

Climate Survivors: A Bullet Heaven for Enhanced Climate Engagement

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Abstract—The climate crisis is one of the most pressing issues humanity has to tackle. Solving it requires civil society to be involved and open to change. Video games have been identified as one communication channel with the potential to support this. However, among the few climate games that see larger success, most limit their impact due to their shared audiences and lack of actionable messages. Following a framework for effective climate communication through games, this paper presents a game concept meant to improve on this and function as example for similar projects in the future.

Keywords—games, climate engagement, climate change, sustainability

I. INTRODUCTION

The climate crisis is one of the most pressing issues humanity has to tackle. In recent years, its negative impacts on human health and welfare have become increasingly apparent all across the globe and are strongly concentrated among the most vulnerable populations [1]. While the need for action is evident, implementation faces hurdles, requiring decisive high-level policies as well as bottom-up change, and an involved and informed population supporting this [2]–[4].

Various tools are explored to spread awareness and foster such engagement, including increasing media representation of the issue as well as gamification and nudging mechanisms [5], [6]. Games are a promising channel for promoting societal and behavioral change [5]–[8], especially now that they have left their initial niche existence to become a mainstream form of entertainment, drawing in a wide variety of people [9].

Despite this, games still seem to be rarely used for climate communication. This hypothesized underutilization and resulting limited impact of games in the climate space is based on three pillars: **availability**, i.e., the number of games featuring climate themes (climate games for short), the number of people they **reach**, and the effectiveness of the **climate content** they transport.

II. THE LIMITED IMPACT OF CLIMATE GAMES

A. Availability

In a systematic compilation, Fernández Galeote and Hamari [8] found 127 climate games released between 2010 and 2019, up from 19 between 2000 and 2009 and only 4 between 1990 and 1999. While this is a positive trend, it starts from a very small number and does not keep up with the growth of overall

game releases. The average number of new annual releases on Steam, a digital marketplace for downloadable PC games, has grown by 2,640% from 311 in the period 2008–2009 to 8,508 in the period 2018–2019 [10] while the average annual releases of climate games on Steam have grown only by 370% in the same time. Additionally, of the 150 climate games documented by [8], at least 51 are no longer easily available to the wider public, either because the game or the hosting account has been taken offline or because they use a discontinued platform, such as Flash.

B. Reach

Beyond its pure existence and availability, the reach of a game limits its potential impact. Of those in the database created by [8] that are still playable, 39 are estimated to have very limited reach and impact due to their scope. They are either unfinished or unrefined games resulting from game jams or otherwise low-resource development, or more refined games limited to specific, small-scope educational settings. For the remaining games, only rough download numbers or, more often, indirect indicators such as the number of reviews are available. To estimate their reach, a downloads-to-reviews factor between 30 for newer and 60 for older games is assumed. Additionally, based on author knowledge, well-known and successful games like *Civilization* [11] are assumed to have significant reach of 100,000 or more people. Using this approach, about 45 still available games are estimated to have reached 1,000 or more people and, of those, about 30 have reached 10,000 or more. Only about 15 games in the database have likely reached 100,000 or more people, highlighting the limited number of climate games with significant reach.

C. Climate content

The investigated games also vary widely regarding how prevalent climate themes are and how important they are to the core game. Many use the crisis as a simple story aspect that provides motivation but does not influence the game. In *1000 days to escape* [12], a climate catastrophe is the reason why the player has to get humanity off of the Earth, but it does not affect and is not affected by anything else in the game. Due to this lack of influence on the crisis, such games may be a starting point transferring basic information about the issue, such as the gravity of the situation, but they lack action-related knowledge that could amplify behavioral change [13].

Another group of games focuses on positive outlooks onto the future. Here, negative impacts of the climate crisis are of

little or no importance. Instead, either the game world or the players' interactions with it create a hopeful vision. In *Flower* [14], players control the wind, blowing flower petals across the game world to make it bloom. In this process, they can find and activate wind turbines, potentially normalizing this green-vision technology and evoking positive emotions while doing so. Such narrative visions are important as inspiration and motivation to drive humanity towards more sustainability [15] and may indirectly transport actionable messages but often lack them.

The third group of games lets players interact with environmental hazards. In some games, their actions affect the climate, leading to tangible negative impacts, disincentivizing such behavior. *Civilization VI: Gathering Storm* [16] allows various player decisions, such as building coal power plants to increase productivity, which amplify global heating. This, in turn, increases the risk of natural hazards occurring. Other choices, such as decommissioning such a power plant, avoidance of deforestation, or investing in flood protection systems, can slow the heating or abate its negative impacts. Other games establish a dangerous environment by default, and players have to react to it. In *Gibbon: Beyond the Trees* [17], players increasingly experience the negative impacts of human encroachment into the gibbons' habitat as it creates hazards and limits their initial freedom of movement, a core pillar of the game.

