Designing a toolkit for visualising desirable sustainable futures in video games

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INTRODUCTION

We live in a time of planetary crises, where human actions have led to a breach of Earth's systems' planetary boundaries, and the corridor for a safe and just future for all continues to narrow (Rockström et al. 2023). Urgent and transformative action is needed to address the crises and chart a path towards a sustainable future (Gupta et al. 2024).

Causal Layered Analysis (Inayatullah 1998) demonstrates how every issue has layers of depth (litany, systems, worldviews, and myth), suggesting that long-term change has to start from the bottom - from the myth or story, and drive upwards from there. Due to resistance to change from current beneficiaries and those in power within the existing system, such transformation will require pro-environmental collective action, which, as shown through research in Social Identity Theory (Wright, Schmitt, and Mackay 2022), is increased by engaging with visions of sustainable futures. Both collective and individual collective action are predicated on being able to imagine such alternatives, as does support of climate legislation (Wright, Schmitt, and Mackay 2022; Lutz et al. 2024; Fernando et al. 2020). Research from science and technology also confirms that significant change requires collective visions, known in this field as sociotechnical imaginaries (Jasanoff and Kim 2009).

These imaginaries of future-based science and technology projects, such as energy generation and climate adaptation, can influence policy and enable large-scale projects to receive funding and priority (Jasanoff and Kim 2009; Olazabal et al. 2024; Hess and Sovacool 2020). Mass media have made such imaginaries increasingly globalised (Cerezo-Pizarro et al. 2023).

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With these frameworks in mind, this research aims to design a toolkit to enable game artists and art directors to visualise desirable, sustainable futures.

VIDEO GAMES AND THE FUTURE

With over 3.2 billion players worldwide (GilPress 2024), video games have a massive popularity, reach, and cultural impact (Cerezo-Pizarro et al. 2023). While important efforts to make the game industry more sustainable and reduce its significant carbon emissions are ongoing (Abraham 2022), at the same time, we can engage with video game content and acknowledge its ability to transmit values (Cerezo-Pizarro et al. 2023). In particular, this research is focused on the visual aesthetics of games, which are of high relevance to evoking eudaimonic experiences (meaningful, virtuous experiences) (Possler, Bowman, and Daneels 2023) and transformative aesthetics experiences (Bopp, Vornhagen, and Mekler 2021), all which can help popularise desirable sustainable futures and through repeated representation which can help build these images into significant sociotechnical imaginaries (Vervoort et al. 2024).

Many video games already depict the future, with dystopias and post-apocalyptic scenarios being the most common future aesthetics (Johnson and Tulloch 2017; Navarro-Remesal and Torres 2024). Also present are business-as-usual (BAU) futures, characterised by late capitalism fantasies of continued growth through the commodification of all things, with mechanics akin to planned obsolescence and perpetual consumption of in-game artifacts, which are common in games' economics science fiction, seen in settings ranging from fantasy lands to spacefaring futures (Higgins 2016).

Where games attempt to address sustainability, they rely on techno-optimism (Martín and Úbeda 2024). This issue is visible not only in scenarios that imagine the future as the 'present continued' (Abraham 2018) but also in supposedly alternative imaginaries such as the popular future aesthetics of solarpunk (Rivero-Vadillo 2022). As seen in Figure 1, of Dator's four generic futures categories: Continued growth, Collapse, Disciplined (values-shift), and Post-human transformation futures (Dator 2019, 45–47), it is the third that receives the lowest visibility in games. This is the category of interest for this research.

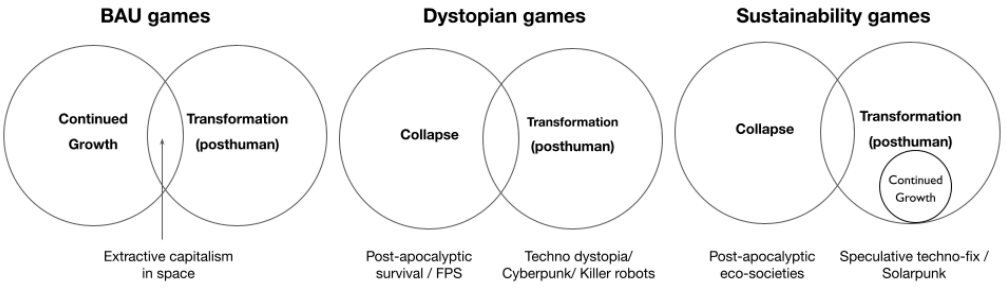

Figure 1 commonly found futures in games based on Dator's generic futures categories.

