GREENING GAMES EDUCATION

A REPORT ON TEACHING AND RESEARCHING ENVIRONMENTAL SUSTAINABILITY IN THE CONTEXT OF VIDEO GAMES

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CONTENTS

CONTENTS

1. INTRODUCING ENVIRONMENTAL SUSTAINABILITY IN VIDEO GAMES

Video games are not only the exemplifications of technological advancements but above all mirrors of everyday culture. As McKenzie Wark argues in Gamer Theory (2007), video games are "a key part of the shared culture from which one can begin the process of creating a reflective and critical approach to the times". [1] Games then become spaces of speculation, where cultural values and realities are at play. This dynamic is also visible with regards to environmental issues. Climate-aware video games (also referred to as green games, environmental games, eco-games or 'cli-fi' games) may contribute to raising ecological awareness. [2] Games can also help players reconnect with the natural world. This is the case of Riders Republic (Ubisoft Annecy Studios, 2021), a sports multiplayer game whose map was created directly from satellite images, so the in-game terrain is the same as in real life. In an interview for the Greening Games project, Boris Maniora, Riders Republic's associate game director, admits that such nature-led level design may help preserve protected areas as well as inspire the players to think more ecologically.

On the other hand, video games are as much objects of culture as they are of nature. Their development is dependent on digital electronic computers. They are played on consoles, whose components rely on the use of natural resources. Jackson Ryan in an extensive piece on the negative impact of next-generation consoles on the planet, notes:

> It's one thing to depict the effects of climate change in games, another altogether for developers, manufacturers, publishers and the world's largest video game companies to address the environmental impacts.[3]

Also, Benjamin Abraham, in his more recent work strongly advocates solving the real problem, that is not making games with green content but making games in sustainable ways.[4]

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1 Wark, M. 2007. Gamer Theory. Cambridge, MA: Harvard University Press, Acknowledgements.
2 Benjamin Abraham and Darshana Jayemanne discuss the potential of games for raising ecological awareness in the following article:
Abraham, B.J., Jayemanne, D. 2017. Where are all the climate change games? Locating digital games' response to climate change.Transformations Journal 30, 75.
3 Ryan, J. 2020. Xbox, PS5 and the climate crisis: Next-gen video games could be worse for the planet. CNET. Gordon, L. 2020. The many ways video game development impacts the climate crisis. The Verge. https://www.cnet.com/science/features/xbox-ps5-and-the-climate-crisis-next-gen-video-games-could-be-worse-for-the-planet/.
4 Abraham, B.J. 2022. Digital Games after Climate Change. Springer International Publishing.

1.1 Our Approach to Environmental Sustainability in Video Games

As the above examples demonstrate, the worlds of environment and video games cross at many diverse points. The Greening Games project navigates this thematic maze from four intertwined perspectives:

1. Games Infrastructures
2. Games Cultures
3. Games Production
4. Games Content

The first two engage with humanities-led topics related to Critical Game Studies, and the latter two fall under the banner of applied approaches to Ecological Game Development (see Figure 1).

CRITICAL GAME STUDIES

ECO GAME DEVELOPMENT

Games Infrastructures

Possible topics may include: materiality of digital media, resource extraction, activism, culture of obsolescence, games distribution, socio - economic power structures.

Games Production

Possible topics may include: sustainable business operation, green game development, energy-conscious development, optimising for less hardware-demanding games, reusing assets, carbon footprint of game-making and game-playing.

Games Cultures

Possible topics may include: in-game representation of cultural values, ecological aesthetic, games as spaces of empowerment and activism, social sustainability, unionism and labour-related issues.

Games Content

Possible topics may include: environmentally considerate design, persuasive design, design affordances, environmental game aesthetic, environmental in-game themes, game jams.

Figure 1. Four thematic clusters that define environmental sustainability in the Greening Games project.

Critical Game Studies

By Critical Game Studies we refer to approaches towards the study of games that engage with ethical and political dimensions of the medium. In this sense, the question of the environmental sustainability of video games is embedded in the existing socio-economic power structures. One of the leading ecological questions of Critical Game Studies is focused on the neoliberal capitalist framework of exponential growth, optimization and culture of obsolescence within which most pro-ecological initiatives of the games and electronics industry are set. This may create a sense of discrepancy between how most businesses are run and how they communicate about the importance of environmental sustainability to their operations.

While the category of Games Infrastructures thematizes the crossovers between environment and materiality of video games, Games Cultures engages with games as spaces of cultural values as well as social sustainability. The leading rationale behind the first two categories belonging to Critical Game Studies is to invite the students to go back to the drawing board and critically approach the conceptual foundations upon which video games rest. In other words, didactic repertoire of eco-critical Game Studies should engage with video games as material as well as labour and energy-intensive products.

Ecological Game Development

The applied Game Development-related perspectives focus on sustainable game production (Game Production) and environmentally considerate game design (Games Content).

The first aspect takes into consideration topics such as energy demands of game development, heating office spaces, flying to conferences or the use of cloud services. These, amongst others, contribute to the industry's overall carbon footprint. According to Ben Abraham's rough estimation based on their data collection from emission reports of a few small and large studios across the globe, the game industry may have to account for 3-15 million tonnes CO2 equivalent emissions per year, or 0.04% of global emissions, when considering only energy use during the development process. [5] To make the above numbers more tangible, this amounts to the emissions of Slovenia. While this may appear a relatively small number, it is not the industry's only impact. The infrastructure upon which games and game making rely (hardware manufacturing, cloud services) and ultimately the energy used by the consumer while playing unoptimized games on power hungry machines, may both present a much bigger challenge to mitigate.

The second aspect focuses on designing games representing and simulating ecological dynamics. Today, within the framework of the Playing for the Planet Alliance (P4PA) and many other international initiatives, developers are encouraged to include themes of climate and environmental restoration in their games. However, in order to be able to successfully design eco-games, developers (and students as future ecologically conscious developers) need to learn to use video games as a medium of both critical expression and representation of systemic complexity.

5 Abraham, B.J. 2022. Digital Games After Climate Change. London: Palgrave Macmillan, 19, 117.

We hope that by interpreting environmental sustainability in games via those four leading paths will help newcomers to the field in grasping its complexity. In the literature review part of the report, we are also working with those four perspectives in order to present a structured overview of the state of the art in research as well as to give the readers the choice to either engage with all the themes or to choose those that are most relevant to their professional background.

1.2 Sustainability in Video Games Education: Needs & Objectives

Those many ways in which environmental issues cross with video games prodded us to rethink ecologically considerate games education. The leading question we want to ask is: What does it mean to teach "green gaming"? What should the students know and what should their instructors aim for? Should they focus on the capacity of games to inspire, raise awareness and change behaviours or is it more important to teach about ethically responsible sustainable game-making? And perhaps most importantly, why to create more awareness for and expertise in teaching sustainability in video games in the first place? We need to ask those questions in order to develop good didactic resources related to environmental sustainability in video game production, design and game studies.

Before embarking on the design of our didactic framework, we conducted initial research on the current state of the arts in higher education (considering both research and didactics) and in the private sector (video games industry). We believe that in order to design successful and long term didactic strategies, we have to build bridges between those two worlds. We have identified three foundational Needs that would pave the way towards developing our teaching content:

> Need 1: To understand the state of the art in green gaming research and teaching conducted at European universities and to understand the current practices of the private sector.
>
> Need 2: To explore the challenges related to teaching green gaming in the higher education context.
>
> Need 3: To identify the skills that the private sector is currently lacking and in order to better prepare the students for their professional futures in the transforming games industry.

In order to address the above Needs, we have set up three aligned Objectives that we completed in the first year of the Greening Games project (2021-2022):

> Objective 1: To conduct a literature review of green gaming including all identified research aspects falling under the four specified themes
>
> Objective 2: To conduct surveys and selected interviews amongst lecturers in higher education institutions.
>
> Objective 3: To conduct surveys among selected stakeholders from the private sector.

The findings that emerged out of the three objectives are presented in later parts of this report.

1.3 The Aim & Scope of this Report

The aim of the Greening Games Education report is to provide a comprehensive picture of the green gaming research, related didactic offer and the interests of the private games industry sector. The report is divided into three parts: Mapping out Teaching and Research, Mapping out the Video Games Industry and Summary and Next Steps. In the Appendices section, we are sharing the question sets and supporting visual data behind the semi-structured interviews and surveys that we conducted amongst higher education experts and game developers.

Mapping out Teaching and Research

In the first part, we are analysing the current state of the art in teaching and researching environmental sustainability of digital media and games, based on semi-structured interviews and surveys (more about the method, sample and findings may be found in part two of this report). This part also includes descriptions of three teaching pilots delivered in the summer and winter semester 2022 at Cologne Game Lab at TH Köln and at Charles University in Prague. We are providing a curated list of literature that the educators may work with in the context of our four themes: Games Infrastructure, Games Cultures, Games Production and Games Content. Finally, we are pointing to the events and panels that the Greening Games team organised in 2022.

Mapping out the Video Games Industry

The second part, focused on the video games industry, begins with an analysis of interviews and surveys conducted amongst game developers. We also summarise major projects and initiatives led by the game developer community and the industry within the context of environmental sustainability. Finally, we are providing a few exemplary analyses of selected environmental games and their affordances.

Summary and Next Steps

In the third part, we are providing an outlook into the future steps of the Greening Games project, assessing the usefulness of the findings presented in this report in building cross-disciplinary didactic materials and formats to teach environmental sustainability of and in video games.

This Greening Games Education report is available as open access material and may be downloaded from the Greening Games project's website: www.greeningames.eu. We have also shared it with the academic community via ResearchGate and Academia platforms of the research team members.

2. MAPPING OUT TEACHING AND RESEARCH

2.1 Introducing the Field

2.1.1 Higher Education: Interview Findings

Based on the data collected from 10 in-depth interviews with selected European academics representing a wide range of higher education institutions and university programs, we have identified a variety of themes that have helped us better understand the intersections between game education and environmental issues.

Below, we are providing a hermeneutic analysis based on the qualitative interview data. We are also sharing a few insights into the analysis method and our collaborative analysis process. Survey data may be viewed in the visualisations provided in Appendix 4: Survey Data Visualisations.

Interview period: May-June 2022 within the framework of the Erasmus+-funded project "Greening Games. Building HE Resources for Sustainable Video Game Production, Design and Critical Game Studies"

Interviewees representing the following HE institutions: Film and TV School of Academy of Performing Arts in Prague (FAMU), Heinrich-Heine-Universität Düsseldorf, Howest University of Applied Sciences, ITU Copenhagen, Macromedia University, University of Jyväskylä, University of Potsdam, University of Warsaw, Uppsala University, Utrecht University

HE institutions representing the following countries: Belgium, Czech Republic, Denmark, Finland, Germany, Poland, The Netherlands, Sweden

Interviewers: Sonia Fizek (Cologne Game Lab, TH Köln), Andrea Hubert (Charles University of Prague), Tuki Clavero (Breda University of Applied Sciences), Maria B. Garda (University of Turku)

Interview lengths: Each semi-structured interview was conducted orally and lasted between 30 to 60 minutes. Most of the interviews were recorded during online sessions over Zoom; some were conducted in person.

Interview questions: see Appendix 4 "Semi-Structured Interview Questionnaires for Higher Education"

Software we used to support collaborative data analysis: Dovetail

Method: Hermeneutic analysis based on collected qualitative data

2.1.2 Method

All the semi-structured 10 interviews were recorded between April and June 2022. We then uploaded the audio files to a secure shared folder on the Sciebo platform (a university-developed platform for higher education institutions in the North Rhine-Westphalia land region in Germany). The audio files (circa 7 hours of material in total) were transcribed, partially manually and partially with the help of the automated transcription tool available in the Dovetail software. The last stage involved an iterative collaborative process of reading through the data and coding it with tags (as seen in figures 2 and 3).

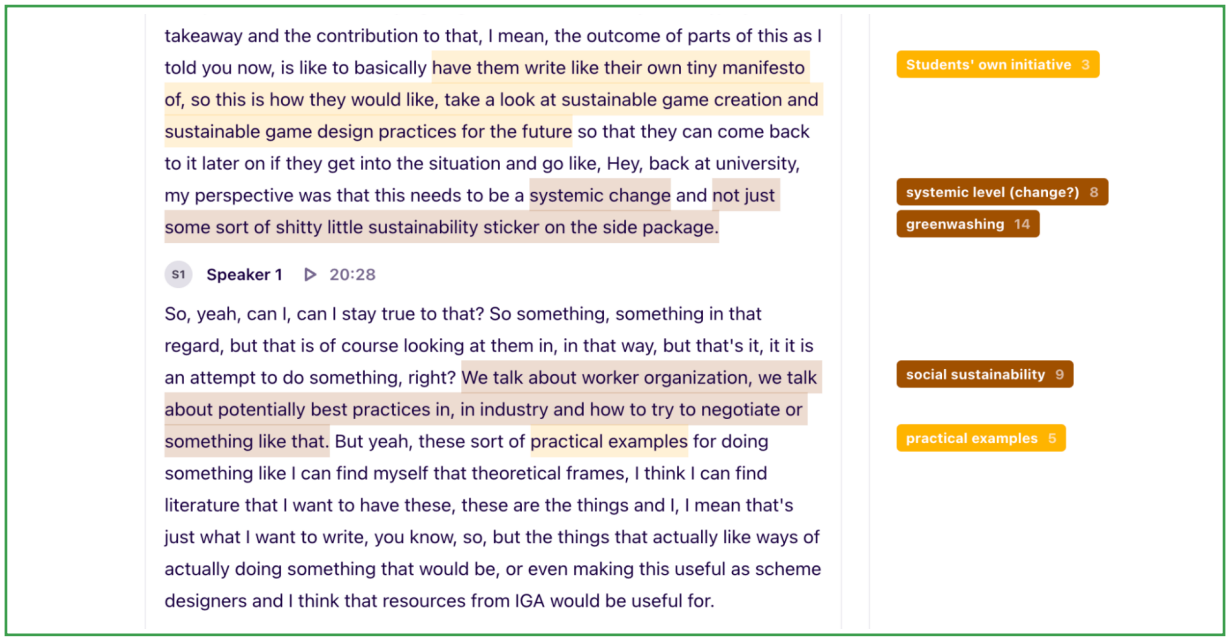


Figure 2. An example of the tagging process in a capture from the interview with Patrick Prax.

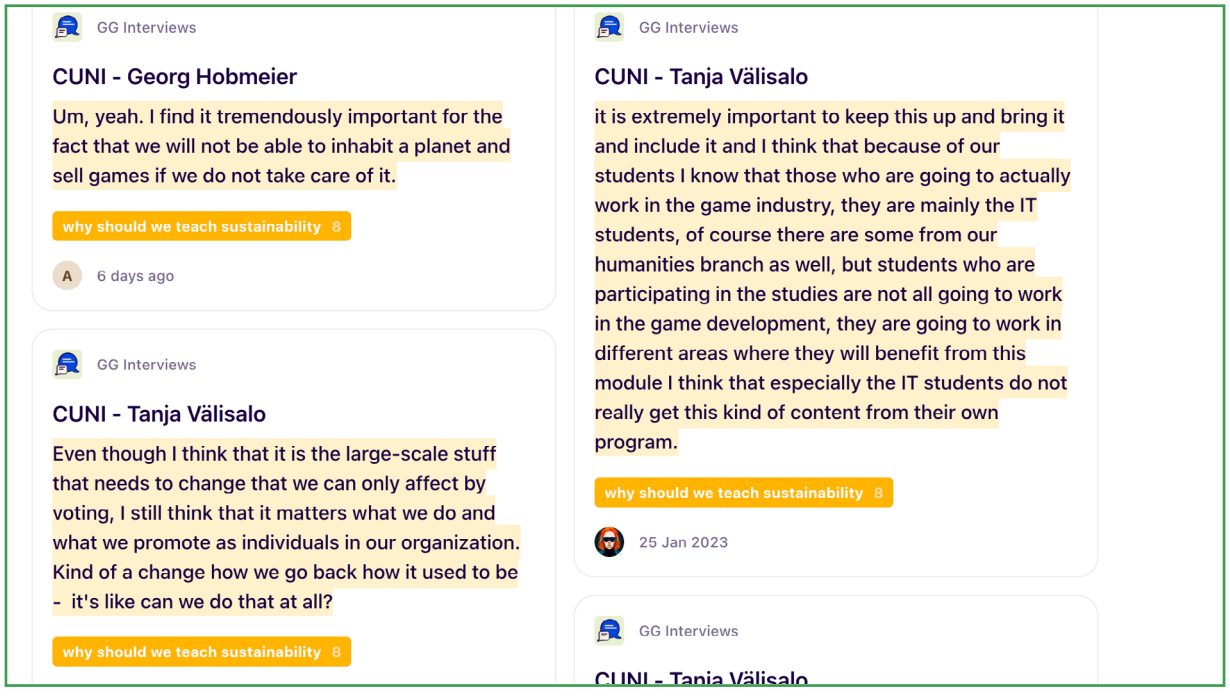


Figure 3. An example of interview data assigned to one tag - "why should we teach sustainability".

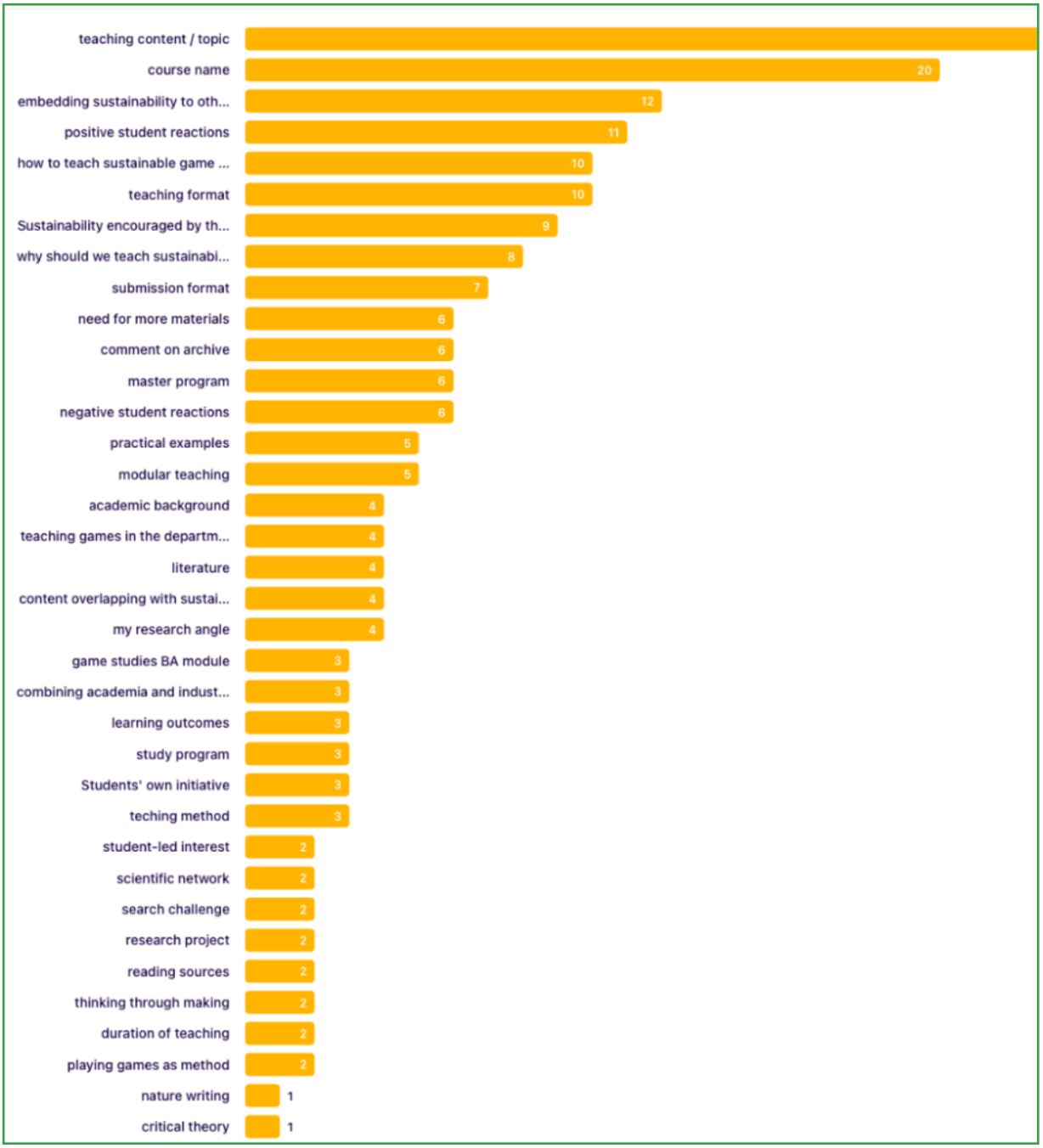


Figure 4. A visualisation of tags from the Higher Education data set (the first tag "teaching content / topic" has been coded 48 times across the interview material - due to the width of the image, the number is not visible here).

