. With few exceptions, most science fiction video games propose imperialistic narratives and forms of exploitation and control (Frelik, 2014). The main themes revolve around spaceship flight and combat, military strategy, survival of dangerous and dreadful extraplanetary environments, and new worlds colonization (Majsova, 2014). Such narratives have been present in science fiction video games since the origin of the medium, which roughly coincides with the years of the Space Race and the Cold War between the United States of America and the Soviet Union. The competition between the two blocks drove large investments in technological innovation for developing military and defense applications. During this period, the emerging video game industry offered a space to programmers where to develop game technologies without military implications (Izushi & Aoyama, 2006). Although the entertainment, technical, and artistic value of this production is acknowledged, it is argued that the abundance of such themes is representative of the utilitarian, exploitative, and neo-colonialist attitudes that have animated, and still animate, past and contemporary perspectives on outer space exploration. If during the Space Race period, science fiction video games' themes reflected the political and military tension between nations, today's neoliberal values that nurture private companies' efforts to access outer space are mirrored in the science fiction game mechanics of resource accumulation, management, and crafting. For Roberts, understanding something as science fiction depends on the moment and the context of reception (Kunzelman, 2022, p. 6; Roberts, 2005/2016). As an example, *Blade Runner* (Scott, 1982) movie portrays climate crisis as an energetic, continuous anthropogenic process driven by capitalist interests that destroy the environment and voraciously consume resources. In *Blade Runner 2049 (Villeneuve, 2017),* the world's resources have ended and the world has been consumed. It can be argued that today, in light of a different perception of climate issues influenced both by the ecological debate and by the witnessing of the effects of climate change, *2049* climate dystopia resonates more with contemporary concerns about climate crisis compared to 1982's movie. In this sense, today's science fiction video games solicit a strong connection with the future of outer space exploration prospected by contemporary narratives of private companies.

4. Escaping Science Fiction Speculation Cliché's Orbit

It has been argued that the adoption of strong dystopian visual clichés in movies (and games) may represent a limit of the medium's capability to invite a critical reflection from the viewers, since they can passively rely on the genre's canonic categories to shape their interpretation (Dunne & Raby, 2013, p. 75). The effort that is required for the reader of science fiction novels is to visualize the story in a process that moves from one word to the other. The subjunctive level of science fiction, being the possibility that certain events could or could not happen, requires a progressive correction process of the visualization that happens in the readers' mind that is coherent with their understanding of the physically explainable universe (Delany, 2009). In visual media, viewers don't need to make a visualization effort. Yet, the critical understanding of the artifacts within the fictional world and their relations with the speculative environment are still there to be made. Visual clichés narrow down the speculation process toward beaten tracks. Hence, when considering science fiction video games as speculative media, original critical and speculative enquires can arise from game worlds that propose alternative narratives and different perspectives that avoid recurring genre clichés. Games can evade stereotypes and clichés by radicalizing the boundaries of the speculation. Still maintaining the "perceptual bridges" with the player's world, visual references can be metaphorized by the worldbuilding and articulate speculation on a more abstract but fundamental level. In science fiction narratives, readers, viewers, and players are constantly invited to make parallels with their own reality. Both scenarist and narrative cliché weaken the speculative potential of science fiction since not much effort is required to situate one's own values within the alternate reality of the fictional world.

Two examples have been chosen to discuss how extreme or radical speculative scenarios can be vehicles to bring different values into the space exploration discourse and, therefore, to broaden the boundaries of inclusion. *He Ao Hou: A New World*[1] (Na Anae Mahiki Collective, 2017) is a game developed during the 2017 SKINS 5.0 workshop as part of the activities promoted by the *Initiative for Indigenous Futures*[2]. During the three-week workshop, Hawaiian indigenous people were given tools and knowledge to develop a video game on the topic of indigenous narratives in a setting of indigenous futurism (Dillon, 2012). As discussed by one of the workshop coordinators Rilla Khaled (Kahled, 2022), the game addresses questions related to the decolonialization of space exploration. The developed game is a point-and-click adventure game in which players explore different worlds inspired by *Mo'olelo*, the traditional Native Hawaiian stories. The progress in the game is achieved through the knowledge of *Mo'olelo* and through the *Aloha 'Āina*, the ecological principle of spiritual, cultural, and social Native Hawaiian identity. In the game, the kukui nut, a symbol of knowledge for Hawaiian Indigenous people, is used as an artifact that allows interactions with the world. The game developed from a radical perspective in which economic or political reasons do not foster space exploration but is a discovery and growth process in accord with the foundational values of the indigenous population. Despite not speculating on practical technologies and solutions to align the contemporary attitudes of space economy to the game proposed values, it points out how underrepresented and unacknowledged such perspectives are. In this act of re-actualization, designers intervein as mediators of knowledge and sensibilities in a co-design process of materialization of these values in game environments, mechanics, and narratives. Moreover, this project stands out as a form of reaction against the Western politics of settler colonialism that are inherent to Indigenous territory occupation for the construction of space research facilities (Sammler & Lynch, 2021; Smiles, 2020). Mauna Kea is a quiescent volcano in the Hawaiian archipelago and, in virtue of the characteristics of the site, is the location of a dozen observatories. Since 2014, local communities have started protests and legal battles against the construction of the Thirty Meter Telescope (TMT) since Mount Kae is the most sacred mountain to Hawaiian people. With the growing interest of private companies in the space economy, there is a growing risk for underrepresented and indigenous communities to undergo exploitative politics. From this case study, it emerges the importance to include marginalized perspectives in the design of speculative artifacts in order to disrupt the hegemonic perspectives that are often represented in the mainstream visions of the future.