Notably, most games in the database that feature the climate crisis as such a core mechanic are strategy games where players manage groups of people, countries, or global organizations. Since an important aspect of the climate crisis is the need for system-wide change [18], this lends itself well to such games where players control said system. Nonetheless, this obvious connection may be a downside as different players prefer different genres [19], [20]. In this case, such strategy games might be preferred by older players but less so by younger ones [21], limiting the combined impact of this set of climate games as they are mostly targeting the same people.

One exception is *Eco* [22], an online survival game where players cooperate to build a settlement fulfilling all their avatars' needs and try not to ruin the environment through the resulting pollution as this would negatively affect them and their settlement. Like strategy games, it employs a level of management and planning, and conveys system knowledge through its mechanics. At the same time, it appeals to a different audience due to its different core loop.

Another difference is the perspective on similar high-level concepts (top-down ruler in *Civilization VI* in contrast to bottom-up citizen engagement in *Eco*). This perspective shift allows *Eco* to communicate actionable messages very directly, as players experience them through their avatars. For example, players can be part of a democratic process to create laws for their settlement, prohibiting or limiting pollution and over-hunting. They learn to organize, advocate, and vote for change similar to how many players can outside the game. For their nutrition, they can choose a mostly plant-based diet, another sustainable action they can copy in the real world. This aligns well with a framework developed by Ouariachi *et al.* [23] for climate communication in games, specifically the aspect of

achievability, i.e., the promotion of "possible actions within the reach of the individual". In contrast, in *Civilization VI*, players change city-wide energy or whole political systems, actions far removed from any citizen's achievability.

In summary, until 2019, there have been few climate games available, especially compared to the overall number of games in the market. Furthermore, only a few of these games have significant reach. Of those that do, many are high-level strategy or management games, focusing on a limited, shared audience, while nearly none communicate actionable messages.

D. Climate games beyond 2019

More climate games have been released since 2019, in further increasing numbers and exploring more diverse genres. This aligns well with the onset of the Fridays for Future movement in 2019 affecting the public perception of climate issues [24] combined with the general upward trend of video game releases [10] and the establishment of initiatives like the Playing for the Planet Alliance [25].

Several initiatives have started to catalog these games, but, based on comparisons between them and spot checks for specific games, none are currently close to complete [26]–[29]. Even so, various examples from these databases show the continuation of the described concepts, albeit more often achieving significant reach. In *Battlefield 2042* [30] and *Timberborn* [31], the climate crisis is the story backdrop that motivates the game the players experience. In *The Climate Game* [32], *Half-Earth Socialism* [33], and *Beecarbonize* [34], players manage large countries or the whole world.

But there are also more examples of genre diversification and actionable messages. *Gibbon: Beyond the Trees* directly embeds information about the biodiversity and climate crisis shown in the game, combined with a call to action and links to several environmental NGOs. *Bear & Breakfast* [35] normalizes vegetarian and vegan cuisine as the default option and teaches players recipes to try.

In addition to gameplay and story, game developers have started to explore other ways to tackle and communicate the climate crisis. *Ultros's* [36] screen resolution settings menu shows estimated power use, both communicating the issue and encouraging real-life energy-saving behavior.

However, despite these examples, across all the databases, the collective number of climate games is still small. Even when considering the incompleteness of the databases, it must be assumed that, despite an ongoing increase and diversification of climate games, there are still only a few successful ones.

As such, there is much room for new climate games, especially those that explore the realm outside the primarily-strategy genre. In this paper, we introduce one such game currently in development, utilizing the framework established by [23] to potentially maximize player engagement and positive climate impact.

III. GAME CONCEPT: CLIMATE SURVIVORS

Drawing on expert interviews and a literature review, [23] have collected 15 attributes that may support cognitive,

emotional, and behavioral reception of game messages by the players, as illustrated in Fig. 1. This combination is important since cognitive reception, i.e., knowing about an issue, likely is not sufficient to motivate people to care and act [37]. To potentially maximize their impacts, goals and messages in a game should be **achievable, challenging, concrete, credible, efficacy-enhancing**, fostering **experiential learning, feedback-oriented, fun, identity-driven**, fostering **leveling-up, meaningful, narrative-driven, reward-driven, simulating**, and **social** [23].