The data and the tags were re-read in an iterative process until all the diverse tags assigned by different team members had been unified. The entire data analysis process was conducted in five iterative stages (each stage was repeated at least three times).

Stage 1: Coding / tagging transcribed data

Stage 2: Sorting tags into thematic categories (to identify recurring themes)

Stage 3: Developing insights for selected categories and most frequently appearing tags (more detailed descriptions expanding on the tags)

Stage 4: Establishing insightful themes based on coded data

Stage 5: Hermeneutically analysing the material under the specified themes (visible in the Interview Analysis section)

After sieving through the existing tags grouped into categories, we started creating insights, short descriptions expanding on the existing tags and helping us in discerning analytical categories and patterns. This stage was followed by the hermeneutic analysis of the entire prepared material. The findings are presented in the Interview Analysis section. Below we are also presenting a table with an overview of our interviewees, their disciplinary teaching angles, departments as well as didactic themes and assignment formats.

Interviewee	Institution and Department	Disciplinary angles	Level	Didactic themes and formats	Assignment formats
Paweł Frelik	University of Warsaw, American Studies Center (with a focus on cultural studies)	American Studies, Cultural Studies, Game Studies	BA, MA	Game analysis of motives, themes, aesthetics and mechanics in selected examples; comparative analysis between games and speculative fiction genres Discussion seminars	Comparative analysis essays
Sebastian Möring	University of Potsdam and University of Applied Sciences Potsdam, European Media Studies (a joint program)	Cultural Studies, Media Studies, Game Studies	BA, MA	Critical game studies supported by creative media interventions (e.g. nature writing, in-game photography, virtual exhibition building), Game analysis (based on play session of selected games) Discussion seminars and practical interventions (design)	Nature writing booklet, virtual exhibitions of in-game photography taken by students

Stefan Werning	University of Utrecht, Media and Cultural Studies	Cultural Studies, Media Studies, Game Studies,	BA, MA, PhD	Framing analysis and critical discourse analysis within the context of green media (audio-visual media, software, video games) Discussion seminars, lecture segments	Video essay, Twine story, academic paper
Gerald Farca	Macromedia University (applied), Game Design	Game Studies, Game Design	BA	Workshops, game studies and world and characters design Game design assignments (worldbuilding) intertwined with discussion seminars	Game levels, game concepts, essays
Hanna Wirman	ITU Copenhagen (applied)	Game Design, Game Studies	MA	Game design assignments	Group projects in critical game design
Patrick Prax	University of Uppsala	Game Design, Game Studies	BA, MA	BA - game dev, MA - games and society(plus sustainability)	Writing assignment: a sustainable game creation
Tanja Välisalo	University of Jyväskylä	Game Design, Game Studies	BA, MA, PhD	Intermediate Game Studies, introduction course	Written assignment, academic essay on the topic of sustainability and games

Table 1. Overview of environmental didactic themes, formats and assignment types in courses including green gaming topics offered across the institutions whose staff we interviewed (in the table we have only included interviewees that are already offering courses in environmental

2.1.3 Analysis

We have analysed the findings under three overarching themes that we will discuss in the sections below.

1. Incorporating Environmental Themes into Existing Teaching Programs
2. Positive and Negative Student Reactions
3. Why Should We Teach Environmental Games?

Incorporating Environmental Themes into Existing Teaching Programs

One of the most relevant questions regarding teaching environmental themes in the context of games, is how to introduce the new teaching material into existing programs, modules and courses. Many of our interviewees have raised this point, asking whether environmental themes should be incorporated into already existing structures or should the entire programs be rebuilt more radically to provide enough space for environmental game education?

Universities and institutes have their own pre-existing curricula and focus points and so in most cases, environmental considerations in games education are being integrated into those. Many of our interviewees describe this dynamic in their own institutes. In the paragraphs below, we are describing how environmental considerations in games are taught from a range of perspectives at selected departments. Many of our interviewees teach from humanities-led perspectives predominantly in Media and Cultural Studies departments (Utrecht University, University of Potsdam and University of Warsaw) as well as in game design programs (Macromedia University, Uppsala University and IT University of Copenhagen). We are also referring to environmental games education in the context of applied game development and design courses (FAMU Prague, University of Jyväskylä and HOWEST University of Applied Sciences).

Utrecht University (Media and Culture Studies)

Stefan Werning, an associate professor for Digital Media and Game Studies, gives a few tangible examples of how environmental topics are taught at the Department of Media and Culture Studies at Utrecht University (The Netherlands), emphasising how the lecturers at the department are “trying to embed those sustainability angles into other courses whenever it makes sense”. At the bachelor, master and doctoral levels, environmental games content has appeared in the following course structures:

a. Green Media and Civic Engagement - a BA course opened to other departments as well. This course engages with wider media-related topics, looking into screen-based media, eco-performativity as well as eco-design. The last thematic pillar includes eco-critical analyses of data visualisations, software applications, product design and games.

b. Serious Games and Gamification - a BA course focused on persuasive gaming, into which topics of eco-gaming are embedded.

c. Playful Media Cultures - an MA course in a newly designed master program, within the framework of which ecological topics will be embedded. Ecological themes will play a relatively minor role in this course.

d. Ecogames Summer School - a dedicated one-week-long Summer School held once a year at the Department of Media and Culture Studies at Utrecht University, inviting international Master and Doctoral students to a week of lectures, seminars and workshops revolving around the topic of ecology and games.

University of Potsdam (European Media Studies)

Sebastian Möring, an assistant professor in media and game studies, describes a similar dynamic in the European Media Studies, a joint study program of University of Potsdam in Germany (Arts and Media Department) and University of Applied Sciences Potsdam (Design Department), which merges theoretical approaches with practical design-oriented methods. Like Stefan Werning, Sebastian Möring notices that ecological content "can be part of all kinds of modules that you already have in the curriculum". In his teaching, he incorporated ecological topics in a number of courses:

a. Approaches to the Ecology of Computer Games - a BA course offering critical analyses of foundational texts in green game studies. The outcome of this course was a framework for eco-critical game analysis.

b. Nature Writing in Games and Reality - a BA course taught in cooperation with Prof. Dr. Birgit Schneider in which the students were exploring ecological themes through creative writing, adapting the literary format of "nature writing". The aim was to explore the relationship to mediated nature in video game worlds.

c. Exhibiting Nature Digitally - a BA course taught in cooperation with Prof. Dr. Birgit Schneider, combining theoretical approaches on the medial construction of nature with creative and applied interventions. The students' task was to perform in-game nature photography and build a virtual exhibition about nature in a social VR tool Mozilla Hubs. In that course Möring was testing "how to implement digital tools and digital methods into humanities study programs".

The course on Exhibiting Nature Digitally was built around learning outcomes specifically developed for the European Media Studies joint study program, which intertwines media theoretical perspectives with design. This type of teaching is foundational for Möring's teaching philosophy, which intertwines media critical theory with creative components. This allows him to explore what he calls "thinking through making" approach:

> In order to be able to reflect about the media, you cannot only write about the media, right? And therefore the idea is that at some point your thought has to be put into practice, and then the practice has to provide something back for theory. So thinking then goes through making, in some kind of way.
> (Sebastian Möring, University of Potsdam)

Macromedia University (Game Design and Development)

Another interesting didactic experience we would like to point towards is that of Gerald Farca, a professor in Game Design at the Macromedia University (Germany) in the Business, Design and Technology Faculty. Farca's case illustrates a humanities-led game studies lens adjusted to an applied BA program in Game Design and Development and MA program in Game Management. Gerald Farca has academic background in English Literature Studies but in the past few years he has been coordinating and teaching courses in game design. He has been integrating environmental considerations into existing modules with focus points on world building and character design. His didactic approach to teaching environmental topics centres around three main perspectives:

a. World Building and Level Design - with a focus on simulated environments and mechanics
b. Sustainability of Digital Media - with a focus on the materiality of media
c. Ecological Aesthetics - with a focus on close readings of environmental themes and motifs in games

Macromedia University plans to integrate sustainability-related topics across all its programs in all its campuses across Germany. An intervention exploring this avenue took place in the summer semester of 2022 during a workshop week at Macromedia University eight campuses. Each campus was exploring one of the sustainable development goals set up by the United Nations:

> The workshop is extra-curricular. We have a project week this week (the interview took place on the 24th of June 2022) and the topic is sustainability. And you have the UN sustainability goals and we divided those goals, two per campus, because we (Macromedia) have 8 campuses and so each campus is trying to envision two of those goals and come up with solutions for them.
> (Gerald Farca, Macromedia University)

University of Warsaw (American Studies Center)

Paweł Frelik, a professor in American Studies, based at the University of Warsaw, has been incorporating material on ecocriticism within cultural studies courses in his department. He has not taught courses that are exclusively focused on eco-games or climate games, but has managed to use games every now and then as reference material within a broader media context, looking specifically into aesthetic and narrative dimensions and how those communicate climate related issues. His main research and teaching perspective is that of speculative fiction as it provides for a great medium, critical of the current times:

> I usually begin with introducing them to how those kinds of narratives, fantastic speculative narratives, are never really about any future. They're not really predicting, they're really the ways of talking about now and here.
> (Paweł Frelik, University of Warsaw)

Heinrich Heine University Düsseldorf (Media and Culture Studies)

Melanie Fritsch, an assistant professor in Media and Culture Studies with focus on Game Studies, describes what role game studies play at her department, admitting that despite three members of staff active in the field of game studies, so far the department does not have a dedicated game studies module but a themed seminar called "Gaming". Beyond the latter, a variety of topics related to games are loosely integrated into the existing modules and taught by herself and two other colleagues. None of the courses so far have explored environmental issues but Melanie Fritsch has already picked up signals of interest from the students. Her focus points in teaching are: ludomusicology, performance studies and game preservations. However, if she was to teach themes related to green gaming in the future,

a. How environment is depicted in games
b. How the industry approached the climate crisis problem

> I would find it very important to look at actual industry examples. How are companies trying to firstly convey that they are aware of the problem?
> (Melanie Fritsch, HHU Düsseldorf)

Uppsala University (Game Design)

Patrick Prax, an associate professor at Uppsala University's Department of Game Design, has been incorporating environmental topics into his teaching, primarily in the Master course. His interest lies at the intersections between games and society (from media and communication studies perspective) and he has been focusing on systemic perspectives, going beyond the impact of individual action. He is also teaching on the impact of the perpetual innovation of the games industry and its connection to producing electronic waste, topics related to carbon trading and carbon offsetting as well as social sustainability: "We talk about churn in the games industry and the exploitation of workers in the cultural sectors".

IT University of Copenhagen (Master of Science in Games)

Hanna Wirman, an associate professor and head of program in Master of Science in Games, has shared how the topics of sustainability are incorporated into the study programs at ITU Copenhagen. She admits that there is no structure in place for environmentally focused courses but many lecturers integrate the topic into already existing modules and courses.

> And it's not that it would be the sole topic for the course, it's not necessarily even the sole topic of a single class, but it is something that we take into account and something that we touch upon. (Hanna Wirman, ITU Copenhagen)

A good example in how environmental topics are included into already running courses is a Master course in Playable Media, which is less focused on the technical skills and more on the so-called critical design. Within the framework of this course, Wirman raises the questions of environmental responsibility of the designer.

As the head of the Master program, she would like to see more didactic focus on sustainability-related issues (also including social sustainability), but until recently, as she admits, we have not been ready due to lack of research and didactic materials:

> Now that the IGDA report on sustainability and gaming is out, we have more tools to talk about the ways in which games can become more sustainable; hopefully also through projects like yours (Greening Games) and the NASG as well (Nordic Alliance on Sustainability in Gaming). We can better understand in what ways games are part of sustainability discourse, taking into account their specific role within a larger body of work on sustainable practices and then potentially when there's interest, create projects that try to alleviate these aspects. (Hanna Wirman, ITU Copenhagen)

The Film and TV School of the Academy of Performing Arts in Prague (FAMU)

Michal Berlinger, a game developer at a Czech independent studio Amanita Design, teaches Game Design and Introduction to Programming at FAMU Prague. Sustainability is a topic that he is involved with in his personal life but not necessarily in his professional practice. A considerable amount of the interview was spent, discussing energy solutions and sustainable living, which he strives for. For Berlinger the most interesting area with regards to green games is related to the designer's point of view. He admits that he is not familiar enough with the topic of environmental design to teach it. However, he would welcome an outside incentive to teach this topic at his institution. Michal Berlinger sees the real value of sustainable efforts elsewhere. In his view, figuring out solutions for fundamental issues such as electricity and gas consumption, is much more pressing at the moment.

> I find it humorous that we deal with plastic straw bans in the media, but then I go to the premises rented by the school, and there's a window open and the heater is on permanently. Nobody's going to address it, it's just the way it is. And that's where it should start, with the awareness of energy consumption. If you're spending time in a place that's wasting heat, how are you supposed to stand up in front of these people and preach when you don't even have a solution for these basic things?
> (Michal Berlinger, FAMU; Amanita Design)

Within the context of design, he would be interested in giving players and designers practical knowledge that could be used to influence a more sustainable everyday life. Berlinger sees games as media able to address such challenging topics and provide players with necessary information to understand their own consumption patterns. He suggests teaching design that can be applied in everyday contexts.

> I see room there to educate people in some basic things. It varies depending on what a person is doing for a living. Recently, I was arranging a rainwater pump and solar panels. So my focus is on energy solutions. I guess there could be a game about that to give people a better idea of what to do. (Michal Berlinger, FAMU; Amanita Design)

Although Michal Berlinger is conscious of behaviours detrimental to the environment and aware of the power of games to persuade or change detrimental behaviours, he still remains sceptical about the level of attention the topic should be given in game development education. He feels the topic is still perceived as fairly unimportant to the general society and therefore it is not applicable to current education needs.

> Maybe one day society will come to the point where sustainability in gaming is regarded as an absolutely essential topic, which it is. I think that we're not there yet and that kind of importance attached to it in the current era is out of proportion.
> (Michal Berlinger, FAMU; Amanita Design)

Berlinger advocates for the studies to be "universal" in a sense that the students should become able to apply their knowledge of game making to all kinds of contexts, including socially conscious and environmental games.

University of Jyväskylä (Faculty of Humanities and Social Sciences)

Tanja Välisalo, a university teacher at University of Jyväskylä, teaches Introduction to Game Studies, a multidisciplinary course where students are introduced to game studies as a research field and gain a foundation for understanding games and playing as parts of contemporary culture. The course approaches games, players and playing from multidisciplinary perspectives. As of yet, Välisalo does not engage too much with the topic of sustainability, but considers it important and thinks that topics such as sustainable development need to be incorporated in a way that instils hope and fosters agency of the students. Tanja Välisalo does not see a problem with having a full-on lecture on sustainability in the industry, but she stresses that teaching sustainability does not need to take on the format of an "info dump". Instead, she advocates for small changes to established ways of one's teaching as effective openings for students to start thinking sustainably and to be able to come up with sustainable solutions and apply them in their own activities, whatever they may be.

> Often I notice that it can be just one minor sentence or a side note that really sticks with students. They often listen far more carefully than you would think, so you can implement really subtle remarks. (Tanja Välisalo, University of Jyväskylä)

Välisalo believes tha incorporating these topics into the general teaching can instil a sense of agency in students to battle feelings of hopelessness she often notices in the field around the environment.

> Often I notice that it can be just one minor sentence or a side note that really sticks with students. They often listen far more carefully than you would think, so you can implement really subtle remarks. (Tanja Välisalo, University of Jyväskylä)

Howest University of Applied Sciences

Regis Le Roy, policy advisor at Howest Kortrijk in Belgium, has ten years of experience at Howest as lecturer in game development and academic director for Digital Arts and Entertainment. Although currently he is not directly involved with creating or delivering educational content to the Bachelor programmes, he believes in providing content for teachers that is accessible and easy to incorporate into their existing course materials. Le Roy suggests that teachers could use examples from existing games to introduce the concept of sustainability, which is already an underlying topic in many AAA games. For example, many games involve mechanics such as collecting elements and resources, which can be incorporated into the sustainability themes (renewables as part of the energy source management, having resources that can be depleted or polluted, etc.) as game mechanics options as part of a Game Design course.Le Roy believes that students will be receptive to this approach as they are already familiar with the concept of sustainability from their previous education.

Regis Le Roy considers video games to be useful tools to improve and move away from discussions on violence and addiction. He notes that sustainability is a broad topic that can be introduced in various ways, giving students creative freedom to explore it in their own way. However, he also acknowledges that teachers may prefer to choose their own educational topics rather than being given one with too many constraints.

Overall, the focus should be on incorporating sustainability as an overarching theme rather than providing solely technical solutions such as hardware consumption concerns. Le Roy mentions that hardware development (optimisations) is a complex area to address as students want to use the best hardware available, and they often do not pay the costs associated with it. However, he believes that the industry should still be mindful of its energy costs and pay attention to sustainability. He mentions that the most vital thing for the games industry should be saving on energy costs, which is a combination of software development and hardware usage. He suggests that game and console developers, such as Nintendo and Sony, should be more aware of their energy consumption, especially when consoles are in a standby mode.

Positive and Negative Student Reactions

In our interviews, we have discussed how the students react to the topics of climate crisis and sustainability. The respondents described both positive and negative reactions. In the case of the latter, the students often felt hopelessness when confronted with such a multifaceted problem that has no apparent solutions. On rare occasions, they dismissed these themes entirely as politicised indoctrination.

Positive Feedback

Most of our interviewees pointed towards positive student reactions towards the topics of climate crisis and sustainability being incorporated into the teaching. While Hanna Wirman observes the students' confusion in relation to the complexity of climate change and the imminent realities of the game developers' role in it ("they assume that by becoming game developers they are part of an industry that creates positive experiences for people. But then someone suddenly tells them that actually you are the problem"), she feels that the students attach genuine value to the topic:

> Those who are in the classroom are very serious about it. Sustainability is something that they appreciate understanding and hearing about. I can see it based on their questions and comments.
> (Hanna Wirman, ITU Copenhagen)

Sebastian Möring received an overwhelmingly positive student feedback after a course on Nature Writing in Games and Reality that he delivered online at the start of the COVID-19 pandemic. Since the students could not go outdoors to experience nature, they decided to play video games and have their experience of nature there. The students would perform nature writing exercises and at the end of the course produce a booklet about their results. While the initial setting left much to be desired, the course ended up being a real success, as in Sebastian Möring's own words: "that was the best class I've ever taught. -- I have the impression they really liked the class." He could not distinguish exactly what made the class work so well and wondered whether part of the success was due to the unprecedented circumstances: "was it just because the whole situation was so special and we took this leap and it just worked out and we were happy with that, so that was good."

Gerald Farca also experienced many positive reactions to incorporating ecological themes into his courses. At the same time, he remains aware of his students' limits:

> The first time I taught this (ecology and sci-fi and ecology and world and character creation), it was a great success. -- They liked it very much especially in combination with science-fiction because we had ecological science-fiction. In essence, I think they are motivated, they like the topic, but not if you overdo it.
> (Gerald Farca, Macromedia University)

The Role of Generation Z

Some of our interviewees point to a generational gap that exists between the current workforce and the people belonging to the so-called Generation Z. Hanna Wirman speaks directly of a generational awareness problem. She has taken notice how the students at ITU Copenhagen are more motivated and often further ahead in sustainability work than their teachers. Whereas the students are already very serious about the topic, it seems more challenging to get the higher-level and mid-level management on board.

Negative Feedback

While the reaction has been generally positive, some of our interviewees (e.g. Stefan Werning and Patrick Prax), have taken notice how the sheer scale of the climate crisis has left the students emotionally affected and otherwise confused by what is expected from them. According to Werning, the "response is usually pretty good. We always have a couple of really excellent papers but also some people who are a bit overwhelmed." Also the students taught by Patric Prax seem to be perplexed by the complexity of the topic without the ability to provide any clear solutions to the problem.