METHODS AND APPROACH

This research aims to design a toolkit that enables art directors, game artists, designers, and those involved in game worldbuilding to incorporate desirable, sustainable futures into their work. The research focuses on visual communication (Barry, 2020, p. 5) as an approach to game worldbuilding, which involves making desirable futures visible (Abraham, 2018; Vervoort, 2019).

The overarching methodology is research through design (RtD) (Chow 2014; Jonas 2007), which has the benefit of producing additional outputs beyond the research itself, in this case, a toolkit designed through the participation of industry stakeholders to enable the integration of sustainable future aesthetics in worldbuilding.

Preliminary research, conducted in the form of an online survey of game designers, artists, art directors, and other professionals involved in worldbuilding, took place between March and May 2025. The survey included sixteen questions that sought understanding of past experiences with future scenarios, challenges with visualising sustainable futures, and preferences for reference materials and tools. Of the sixteen questions, one was an open text comment box; the rest were multiple-choice, with ten allowing multiple selections. The questions aimed to establish industry experience (role, years, types of games typically worked on) and to understand participants' experience and interest in futures, including questions such as "If you have, what types of scenarios have you worked on? [Select as many as apply]"; "What kind of future scenarios would you like to work on? [Select as many as apply]"; "When thinking about the aesthetics of a game, what aspects of creating sustainable futures do you find challenging? [Select as many as apply]" and questions where participants selected their preferred toolkit components from lists of reference materials, tools, and interactive options.

This paper presents preliminary survey results. Insights from the survey will inform the participatory design stages described below:

- Participatory design sessions (2025): Six monthly iterative design sessions with industry stakeholders, divided into two groups based on time zone.
- Regenerate Game Jam (early 2026): Toolkit testing and additional feedback will be conducted through a special edition of 'Regenerate Game Jam' (Kay and Topp, 2025). The game jam will serve four purposes:

  a) Test the toolkit prototype's ability to inspire a plurality of games showcasing desirable, sustainable future aesthetics.

  b) Analyse participants' rankings of submitted games based on criteria informed by the toolkit that assesses its implementation and criteria ranking desirable future experiences of the games.

  c) Collect improvement suggestions via a survey at the end of the jam.

  d) Act as an 'innovation niche' for sustainable imaginaries.

- Outcome documentation and toolkit publication (2026-2027): Diligent documentation will be collected throughout as a crucial component of RtD (Hook & Coulton, 2017), as it allows ‘recoverability’ and academic scrutiny of this methodology (Khaled, Lessard, and Barr, 2018).

PRELIMINARY SURVEY RESULTS:

One hundred and three participants from around the world took the survey. The sample provides a 95% confidence level with a ±9.7% margin of error.

The participants had a wide range of industry experience, with just over 50% who had worked in the industry for six or more years (0-2 years: 15.7%, 2-5 years: 33.3%, 6-10 years: 22.5%, 10+ years: 28.4%).
A likely self-selection bias (whereby participants with pre-existing interest in sustainability were opting to take the survey) may explain the high levels of interest in working on sustainable, solarpunk, and hopeful futures (70%, 68%, 67%, respectively). To clarify what participants meant when selecting ‘hopeful futures’, it was tested for association with other futures choices, using Fisher’s exact test (Bower 2003). As illustrated in figure 2, across both questions where it has appeared Q_5 - relating to past work on futures and Q_7 - where respondents indicated which futures they would like to work on, it is strongly related to sustainable futures (Q_5: $p < 0.00001$, Cramér’s $V = 0.505$; Q_7: $p < 0.00001$, Cramér’s $V = 0.509$) and, to a lesser extent, to solarpunk futures (Q_5: $p = 0.033$, Cramér’s $V = 0.238$; Q_7: $p = 0.021$, Cramér’s $V = 0.239$).