To maximize its potential impact, the game *Climate Survivors* is designed around all 15 attributes. In this single-player top-down action game, targeting a genre sometimes termed “bullet heaven”, players are tasked with surviving the hazards and impacts of the exacerbating climate crisis. These hazards, such as floods and droughts, are embodied by monsters attacking the players’ avatars in various arenas, each representing a specific country or region with its own mix of relevant climate hazards. Players need to evade monster attacks, defend country-specific landmarks, such as the capital, and collect resources dropped by defeated monsters.

To achieve this, they utilize weapons and upgrades that represent technologies as well as societal and political changes that can help with climate mitigation and adaptation and shape the path to a more sustainable society. Similarly, these upgrades can feed into a simple emissions accounting model affecting the strength and difficulty of the monsters, as global heating is accelerated or dampened. New upgrades are unlocked and improved by investing the collected resources in a country-wide build phase and activated through a level-up mechanism. The goal of such an action-oriented concept that introduces high-level planning only as a secondary feature is to bring climate knowledge, basic systems thinking, and actionable messages to audiences who, so far, have seen few

climate games directed at them.

In addition to its climate content, the game is designed to be resource efficient. Its simple graphical style has been chosen to be appealing while also minimizing processing and associated electricity demand. Even so, additional power-saving options such as a frame-rate cap may be implemented.

In the following, the 15 attributes defined by [23] are shortly summarized and put in context of the *Climate Survivors* concept. For comparison, climate-engagement attributes of selected games are shown in Table I, as assessed by [8].

A. Achievable

Players should be able to perform well in the game world, receiving challenges that can be solved and positive feedback for doing so. Also, actionable messages should provide specific real-world actions that are easy to adopt.

While some are difficult, all tasks in *Climate Survivors* are solvable. Regarding actionable messages, *Climate Survivors* mixes high-level messages targeting the system and short-term achievable low-level ones, as both the costs and benefits of larger systemic changes and individual action as well as their synergies are shown. For example, several weapons and upgrades highlight the climate benefits of reduced meat intake which can directly be translated into real-life action.

B. Challenging

Players should face a challenge that is neither too difficult nor too easy so that it is possible but rewarding to overcome. This can be supported by implementing randomness or variable difficulty.

In *Climate Survivors*, difficulty is dynamic based on player choices. Meta-progression between tries helps alleviate difficulty while optional higher challenges can increase it to the players’ tastes. Meta-progression in each arena fosters country-specific exploration and offers rewards for continued engagement. Unlocked upgrades are available in a pool from which several options are randomly chosen as potential level-up reward, enforcing and encouraging experimentation.

C. Concrete

Players should be able to take simple messages from the game. Wall of texts or other forms of data dumps should be avoided. Instead, information should be integrated into the game mechanics.

While *Climate Survivors* is designed to transport core messages from the IPCC reports [18] and similar sources, the game is showing system mechanics only at an abstract, simplified level reduced to a select few core player attributes. After some time, and optionally, a more in-depth dashboard can be unlocked, to provide more information to curious players without overwhelming others.

D. Credibility

Players should be able to trust the science in the game which thus needs trusted sources. Such sources could be represented through an avatar to improve credibility.

Climate Survivors builds on a wide corpus of science, with [18] at its core. This corpus should be reflected in an in-game

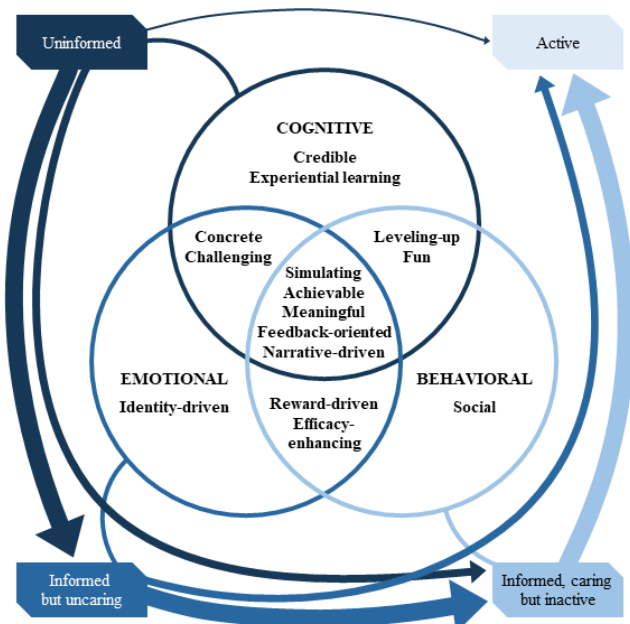


Fig. 1. Illustration of how cognitive, emotional, and behavioral reception of video games support behavioral change. Adopted from [23].