One of these rare instances where the students have dismissed the topic of climate crisis and sustainability as too political, comes from Werning. In his teaching experience, he was confronted with "some accusations from people (students) suggesting that we tried to push a leftist agenda". Tanja Välisalo, lecturer at the University of Jyväskylä, pointed to a similar issue:

> We have to go through stuff that is more difficult to sink in for some such as gender and equality in game cultures. In certain gaming cultures, these topics may be provocative. (Tanja Välisalo, University of Jyväskylä)

On the other hand, Regis Le Roy feels that some of their students lack enthusiasm for the topic of sustainability, because they have already been exposed to sustainability in previous education: "they don't care. They want to develop games." Le Roy suggests that merely explaining sustainability through lectures can be boring and uninteresting for students who may feel that they have already learned enough about the topic. However, by introducing sustainability through the medium of game mechanics, students may become more interested and engaged. According to them, sustainability should be taught at the university level rather than just at the degree level and that creating a culture of sustainability within the university can help students to develop a more contextualised view of sustainability and inspire long-lasting behavioural changes.

Why Should We Teach Environmental Games?

Our interviewees often shared their personal motivation regarding teaching on environmental sustainability and games. For example, Tanja Välisalo notes that incorporating sustainable themes into teaching, especially in more subtle ways, has to be driven by the lecturer's own beliefs and values. Simply relaying the information may not be enough.

> It does not matter what I say if I do not believe it. If I am not enthusiastic about what I teach I cannot expect that from students. If I am not interested, why should the students be? (Tanja Välisalo, University of Jyväskylä)

Paweł Frelik's interest in the topic came partially from his original field of inquiry, speculative fiction, where the dystopian themes are very common.

> The questions of climate and planetary change have been very central to all kinds of fantastic media. So the interest came from two directions, one of the themes in the field that I have studied, but also as a natural extension of my political ethical being in the world. (Paweł Frelik, University of Warsaw)

This interplay between personal values and professional lives was also something that manifested itself in discussions on the societal responsibility of academia. Sebastian Möring believes that teaching sustainability is an obligation and responsibility all educators share. He recognizes this as extremely important because of academia's unique position as a social actor for change that should not be otherwise focused on making profit.

> As academics we should be independent in our thought, right? We should not be driven by market reasons, which obviously is not entirely the case because even academia works according to market mechanisms. But that set aside, what we can do is to stay critical. We have to do that. This is something that we can contribute with; something that the industry is not able to do to the same extent.
> (Sebastian Möring, University of Potsdam)

Välisalo reflects on her role as an academic teacher:

> It is our purpose to train or educate future professionals and experts who have the ability to think critically, so we can plant these seeds and hope that something grows from them. At the same time, we can't indoctrinate the students, no matter how right we think it is. We are not omnipotent. (Tanja Välisalo, University of Jyväskylä)

Välisalo notes that educating future game developers and people working in the technology sector who at some point will be decision makers, means incorporating many other components into the curriculum besides critical thinking and assessment of environmental impact of the industry. She stresses that the delivered messages may be subtle and do not necessarily require a lot of teaching time. According to Välisalo, game studies teachers have a unique opportunity to introduce IT students to these important topics:

> I think we can affect a lot of people who are going to work in technology and game development. It is important to make a difference for those individuals, because they might go through their education without really coming into contact with this topic otherwise. (Tanja Välisalo, University of Jyväskylä)

Sustainability action encouraged by the university

The Council of Europe, as well as national governments across the EU, are working together on implementing the United Nations 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDG). These policies are being developed on a local level by various public sector institutions including higher education. Many of the universities mentioned in this report are committed to the 2030 Agenda principles and some even consider themselves international leaders in sustainable development and responsible academia. For example, the University of Jyväskylä seeks to become carbon neutral by no later than 2030. This is only one of many ambitious environmentally oriented goals this institution has proposed in its Roadmap to Planetary Wellbeing.

Such policy level initiatives result in top-down pressures regarding curricula building expectations to consider these issues in teaching, and not only in Finland. Farca points out that the German Macromedia University "wants to have sustainability infused into all their courses." Also, for the ITU Copenhagen sustainability is one of the key focus areas and the Master of Science in Games is supported as being in line with these bigger, institutional goals, Hanna Wirman reports.

In general, our respondents shared an opinion that most likely many university lecturers would be interested in teaching on sustainability but not always have the resources to. Even in Nordic institutions, some interviewees recognized teaching on these issues as a bottom-up initiative. At the Uppsala University, a group of colleagues - including Patrick Prax - was interested in the topic and decided that a good way for them to make some actual impact would be to do an interdisciplinary course together. During one of the lectures for that class, Prax spoke to the students while standing knees deep in the Baltic Sea, a gesture that was meant to remind everyone about the rising sea levels. A threat especially tangible for the university's Visby campus located next to the shoreline and endangered with possible flooding according to current climate warming models.

> The problem with sustainability is that it is not very tangible. We see it as a problem far away from us. For instance, ocean pollution is not something that we get confronted with here in Belgium or in the Netherlands.
> (Regis Le Roy, Howest)

Academia and industry joining forces?

Melanie Fritsch considers connecting theoretical and practitioner perspectives as something very important to her personally. She thinks this would help people understand games not only from a consumer standpoint but also from the design perspective: "how the stuff is actually made" (i.e. what processes are involved).

Stefan Werning said that in his opinion academics should use all the opportunities they have, to at least try to do something: "to alert people, not to discourage them."

> It is important to be realistic that the games will not save the world, but they may change something. Many people who come to courses are gamers. This concept of imaginaries, of inspiration… Using the knowledge and love for games to encourage people to think productively about the future and maybe games can help us inspire people to look for those ways. Be realistic and avoid 'preaching'. (Stefan Werning, University of Utrecht)

Regis Le Roy thinks that incorporating sustainability topics in the teaching of game development can create a culture around students that will influence the behaviour they carry with them in their future workplaces. It is a challenging topic, but game mechanics and technology can be used to promote personal and cultural changes. Universities can also incorporate a research component into this topic, involving students and focusing on finding solutions to environmental challenges. This approach can be an effective way to promote sustainability and engage students.

> We also have a research component. And I think there are a lot of possibilities to use game mechanics or game technology towards a sustainable environment. For instance, creating digital twins. You can prototype a lot of things without involving physical resources. (Regis Le Roy, Howest)

On the other hand, Frelik observes that digitalization also has a dark side:

> Beginning with the completely unfettered demand for more and more energy, right. In every possible aspect, whether it's graphics or actual manufacturing, most of that energy continues to come from fossil fuels, right? There are hard empirical studies that demonstrate that the whole digital sector, of which of course video games are a part, has been incredibly ravenous about energy. And there are really no signs of this changing or abating. Quite the opposite, the whole drive is towards blockchain, cryptocurrencies and NFTs that are demanding more energy. (Pawel Frelik, University of Warsaw)

2.1.4 Higher Education Needs

Based on the undertaken analysis, we have identified the following needs focused on availability and content, as well as targeting of educational materials related to environmental sustainability and games, designed for higher education purposes. Furthermore, we recognize that the language and narratives around these topics have to be considered with utmost care, as based on student reactions encountered by our interviewees, they might be emotionally distressing or triggering.

Need for more materials

One of the most important findings, recurring through the conducted interviews, is that there simply is not enough easily accessible academic resources on environmental sustainability and video games. As Hanna Wirman sums up the current situation: "at this point there's not enough written and the material that we have is… if we need to rely on popular magazine articles - - it's a little bit difficult." She also mentions that while there is an abundance of scientific reports on the topic on a global scale, they are too far removed from a practical context.

Practical examples

> There are no examples. There's no success story to build on. Is there a use case?
> (Michal Berlinger, FAMU; Amanita Design)

Patrick Prax suggests that the most helpful educational content would probably focus on providing examples of initiatives that work. A similar view is shared by Wirman who thinks that real life cases of companies who adopt sustainable practices successfully could inspire others. She insists these kinds of case studies should be not only prepared with attention to detail but also thoroughly contextualised:

> What has sustainability thinking changed, for instance, in the balance sheet or in the daily routines or communication between people and so forth? What are the implications of adopting some of these models in your daily practice?
> (Hanna Wirman, ITU Copenhagen)

Inclusion of other aspects of sustainability

Respondents also mentioned the intersection of environmental and other pillars of sustainability: economic, social and cultural. In some institutions, integration of United Nations SDGs in education is already taking place (e.g. Macromedia University, University of Jyväskylä). In our conversations, this wider perspective came back several times. Patrick Prax openly and passionately advocated for systemic change, while Wirman stressed the need to take into account not only environmental issues but also other sustainability problems the game industry is still struggling with, such as cultural inclusion. Even preliminary guidance in this area might be a beneficial addition to the educational materials offered.

Consideration of target audience

Some experienced educators we spoke to, for instance Sebastian Möring, said he might not be interested in using a proposed Greening Games repository to prepare classes, as they have their own trusted teaching materials and well tested didactic processes. However, even he recognized a great need for this kind of material. Based on various levels of incorporation of the sustainability topics in curriculum, we have identified two main types of teachers that might be interested in using the Sustainability Kit:

1. A lecturer who does not have the time to dedicate a full course, but still can potentially sprinkle their existing courses with questions of sustainability and do so with certainty and confidence that they know what they are talking about. e.g. as Välisalo describes incorporating subtle mentions or single sentences into the classes or Wirman assigns students to think on the environmental responsibility of the designer in a course focusing on the fundamentals of game design.

2. A lecturer who wants to and is able to dedicate more time towards teaching the topic in more detail. Such as the interdisciplinary course taught by Prax and others, pointing out the industry's impact, or Werning's writing about nature in games and Farca's classes on ecology and sci-fi worlds.

2.2 Teaching Pilots and Post-Mortems

2.2.1 Environmental Impacts of the Games Industry at Charles University

When: 18.11. 2022, the session lasted 1 hour and 30 minutes

Where: Charles University, Faculty of Mathematics and Physics

How: Within the regular course Game development seminar, which consists (amongst other things) of a series of discussion seminars on the current issues of the gaming industry,

Who: Led by Andrea Hubert and Lukáš Kolek

Target group: 10 students of Computer game specialisation with mostly technical

The objective

There were two goals for this pilot workshop. First, it was to provide information and space for students to understand and discuss the complexities of the environmental impact of the industry. Second, as students of this program had no other formal preparation covering this topic, we wanted to pilot-test the format on how to introduce them to the relatively complex topic in a short timeframe.

Structure of the workshop

Before the session started, students had two homework tasks. First, they had to read two articles from Lewis Gordon published online on The Verge.[6] Despite being a few years old, both articles provide a fairly up-to-date and beginner-friendly introduction to most of the topics related to sustainability in the gaming industry. From both articles, we asked the students to write what they found the most surprising or interesting. Second, we asked the students to research official communication channels of their three favourite video game studios for any publicly available sustainability reports and company practice.

6 Gordon, L., The many ways video game development impacts the climate crisis. The Verge, 5. 5. 2020 (last accessed 5.1.2023).
Gordon, L., The environmental impact of a PlayStation 4. The Verge, 5. 12. 2019 (last accessed 5.1.2023).

Instead of frontal teaching, we held the workshop in a roundtable format supported by slides from a PowerPoint presentation. Those acted as discussion openers and summarised basic information (e.g. questions or example tables showing energy consumption of current gaming consoles). In the middle of the roundtable, we wrote a question: "Is it worth the effort to mitigate the environmental effect of the video game industry?" Under the question, we drew a straight line representing a scale going from "Totally Agree" on one end, through "No Opinion" in the middle to "Totally Disagree"on the other end. The students were to first write their initials on sticky notes and then place them anywhere on the line, expressing to what degree they agree with the statement that was written out. We encouraged the students to get up from their seat anytime during the session and move their sticky note on the line if they change their opinion during the discussion.

We aimed to encourage the students to process the information we provided by themselves and to come to their own conclusions, while discussing with others, and we attempted to correct the course of the discussion if the students were hung up on something too long.

Lessons Learned

1. Non-linearity

We initially planned a small intro presentation which summarises the most important aspects of the impact of the game industry. During the presentation, when we asked the first questions, a lively discussion started. Students often had strong opinions about the topic from both sides of the opinion spectrum. After that, we moderated the discussion using the remaining slides as openers for new topics, but in different order than we had originally expected. For the next session, we intend to create several non-linear blocks for discussions with strict time restrictions, so we can give all the topics equal attention.

2. Bigger picture

Most of the students were not of the opinion that greening the industry would be worth the effort, but, retrospectively, we believe we did not manage to put the industry's emissions in a bigger context. For example, mentioning that energy spent by production is estimated to be about 0.04 percent of global emissions (Abraham 2022: 19;117) is not necessarily as useful information as how much could be saved by implementing some of the existing initiatives on the global scale, etc. Comparing the energy use of video games to other industries also seems useful.

3. Content overload

Even after reading the articles, there was still a lot of information to cover in order to allow the students to see the complete picture. For a person not familiar with the topic, the complexity of the situation may be too much to fully process in one session. Perhaps it may be beneficial to have two sessions, one that is introductory and focused on the different aspects of the industry's impact, followed by a second session dedicated to discussing solutions and transformations.

4. Imagining solutions

One way to discuss the solutions to the problem is to apply the workshop methodology proposed by Rutting et al. (2022).[7] The workshop is based on the "Seeds of Good Anthropocene" approach and incorporates questions on power relations, which help participants identify the key problematic elements of the current status quo.

5. Helpful discussion topics

We find that some of the most insightful and lively discussion topics were those that related to the practices and environmental nudges which the students may be already familiar with in their daily lives. Such as:

- how to save your money and energy; this is especially relevant in an energy crisis
- how to save money AND the environment?
- environmental branding versus greenwashing
- energy efficiency stickers for game devices
- energy saving practices made available and visible on consoles (such as the new energy saving mode on Xbox)

2.2.2 Environmental Game Design at Cologne Game Lab (TH Köln)

When: Summer Semester 2022 (mid May to mid July 2022), four three-hour sessions with additional team mentorship in arts, design and programming

Where: TH Köln, Cologne Game Lab. Institute for Game Development & Research

How: Within the framework of the Collaborative Projects module regular course Game development seminar, which consists (amongst other things) of a series of discussion seminars on the current issues of the gaming industry

Who: Led by Sonia Fizek, co-led by Katharina Tillmanns, Jonas Zimmer and Peter Bickhofe with support of three external mentors from the Advisory Board of the Greening Games project: Trevin York, Hugo Bille and Paula Angela Escuadra (IGDA Climate SIG, (International Game Developers Association's Climate Special Interest Group)

Target group: 39 students of the fourth semester in the B.A. Digital Games program at CGL. The students represented three cohorts specialising in game arts, game design and game programming.

7 Rutting, L., Vervoort, J., Mees, H. et al. Disruptive seeds: a scenario approach to explore power shifts in sustainability transformations. Sustain Sci (2022). https://doi.org/10.1007/s11625-022-01251-7

Learning Objectives

The main didactic goal of the pilot project was to explore video games as playable forms of critical ecological thought. To achieve this, we set-up the following learning objectives:

- Objective 1: to provide the students with critical impulses and creative space to develop experimental games within the context of climate crisis,
- Objective 2: to enhance the students' capacity to experiment within the context of game design, game programming, and game arts,
- Objective 3: to familiarise the students with the collaborative environmental game design work by the IGDA Climate Special Interest Group, and to apply this work into their own environmental design,
- Objective 4: to give the students an opportunity to present their games to and learn from external mentors from the IGDA Climate SIG.

Description of the course

The pilot project was the first didactic intervention designed and delivered in the summer semester of 2022. We integrated it into the existing module Collaborative Projects in the B.A. Digital Games study program at Cologne Game Lab at TH Köln. During the second half of each semester, CGL Bachelor students of three specialisations (game arts, game programming, game design) work in small teams in order to develop playable game prototypes. Thirty-nine 4th semester Bachelor students formed ten game development teams, each designing their own environmental video game - a playable prototype of at least 5-minute gameplay length.

We encouraged the students to experiment with design, consciously implementing components such as game mechanics, visual and system aesthetics, and narrative structures to best support the environmental message to be communicated through their games. In that sense, we framed the design process as a practice of political and social critique, exemplifying what Mary Flanagan refers to as radical game design (2007). In order to learn about the specificities of game design with a focus on environmental issues, the students had to familiarise themselves with selected concepts from the Environmental Game Design Playbook, a collaboratively written document that "connects environmental psychology to best practices in game design for the purpose of co-creating a common design language for discussing climate action in games" (IGDA Climate SIG, 2022).

Four mentors from Cologne Game Lab supported the students, each offering a different area of expertise: game studies, game programming, game design, and game arts. In addition, three external mentors from the IGDA Climate SIG joined the module: Paula Angela Escuadra, Trevin York, and Hugo Bille. They took part in three meetings: game pitching (online over Zoom), intermediate game presentations (online over Zoom) and final game presentations (on-site at Cologne Game Lab in Cologne). They also provided individual feedback via a dedicated Discord server.

We asked the students to deliver the following components:

- A game pitch
- A game concept
- Intermediate and final project presentations
- A gameplay video or a trailer
- A playable prototype (2-5 minutes of high-impact gameplay)
- A game build

Environmental games prototypes

The delivered game prototypes formed a collection of diverse game genres and formats.

1. Hold my Hand, I'm Scared - a narrative 2D side-scroller game with an experimental controller: a hand made from paper scraps and powered by Arduino.
2. What about Fish - a narrative game in which the player leads a group of fish through polluted waters.
3. 100 Days of Wind - an augmented reality mobile experience featuring an island with wind turbines modelled on an existing island El Hierro powered by 100% renewable energy (mechanic: blowing in order to propel the wind turbines).
4. EcOS - a simulation of a desktop application published by the fictional company POLAR in which the player tests the beta version of a new operating system and, in doing so, plays environmental mini-games. The games serve as ironic commentaries on greenwashing PR by software companies.
5. Planet B - a single-player economy simulator in which the player manages a planet by manipulating its political system, use of technology, and the lifestyles of the in-game characters.
6. Beeware - a local mixed reality game with educational content about wild bees. For the full experience, the player needs to travel to a real-life location, in this case, Gut Leidenhausen, a wild bee informational area outside of Cologne.
7. Mini Marbles - a mobile puzzle game in which the player balances the planet's ecosystem in different eras between the year 1650 and 2000.
8. Greenwashing - a first-person 3D narrative game about greenwashing. The player explores the scene and collects information on a fictional car-producing company in order to expose their greenwashing practices.
9. ClimateCore - a 3D environment in which the player explores locations representing abandoned early-2000s websites devoted to environmental movements and climate change.
10. Garbage Sorting - a mobile game in which the player sorts out four types of garbage: general, plastic, paper, and drop-off within a timeframe of 30 seconds.

Figure 5. Project What about Fish (BA4 Students of Cologne Game Lab, Summer Semester 2022: Ehsan Tabesh, Roy Devashis, Mahmoud Sewilam, Pilip Brian Nees.)

Lessons Learned

This pilot project made us aware of the challenges behind the complex task of designing games that educate, raise awareness or, in the most complicated scenario, contribute to the behavioural change of their players. Among multiple smaller topics, there are two very tangible lessons learned from this hands-on didactic intervention.

Lesson 1: Reserving enough time for research

Developing a game with an environmental theme or visual aesthetic is, at a basic level, a relatively straightforward task. After all, students in game design programs are likely already equipped with the skills needed to make engaging and appealing games, regardless of specific subject. However, many of these students are neither proficient in the rhetorical capabilities of the medium nor in environmental science. (The latter point also often applies to their instructors.)

It is crucial to set aside time before the game creation phase for students to understand specific environmental issues and explore the different ways in which they can represent these issues in games. In order to make conscious game design decisions, choosing game mechanics and aesthetics to fulfil a specific rhetorical purpose, students would benefit from engaging with such concepts as critical play, procedural rhetoric, systemic design, and operational logics. A good place to start from is the aforementioned Environmental Game Design Playbook, in particular Part Two, which outlines the “tactics” of designing environmental games, breaking them down into mechanics and procedural rhetoric, narrative tactics, mixed reality designs, and system knowledge and simulations.

Prior to the design, another helpful task to consider is a close-analysis of selected environmental games focusing specifically on their design patterns, mechanics, themes, and aesthetics. Involving subject matter experts from environmental science is a good way to complement the game design instructors' expertise and make sure the game ideas actually reflect real-life environmental processes and issues.

Lesson 2: Designing for local context

Global-scale problems are hard to design for, as they often seem overwhelming or vague and distant from students' lived experience. Focusing on local issues that exemplify broader environmental concerns is a way to make the design process more tangible and personally meaningful. Many regional and municipal authorities work on local sustainable development goals (SDGs) tailored to the challenges and needs of their specific communities. These provide a useful reference point not just for environmental action, but for game design projects, enabling them to engage with local contexts and address specific issues affecting a particular area.