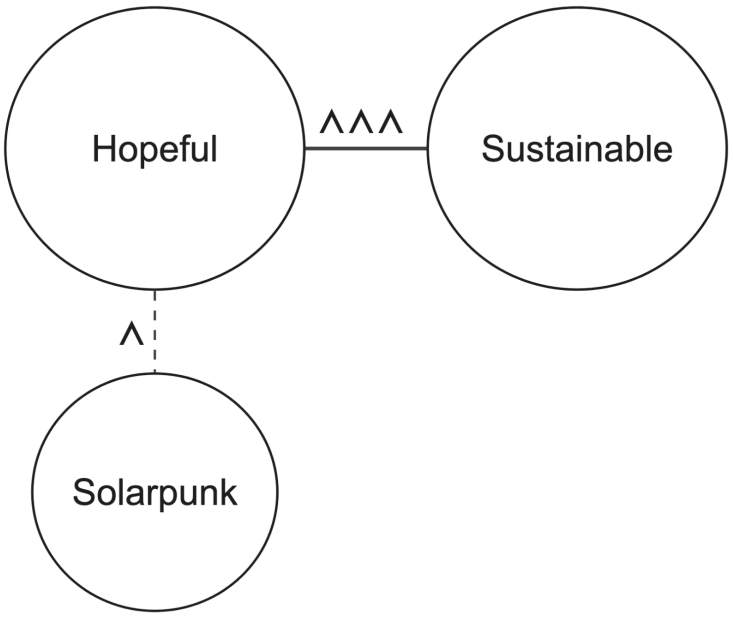

Figure 2 illustrates the significant relationships between hopeful futures and sustainable futures, as well as the smaller but significant effect relationship between hopeful futures and solarpunk in participants' responses.

The results align with the literature review regarding common futures in games. A majority of respondents (57.8%) have previously worked on post-apocalyptic games, with 'Dystopia: corporate' (35.6%) being the next most frequent category. However, as shown in Figure 3, only 44.2% of respondents who have worked on a post-apocalyptic future expressed interest in doing so again, while 69.2% would like to work on sustainable futures. In contrast, 84.6% of those who had worked on sustainable futures wanted to continue doing so, and only 34.6% were interested in working on post-apocalyptic futures.

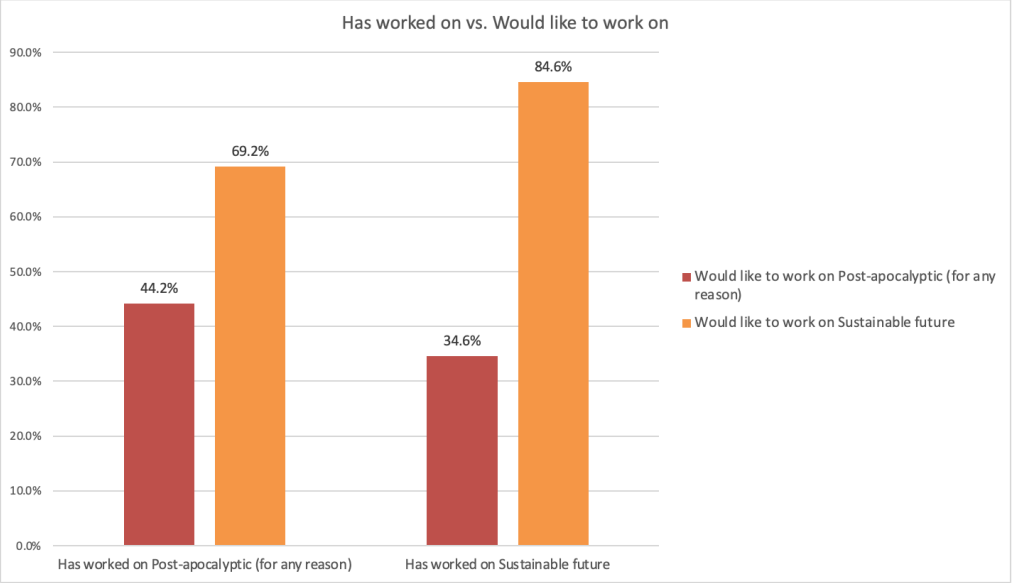

Figure 3 A comparison between respondents who have worked on post-apocalyptic futures (on the left) and those who have worked on sustainable futures (on the right) and the futures they indicated they would like to work on - in red, post-apocalyptic and orange, sustainable futures.