In *Climate Survivors*, leveling-up occurs both within and outside a level. There are several arenas that players can progress through, each representing a different country or region increasing in challenge as they are affected by different climate hazards to a different degree. Within a level, both the player character and the monsters are leveling-up over time and based on player actions. While many of the actions are reset after a level is finished, several unlocks stay available across tries, functioning as meta-progression for the players' avatars.

K. Meaningful

Games need to transport the impacts of the climate crisis to transport the need for action. However, fear alone is no good motivator and should be accompanied by messages of hope.

Climate hazards lend themselves well to a horde survival game such as *Climate Survivors*. If players choose inaction instead of climate mitigation, they will soon be swarmed by an increasing wave of quite negative impacts of their virtual climate crisis. They may choose to focus on climate adaptation options, increasing their resilience. But if no or little mitigation options are chosen, this adaptation will likely be futile or a quite expensive route to take. However, the game makes sure to emphasize survival and possible pathways to positive visions. Each level can be won, each country be saved. To do so, players can utilize several different mitigation-adaptation mixes and see it illustrated in the end as sustainable vision.

L. Narrative-driven

A guiding narrative can be a strong connection to the players' emotions and can increase engagement as well as foster a better understanding of the context of a game.

The core narrative of increasing climate impacts and the hopeful vision of pathways to a green future is strengthened by the connection to different real countries and impacts as well as options already visible and available today. A campaign-mode connecting all levels can strengthen the narrative of needed international cooperation and responsibility. Mechanisms such as a level-bridging climate adaptation fund can support this.

M. Reward-driven

Meaningful rewards can foster additional engagement and repeated behavior. This can take various forms from high scores to achievements and badges to other unlockables.

Several types of rewards are at the heart of *Climate Survivors*'s motivational systems. For one, rewards are inherent to the core loop of the game, where defeating monsters and collecting resources rewards the players with increasing power and agency. Players who enjoy exploring the depth of a system are rewarded by uncovering the strongest synergies in the game. Further rewards are unlockable features for exploring levels and successful defenses of landmarks. Additional customization options for their avatar and the visualization of the players' green versions of the played country can be aesthetically rewarding. Competitive players are rewarded with high scores on leaderboards.

N. Simulating

Simulating real world effects allows players to experiment with causes and effects, potentially leading to a better

understanding of both. The short run time of a game can bridge the climate impacts' long delay and help visualizing them to players, especially if they repeat their experiments with different variables.

Climate Survivors features a simple accounting model, keeping track of greenhouse gas concentration and associated heating. Players can directly feel the impact of changes in these variables due to the increasing challenges the monsters and additional hazards in the arena may create. Further, the levels can reflect different stages of the climate crisis, where a level on a heating pathway shows more signs of hazards such as droughts or flooding compared to a more sustainable pathway.

O. Social

Socializing is a key driver of behavioral engagement and can take many forms, such as cooperative or competitive multiplayer, leaderboards, or community integration.

Leaderboards are a direct way for *Climate Survivors* to bring a social component to the game, encouraging players to improve their score and thus find even more sustainable pathways for each level. Another option that will be explored is a multiplayer mode, where players will have to discuss their upgrades and may experience the struggle of finding shared policy pathways. Outside the game environment, fostering a vibrant community that discusses the game's content, balancing, and reasoning is another option. Lastly, integrating modification support where players can refine parameters and even create new levels, is a social component that also potentially links well to identity and narrative-driven aspects, as players can bring their own experiences more directly to the game and other players.

IV. CONCLUSION AND DISCUSSION

There is much room in the large and still growing mainstream gaming space for climate crisis narratives and other climate content. Only very few climate games exist so far and even fewer have seen wider success. Of those that have, many belong to similar genres and appeal to similar people. Additionally, they often lack actionable messages that could help strengthen their climate engagement impact. With *Climate Survivors*, an in-development prototype was presented as one example aiming to address these gaps, following the framework developed by [23] for utilizing games for effective climate engagement.

Following the development of *Climate Survivors*, the climate communication efficacy of this game beyond the underlying theoretical framework needs to be assessed. In addition, the game's utility for citizen science should be investigated. The player-created climate scenarios could potentially be used as input for future integrated assessment modeling efforts, representing a new form of stakeholder engagement and public consultation. Similarly, the social aspects fully or partially outside the game such as a community forum or modding support may provide a new avenue for citizen science. Lastly, there is a need for an updated climate game database and a solid process of keeping it up to date to solidify assessments of climate games as a whole.

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