An alternative approach is to choose an existing environmental project on which sufficient, and reliable, data is available. For example, in the Greening Games pilot, one team chose the isle of El Hierro in the Canary Islands as their point of reference, which is powered entirely by renewable energy. The students modelled the island as the setting for an augmented reality experience to highlight an environmental success story.

2.2.3 Climate Change and CG Art at Cologne Game Lab (TH Köln)

When: Winter semester 2022/23, four sessions, each lasted three hours.

Where: TH Köln, Cologne Game Lab. Institute for Game Development & Research

How: Media Studies III seminar series in the third semester of the MA 3D Animation for Film & Games

Who: Led by Laura Frings

Target group: 16 students in their third semester. The students study and work part-time and have a background in games or animation film production, in some cases graphic design. Also, the majority of students have an international background.

Supporting Materials: Academic and journalistic readings, reference movies and games, presentations.

Delivarables: Two short essays on set topics plus a rewrite on each of them based on feedback, one artist statement after the end to reflect on the outcomes of the course.

The Objective

The objective of the cultural studies course was to teach students to communicate and critically discuss the ecological impact of the games and animation industry, as well as environmental concepts and concerns in academic writing, works of art, and their own media production.

Structure of the workshop

The seminar series was designed to engage students who work as artists in the game, film, or graphic design industry, thus unifying them in the common pursuit of visual digital media production. Due to this particular focus on visuals and to some extent stories, game design was only touched upon.

The course was divided into two parts. The first half, comprising the initial two sessions, focused on fundamental academic concepts in Eco Media Studies, with emphasis on materiality, infrastructure, and nature representation. In preparation, students read essential texts. The latter half of the series focused on artistic analysis and self-reflection, providing students with the opportunity to engage with selected artworks and other artists' accounts.

In the first session, titled "The Materiality of the Digital Arts" and conducted online, students were prompted to identify their personal experiences with climate change, as well as initiatives in the games and film industry, facilitating a self-assessment of their current knowledge and the evaluation of their learning trajectory in their artist statements by the end of the semester. This exchange subsequently culminated in a team-based close reading session of texts by Benjamin Abraham, Inge Ejbye Sørensen, and Caitriona Noonan, and concluded with a lightning talk and ensuing discussion of the environmental impacts of media dissemination, including clouds and consoles.

During the second session "Conceptualizing Nature" students delved into the cultural perceptions of nature (online). An interactive exercise was employed to scrutinise the cultural conditioning of nature representation in visual media, with an emphasis on games and animated films. Selecting compelling still images based on their artistic merit, including composition and lighting, students subsequently subjected their choices to critical analysis and questioning. This process was preceded by an introduction to selected patterns of nature representation, such as paradise motif, nature-culture dualism, and the portrayal of humans as explorers in the works of the Hudson River School. The ultimate aim of this exercise was to underscore the impact of cultural-visual patterns. In the subsequent close reading session, exemplary texts from the field of eco-criticism were analysed and discussed, highlighting their deviation from the aforementioned patterns of nature representation. The eco-critical approaches examined included deep ecological, eco-feminist, eco-Marxist, and post-colonial perspectives.

The third session "Exploration of Animated Worlds" served as a pivotal point in the course's evolution from seminar to workshop format. In this on-site session, students engaged in a hands-on exercise involving the redesign of a selected storyworld, displaying ecological themes worked into the world's fabric, through the use of Lego blocks. Working collaboratively in teams, students conceptualised the interest groups, ecological conditions, political linkages, etc. in a 3D space, and presented their ideas to each other to underscore the particularities and dynamics of their respective worlds. In the following step, students analysed their newly constructed storyworlds, applying ecocritical theories introduced in the previous lesson.

The final session, entitled "The Artist as Advocate," (online) focused on various artistic strategies for addressing climate change, including artistic, research-based, and activist approaches. Students evaluated the presented strategies and analysed the Good Energy Stories playbook in more detail (https://www.goodenergystories.com/playbook) . Next, they formed teams to create a basic framework for small stories, utilising prompts that incorporate climate-related topics. This exercise allowed students to practise integrating ecological themes into their storytelling while also providing a platform for artistic expression

Lessons Learned

Lesson 1: Empowerment

The primary objective of this course was to enable students to engage in critical reflection on the interplay between climate change and digital media, and hopefully to inspire them to also reflect their artistic practices. The course content was divided into two theory blocks: "The Materiality of the Digital Arts" and "Conceptualizing Nature." While the topic of energy usage and carbon footprint was an effective opener, students found their scope of action in this area to be limited. One student had already conducted research on the reduction of energy consumption in offline rendering and shared their findings with the group. Nevertheless, most students felt that broader political efforts were needed to effect more substantial change, such as standardised methods for measuring electricity consumption, and they did not see themselves as capable of driving such changes. To overcome this perceived limitation, incorporating case studies that highlight successful models of smaller-scale change could be beneficial. In contrast, the cultural aspects of the course had a more profound impact on the students, providing them with insights into how to integrate climate topics into their digital productions. Whether they will actually do so remains to be seen, but at least they felt less constrained in this regard. This is in itself not surprising as artists can control their creative output but only to an extent their powergrid. So, positive role models for the latter case on a small scale may counter that effect in future iterations.

Lesson 2: Normalising Climate Topics in Digital Productions

The final session and the artists' statements submitted provided valuable insights into the concerns of the students regarding the artistic treatment of the climate crisis. A central concern that emerged was the potential saturation of climate content in digital media. Most students responded positively to approaches that aimed to normalise climate content, meaning that while integrating climate content should be the norm to create a change in cultural perception, not every project needs to centre around the topic. One student captured this sentiment in their artist statement:

> Specifically, I have learned how to incorporate important topics into a story without being overly obvious. In recent months, I was worried about people growing tired of stories about climate change, but I now gained new trust in more subtle and elegant methods of weaving big topics into any media.

The incorporation of techniques for normalising climate-related subjects in digital media production within a course curriculum is contingent on its framing. In the event that the course's objective is to present a comprehensive overview, the integration of such techniques would address apprehensions surrounding media overexposure to the topic. Additionally, all students, regardless of their position on climate, to experiment with integrating climate topics on a less complex level than, for example, doing the amount of research that is needed to create an actual eco-game. With this in mind, future iterations of the course may benefit from introducing this aspect earlier.

2.3 State of the Art in Green Games Research

2.3.1 Flagship European Projects

Greening Games

"Greening Games. Building Higher Education Resources for Sustainable Video Game Production, Design & Critical Game Studies" (2021-2024) is an Erasmus+ interdisciplinary project conducted by research teams at four universities: TH Köln University of Applied Sciences (Germany), Breda University of Applied Sciences (The Netherlands), Charles University (Czech Republic), and the University of Turku (Finland). The aim of the project is to develop, test, and disseminate teaching materials and know-how to support educators in addressing the interdisciplinary nature of green digital gaming. The findings presented in this report will inform further research on didactic deliverables.
To find out more, visit: www.greeningames.eu.

Nordic Alliance for Sustainability in Gaming

The Nordic Alliance for Sustainability in Gaming (NASG) is a Nordplus-funded network of six universities from Denmark, Estonia, Finland, Iceland, and Sweden whose aim is to promote environmental and cultural sustainability in games education and the video game industry. A notable feature of the network is its integration of aspects related to environmental and cultural sustainability, viewing diversity, inclusivity, and job security in the game industry as parts of the same continuum as its environmental footprint.
More information about the network is available on its website: http://nasg.tlu.ee.

Green Mediography

The Green Mediography website is part of the Green Media Studies initiative at Utrecht University (https://greenmedia.sites.uu.nl). The website is a collection of short reviews of media that contain environmental themes or messages. The style of the reviews can be subjective in tone, but each item is tagged with a number of keywords, which allow easy exploration of related treatments of similar themes, such as 'ice age' or 'critical dystopia'.

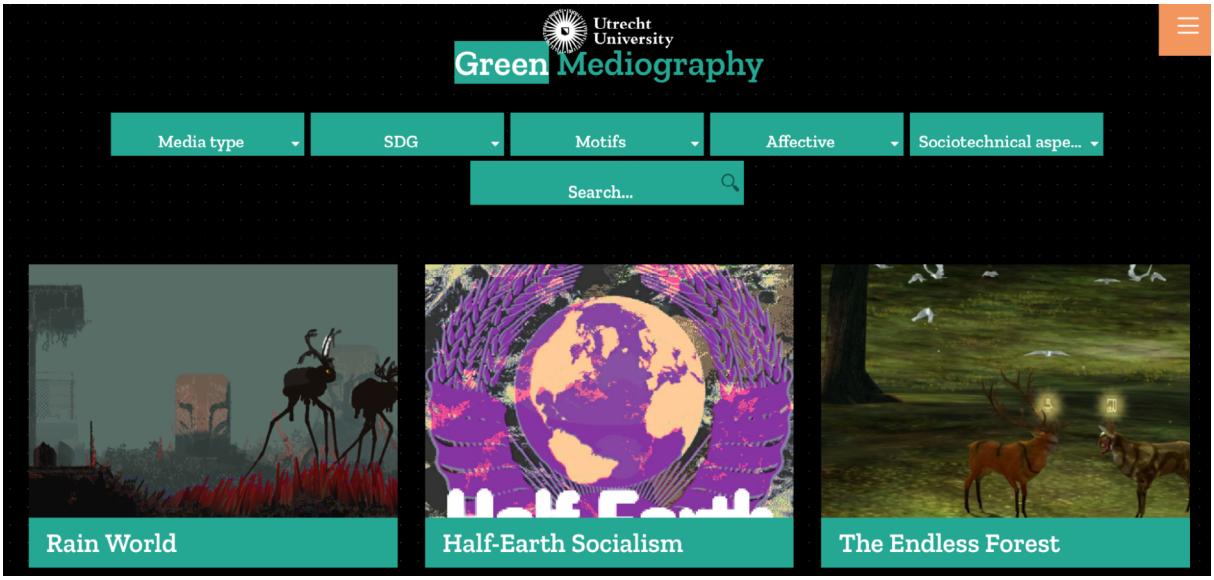


Figure 6. Caption from the Green Mediography website.

2.3.2 Curated Literature Lists

This section entails contextualised lists with selected literature for each of the four thematic categories we are working with within the framework of the Greening Games project. A more extensive list of publications related to environmental sustainability in video games may be found in our Zotero library and in the Notions database. We keep those references updated throughout the project.

Greening Games Reference Library

Interactive database connected with Zotero

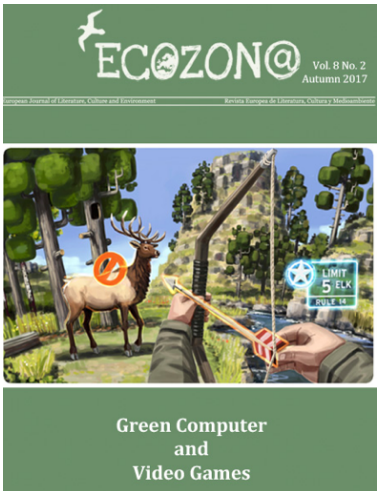
Bibliographic Info | Reading Status | Literature Review | Books | Collections | Filter | Sort

Reading Stat...	Item Type	Aa Name	Authors	# Year	Title	DOI
Ready to Start	Thesis	(Aslan, 2020)	Aslan, Joshua	2020	Climate change implications of gaming products and services	
Ready to Start	Journal Article	(Backe, n.d.)	Backe, Hans-Joachim		Within the Mainstream: An Ecocritical Framework for Digital Game History	https://doi.org/https://doi.org/10.37536/ECOZONA.2017.8.2.1362
Ready to Start	Book Section	(Abraham, 2022)	Abraham, Benjamin J.	2022	Where to from Here?	
Ready to Start	Document	(Abraham, n.d.)	Abraham, Benjamin		What can I do about my games' impact on the planet?	
Ready to Start	Journal Article	(Mills et al., 2019)	Mills, Evan Bourassa, Norman Rainer, Leo Mai, Jimmy Shehabi, Arman Mills, Nathaniel	2019	Toward Greener Gaming: Estimating National Energy Use and Energy Efficiency Potential	https://doi.org/10.1007/s40869-019-00084-2

Figure 7. Caption from the Greening Games Reference Library in Notions.

Games Infrastructures

Benjamin Abraham's Digital Games After Climate Change (2022) is one of the first monographs within the field of game studies devoted to video games and their relationship to environmental issues. Within the context of games material infrastructures, chapters four (How Much Energy does it take to Make a Video Game) and seven (The Periodic Table of Torture) are particularly useful as didactic resources.



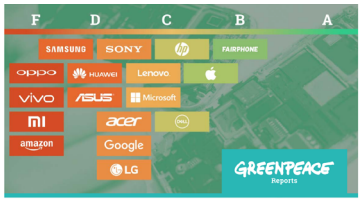
The article Digital Games about the Materiality of Digital Games is a good introduction to the material conditions of video games and how these may be critically addressed in the games themselves. Josef Nguyen's work is placed at the intersection between critical game design and critical game studies. It has been published in a special issue of Ecozona dedicated to green video games.

In order to teach the ethical and political dimension of video games, it is helpful to place them within a larger context of digital media. The works of Sean Cubitt and Jussi Parikka provide analytical lenses to examine the material underpinnings of digital software and hardware as well as their implications of mass digital entertainment on the environment.

Sean Cubitt. 2016. Finite Media. Environmental Implications of Digital Technologies. Durham, NC: Duke University Press.
Jussi Parikka. 2012. Media Archeology. Hoboken, NJ: Wiley.
Jussi Parikka. 2015. A Geology of Media. University of Minnesota Press.

Activist and investigative journalistic sources may complement the academic literature. Some of the most recent and eye-opening pieces on the gaming hardware and NFT minting and their hazardous impact on the environment have been published in such outlets as The Verge. In 2019 Gordon Lewis of The Verge cooperated with two computer engineering scientists from the University of Cambridge (Claire Barlow and John Durrell) to explore the carbon footprint of Sony's PlayStation 4 (The environmental impact of a PlayStation 4).

The two below reports on the electronics and game consoles published by Greenpeace widen the context of the material analysis of PlayStation4. Although the source from 2008 may seem outdated, it is a necessary read in order to be able to critically assess the most current self-regulating measures by the three biggest players in the industry: Sony, Nintendo and Microsoft.



Guide to Greener Electronics

2017

Guide to Greener Electronics. 2017. Greenpeace.

Playing Dirty. Analysis of hazardous chemicals and materials in games console components. 2008. Greenpeace.

Energy Efficiency of Games Consoles. 2021. Sony, Nintendo, Microsoft.

Selected Bibliographical Sources

Abraham, B.J. 2022. Digital Games after Climate Change. Palgrave McMillan.

Brigden, K., Santillo, D., and P. Johnston. 2008. Playing Dirty. Analysis of hazardous chemicals and materials in games console components. Greenpeace. https://www.greenpeace.org/usa/wp-content/uploads/legacy/Global/usa/report/2008/5/playing-dirty.pdf.

Cook, G., and E. Jardim. 2017. Guide to Greener Electronics. Greenpeace. https://www.greenpeace.de/publikationen/20171016-greenpeace-guide-greener-electronics-englisch.pdf

Cubitt, S. 2016. Finite Media. Environmental Implications of Digital Technologies. Durham, NC: Duke University Press.

Gordon, L. 2019. The Environmental Impact of a Play Station 4. The Verge. https://www.theverge.com/2019/12/5/20985330/ps4-sony-playstation-environmental-impact-carbon-footprint-manufacturing-25-anniversary

Nguyen, J. 2017. Digital Games about the Materiality of Digital Games. Ecozona 8 (2): 18-38.

Parikka, J. 2012. Media Archeology. Hoboken, NJ: Wiley.

Parikka, J. 2015. A Geology of Media. University of Minnesota Press.

Sony Interactive Entertainment Inc., Microsoft Corporation, Nintendo Co., Ltd. 2021. Energy Efficiency of Games Consoles. https://www.efficientgaming.info/fileadmin/user_upload/VA_file/Games_Consoles_SRI_v4.0.pdf.

Games Cultures

Within the theme of Games Cultures we are looking into the intersections of video game cultures and environmental sustainability, ecocriticism and climate change activism.

Alenda Y. Chang's monograph Playing nature: Ecology in video games (2019) is a key publication in the research area of environmental game studies. The book "develops ecological frameworks for understanding and designing digital games" and offers a nuanced discussion on the meaning of games as a cultural form in the time of climate crisis.

The article "Sustainable Play: Toward a New Games Movement for the Digital Age", draws from the cultural history of the New Games movement, "formed by Stewart Brand and others in the early 1970s in the United States as a response to the Vietnam War", and by taking inspiration from that period, proposes a similar intervention, only now focused on climate change. This article is a good point of departure to discuss political and social activism within game cultures in a longer historical perspective, beyond the digital era.

Selected Bibliographical Sources

Abraham, B.J. 2018. "Video game visions of climate futures: ARMA 3 and implications for games and persuasion." Games and Culture 13.1 (2018): 71-91.

Abraham, B.J., Jayemanne, D. 2017. Where are all the climate change games? Locating digital games' response to climate change. Transformations Journal 30, p. 75. http://www.transformationsjournal.org/wp-content/uploads/2017/11/Trans30_05_abraham_jayemanne.pdf.

Chang, A. Y. 2019. Playing nature: Ecology in video games. Vol. 58. University of Minnesota Press.

Condis, M. 2020. "Sorry, wrong apocalypse: Horizon Zero Dawn, Heaven's Vault, and the ecocritical videogame." Game Studies 20.3. https://gamestudies.org/2003/articles/condis/

Cox, M., Zagal J. 2022. "Sustainability in City-Building Games", Proceedings of the International Conference of the Digital Games Research Association (DiGRA), July 7-11, Krakow, Poland. Published, 07/2022.

op de Beke, L. 2020. "Anthropocene Temporalities in Climate Change Video Games." DiGRA 2020.

Pearce, C., Fullerton, T., Fron, J., & Morie, J. F. 2007. Sustainable play: Toward a new games movement for the digital age. Games and Culture, 2(3), 261-278.

Möring, S. and B. Schneider. (2018. "Klima – Spiel – Welten. Eine medienästhetische Untersuchung der Darstellung und Funktion von Klima im Computerspiel," in: Paidia. Zeitschrift für Computerspielforschung, Sonderausgabe "Repräsentationen und Funktionen von 'Umwelt' im Computerspiel," http://www.paidia.de/?p=11517 (open access).

Kray, L., and S. Möring. 2021. "Das Wetter kontrollieren – Zur Darstellung von Beziehungen zwischen Klima, Umweltlichkeit, Technologie und menschlicher Agenzialität im Computerspiel am Beispiel von Pokémon Smaragd," in: Dritte Natur. Climate Engineering 3 | 2021, ed. by D. Müller and U. Büttner, 183-199.

Games Production & Development

Selected Bibliographical Sources

Asher, C. 2022, October 26. Playing dangerously: The environmental impact of video gaming consoles. Mongabay Environmental News. https://news.mongabay.com/2022/10/playing-dangerously-the-environmental-impact-of-video-gaming-consoles/

The article discusses the environmental impact of video gaming consoles. It specifically focuses on their energy consumption and carbon footprint. It highlights the fact that gaming consoles can consume a large amount of energy making them possibly the most demanding consumer devices at home. That contributes to greenhouse gas emissions and climate change. The article also discusses the potential solutions to reduce the environmental impact of gaming consoles. One example might be a Nintendo Switch consuming significantly less energy than Xbox One or PS4 however, at the cost of less performance. The article also discusses (in)effectiveness of energy-savings implemented into new consoles, cloud gaming and e-waste caused planned obsolescence of consoles.

Mills, E., Bourassa, N., Rainer, L., Mai, J., Shehabi, A., & Mills, N. 2019. Toward greener gaming: Estimating national energy use and energy efficiency potential. The Computer Games Journal, 8, 157-178.

Authors comprehensively measured the consumption of 26 gaming systems. Based on the data in 2019, they calculated that gaming used 34 TWh/ year with 24 MT/year of associated carbon-dioxide emissions in the US. These numbers are equivalent to 85 million refrigerators or 5 million cars. The authors suggest that with some effort in the development of both hardware and software, it is possible to decrease energy consumption by approximately 50% while maintaining the same level of player experience.

Wood, D., Ruiz, B.2021. Green Games Guide: An Action plan for the sector. Ukie. https://ukie.org.uk/download/44dwrszqf32xq0atp1bh8ck5ct/0

Ukie, the trade body for the UK games and interactive entertainment industry, introduced this practical guide on how to reduce emissions, energy consumption and waste in game developers and publishers operations. The objective is to help implement and provide practical examples on how to make game development more sustainable.