When it comes to challenges that participants face regarding integrating sustainability within games, four main challenges show similar frequencies: Combining sustainable imaginaries with engaging gameplay (57%), Representing complex systems accurately (56%), Avoiding heavy-handed messaging (56%) and Balancing fiction with correct environmental science (52%).

Participants were asked to rank how often they use physical and digital tools for worldbuilding references and inspiration. With a cumulative of 85% indicating that they always or often use digital tools, compared with 36% indicating the same for physical tools, a digital delivery method is the clear choice.

Of the various options for toolkit content, referencing materials was particularly popular, with the top choices in this category being:

- Examples of sustainable worldbuilding from other games and media (72.8%)

- Comprehensive guides explaining key concepts (e.g., circular and post-growth economies, agroecology, Nature-People values, etc.) (71.8%)
- Case studies of sustainability solutions and adaptations from real-world projects (68.9%)

Followed by two main tools:

- Frameworks for integrating diverse cultural perspectives (59.2%)
- Design patterns for regenerative environments and multispecies considerations (56.3%)

Among those who had indicated they would like to work on sustainable futures the results were similar though in the opposite order, when it came to reference materials, with case studies from the real world coming on top (78.9%) followed by guides to key concepts (74.6%), and examples from other games and media (70.4%).

Notably, among art directors, a key audience for the toolkit, the leading choice for the tool was asset creation guidelines for sustainable world elements (76%). The relationship between the role and this tool is statistically significant ($p = 0.003$, Cramér's $V = 0.304$), as is the relationship between this tool and those who selected "Designing appealing, sustainable aesthetics" as a challenge. Finally, a significant relationship exists between this tool and participants working on AAA/AA games.

While further analysis of the results will keep informing this project, the indication of the high interest in guides on key concepts and examples of sustainability from both media and the real-world projects suggests that an initial direction of exploration can be a game development-specific adaptation of the "seeds for a good anthropocene" approach to imagining sustainable futures (Pereira 2021; Preiser et al. 2024). This approach uses existing alternatives to business-as-usual, known as seeds, as the basis of future scenarios. A resource using this approach could incorporate all three preferred reference materials and is therefore a high-priority investigation for the next stage. Other elements of interest are investigating ideas for regenerative design patterns and sustainable asset creation tools. Integrating diverse cultural perspectives would likely need to be addressed across tools, with additional referencing to complementary tools devoted solely to this need.

These explorations will be presented to stakeholders as starting points for the participatory design sessions, the next stage of the research.

CONCLUSION

To achieve the sustainable transformation needed for a safe and just future, an urgent cultural shift is necessary. Video games can play a part by opening and pluralising the future. While a majority of video industry participants who took our survey would like to work on games showing sustainable futures, they identified several challenges to doing so. Given the choice between nineteen possible toolkit components, reference materials in the form of guides to key concepts (e.g., circular and post-growth economies, agroecology, Nature-People values, etc.), real-world examples of sustainability, as well as examples from other games and media, were particularly of interest to respondents. Tools relating to cultural diversity, regenerative design, and asset creation rank high. These choices provide a starting

point for the development of a toolkit that enables the visualisation of sustainable futures in video games.

BIBLIOGRAPHY

Abraham, Benjamin. 2018. “Video Game Visions of Climate Futures: *ARMA 3* and Implications for Games and Persuasion.” *Games and Culture* 13 (1): 71–91. https://doi.org/10.1177/1555412015603844.

Abraham, Benjamin J. 2022. *Digital Games After Climate Change*. Palgrave Studies in Media and Environmental Communication. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-91705-0.