[1] The game is freely accessible at: https://skins.abtec.org/skins5.0/?page_id=1689.

[2] https://indigenousfutures.net.

Another game that can considered an example of science fiction that avoids visual clichés is *Outer Wilds* (Mobius Digital, 2019). *Outer Wilds* is a successful commercial video game that proposes an exploration adventure of a fantastic solar system. The game, developed from Alex Beachum's Master Thesis project at USC Interactive Media & Games Division (Beachum, 2013), combines elements of science fiction and fictional archaeology. The gameplay is based on a 22-minute loop that recursively brings the players to their planet of origin. The game progression is not based on the usual mechanics of skills' acquisition or mission achievements. The element that drives progression in the game is the acquisition of information that players need to elaborate to understand the events happening the game universe and how to proceed in the exploration. It has been argued that in *Outer Wilds* "the experience of learning and knowing proceeds from an obstinate tension toward the unknown" that constitutes a game mechanic that "values curiosity and exploration over achievements" (Luersen & Paula, 2023, p. 17). As well as the previous example, the artifacts players can use are probes to investigate the world and gather clues that contribute to form speculation about the game universe. These artifacts do not propose self-reflective speculation on technology but depict technology as a means to access information and develop knowledge. As discussed by Luersen and Paula, in *Outer Wilds,* the devices players can use to explore the solar system (such as the signal scope that detects acoustic signals, the probe that allows the survey of inaccessible areas, and the translation tool that translates the inscriptions of the extinct alien civilization) establish with the data they produce and the player a meaningful relationship that drives the experience of discovery (Luersen & Paula, 2023). Reflecting such critical observation on our actual reality, the instruments that have been sent to orbit over the years have produced knowledge about the universe and the Earth. Military technologies and services based on space infrastructure have become accessible to a greater number of people. However, contemporary conflicts, social and climate challenges make orbital infrastructures and satellite data a strategic and critical asset. In this context, the contribution of critical design is to balance the economic value of space operations with the social one adopting speculative artifact as means of representation, analysis, and critique. Critical design needs to advocate for a just and responsible distribution of the positive impacts of the space endeavor, broadening the discussion and reflecting on the ways designers can contribute to this process.

If the dominant narratives of the majority of science fiction video game impose a top-down perspective of the futures, countergaming (Galloway, 2006/2022) practices propose alternative ways of engaging with such scenarios, turning them into platforms for divergent speculation. For Galloways, countergaming is a form of critical engagement with the game medium that questions the hegemonic practices of the game industry. Game mods are a form of countergaming. Modifying the game code to alter the gameplay mechanics, the control system, and the visual representation of the 3D environment, is a form of appropriation and re-functionalization that establishes a negotiation between the imposed narrative of the game world and the players' sensibilities. Another way to open up and subvert confined game narratives is through the making of machinima (Berkeley, 2006). Machinima can be seen as another form of countergaming. Machinima are linear media such as short movies, video essays or feature-length films that are produced within the game environment and recorded through the game rendering engine. Authors of machinima often remediate the game system into a tool for telling stories unrelated with the original game narrative. Some machinima authors even intervein on the game code to introduce new 3D models, custom visual effects, or additional camera viewpoints. Although games propose their own representation of fictional and speculative futures through worldbuilding, narrative and gameplay, an approach that leverages critical engagement and countergaming practices suggests that video games can be adopted as speculative platforms in anticipatory design practices.

5. Conclusions

In this paper, it has been argued that video games, and science fiction video games in particular, can be understood as speculative artifacts that can propose alternative perspectives on outer space exploration, which is currently dominated by neoliberal and neocolonialist ideals. It has been discussed how both private companies' self-narration and science fiction media concur to represent future scenarios in which human presence in outer space is primary driven by exploitative interests and implemented through forms

of neocolonialism. However, it is argued that both commercial and non-commercial games can become platforms for developing critical reflections and promoting forms of reaction to the values and means that drive contemporary outer space exploration. Such critical artifacts, rather than suggesting technical solutions or practical approaches, fictionalize novel perspectives emerging from the alternative ideals that aim to nurture the space endeavor. It emerges the need to involve marginalized and underrepresented communities in the co-design of speculative artifacts, which come to be empowering tools that challenge the hegemonic perspectives on future technologies and their use. For their capability to reach and engage with a vast audience, video games can be adopted as speculative platforms that contribute to including more people, a wider range of sensibilities and more diverse identities in the public discourse on space exploration politics. The commercial narratives proposed by private space operators, based on the exploitative premises of the space economy, restrict the boundaries of inclusion towards those who don't share such a vision. Understanding video games as speculative media enables designers to adopt game design approaches to explore new methods for speculative enquiries and to engage with games as critical artifacts that can reflect and develop in design practice. The acknowledgment of concepts, ideas, methodologies, approaches, and practices that can resonate both in design and game cultures addresses the need to confront the complexity of contemporaneity from multiple perspectives. The adoption of video games as tools and methods for broadening the discussion on such relevant topics is synergic with other co-design practices. In fact, the inclusion of underrepresented communities in the co-design of speculative games, as the *He Ao Hou* case study demonstrates, allows to escape science-fiction clichés promoting the development of divergent speculative scenarios. Forms of countergaming, re-mediation, re-functionalization, and appropriation allow designers and non-designer to critically engage with the game worlds, promoting bottom-up critical and creative processes. Future development of the arguments presented in this paper will investigate how design can act as a mediator in developing a promising research field at the intersection between game design and cultures, playful design, speculative and anticipatory design practices, and critical theory.

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