Playing for the Planet. 2023. Green Game Jam Initiative https://playing4theplanet.org/green-game-jam

Green Game Jam is the event in which members of the Playing for the Planet Alliance modify their games to raise awareness about climate change, act or learn in relation to climate change. The Green Game jam has been happening since 2019 and represents one of the ways larger game studios draw attention to climate change.

Ryan, J. 2020. Xbox, PS5 and the climate crisis: Next-gen video games could be worse for the planet. CNET. https://www.cnet.com/science/features/xbox-ps5-and-the-climate-crisis-next-gen-video-games-could-be-worse-for-the-planet/.

The article offers an insight into challenges that were represented by the upcoming next-gen video game consoles in relation to their environmental impact. The new powerful and energy-demanding consoles are also put into context with the Nintendo Switch, which consumes significantly less electricity and has less processing power, despite being the most popular console among gamers for a long time. The article also opens up an important debate, who will ultimately be responsible for greener industry solutions?

Games Content & Design

The Games for Change - Game Directory is a curated list of over 150 games with a variety of positive themes, such as racial equality, empathy, and environmental impact. Although each title in the directory is tagged with the prominent themes addressed in the game, the tags are not currently browsable. The approach is more curatorial than oriented towards stimulating game-development insights, but this selection still provides a good starting point for teachers and students who wish to explore meaningful game design.

The International Game Developer Association (IGDA) is a respected collective of game developers who have Special Interest Groups that collect and share knowledge. The IGDA Climate SIG have published The Environmental Game Design Playbook. It contains approachable information about the psychology of behavioural change and "tactics" for integrating positive environmental themes into video games. Each tactic is explained alongside examples that show how the tactic has been implemented in an existing game. The intention is to give game developers the knowledge they need to implement/integrate these concepts and approaches into their own games. This is currently the most comprehensive list of environmentally conscious game design approaches, and so also features in our key projects and initiatives section of this report (3.2).

Playing For The Planet is an alliance of game development companies who have agreed to lower their carbon footprint and offset unavoidable energy use, include "green nudges" in their games, and commit to reduction of e-waste (electronics and related hardware that would previously have entered landfill due to the complexity of recycling their component elements). Their website primarily focuses on sharing news of progress, rather than actionable steps. The main supporter of the initiative is the UN Environment Programme. Companies that join the alliance gain information regarding steps they can take to measure and lessen their environmental impact.

Selected Bibliographical Sources

GamesForChange. 2023. Game Directory, https://www.gamesforchange.org/games

Playing for the Planet, 2023, https://playing4theplanet.org

Whittle, C., York, T., Escuadra, P.A., Shonkwiler, G., Bille, H., Fayolle, A., McGregor, B., Hayes, S., Knight, F., Wills, A., Chang, A., & Fernández Galeote, D. 2022. The Environmental Game Design Playbook (Presented by the IGDA Climate Special Interest Group). International Game Developers Association. https://igda.org/resources-archive/environmental-game-design-playbook-presented-by-igda-climate-special-interest-group-alpha-release

Woolbright, L. 2017. Game Design as Climate Change Activism. Green Computer and Video Games. Ecozona. 8 (2): 88-102.

Our Publications in 2023

Fizek, S. forthcoming in 2023. Material Infrastructures of Play. How the Games Industry Reimagines Itself in the Face of Climate Crisis. In Ecogames, eds. Raessens, Joost / Werning, Stefan / Op de Becke, Laura. Amsterdam: Amsterdam University Press.

Fizek, S., Fiadotau, M., Garda, B. M., Wirman, H. 2023. Environmental considerations in video game design education. ACM Games: Research and Practice Association for Computing Machinery, eds. Sebastian Deterding, Kenny Mitchell. ACM Digital Library.

2.3.3 Events & Panels Organised by Greening Games

Workshop at Central and Eastern European Game Studies Conference

Date: 13.10. 2022

Place: Tallinn, Estonia

Event: Part of the international conference CEEGS 2022

Speakers: Pawel Frelik, Eduardo Luersen, Velvet Spors, Ondřej Trhoň (moderator), Andrea Hubert (organiser)

Organisers: Andrea Hubert, Lukáš Kolek

The Objective

There were two interconnected objectives of this workshop. First, to connect academics and researchers dealing with current and future challenges of video games and their environmental impact. Second, to present the Greening Games project, the preliminary resources, our upcoming plans, and to discuss these with the panel and audience.

The Structure

During the first half of the workshop, invited academics and researchers presented their area of research in relation to video games and environmental issues. The second half was focused on the Greening Games project and the discussion on preliminary deliverables and the upcoming plans and challenges. The summary of the Greening Games project and its current state was followed by the moderated debate.

Talk Line-Up

Introduction & Welcome
Ondřej Trhoň, Andrea Hubert

Playing with Catastrophe: Towards the Definition of Climate Games
Paweł Frelik

What is nature in games?
Velvet Spors

Reflection on environmental themes in mainstream games: Asking players
Andrea Hubert

Paradoxes of sustainable gaming through cloud platforms: Is infrastructure the elephant in the room?
Eduardo Luersen

An introduction of the "Greening Games" project
Andrea Hubert

Panel - Games and Green Gaming (Ondřej Trhoň)
Paweł Frelik, Velvet Spors, Andrea Hubert, Eduardo Luersen, Maria Garda

Closing remarks
Ondřej Trhoň, Andrea Hubert

Summary of Notable Outcomes

Regarding the awareness among university students:
- It is increasing
- Larger studios have sustainability officers and similar functions, but their impact is hard to assess

Regarding the teaching of green gaming at their institutions:
- Among the attendees' institutions, the eco-gaming, eco-critical approach or discussion about environmental aspects of media are present to various extents

Regarding the most problematic to teach:
- Gaming infrastructure seems the most complicated. It is hard to define what to teach due to the complexity of the area and also in defining what impact can we have on it

Regarding their institution's capacity to teach green topics in relation to video games:
- General agreement that it moved forward significantly compared to ten years ago

Regarding the lack of pedagogical resources:
- There are a lot of resources, but they need curation

Regarding the target group:
- Several other topics were mentioned for debate, but we did not have enough time to discuss them. For instance, a member of the audience at the end of the workshop suggested creating educational materials for policy makers and supporting game development professionals.

Green Games. (Un)Sustainability of Digital Play - Panel at DiGRA 2022

Date: 09.07.2022

Place: Kraków, Poland

Event: Panel at the Digital Games Research Association's Annual Conference (DiGRA)

Speakers: Maria B. Garda (Turku University), Pawel Grabarczyk (ITU Copenhagen), Mikhail Fiadotau (Tallinn University), Patrick Prax (Uppsala University)

Organisers: Sonia Fizek, Maria B. Garda

Talk Line-Up

Green Jamming and the Nordic Alliance for Sustainability in Gaming
Mikhail Fiadotau

On Distractions and Systemic Approaches
Patrick Prax

Evergreens are really green. On the ecological side of retrogaming.
Paweł Grabarczyk and Maria B. Garda

Panel Description

Digital games are entangled within the dynamics of ecology on many levels. On the one hand, games have been explored and praised as powerful tools for behavioural and social change. On the other hand, a growing number of studies demonstrate the infamous role they play within the context of climate change (Gordon 2020, Chang & Parham 2017). A Greenpeace report addresses the issue of unsustainable and environmentally harmful hardware production and disposal practices of the biggest players in the field (Greenpeace 2017). Another unecological dimension of video gaming points to its growing reliance on cloud computing, which requires huge amounts of energy, often powered by non-green energy sources (Mills et al. 2019). Also, the very production and development of video games is exposed to unsustainable practices. It is only recently that the topics of greener coding or environmentally conscious workplaces have gained visibility in the game industry. In game studies, we have also looked for ecological frameworks to approach ecology-related topics (Chang 2019). The relationship between digital gaming and ecology is a complex one and requires perspectives across disciplines. This panel is an invitation to rethink video gaming within the context of (un)sustainability, a topic of great interest for the game studies community. In five position statements, we will map out exemplary crossovers between gaming and ecology, opening the floor for audience debate.

Games & Climate Summit at Clash of Realities Conference 2022

Date: 29.09. 2022

Place: Cologne, Germany

Event: Games & Climate Summit at the 13th Clash of Realities Conference

Speakers: Stefan Werning, keynote (Utrecht University), Arnaud Fayolle (Ubisoft Positive Play), Claudia Frick (TH Köln), Andrea Hubert (Charles Games), Laura Op de Becke (University of Oslo), Enrique Perez (Civic Playgrounds), Trevin York (IGDA Climate SIG)

Organisers: Sonia Fizek, Laura Frings, David Wildemann

Summit Description

The ecological context of video games opens up a complex map of relations. Often the first association is that of games as tools for change capable of affecting the players' attitudes. However, as much as they have proven to be great means of persuasion, simulations of utopian futures and alternative scenarios or playful representations of climate, video games are also digital objects literally embedded in earthly matter. They are as much objects of culture as they are of nature, relying on the extraction of natural resources and human labour. The Games & Climate Summit explored the manifold crossovers between games, climate, and ecocriticism with a particular focus on teaching green game studies, designing for environmental sustainability, and contemplating ecological imaginaries and gameworlds. The invited speakers represented diverse voices from academia and the game development community.

Figure 8. Dr. Enrique Perez (game designer and founder at Civic Playgrounds).

Talk Line-Up

Welcome & Introduction
Sonia Fizek, Laura Frings, David Wildemann

Keynote: How Creative Metagaming Practices Can Augment Climate Communication and Action
Stefan Werning

What's an Environmental Game to You? A Look at How Players May Process Environmental Themes in Games
Andrea Hubert

Climate Game Toolkit for Content Creators
Arnaud Fayolle

Designing Games that Transform Players
Trevin York

To Learn What the World Will Bear: Ecogames and the Climate Crisis
Laura Op de Beke

Climate Science Communication, Games, and the Hidden Face of Climate Change
Claudia Frick

The Design of More "Sustainable Realities" through a Different Paradigm
Enrique Perez

takeaway and the contribution to that, I mean, the outcome of parts of this as I told you now, is like to basically have them write like their own tiny manifesto of, so this is how they would like, take a look at sustainable game creation and sustainable game design practices for the future so that they can come back to it later on if they get into the situation and go like, Hey, back at university, my perspective was that this needs to be a systemic change and not just some sort of shitty little sustainability sticker on the side package.

S1 **Speaker 1** ▷ 20:28

So, yeah, can I, can I stay true to that? So something, something in that regard, but that is of course looking at them in, in that way, but that's it, it it is an attempt to do something, right? We talk about worker organization, we talk about potentially best practices in, in industry and how to try to negotiate or something like that. But yeah, these sort of practical examples for doing something like I can find myself that theoretical frames, I think I can find literature that I want to have these, these are the things and I, I mean that's just what I want to write, you know, so, but the things that actually like ways of actually doing something that would be, or even making this useful as scheme designers and I think that resources from IGA would be useful for.

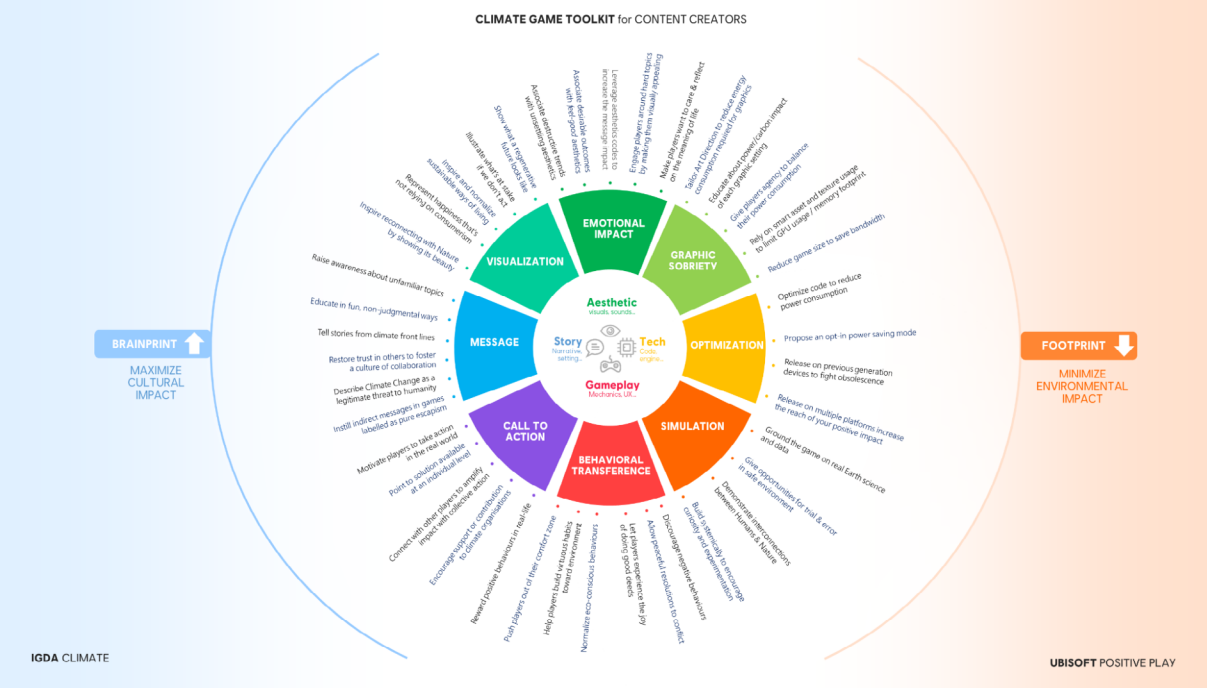
Students' own initiative 3

systemic level (change?) 8

greenwashing 14

social sustainability 9

practical examples 5



Figures 9 and 10. Climate Game Toolkit for Content Creators by Arnaud Fayolle (Ubisoft Positive Play).

3. MAPPING OUT VIDEO GAMES INDUSTRY

This part of the Greening Games Education report is devoted to the video games industry. We will open it by presenting an analysis of the data acquired from semi-structured interviews conducted with selected game developers supported by surveys completed by the international game developer community. The survey data visualisations may be found in the Appendices section. In the second part, the reader will find an overview of flagship pro-environmental projects and initiatives run by the industry. And finally, we have selected five representative video games which thematize environmental issues. One of the described games, Beecarbonize (2023), has been developed by Charles Games, an independent Czech studio, run by one of the partners in the Greening Games project.

3.1 Games Industry: Interview Findings

3.1.1 Introducing the Field

Based on the data collected from 11 in-depth interviews with selected European game developers from triple-A, as well as smaller studios, we have identified a variety of themes that shed a light on diverse crossovers between game development and environmental issues. Our interviewees from the game development sector pointed towards processes, game themes, environmental initiatives, and work cultural dynamics that allowed us to paint a more nuanced picture of the industry's ecological stance, one that goes beyond existing industry public outreach publications. The statements and opinions of our interviewees do not necessarily represent the official positions of the companies they work for.

While some of our interviewees seemed rather cynical about the environmental impact of the industry, others were more hopeful and reported that their companies had been already engaged in pro-environmental projects and smaller initiatives: such as lowering waste generation, modifying game content in order to raise environmental awareness among their players (such as Ubisoft Positive Play[8]), creating games with environmental themes, or growing more plants in the office to affect the wellbeing of the employees (CD Projekt Red reportedly changed their office decor after the pandemic to a greener one).

The notion of a "greener or more sustainable industry" has often been associated with the need for a long-term change in the work culture, design of environmentally conscious games, more effective recycling of in-office waste as well as creating games with low hardware requirements, accessible to a wide range of devices. Very rarely did the developers we interviewed delve in detail into topics such as carbon footprint or energy consumption of the industry or the companies they work for. These aspects are attributed to the corporate sustainability units, which are ever more common in triple-A companies (see Ubisoft's Corporate Environmental Sustainability). Many of the interviewees mention offsetting as the only and most common solution they can think of implementing to lower their carbon footprint.

8 Ubisoft Positive Play is a unit dedicated to demonstrating and amplifying the positive impact of videogames on players.

The general impression emerging from collected data (both the surveys and the interviews) is that there is no concrete indication or comprehensive overview of the impact of game development on the environment yet. There are no standards on the effective and comparable measurement of this impact beyond general tips and guidelines (we are pointing to some of these in the Flagship Projects and Initiatives part of the report). Access to standardised measurement tools and clear guidelines would be essential to ensure that the most up-to-date and relevant information is taken into account when it comes to making decisions about the sustainable future of game development.

Another recurring theme that emerged from the collected data is that developers have different understandings of what kind of action they can take to mitigate the impact of the games industry on the environment. The interviewees also have different views regarding the value of pro-environmental activities of the games industry. Some of the interviewed and surveyed developers consider other industries to be much bigger polluters and they do not see any real value in pro-environmental transformation of the games industry. The developer's attitudes range from being highly engaged with the topic of environmental sustainability through being aware of the industry's impact, but not knowing how to contribute, to being straightforwardly sceptical about the relevance of sustainability to the games industry.

Below, we are providing a hermeneutic analysis based on the qualitative interview data. We are also sharing a few insights into the analysis method and our collaborative analysis process. Survey data may be viewed in the visualisations provided in Appendix 5: Survey Data Visualisations.

Interview period: May-June 2022 within the framework of the Erasmus+ project "Greening Games. Building HE Resources for Sustainable Video Game Production, Design and Critical Game Studies"

Interviewees working at the following companies: About Fun, Amanita Design, Causa Creations, CD Projekt Red, Dimension 11, Earthgames, LFG Red, Sassybot, Ubisoft Annecy, Ubisoft Positive Play

Companies representing the following countries: France, Austria, Czechia, Poland, Netherlands, UK, Nigeria, USA

Interviewers: Sonia Fizek (Cologne Game Lab, TH Köln), Lukáš Kolek and Andrea Hubert (Charles University of Prague), Tuki Clavero (Breda University of Applied Sciences), Maria B. Garda (University of Turku)

Interview lengths: Each semi-structured interview was conducted orally and lasted between 40 to 60 minutes. Most of the interviews were recorded during online sessions over Zoom; some were conducted in person.

Interview questions: see Appendix 4 "Semi-Structured Interview Questionnaires for Private Sector"

Software we used to support collaborative data analysis: Dovetail

Method: Hermeneutic analysis based on collected qualitative data

3.1.2 Method

All the semi-structured 11 interviews were recorded between May and June 2022. We then uploaded the audio files to a secure shared folder on the Sciebo platform (a university-developed platform for higher education institutions in the North Rhine-Westphalia land region in Germany). We then transcribed the audio files (circa 60 hours of material in total), partially manually and partially with the help of the automated transcription tool available in the Dovetail software. Once we had all the transcriptions ready, we started a collaborative process of reading through the data and coding it with tags (as seen in figure 11).

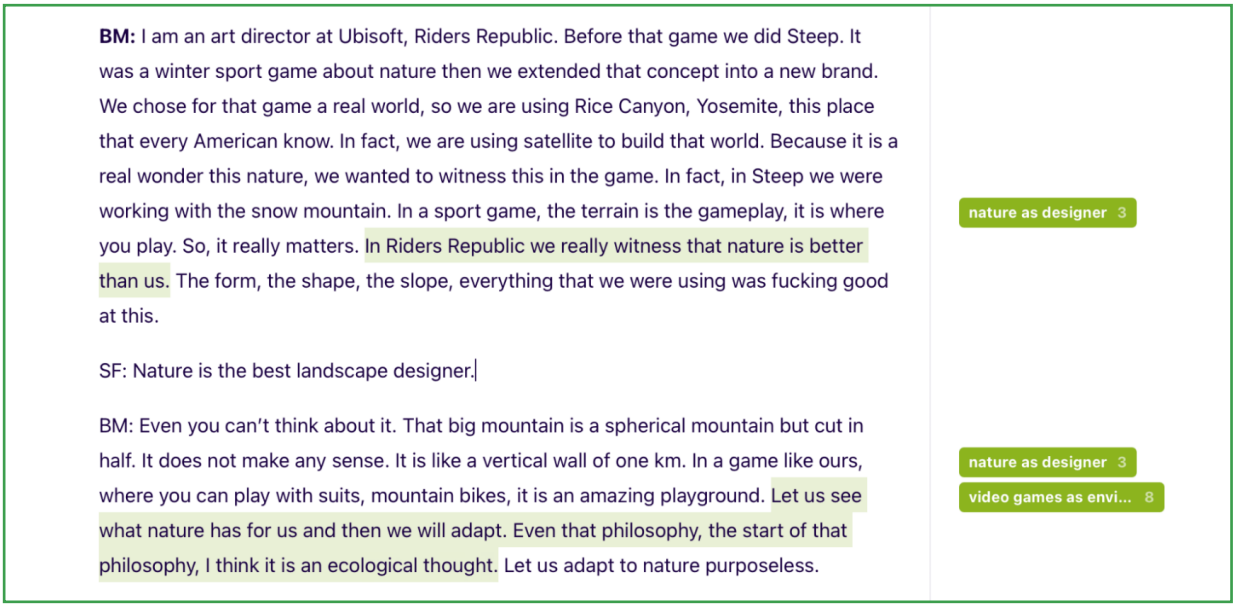


Figure 11. An example of a tag "nature as designer" placed in the transcribed interview with Boris Maniora, Gameplay Director at Ubisoft Annecy.