Barry, Ann Marie. 2020. “Perception Theory: A Neurological Perspective on Visual Communication.” In *Handbook of Visual Communication*, 2nd ed. Routledge.

Bopp, Julia A., Jan B. Vornhagen, and Elisa D. Mekler. 2021. “‘My Soul Got a Little Bit Cleaner’: Art Experience in Videogames.” *Proc. ACM Hum.-Comput. Interact.* 5 (CHI PLAY): 237:1-237:19. https://doi.org/10.1145/3474664.

Bower, Keith M. 2003. “When to Use Fisher’s Exact Test.” In *American Society for Quality, Six Sigma Forum Magazine*, 2:35–37. American Society for Quality Milwaukee, WI, USA. https://bbs.sciencenet.cn/upload/blog/file/2010/1/2010111174453789577.pdf.

Cerezo-Pizarro, Mario, Francisco-Ignacio Revuelta-Domínguez, Jorge Guerra-Antequera, and Jairo Melo-Sánchez. 2023. “The Cultural Impact of Video Games: A Systematic Review of the Literature.” *Education Sciences* 13 (11): 1116. https://doi.org/10.3390/educsci13111116.

Chow, Rosan. 2014. “What Should Be Done with the Different Versions of Research-Through-Design?” In *Entwerfen - Wissen - Produzieren: Designforschung Im Anwendungskontext*, edited by Claudia Mareis, Gesche Joost, and Kora Kimpel, 145–58. transcript Verlag. https://doi.org/10.1515/transcript.9783839414637.145.

Fernando, Julian W., Léan V. O’Brien, Nicholas J. Burden, Madeline Judge, and Yoshihisa Kashima. 2020. “Greens or Space Invaders: Prominent Utopian Themes and Effects on Social Change Motivation.” *European Journal of Social Psychology* 50 (2): 278–91. https://doi.org/10.1002/ejsp.2607.

GilPress. 2024. “How Many Gamers Are There? (2024 Statistics).” Whats the Big Data. January 31, 2024. https://whatsthebigdata.com/number-of-gamers/.

Gupta, Joyeeta, Xuemei Bai, Diana M. Liverman, Johan Rockström, Dahe Qin, Ben Stewart-Koster, Juan C. Rocha, et al. 2024. “A Just World on a Safe Planet: A Lancet Planetary Health–Earth Commission Report on Earth-System Boundaries, Translations, and Transformations.” *The Lancet Planetary Health* 0 (0). https://doi.org/10.1016/S2542-5196(24)00042-1.

Hess, David J., and Benjamin K. Sovacool. 2020. “Sociotechnical Matters: Reviewing and Integrating Science and Technology Studies with Energy Social Science.” *Energy Research & Social Science* 65:101462. https://doi.org/10.1016/j.erss.2020.101462.

Higgins, David M. 2016. “Dreams of Accumulation: The Economics of SF Video Games.” *Science Fiction Studies* 43 (1): 51–66. https://doi.org/10.5621/sciefictstud.43.1.0051.

Inayatullah, Sohail. 1998. “Causal Layered Analysis: Poststructuralism as Method.”