Figure 12. An illustration of exemplary tags from the Private Sector data set corresponding to the Game Development Work Culture category.

We then re-read the data and the tags numerous times in order to unify the tags coded by five members of the "Greening Games" project. We grouped the tags into a selection of categories (as illustrated in figures 13 and 14):

a) Production & Consumption
b) Perspective
c) Policy & Government
d) Games as an Eco Medium
e) Game Development Work Culture
f) Games Industry
g) Awareness & Activism

The entire data analysis process was conducted in five iterative stages (each stage was repeated at least three times):

1. Stage 1: Coding / tagging transcribed data
2. Stage 2: Sorting tags into thematic categories (to identify recurring themes)
3. Stage 3: Developing insights for selected categories and most frequently appearing tags (more detailed descriptions expanding on the tags)
4. Stage 4: Establishing insightful themes based on coded data
5. Stage 5: Hermeneutically analysing the material under the specified themes (visible in the Interview Analysis section)

Figures 13 and 14. An overview of selected tags grouped into categories as visible on the interface surface in Dovetail.

After sieving through the existing tags grouped into categories, we started creating insights, short descriptions expanding on the existing tags which helped us discern analytical categories and patterns. Having completed this stage, we moved on to the hermeneutic analysis of the entire prepared material.

3.1.3 Analysis

As a result of the conducted analysis, we have identified three overarching themes that we will discuss in the sections below.

1. Interplay between Personal Values and Professional Lives
2. Responsibility and Motivation to Act for Change
3. Games as Ecological Media

Interplay between Personal Values and Professional Lives

There seems to emerge an interplay between personal pro-ecological attitudes of the developers and the game projects they are working on. In some cases, the developers of games with environmental themes tend to become more ecologically aware in their personal lives and as a result make more sustainable lifestyle choices. In others, the developers already have personal stories of closeness to nature and the game projects allow them to merge personal values with professional lives.

> I am really focused on my individual behaviour towards the climate, trying to change how I use and consume things.
>
> (Joy Ajayi, Gameplay Programmer)

Ajayi believes that incorporating sustainable decisions in day-to-day work routines can provoke behavioural changes in other aspectes of employees' lives.

Marcin Momot, Global Community Director at CD Projekt RED, is sensing that in recent years people around him have become more aware of climate change and personal attitudes seem to be becoming more action oriented. This can be illustrated with the number of participants of initiatives organised by the company, for example a voluntary cleaning-up operation at the banks of the river Vistula, near the studio headquarters in Warsaw. Momot believes that such small actions are affecting the entire company culture, perhaps helping everyone change their behaviour and introduce new, more environmentally friendly habits. This represents a recurring theme of breaking old, unsustainable habits, both in personal and work life.

However, this is not a rule. Even though Elwin Verploegen, Programmer at Sassybot, admits he thinks a lot about the environment at home, trying to be a good citizen: not to waste energy, separate his waste, installing solar panels and repairing house insulation; at work this is not really a concern. We might speculate that while Sassybot is a small, two person studio, there is little room for improvement, at least in regard to optimising or scaling down operations, as it is usually the goal for bigger companies. It is one of several examples from our sample that demonstrates how developers do not think they can make a difference in the grand scheme of things. In this particular case, it is especially interesting, as it seems to contradict the stance Verploegen has in his private life.

For some creators game development becomes a process of ecological awareness or may be even described as an ecological thought in itself. Boris Maniora, Gameplay Director at Ubisoft Annecy, reveals how game development for the multiplayer sports game Riders Republic (2021) has intertwined with his "personal ecological path", pointing to the game development process as an "intimate journey". He also believes that the surrounding nature can be a decisive factor in his team's environmentally conscious attitudes. The studio is located in the scenic city of Annecy, sometimes called the Pearl of French Alps.

> We (team members) are basically all passionate about the outdoors. There is no real coincidence. If you look outside of the studio, you see that it is surrounded by mountains. You can't fight against that. (Boris Maniora, Ubisoft Annecy)

It should also be noticed that the gameplay maps and landscapes in Riders Republic were sculpted based on the existing locations. Selected sights from seven US national parks were scanned and based on that data the in-game terrain was created. In that sense, in this project nature itself supported the design process:

> Let us see what nature has for us and then we will adapt. Even that philosophy, the start of that philosophy, I think, is an ecological thought. (Boris Maniora, Ubisoft Annecy)

Also Arnaud Fayolle, Art Director at Ubisoft Positive Play, is motivated in his professional work by a personal story revealing, on one side, a deep care for nature, and growing eco-anxiety on the other.

> I've always felt close to the natural world. I grew up in the countryside, and spent all my childhood in the forest. All I wanted at that time was to create worlds, to tell stories that would feel real: I've tried writing, drawing, and ended up building 3D worlds and video games to live in my stories. (Arnaud Fayolle, Ubisoft Positive Play)

Later in his career he realised there is no point in continuing to develop games that are not contributing to a better future. This impression was overthrown by a realisation that he can achieve a lot in his position as a game developer.

> I realised that I was already in a perfect place to change the world! That video games has the power to reshape popular culture by reaching 3 billion players and giving them a vision of what a desirable future looks like, or how modern-days heroes should act to save what matters to them. (Arnaud Fayolle, Ubisoft Positive Play)

Many other interviewees also made a connection between their personal ecological lifestyle decisions and their altering attitudes at work.

Responsibility and Motivation to Act for Change

Quite a few developers were interested in lowering their carbon footprint but remained unsure how to do so in a complex and effective manner. Employees saw opportunities in, for example, cultivating their workspace and turning off devices while not in use or travelling to work by public transport or cycling. However, they were sceptical about their power in influencing company-wide sustainability strategies. It was not surprising to hear that companies' direction towards pro-environmental actions is highly dependent on the attitudes of those in managerial positions.

Many of the interviewees, whether at managerial or other positions, expressed that they would appreciate examples of existing successful sustainably running businesses or projects. A more policy oriented perspective, focused on enforcing specific legislative measures was also suggested. Here, one of the developers suggests such an approach which would lift the blame off the individual consumer:

> I also think that we should not control climate change by blaming the consumers for everything. Consumers are of course part of the cycle but we should not make consumers make these sorts of decisions. I think we should make the industry accountable through legislation.
> (Georg Hobmeier, Causa Creations)

Hobmeier, Creative Director at the Vienna-based studio, also provides another example that points to a systemic rather than individual solution to supporting pro-environmental change. He mentions how the citizens in Austria are encouraged to reduce electronic waste by being subsidised for repairing electronic equipment rather than replacing it:

> Austria does spend money on these kinds of things, we now have initiatives to reduce electronic waste. So if my monitor breaks and it's repairable but I cannot be bothered because it is probably too expensive, I get 50 percent of all repairs between 8.50 and 400 euros.
> (Georg Hobmeier, Causa Creations)

Furthermore, Hobmeier expressed clear interest in including sustainability issues in agendas of local developer organisations. For example, he thinks that "the Austrian association would be well advised to coordinate this with official bodies", meaning help the industry and public institutions reach common solutions. He also suggests that developer associations themselves being active in these efforts, providing support and fostering communication among companies, would help the industries in different countries organise their actions better.

The issue of corporate responsibility was raised quite often. Both in reference to whether consumers should play fewer games or whether game developers have an obligation to make climate responsible games. Most of the developers we spoke to agreed that games have the power to raise awareness within the context of the climate crisis.

Marcin Momot points out that because video games are attracting millions of players, it is the developers' responsibility to use their platform for educational purposes:

> When I was reading over our [sustainability] report, it really shows that we are really doing a lot to offset [our] operations. So I feel like all the necessary first steps have been done, but there are definitely some additional things that we could be doing in the future. It is also a matter of education and being able to reach millions of people. It is our responsibility and we have a platform to reach people and to educate them. Maybe we could be doing that a bit more frequently. (Marcin Momot, CD Projekt RED)

Some go even further, believing in the political responsibility of the games industry and game developers. For Boris Maniora engaging in politics and delivering pro-environmental values are the future of video games. In critical times, it is impossible not to engage in global political issues.

> Delivering positive messages is the future of video games. Our players are awaiting that. Gen-Z people want to know that the brand to which they attach emotionally and financially, carries the values that are okay with them. (...) We need to do politics. We need to find a balance of how to do it. (Boris Maniora, Ubisoft Annecy)

However, some of the interviewees pointed out opposing voices in the industry. Based on Jana Unzeitigova's experience, Game Designer at About Fun, there may at first be hesitation to implement elements pointing to issues which are perceived or thought to be perceived by developers as politically charged and that developers may not see including environmental elements as their responsibility. It is not a surprising nor a wrong tendency to create experiences which allow players to escape reality.

However, as Jana described her experience in the interview, her team was open to conversation and listened to her intentions on broadening the inclusivity of the game by adding an older female character to their game and creating a past story point pointing to one character being trans. In the interview, she mentions she can imagine similar conversations about adding environmental elements in games.

> And I'm like, well, it'll be cool and it'll make somebody happy, open up the subject somehow. Well... yeah. I think it's the same thing with the environment, that there's like someone sitting there in the studio who's like, hey what if this character was raising some environmental issues and being responsible and it would be visible in the game? (Jana Unzeitigova, About Fun)

A similar divide occurs when discussing whether and how companies should account for their carbon footprint. While games with environmental themes come to mind easier for developers, the possibility of mitigating one's environmental impact has been overshadowed by the "bigger problem" or feelings of powerlessness, particularly in the non-decision making positions. Below, we have selected several quotes illustrating this finding:

> I think it is more important for all the bakers in the country to get the change of infrastructure, than the game industry, we do not matter that much in numbers, we are not that great. (Georg Hobmeier, Causa Creations)

> Whoever wants to use their energy responsibly, shouldn't play computer games. (Michal Berlinger, FAMU; Amanita Design)

> I don't feel my role there in terms of game development. I don't see the connection there, that it should somehow be solved through me, it's not an interesting topic for me. I'm not saying it's nonsense. There's plenty of other things that are more interesting to me from this area, like how to save energy at home, talking to a friend about farming, and figuring out how to change our behaviour. But within the gaming realm, I don't see the opportunity because what can I do? (Michal Berlinger, FAMU; Amanita Design)

> There are far worse industries that need to be regulated. A games company is no different to [university]. You have a bunch of people with computers turned on. That's it. That's the only thing that's going on. (Will Davis, Studio Red, Netherlands)

> I mean, everything in the video games industry runs on electricity. And a lot of it, especially if you think, you know, big MMORPGs run a lot of servers, they need cooling and just running it. And then at the same time, you know, where does the electricity come from? Is it like, is it just burning coal in, in, in the United States or wherever else? Or is it solar power? Unfortunately, it's rather the former than the latter. And that has a huge footprint on the planet and it should be something we should think about. And I don't think it's being thought about enough at the moment right now, it's just like, oh, we need to make money. We need to make it, we need to keep it running. It needs to work. And then it's like, yeah, but you know, eventually it's gonna ruin everything. (Lars Den Herder, Cloud Imperium Games)

In other cases, those developers that are in more senior positions tend to have a stronger feeling of empowerment and responsibility to take action.

> I think a lot of people think I am not sure if I am doing the right job to have impact. My deep thoughts, I am good at doing games, games are art and we have to tell players how we can keep that fragile nature, and how we can showcase that. (Boris Maniora, Ubisoft Annecy)

The road to sustainable action can often be a long-term ambition of a single activist or a group of advocates. As Arnaud Fayolle admits, in the early days of his pro-environmental initiatives in the company, there was a lot of resistance on the side of the line managers.

> So, it is not that all the managers were blocking. At the very top, the intention was here. It is just down the line the intention was not correctly communicated to the line managers of development teams. (Arnaud Fayolle, Ubisoft Positive Play)

Yet he was persistent in his actions and in the end got through to the higher management which embraced his ecologically oriented vision and supported him with a platform to act further: Ubisoft Positive Play.

> I reached out to Nicolas Hunsinger, director of corporate sustainability, and told him that I am really interested in helping game developers achieve green games. I sent him the presentation on the climate toolkit for content creators. He was very excited because it looked concrete and actionable, which was something the people in Ubisoft HQ were looking for to translate their ambitions to actions. (Arnaud Fayolle, Ubisoft Positive Play)

At the same time Arnaud recognises that despite all the green initiatives within the company, there is still a lot of suspicion amongst the employees who do not trust the sincerity of the ecological turn. The process of changing the work culture and the employee attitudes is a long-term game. This may be an important lesson to learn for other companies in the industry: relying on PR statements and cosmetic changes in everyday business operations may not be enough to convince or change the employees, let alone the players worldwide.

There was a strong assumption amongst employees that top managers only expect them to maximise profit, as all secondary interests often get lost when communication goes through several intermediaries. (Arnaud Fayolle, Ubisoft Positive Play)

The interviewees have mentioned multiple challenges related to the possible transition to a sustainable business. On one hand, companies rarely have (financial or other) incentives to choose the sustainable option despite its potential long-term benefits. On the other hand, many of our interviewees are battling cynicism and pessimism in regards to the possible sustainable future of the industry. Managing the company's carbon footprint becomes an especially difficult task when the studio does not have access to any clear guidelines and does not employ a dedicated and well-informed person to focus on these issues. For these reasons, sustainability is rarely considered a priority by the interviewed game creators. In addition to providing access to clear and up-to-date information on the industry's footprint, there is a significant need for not only arguing for its relevance but also displaying the advantages action and mitigation could bring for the video game industry.

I think the game industry has little focus on sustainability. I think the general perception is that while games are virtual, it's quite okay for the environment because it's all digital. You don't spend a lot of resources on this, but I think it's fake because there are multiple elements that are very involved in sustainability or the problem with sustainability versus the development process itself. (Regis Le Roy, Howest)

In Africa [it] is going to be hard to say: I want to be sustainable, when it's hard to get by. But it's easier for my company now in the UK to decide to go sustainable because it's easier to make that decision and the government can help make sustainable decisions cheaper, but that's not going to be the issue back home in Africa. (Joy Ajayi, Gameplay Programmer)

What seems to be an indisputable trend is the preoccupation of the industry with environment-related issues. Despite existing scepticism towards it and lack of clear strategies and solutions, it seems that there is no way back to business as usual.

This is just the beginning but we've really got the ball rolling. Three years ago, it was hard to find people interested in tackling environmental issues in video games, but now more and more people are excited about this. During the first edition of the green game jam in 2020, we only had one Ubisoft studio participating. Last year we had 5, and this year 15 Ubisoft studios joined the party! There is an exponential interest, even though we're still experimenting on what works and what doesn't.
(Arnaud Fayolle, Ubisoft Positive Play)

I think people will be a lot more aware and then there'll be a lot more effort to reduce the effects on the climate. People would actually take more decisions in trying to change behaviour in game production. (Joy Ajayi, Gameplay Programmer)

Games as Ecological Media

Many of our interviewees pointed to video games that feature environmental themes and visual aesthetic, or games being used as spaces for environmental activism. Some of the developers we interviewed were either developing games about climate change (e.g. Causa Creations), or including environmental aesthetics in their existing games (e.g. Ubisoft's Riders Republic). On the level of content creation, video games may be regarded as ecological media, that is media engaging critically with ecological themes or in some cases, even as media enabling ecological action.

David Olamide, Co-Funder of the Dimension 11 Studios, mentioned in the interview his time at the German studio SpheriEarth and praised the team for being focused on "sustainability and creating awareness about the environment through games". Based on that experience, he argues that creating games on environmental topics is probably the best and most engaging way to reach Generation Z and promote pro-ecological thinking among this age group.

Arnaud Fayolle (Positive Play Ubisoft) believes that video games have a real cultural impact and may transform players by opening up new imaginaries, and by doing that shifting their mindsets. He is critical towards the leading imaginaries of capitalism, favouring power fantasies and exploitation of nature. He notices that in many video games the leading mechanic is focused on competitive collecting of resources that are supposed to make the player characters stronger and better than the others. Exploitation and competition, in his view, have set a dominant narrative in video game design. His role in Ubisoft's Positive Play is, amongst others, to lay those dynamics bare and teach designers to shift the dominant stories.

> We can expose the players to the consequences of their actions, we can give them a vision of what a sustainable world will look like, so they can chase this vision rather than chasing an ideal of wealth and riches which cannot be sustainable. We can aim at transferring more positive behaviours to players. When the context of the game is close enough to the real world, these habits can shift to the real world. And, this is what Paula (Paula Angela Escuadra, Senior UX Strategist at Xbox Studios and a member of the IGDA Climate SIG) calls behavioural transference. Now, we are all using this term. (Arnaud Fayolle, Ubisoft Positive Play)

Boris Maniora (Ubisoft Annecy) stressed the importance of video games in raising the emotional engagement of players. He is convinced that humans are better at listening to emotions rather than reason and believes that video games are a medium with a huge potential to trigger the right emotions in players. At the time of the interview, his team was working on an digital reforestation initiative in the game Riders Republic that was planned for a week in July 2022 as a special online in-game event. The point was to simulate the so-called deep time in a short period of time to show long-term consequences of today's actions.

> We need to connect more to this long-time process that is lacking in modern society. (Boris Maniora, Ubisoft Annecy)

He also pointed out how crucial it is to start acting: "But first, you need to act. It is a good start. Do things". Initiatives such as digital reforestation may encourage some players to act, even if the action is performed within the framework of a virtual environment.

However, not every developer and every studio is as enthusiastic and politically involved as some of Ubisoft's studios mentioned in this analysis. Some regard environmentally themed games and ecological initiatives as unnecessary or too invasive, putting certain values metaphorically in the customers' face. Some just do not consider video games as an impactful medium, at least not yet:

> Even though there are millions and millions of players, like 60% of the world play video games (...); it's mainstream television, where you get a bigger effect where it can be subtle. And the message can seep in slowly that then you're only changing the opinions of the people who can't actually do anything about it. I mean, making a video game to point out whatever the issue is, doesn't really make the politicians or the people who can make the decisions aware of it.
> (Will Davis, Studio Red, Netherlands)

Sometimes the very process of developing green games may lead to a positive change in attitudes towards environmental issues. Joy Ajayi participated in a green game jam that encouraged programmers to develop more optimal, hence less power consuming code. The event also included various talks "trying to inform people about being sustainable". Based on various mentions in our interview sample, it seems that game jam cultures are embracing sustainability issues at a more significant scale in recent years.

3.1.4 Industry Needs

Based on the undertaken analysis, we have identified the following needs, grouped in two clusters related to: climate change mitigation and corporate responsibility. We would like to address the existing gaps but also acknowledge the important work done by the many game studios that are already paving the way towards a more sustainable future.

Climate change mitigation

Climate change mitigation requires developing industry specific strategies for decarbonization, yet in order to conceptualise such guidelines, a comprehensive outlook on the existing carbon footprint is needed first. Many interviewees mentioned practical challenges regarding measuring their studios' emissions, as well as lack of practical guidelines on how to lower them. Unfortunately, there is a lack of measuring standards that could be applied industry-wide and enable comparison between various studios or across entire industries.

The emission reports of selected video game companies completed by Benjamin Abraham indicate that the existing guidelines to measure carbon footprint are not clear or are interpreted by companies in different ways.[9] Determining the responsibility of emissions remains a significant concern as well. Abraham suggests companies should at least address the emissions no one else but them can account for: emissions related to production (e.g., heating and energy consumption) and any additional emissions produced by the company directly (e.g. travel). Otherwise, ideally, companies should look for services of third-party companies who account for their emissions (e.g. servers' maintenance, physical game production, and distribution).

It seems that what the private sector would benefit from are clear guidelines on how to incorporate decarbonization practices into company operations and at the same time avoid the perils of greenwashing. Some interviewees explicitly expressed a growing need for success stories in this area. Thankfully, industry leaders in sustainability such as Ubisoft Positive Play or Space Ape Games can act as sources of inspiration.

Corporate responsibility

Although there is a growing trend of including decarbonization efforts and other actions towards more sustainable practices in corporate responsibility reports, so far only bigger, publicly listed companies have the resources to produce such strategies (e.g. CD Projekt RED, Ubisoft). Furthermore, it is important to acknowledge that some of the interviewees expressed doubt in the relevance of such efforts in the first place, as there are other industries that are viewed as much bigger polluters than the video game industry. Others did not consider the creation of environmentally conscious games a moral obligation on the part of any singular business, following profit-driven neo-liberal reasoning.

There is no consensus on who within the industry in general, or inside a specific studio's organisational structure, should "step up" and address the many different parts of the problem and how. Both the industry employees and decision makers may be interested in mitigating the industry's impact, but become demotivated in direct consequence of the lack of knowledge about their impact. In addition, some employees express the lack of influence in company decisions and are unsure what their pro-environmental actions could entail.

Providing educational materials that will help build a more ecologically conscious but also accountability oriented corporate culture emerged as one of the most important needs in this area. Such materials could focus on raising sustainability awareness, avoiding greenwashing, and motivating future game developers to join the global action on climate change, regardless of the size of their studio. For example, in one of our teaching pilots (chapter 2.2.1) we realised that it was necessary, to battle cynicism, to explain how the game industry's impact fits into a wider context. We needed to show that, while the industry is indeed a part of a bigger problem, it can stand as an example for other industries to follow and can participate in creating a greener future.

The industry needs specific options and solutions for people on different levels of power without attributing guilt to individuals and consumers for the impact that the industry's systems are creating.

9 Abraham, B.J. 2022. Digital Games after Climate Change. London: Palgrave Macmillan.

3.2 Flagship Projects and Initiatives

In the past few years, the games industry has intensified its efforts in pro-actively engaging with the topic of the climate crisis. The year 2019 was a turning point in the way some of the industry's companies started communicating their role within the context of the climate crisis. In 2019 the United Nations' Playing for the Planet Alliance (P4PA) was launched, inviting video game companies of all sizes worldwide to join the initiative.

On a national level, many game developer associations have started promoting green production guidelines: Ukie in cooperation with Games London and the P4P Alliance were the first to present their Green Games Guide in September 2021, followed by the German Games Industry Association's game Environmental Guide (2021) and Neogames - the hub of the Finnish Games Industry, who presented a model for calculating the CO2 emissions of a game studio (2022); and last but not least Nordic game developers launched a PlayCreateGreen community for industry professionals who want to contribute to a collective effort in creating a greener game industry.

By studying the messages, mission statements, and guidelines of these initiatives and programs, a recurring pattern emerges that exposes how the games industry and game making community see their role as ecologically aware subjects. Three categories tend to be addressed most often: 1) raising awareness and sharing best practices through collective actions, 2) exploring the potential of video games as tools of persuasion and change, and 3) measuring the carbon footprint of making games and decarbonizing the games industry.

3.2.1 The Environmental Game Design Playbook

Authors (in alphabetical order): Whittle, C., York, T., Escuadra, P.A., Shonkwiler, G., Bille, H., Fayolle, A., McGregor, B., Hayes, S., Knight, F., Wills, A., Chang, A., & Fernández Galeote, D.

Supporting institution: IGDA Climate SIG (International Game Developers Association, Climate Special Interest Group)

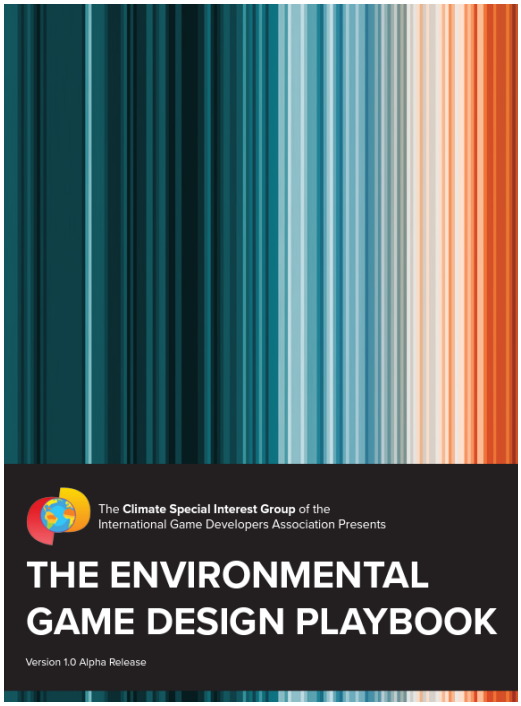
Year of publication: 2022

Audience: Game Developers, Games Industry, Game Scholars

Format: A downloadable 84-page-long handbook

Purpose: To provide a navigable handbook for game developers to work with in designing environmental games for action

Content structure: Background from psychology, how to approach designing green games and how your players perceive them, summary of related game design theory and practical approaches to develop games with green topics, summary of importance of social dimension of and in video games.



The Environmental Game Design Playbook[10] is a guidebook developed by the International Game Developers Association's Climate Special Interest Group that provides game developers with a comprehensive set of guidelines and best practices for designing games that tackle environmental issues. The guidebook is unique because it has been developed in collaboration with climate and sustainability experts who have provided valuable insights and feedback throughout the design process. The guidebook covers various aspects of game development, including design, narrative, mechanics, art, and sound, and includes case studies, examples, and tools to help developers incorporate environmental themes and messages into their games. By using the guidebook, game developers can create games that not only entertain but also educate players about important environmental issues and inspire them to take action in their daily lives.

3.2.2 Green Games Guide

Authors: Daniel Wood (Special Projects lead at Ukie) and Benoit Ruiz (advisor for Interreg Europe and CNC)

Supporting institution: Ukie, Games London and Playing for the Planet

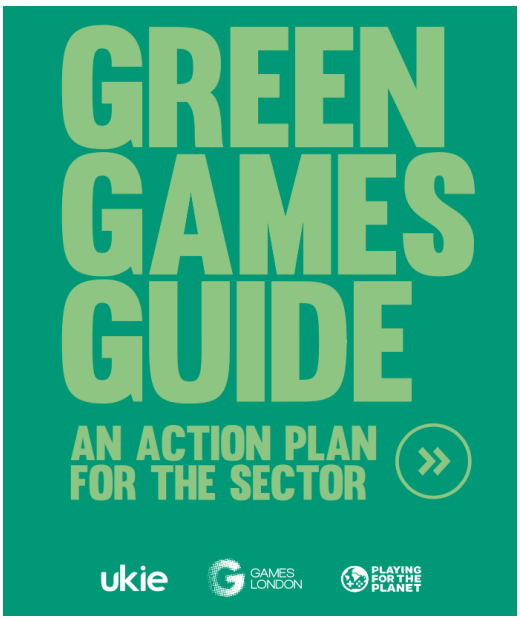
Year of publication: 2021

Audience: Games Industry, Policy Makers

Format: A downloadable 18 page document

Purpose: To provide an action plan for the games sector

Content: Advice for Games Businesses on how to measure their carbon footprint, Data regarding gameplay consumption, Physical Goods and Device Energy Consumption, examples of environmental games



The Green Games Guide[11] provides practical advice to game developers wanting to cut down their emissions, calling on Playing for the Planet's five steps: 1) Defining the scopes and timeline of carbon emission reduction 2) Calculating emissions 3) Taking action to reduce carbon footprint 4) Offsetting 5) Reviewing and sharing with others. The most crucial aspects involve defining scope and emission calculation. The aspects that companies usually include in their calculations are direct company activity (energy use in office, travel, data storage policies), supply chain (including data centres), and indirect emissions by players. Of these, "data storage policies" are particularly important since "Data storage needs energy: the more data you store, the higher your emissions" (GGG 2021, 11). Some of the ways to reduce data size is not keeping multiple copies of the same file, compressing data, and finding out more about the sustainability of data storage with cloud providers. Another aspect touched upon on page 12 refers to energy-efficient coding and re-use of digital assets.

10 Whittle, C., York, T., Escuadra, P.A., Shonkwiler, G., Bille, H., Fayolle, A., McGregor, B., Hayes, S., Knight, F., Wills, A., Chang, A., & Fernández Galeote, D. (2022). The Environmental Game Design Playbook (Presented by the IGDA Climate Special Interest Group). International Game Developers Association.

11 Wood, D., Ruiz, B. 2021. Green Games Guide. An action plan for the sector. https://ukie.org.uk/sustainability.

3.2.3 game Environment Guide

Authors: game: The German Games Industry Association
Supporting institution: game: The German Games Industry Association
Year of publication: 2022
Audience: Games Industry, Policy Makers
Format: A dedicated part of the website
Purpose: To provide information regarding the environmental sustainability in the European games industry
Website: game Environmental guide

3.2.4 GDC State of the Game Industry

Authors: gdconf.com (Game Developers' Conference)
Supporting institution: GDC, Informatech
Year of publication: 2023 (yearly)
Audience: Games Industry, Policy Makers
Format: A downloadable 34 page document
Purpose: To provide information regarding issues and trends in the work of game developers
Content: Numerous survey question result statistics, analysis, and selected comments from developers

The GDC State of the Game Industry documents are published annually, and typically reflect the survey results collected from 2k-4k game developers. As such, it is the strongest single piece of research data on the games industry, collected from those working in it on a daily basis. It is connected to 'GDC', the annual Game Developer Conference held in San Francisco. In 2021, the survey introduced questions regarding sustainability efforts in studios. In three years of publishing this data, the percentage of studios that have done, in the opinion of respondents, 'a lot' towards environmentalism, sustainability, or carbon offsetting was approximately 10% (2021 = 11%, 2022 = 8%, 2023 = 10%). Studios that had made no effort at all appear to have varied, but hovers around 50% (2021 = 35%, 2022 = 55%, 2023 = 47%). The remaining percentage each year comprises studios who have done 'a little' or 'a moderate amount'. This research suggests that approximately half of studios have already begun engaging with sustainability efforts, but also that at least 90% could go significantly further.

3.2.5 Public Green Initiatives of Czech Video Game Studios

Characteristics of the Czech video game industry

The video game industry in the Czech Republic is growing every year. There are 135 video game studios and 90 % of those are owned locally. Most of the income, 95 %, is generated from abroad.[12]

12 https://gda.cz/wp-content/uploads/2022/10/Infografika2022.pdf

Method

As a case study, we have analysed the official communication including webpages of 33 Czech video game studios. We have included all members of the Czech Game Developers Association[13] and few other significant studios that have released a commercial game in the past and continue to work on another title. The final check happened as of 19. 1. 2023.

Results

None of these 33 games published any initiative, code of conduct or similar document mentioning their efforts in relation to the environment. One studio developed a game happening in a world destroyed by the environmental crisis and one studio did not develop a game yet, but its core business lies in the solar industry. Beyond that, we have not identified any mention of any green initiative.

However, as far as we are aware, several studios are involved in activities directly related to sustainability and protection of the environment. For instance, one studio is regularly doing sales of their games with revenues supporting nature protection, another is developing games directly implemented in educational systems to support the teaching of environmental themes. Larger studios here have code of conducts and procedures in relation to their environmental responsibilities. Yet, all these initiatives are not publicly communicated. To better analyse the impact and activities of video game studios in relation to the environment, we would have to conduct a deeper analysis relying on different methods, e.g. interviews. The question of why studios are not publicly communicating their environmentally oriented efforts remains to be answered.

3.2.6 Analysing Environmental Activities of the Playing for the Planet Initiative

What is Playing for the Planet?

The Playing for the Planet Alliance brings together video game companies that are committed to integrating green policies into their games, into their development processes, or that are actively involved in supporting various green initiatives. The whole programme is initiated by the UN Environment Programme. The supported activities range from research data collection and articles to individual contributions by video game companies that are members of the Alliance or their participation in so-called Green Game Jam. Green Game Jam is the annual event during which participating studios incorporate content related to any environmental themes.

The Playing for the Planet Alliance initiative includes large and important players on the video game market. Also, UN support alone gives individual members great credibility with regard to their green efforts.Therefore, we have intentionally focused on the analysis of these individual contributions by each member of the Alliance.

13 https://gda.cz/

Method

As of June 2022, we have analysed all the activities of the members of the Alliance. Then, we have identified 56 companies or associations involved. It should be mentioned that 13 of them are different Ubisoft affiliates from different countries.

We have checked three things. First, whether they have participated in the Green Game Jam 2022 and how they modified their game. Second, we have analysed what they have pledged to do on their Playing for the Planet website profile in relation to the environment. Third, we have checked whether these activities were somehow published on their company website. The last focus was chosen intentionally to compare it with the situation in the Czech Republic, where the environment-related activities are not published on their websites or official communication.

What companies pledged within the Playing for the Planet?

Most of the members (42) promised to raise awareness about the environmental themes and climate change, either among their players or among the game development community using handbooks and collective initiatives. Regarding their pledges to decrease their carbon footprint, 32 members promised to decrease their carbon emissions and 22 members even promised to be at least carbon neutral by a certain deadline. However, we have found that only 14 members of Playing for the Planet had those pledges to be easily identified on their webpages. Furthermore, we have not identified any reliable system for monitoring the fulfillment of these pledges.

Green Game Jam 2022

From all the 56 members, 29 participated in the Green Game jam. In particular, 13 Ubisoft affiliates from different countries and 16 different members. By their participation, all 29 members promised to raise awareness about the topic. Their involvement ranged from simply describing the functions of planting trees for the climate to more complex and elaborate social media campaigns, seminars, newsletters or through specific modifications of game levels. Beyond awareness, 24 members mentioned that they created specific green-themed levels, events or sets of new items/skins to support environmental awareness. 19 of those members committed to actions beyond raising awareness, mostly by supporting the environmentally-focused charities. Specifically, 16 of those plant trees for players actions and purchases, the other three members supported farmers' education in regenerative agriculture methods, coastal restorations or nature conservation. Again, these activities only rarely appeared on the companies' websites.

Summary

Playing for the Planet Alliance is a relatively young initiative, but it seems that it might have an impact on reduction of carbon emissions of the video game industry. As far as we were able to identify, studios moved from raising awareness about climate change to more complex actions including: financially supporting green initiatives, reducing their carbon footprint or pledges for carbon neutrality including the largest studios and companies involved in the game industry. There is one big 'but', there is no way to monitor the fulfilment of these promises. At the same time, many of these activities do not make it into the official communications of those involved, which would also put these activities further outside the community that specifically follows these initiatives.

3.3 Selected Environmental Games

In this section, we provide critical analyses of selected examples of environmental games, with a focus on the context of their production, game aesthetic as well as game mechanics. These serve as best-practice examples and give an indication of the aspects that are crucial in order to categorise a game as an environmental or ecological one. For a more extensive list of eco-games, see IGDA Climate SIG's Games Database and the Green Mediography project by Utrecht University in the Netherlands.

3.3.1 Sonic the Hedgehog

Environmental themes in video games are not a recent phenomenon. Examples of environmental consciousness in games appeared in the 1980s, such as acid rain in Dizzy (1987), but the 1990s saw increased frequency of themes of environmental damage in video games. When the video game industry scaled up from 8-bit to 16-bit computers in the early 1990s there were two main competitors: Nintendo and Sega. Nintendo had their mascot, Mario, but Sega lacked a character with a similar level of recognition. To fulfil this need, they created Sonic the Hedgehog.

Like Super Mario Brothers, Sonic the Hedgehog is a 2D platformer, meaning that the gameplay occurs in a side-on view, with the character moving sideways or up and down, but never into or out of the screen, and they move between platforms of various heights, past obstacles and enemies, to reach the end of the level. These basic mechanics had been popular in games for many years, and some features, such as leaping onto the heads of enemies to attack them, had previously appeared in games featuring Mario.

Unlike Mario, where the character is searching for a princess, Sonic was occupied with a quest to save his woodland home from Doctor Ivo "Eggman" Robotnik. Yuji Naka, creator of Sonic and Dr. Robotnik, envisioned them as opposites, where Dr. Robotnik was on the side of "developers" and Sonic was aligned with "environmentalists".[14] Naka explained this further in a later interview: "Dr Robotnik is a slightly radical representation of all humanity and the impact humanity is having on nature. In 1991, it was a very sensitive subject to talk about the environment and while I had my viewpoint, I did not speak of it. With Sonic, I was given an opportunity to express my views in a different way and did so, showing Robotnik using pollution and creating machinery which desecrates the environment and it is down to Sonic to change his ways."[15]

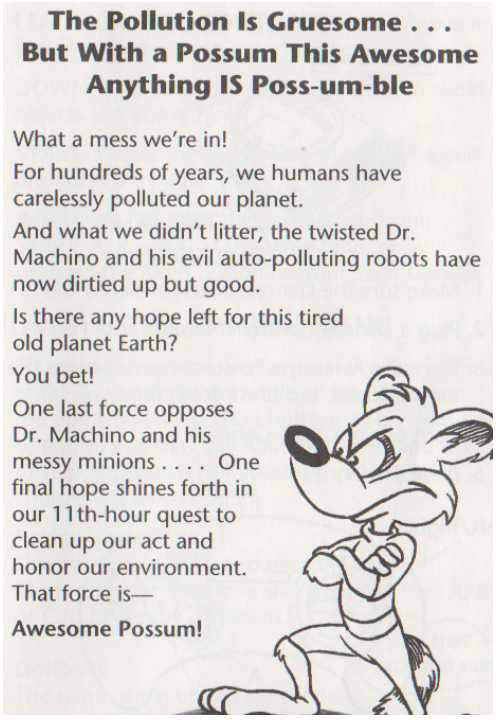
Figure 15. Sonic the Hedgehog bounces on enemy robots to release, in this screenshot, a small blue bird.

14 Sega.com, Interview with Yugi Naka: Creator of Sonic the Hedgehog (https://web.archive.org/web/19970605172353/http://www.sega.com/features/allsonic/creator/naka04.html, accessed 31/01/23), 05/06/97.

15 Willmott, Ray, Interview: Yuji Naka (https://thisismyjoystick.com/feature/interview-yuji-naka/, accessed 31/01/23), 13/10/10

This environmental theme was reflected in the game through both the environments and the response of enemies to being defeated by Sonic: rather they dying, when the robotic minions of Dr. Robotnik are destroyed, they release a small woodland animal which scurries away, showing that the evil Doctor has enslaved creatures to work for him in his plan to exploit the environment.

This environmental theming was not necessary, as is shown by Mario's similar mechanics that lack the same message, and it reflected the increasing presence of environmental concerns in popular culture of the time. This manifested somewhat subtly in stories such as Teenage Mutant Ninja Turtles (comic book, 1984, video game 1989) with its toxic mutant-creating sludge, more thematically in Ecco the Dolphin (video game, 1992) where mysterious forces are destroying the oceans, and explicitly in titles such as Awesome Possum... Kicks Dr. Machino's Butt (1993). [16]


The Pollution Is Gruesome . . . But With a Possum This Awesome Anything IS Poss-um-ble

What a mess we're in!

For hundreds of years, we humans have carelessly polluted our planet.

And what we didn't litter, the twisted Dr. Machino and his evil auto-polluting robots have now dirtied up but good.

Is there any hope left for this tired old planet Earth?

You bet!

One last force opposes Dr. Machino and his messy minions . . . . One final hope shines forth in our 11th-hour quest to clean up our act and honor our environment. That force is—

Awesome Possum!

Figure 16. Image from the instruction manual for 'Awesome Possum'.

3.3.2 Final Fantasy VII

Final Fantasy VII was released in 1997 and became an iconic game for several reasons. There was a daring narrative twist, with a central playable character dying during the game, but the political situation of the narrative was also unusual: the hero's team were members of 'AVALANCHE', an eco-terrorist group destroying power stations run by a global corporation called 'Shinra'.[17] These power stations are draining the planet's energy. It is left somewhat ambiguous whether Shinra knows of the threat and prioritises profit, or whether it underestimates the threat, but Shinra's threat is taken further by a subsequent antagonist who explicitly acknowledges their intention to drain the planet and end all life.

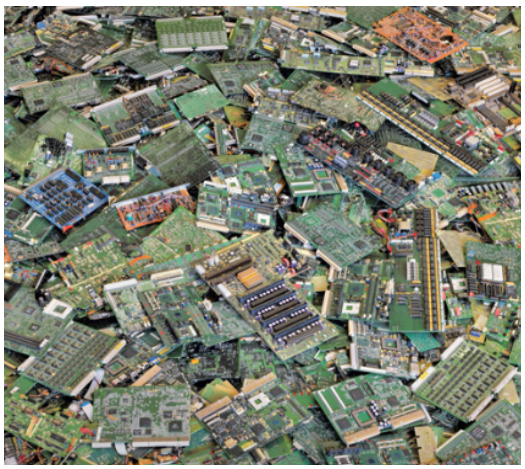


Figure 17. A scene from Final Fantasy VII, showing the character Barret explaining the global threat by the events of the plot.