Futures 30 (8): 815–29. https://doi.org/10.1016/S0016-3287(98)00086-X.
Jasanoff, Sheila, and Sang-Hyun Kim. 2009. “Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea.” *Minerva* 47 (2): 119–46. https://doi.org/10.1007/s11024-009-9124-4.
Johnson, Craig, and Rowan Tulloch. 2017. “Video Games and Dystopia: Total Cities, Post-Cities and the Political Unconscious.” *Journal of Gaming & Virtual Worlds* 9 (3): 243–56. https://doi.org/10.1386/jgvw.9.3.243_1.
Jonas, Wolfgang. 2007. “Research through DESIGN through Research: A Cybernetic Model of Designing Design Foundations.” Edited by Ranulph Glanville. *Kybernetes* 36 (9/10): 1362–80. https://doi.org/10.1108/03684920710827355.
Kay, Niva, and Kerry Topp. 2025. “REGENERATE Game Jam - Reimagining Farms in Games to Showcase Organic, Regenerative and Indigenous Farming Knowledge.” In *He Rourou*, edited by David Parsons, 3 (1):46–49. Auckland, New Zealand: academyEX. https://doi.org/10.54474/herourou.v3i1.
Lutz, Annika E., Michael T. Schmitt, Caroline Mackay, and Joshua D. Wright. 2024. “Experimentally Elevating Environmental Cognitive Alternatives: Effects on Activist Identification, Willingness to Act, and Opposition to New Fossil Fuel Projects.” OSF. https://doi.org/10.31219/osf.io/7xey2.
Martín, Ruth García, and Frederic Torres Úbeda. 2024. “Playing to Understand the Environment: From Superficial Skins to Truly Ecological Gameplays.” In *Video Games and Environmental Humanities: Playing to Save The World*, edited by Kelly I. Aliano and Adam Crowley, 107–21. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-67980-3_7.
Navarro-Remesal, Víctor, and Mateo Terrasa Torres. 2024. “Healing a Life out of Balance: Slowness and Ecosophy in Death Stranding.” In *Ecogames*, edited by Laura op de Beke, Joost Raessens, Stefan Werning, and Gerald Farca, 223–40. Playful Perspectives on the Climate Crisis. Amsterdam University Press. https://doi.org/10.2307/jj.10819591.12.
Olazabal, Marta, Ana T Amorim-Maia, Cecilia Alda-Vidal, and Sean Goodwin. 2024. “What Is Limiting How We Imagine Climate Change Adaptation?” *Current Opinion in Environmental Sustainability* 71 (December):101476. https://doi.org/10.1016/j.cosust.2024.101476.
Pereira, Laura. 2021. “Imagining Better Futures Using the Seeds Approach.” *Social Innovations Journal* 5 (March). https://socialinnovationsjournal.com/index.php/sij/article/view/694.
Possler, Daniel, Nicholas David Bowman, and Rowan Daneels. 2023. “Explaining the Formation of Eudaimonic Gaming Experiences: A Theoretical Overview and Systemization Based on Interactivity and Game Elements.” *Frontiers in Communication* 8 (September). https://doi.org/10.3389/fcomm.2023.1215960.
Preiser, Rika, Tanja Hichert, Reinette Biggs, Julia van Velden, Nyasha Magadzire, Garry Peterson, Laura Pereira, Keziah Mayer, and Karina Benessaiah. 2024. “Transformative Foresight for Diverse Futures: The Seeds of Good Anthropocenes Initiative.” *Development Policy Review* 42 (S1): e12791. https://doi.org/10.1111/dpr.12791.
Rivero-Vadillo, Alejandro. 2022. “Challenging Solarpunk s Technophilia through Degrowth Imaginaries in Julia K. Patt s ‘Caught Root’ and Linda Jordan s ‘Reclaiming.’” *Ecocene: Cappadocia Journal of Environmental Humanities, Cappadocia University*, June, 3 (1). https://doi.org/10.46863/ecocene.64.

Rockström, Johan, Joyeeta Gupta, Dahe Qin, Steven J. Lade, Jesse F. Abrams, Lauren S. Andersen, David I. Armstrong McKay, et al. 2023. “Safe and Just Earth System Boundaries.” *Nature* 619 (7968): 102–11. https://doi.org/10.1038/s41586-023-06083-8.

Vervoort, Joost M. 2019. “New Frontiers in Futures Games: Leveraging Game Sector Developments.” *Futures* 105 (January):174–86. https://doi.org/10.1016/j.futures.2018.10.005.

Vervoort, Joost, Tara Smeenk, Iryna Zamuruieva, Lisa Reichelt, Mae Van Veldhoven, Lucas Rutting, Ann Light, et al. 2024. “9 Dimensions for Evaluating How Art and Creative Practice Stimulate Societal Transformations.” *Ecology and Society* 29 (1): art29. https://doi.org/10.5751/ES-14739-290129.

Wright, Joshua D., Michael T. Schmitt, and Caroline M. L. Mackay. 2022. “Access to Environmental Cognitive Alternatives Predicts Pro-Environmental Activist Behavior.” *Environment and Behavior* 54 (3): 712–42. https://doi.org/10.1177/00139165211065008.