16 Tengen, Awesome Possum Manual (https://segaretro.org/images/3/35/Awesome_Possum_MD_US_Manual.pdf, accessed 02/02/23), 1993.

17 McLaughlin, Rus, IGN Presents: The History of Final Fantasy VII (https://web.archive.org/web/20100507155559/http://retro.ign.com/articles/870/870770p4.html, accessed 02/02/23), 01/06/97.

While the team is explicit in their intention to represent eco-terrorists as saviours of the world, the game's execution allows accountability to be moved from Shinra (a human and capitalist source for planetary destruction) towards an alien threat, which somewhat undermines its critical stance. Unlike Sonic the Hedgehog, where the actions in the game are generally coherent with the environmental theming, many of the mechanics in Final Fantasy VII, and later games in the series, rely on extraction of natural resources, either through combat with animals or (in later games) mining for resources. Nonetheless, "the game's radical environmental themes and Shinto-tinged philosophies wound up influencing a generation of environmentalists."[18]

3.3.3 Abzû

Abzû was released in 2016. Unlike many games, including Sonic the Hedgehog and the Final Fantasy series, it does not feature combat as a core gameplay activity. Abzû reflects a minor trend in the 2010s for games that are considered to be experiential, artistic, contemplative, or entirely story focused, rather than oriented towards competition, challenge, and/or dominance. In 2019, Abzû was included in a collection of games being sold in aid of World Environment Day. [19]

In Abzû, the player controls a diver who explores a series of vast underwater areas. In each area, the player performs simple interactions with the environment, many of which return life to the oceans. This life manifests as corals regrowing or shoals of fish emerging. The journey is "unabashedly eco-friendly" and includes tasks such as clearing pollution and mines among the ruins of an ancient civilisation, but the game "takes care to point out that technology isn't inherently bad". [20]

Like Final Fantasy VII, the basic premise of Abzû's story (which is told through abstract and ambiguous scenarios) is that there are mysterious machines that are drawing energy from the oceans, which is creating the problems and harming biodiversity. This abstraction of industrial pollution allows the game to create a dream-like feel for the narrative, and may contribute to the goal of Matt Nava's (the creative director) to deliver a hopeful message: "'Even though things are dire, there can be positive change [...] You can't really change the world or fix these problems if you don't believe they can be fixed.'" [21]

Learning about the oceans is a core activity of the game, with opportunities presented for the player to observe and identify marine life which is based on the real world, but, arguably, the abstraction from real problems which is intended to inspire hope for change could also be counterproductive.

The complexity of reversing the degradation of our natural environment is infinitely more nuanced than the simple interactions executed by a solo diver in Abzû (and similarly in Sonic the Hedgehog and Final Fantasy VII). The clarity of the path to progress which is presented in games, to enhance their experience and empower the player, is not easily replicable or applicable to life, and this risks hope being destroyed when it meets the reality of the challenges that humanity faces if we hope to halt our destruction.

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18 Hirst, Stephen K. 2021. How Final Fantasy VII radicalized a generation of climate warriors (https://arstechnica.com/gaming/2021/07/how-final-fantasy-vii-radicalized-a-generation-of-climate-warriors/, accessed 02/02/23), 29/07/21.

19 Diaz, Ana, Abzu, Subnautica, and other titles on sale now for Steam's World Environment Day Sale (https://www.polygon.com/deals/2019/6/4/18652598/world-environmental-day-sale-steam-windows, accessed 07/02/23), 04/06/19.

20 Berkeley, Kim, How This Game is Using Technology to Reconnect People With the Natural World (https://www.onegreenplanet.org/environment/this-game-is-using-technology-to-reconnect-people-with-the-natural-world/, accessed 07/02/23), 2017.

21 Haske, Steve, Exploring the hidden depths of 'Abzû' (https://www.inverse.com/article/21362-abz-creative-director-matt-nava-interview, accessed 07/02/23), 27/09/16.

Figure 18. A typically idyllic underwater scene from Abzû. Darker moments also appear in the game.

3.3.4 Terra Nil

Terra Nil is an upcoming game, due for release in 2023.[22] It contrasts with the previous games in that it is strongly engaged with the sustainability of our environment on both a thematic and systemic level.

Terra Nil has many of the features of a typical city-builder game, where the usual goal is expansion across and upwards from a natural landscape. In city-builders, the goal is typically the optimisation of life for the human inhabitants or the administrators of the city, and this is typified in the archetypal SimCity series of games.

Where Terra Nil differs is that, rather than expanding across the land to create a human-friendly city, the player begins with a wasteland and their objective is to return life to the area. At the end of the rejuvenation, rather than creating a habitat for humans, the goal is for the rejuvenation equipment to be fully removed from the environment, leaving no trace of human involvement in the natural processes. The wasteland can begin either as barren land, or feature buildings, such as factories to be removed. There are multiple environments to be cleaned, including land, rivers, and oceans, and also multiple biomes, such as North American forest-like areas and arctic zones. Along with removing pollutants and planting vegetation, fauna is also included in the simulation.

From the contrast in approaches between Sonic The Hedgehog, Final Fantasy VII, Abzû, and Terra Nil, there is a pattern of two prominent axes of environmental awareness in commercial entertainment video games: thematic and systemic engagement. Further research should be conducted to assess if this could become a useful model for categorising video games.

22 Free Lives, Terra Nil on Steam (https://store.steampowered.com/app/1593030/Terra_Nil/ accessed 16/02/23), 2023.

Figure 17. Terra Nil's distant isometric viewpoint shows the landscape, with the player's actions slowly removing pollution and returning life to the environment.

3.3.5 Beecarbonize

Beecarbonize (2023) is a climate survival strategy card game developed by Charles Games, an independent games studio based in Prague in Czechia. In this game, players are facing climate change and its impact on the planet. In this simulation of climate change impact on the planet Earth, they gain resources which they can invest to get new cards that represent inventions, social reforms, laws, industry innovations or ecosystem approaches inspired by real-world measures helping to solve climate change. Combinations of these cards help them to reduce carbon emissions, mitigate disasters caused by climate change and in the end to develop a way to deal with climate change. The game's message emphasises negative effects of climate change, but it also reminds players that solutions exist if we act fast enough. Beecarbonize is an example of procedural rhetoric and how game systems might represent a message about complex topics such as climate change. Rather than focused on particular numbers, Beecarbonize favours the approach to simulate trends and interconnections between various policies on a general level including the cascading effect of tipping points and the importance of solving environmental disasters in time. As such, players can develop different strategies and mental models on how to balance their efforts in solving the energy crisis while taking care of people and ecosystems. The game also contains encyclopaedia entries for each of the 120 cards in the game. The game was developed in cooperation with leading climate experts from NGO People in Need as a part of the 1Planet4All project financed by the European Union.

Figure 20. Promotional image for Beecarbonize, showing cards available during gameplay.

4. SUMMARY AND NEXT STEPS

The interview material, accompanied by survey findings, the analysis of relevant academic literature, and video game industry's outreach materials, has allowed us to gain insight into the current needs of higher education as well as the industry. It has also allowed us to better understand and contextualise existing pro-environmental initiatives, identify gaps in current knowledge, and most of all to embrace the variety of voices and attitudes towards these issues across the field. This multitude of perspectives may be a contributing factor behind the lack of industry-wide climate impact mitigation strategies. The intersection of environmental sustainability and game production is in constant development and the game developer community is trying to navigate its way through the muddy waters.

One of the most relevant questions that emerges from our Greening Games Education report may be formulated along the following lines: What should we teach in game development and game design higher education programs to fill the gaps identified by the industry professionals? It is worth noting, this is a very different question to the one that is usually posed in such a cross-institutional context, i.e., how to provide the students with relevant skill sets to support the industry? The latter question does not reach beyond teaching a standardised set of predefined skills that the industry is looking for in graduates (e.g., knowledge of specific design tools). However, our inquiries suggest that the existing situation, dire and uncertain as it is, calls upon the higher education institutions to be partners in this important and challenging endeavour, not merely service providers.

Critically approaching the issues of sustainability in the lecture room may result in a much larger number of future developers that are intrinsically motivated to change the industry from within. We should also recognise that Generation Z is already very aware of the climate crisis, as the consequences of humanity's actions will fall upon this demographic group the hardest. While motivation to act pro-environmentally in a professional setting may seem a novelty for many current employees, some of our interviewees expect it to be the norm in the future. This also means that we need to rethink how to best integrate the topics and skill sets connected to environmental sustainability within game development programs Europe wide. As educators, we have the tools and necessary expertise to work on providing science-based solutions.

This report is a modest start to demonstrate the state of the art of green game education, find gaps in existing research and didactics, and envision better paths to address future challenges. Perhaps more than ever, we should start building bridges with the industry, but on different terms than those dictated by neoliberal markets. We need to make our work more visible in the game development communities and collaborate, whenever necessary, on developing common solutions. The Greening Games Education report is not the end but a start. It will springboard us to the next phases of the Greening Games project. In 2023 and 2024, we will be developing a repository with educational resources connected to teaching all the manifold environmental considerations in games. The repository will include:

a. Examples of teaching methods
b. Examples of assessment formats
c. Exemplary Syllabi for BA and MA level education
d. Decks with lecture material
e. Short podcasts
f. Extended and updated list of resources (divided into four thematic areas)

We will also test the developed resources in four universities (Cologne Game Lab, TH Köln, Breda University of Applied Sciences, Charles University as well as Turku University). We hope that all the resources and materials prepared by our team will help not only the educators and students, but also the industry to look for more research that can strengthen their own visions, strategies and research programs.

5. APPENDICES

5.1 Appendix 1: Survey Templates for Higher Education and Private Sector

5.1.1 Survey Information & Consent

Welcome, and thank you for your interest in our survey.

You will be asked questions about your experience or opinion regarding the environmental sustainability of video games. We will not ask any personal questions that could disclose your identity. It is anticipated that the survey will not take longer than 5-10 minutes.

By participating in this survey, you are taking part in a scientific study conducted by the following universities: Cologne University of Applied Sciences, Breda University of Applied Sciences, University of Turku and Charles University.

The study is carried out within the framework of the "Greening Games" research project, which focuses on video games within the context of sustainability with the aim to develop, test and distribute didactic materials across European higher education video game-related programs.

The core research team will analyse the data collected in this survey (see http://greeningames.eu/researchers). The analysis will be presented in various formats, including academic conference presentations and journals. It will also inform the development of teaching resources for sustainable video game production, design and critical game studies. No personal information related to the survey participants will be disclosed.

The collected data will be stored in a secure digital environment on university servers of the coordinating institution.

By agreeing to participate in this survey, you allow the "Greening Games" research team to collect, analyse and present research data based on the analysis of the surveys.

Please be mindful when answering open-ended questions about not providing personal identifying data (e.g. the name of your own institution, department, etc.)

For further questions, please contact the principal investigator, Prof. Dr Sonia Fizek over e-mail: sf@colognegamelab.de.

You can learn more about the project and its research team at www.greeningames.eu.

— All questions marked with an * require a response.

I have read the information regarding the nature of this survey. I understand how my data will be used, and I freely and voluntarily choose to participate in this study *

o Yes, I consent
o No, I don't consent

5.1.2 Screening Question

What best describes your current situation? *
In case you are involved in both, pick the one you do the most.
o I'm involved with the development of video games in the private sector
o I'm associated with academia and/or I teach in a higher education institution
o Neither applies (I am not developing games or researching/teaching about game development)

5.1.3 Start of Block: Higher Education

HE|Q1 Have you ever delivered teaching content related to 'video games and sustainability'? *
(e.g. seminars, lectures, workshops, tutorials, modules, etc.)
o Yes
o No

HE|Q1a Would you consider teaching video game sustainability-related content in the future?
o Yes
o No
o Maybe

HE|Q1b (Optional) What are your reasons for not wanting to teach sustainability-related content?

_____

_____

HE|Q2 Please rank the following options regarding teaching 'video games and sustainability' in order of importance to you.
To rank your answers, click & drag up or down (1 being the most important and 4 the least important)
——Environmental impact of playing video games (e.g. streaming, device power usage, etc.)
——Environmental impact of production (e.g. environmental harms of game production and distribution)
——Societal issues (e.g. diversity, inclusion in game cultures and corporate responsibility of game companies)
——Environmental games (e.g. designing games addressing issues related to sustainability)
——Video game hardware manufacturing and distribution (e.g. console making and shipping, graphic cards and other hardware components)

HE|Q3 What kind of educational resources on sustainability and games would you recommend to your students?
(More than one answer is possible)
☐ Curated lists of most recent open access academic publications on the topic
☐ In-depth case studies exploring best practices in academia and industry
☐ Detailed information on the carbon-footprint of game production, distribution and consumption

HE|Q4 Is there any other sustainability-related topic you consider important to teach?

_____

_____

HE|Q5 How would you describe the accessibility of academic/teaching materials on sustainability and games?

o Inadequate
o Fair
o Good
o Very good
o Excellent

HE|Q6 What would be your suggestion(s) to improve the accessibility of academic/teaching materials on sustainability and games?

_____

_____

HE|Q7 Is there anything else related to 'video games and sustainability' that you would like to share with us?

We are happy to hear about any sustainability-related experiences, initiatives or plans. Please be mindful when answering open-ended questions about not providing personal identifying data (e.g. the name of your institution, department, etc.)

_____

_____

HE|Q8 In which country is your teaching institution based? *

Afghanistan ... Zimbabwe ▼

HE|Q9 What field do you teach in? *

o Game Studies
o Game Design
o Game Development
Other (please specify) _____

5.1.4 Start of Block: Private Sector

PS|Q1 Do you think that the video games industry has an impact on climate change?
For example, as a result of direct emissions due to the electricity used by programmers, artists and producers working on high-powered computers and company servers.
o Yes (a significant impact)
o Somewhat (it has an impact but is not significant)
o No (it does not have an impact)
o Not sure
o Other _____

PS|Q2 According to your own estimations, which moment in the chain of video game production has a more significant effect on direct carbon emissions?
(Drag & drop, ranking in order of significant effect, 1 being most significant and 3 less significant)

_____Video game development (making from initial stages till completion)
_____Video game distribution (shipping discs, digital downloads, etc.)
_____Playing video games (on smartphones, tablets, consoles, PCs, cloud services, etc.)
_____Hardware manufacturing and distribution (e.g. console making and shipping, graphic cards and other hardware components)

PS|Q3 Is the topic of reducing or eliminating carbon emissions in the game industry ever discussed in your professional context?
(e.g. among your colleagues, at company workshops, management, etc.)
o None at all
o A little
o A moderate amount
o A lot
o A great deal

PS|Q4 Is the topic of what your studio (in particular) can do to reduce emissions ever discussed in your professional context?
(e.g. among your colleagues, at company workshops, management, etc.)
o None at all
o A little
o A moderate amount
o A lot
o A great deal

PS|Q4a When discussing what your studio can do to reduce or eliminate carbon emissions, who is having these conversations?

(More than one answer is possible)

- ☐ Employees among themselves
- ☐ Individuals in managerial positions
- ☐ Employees towards management
- ☐ Company-wide communications

Other (Please specify) _____

PS|Q5 If your company offered one, would you be interested in attending a workshop on ways to change and reduce emissions in the game industry?

- o Definitely yes
- o Probably yes
- o Probably not
- o Definitely not

PS|Q5a What topics regarding best practices and skills needed to fight climate change in the workplace would you like to know more about?

(More than one answer is possible)

- ☐ Developing green-themed games (mobilising/educating players)
- ☐ Managing energy and water usage at the office
- ☐ Reducing waste
- ☐ Measuring your own carbon footprint (environmental calculator)
- ☐ Switching to renewable energy
- ☐ Fostering a sustainability culture at the office
- ☐ Sustainable operations planning
- ☐ Making your office carbon neutral
- ☐ Making environmentally conscious office/business decisions
- ☐ Storing data more sustainably

Other (please specify) _____

PS|Q6 In which country is your company based? *

Afghanistan ... Zimbabwe ▼

PS|Q6 What is the size of your company? *

(Approximate number of employees)

- o 1
- o 2~5
- o 6 ~10
- o 11~20
- o 21~50
- o 51~100
- o 101~250
- o 251~500
- o 501+

5.2 Appendix 2: Semi-Structured Interview Questionnaires for Higher Education

1. Can you tell me a bit about [name of university] programme and your role?
2. What is the strategic place of video games in your institute? (Does [name university] educate in game design, programming and arts, game studies, and game culture?
3. Which discipline do you represent/associate yourself with? Are there any seminars/ lectures/modules you teach?
4. What is your general perception regarding (environmental) sustainability within the games industry? Do you think that video game production has an impact when it comes to climate change and the environment?
5. What would you say (in regards to these themes) is the most vital for the games industry to pay attention to?
6. Do you think sustainability in the context of video game production could be taught?
7. Do you teach seminars/modules that touch on the question of green gaming / eco-games / sustainability of video games production?
8. If yes, How did you become interested in the topic of sustainability in/media and games?
    1. How do you teach sustainability within the context of video games? (e.g. can you elaborate on the topics, literature and disciplinary approaches?)
    2. How long has your institute been offering courses of this kind?
    3. What was the rationale behind providing such courses? Why offer seminars in eco-games / green gaming/sustainability of video games?
    4. What didactic formats have you been using? (discussions, experiments, group work, any other?)
    5. What teaching resources are you using?
    6. What do you want your students to learn? (learning outcomes)
    7. How do the students react to this specific thematic scope?
    8. If you have course documentation related to this topic, would you be willing to share this with us?
9. If not, Would you like to teach sustainability and video games?
    1. What topics would you consider important and why? What would you like your students to learn if you were to teach in "green gaming"?
10. Do you know of any (other) programs where video game sustainability is taught?
11. Would you be interested in using an interdisciplinary teaching archive of green gaming? If so, what kind of content would help you most?
12. How do you perceive our role as scholars and higher education lecturers within the context of green gaming?
13. Are there any actions that the HE community could do to improve the teaching of sustainability of video game production / eco-gaming / green gaming?
14. Do you collaborate with the game industry or game development community in any capacity? If so, how? If not, how do you envision such a dialogue for the purpose of sustainability-related didactics?

5.3 Appendix 3: Semi-Structured Interview Questionnaires for Private Sector

Survey: Greening Games | Needs & State of Play

1. Can you tell me a bit about your work and your company? Nothing NDA breaking of course, but just to get an idea of company size, type of games being developed, your role and that kind of things...
2. What is your general perception regarding (environmental) sustainability within the games industry?
    a. Is there any aspect that interests you about this topic?
3. What would you say (in regards to these themes) is the most vital for the industry to pay attention to?
4. How did you get interested in the subject of sustainability and video games? (only if they explicitly have the interest)
5. How do you perceive the interest in and awareness of sustainability-related issues among other colleagues in your company?
6. Do you know of any sustainability-related initiatives in the games industry or run by the gaming community?
    a. Are you or is your company involved in any such initiatives?
        i. Do you have a sustainability manager/assistant or any other person responsible for ecological game production in your team? OR (if interviewing a person who is a sustainability manager/expert etc.). What does your daily work look like? / Can you tell me a bit more about it within the context of sustainability?
        ii. If you had to make an "elevator pitch", how would you summarise why this type of work is important?
7. Do you think that video game production has an impact when it comes to climate change and the environment?
8. If we could, how do you think we should measure the ecological footprint of game production? Do you think this is something that should become more standard practice? or are there, in your opinion, other more important actions that the industry should focus on?
    a. Are you or is your company involved in any such initiatives?
        i. If not, do you think your company/team would be interested in measuring the footprint of its video game production?
9. What are the biggest challenges, do you think, in turning to green production?
10. Do you think video games can play a role in making a change in educating about ecology-related issues?
    a. If yes, How do you think video games can bring about this change?
11. Have you heard of the term 'eco-games'(games with ecological themes or games educating about ecological issues)?
    a. If yes, Have you or your company been involved in making eco-games?
12. Would you be interested in exploring further the topic of video game sustainability? If so, what aspect would interest you the most?

* Questions with the pink background are optional or conditional questions

5.4 Appendix 4: Survey Data Visualisations

[23-01] Greening Games Survey Data Visualisations.pdf

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