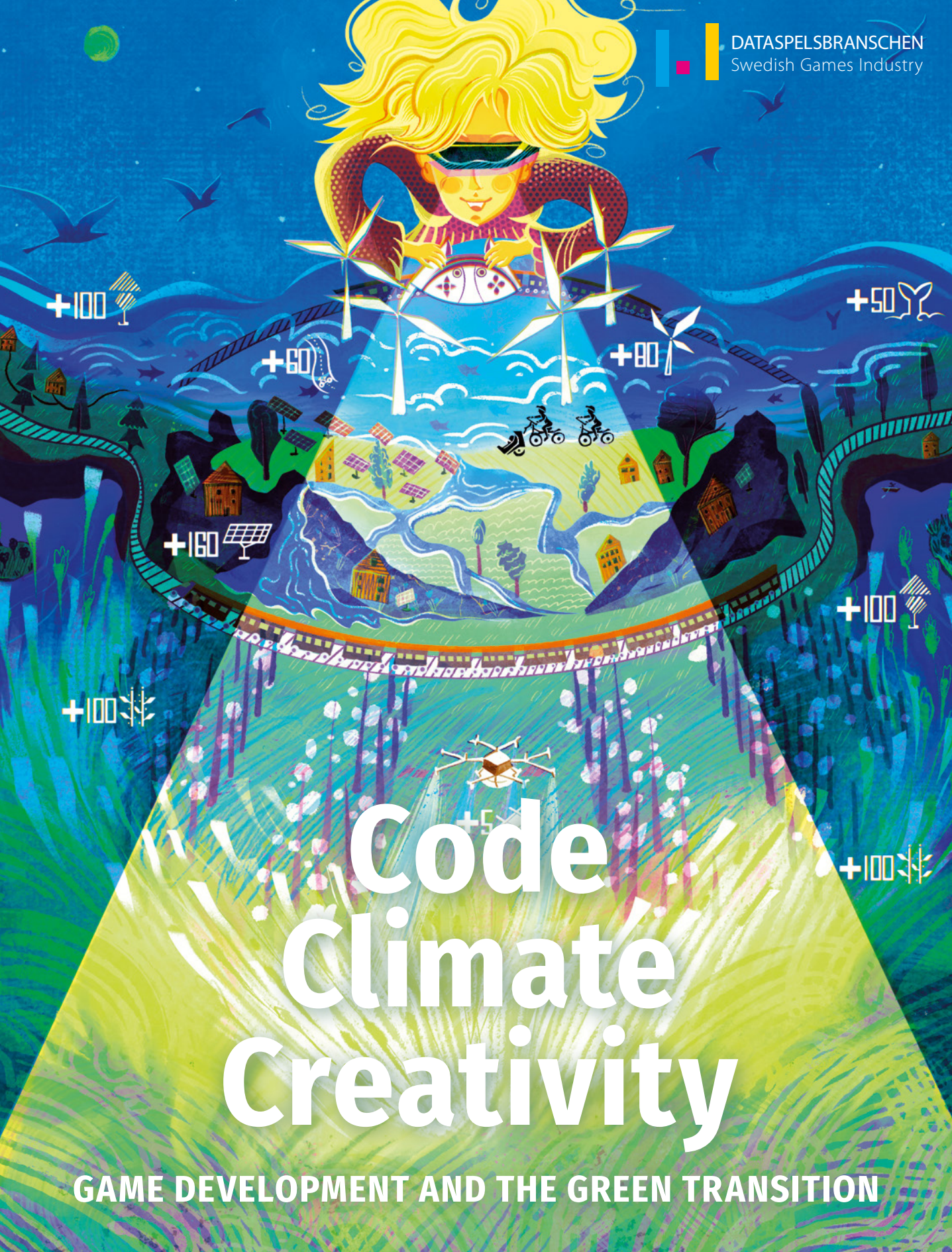




Code Climate Creativity

GAME DEVELOPMENT AND THE GREEN TRANSITION

Third edition

December 2024

This is the final report for project SUSINDI – a collaboration between the Swedish Games Industry, RISE, Game Habitat and U&We, with funding from Vinnova.

Project group: Marlène Tamlin, Johanna Nylander, Per Strömbäck, Elin Carlsson, Björn Flintberg, Gabriella Kalteneckar, Linnéa Svenman Wiker, Peter Lübeck, Elin Arvidsson, Erik Sundberg, Anna Larsson Corcoran and Amanda Möttönen

Operational project manager: Marlène Tamlin

Published by **The Swedish Games Industry**

Editors: Marlène Tamlin, Elin Carlsson, Johanna Nylander

Layout: Emilie Ihre

Illustration, cover: Yelyzaveta Anysymova, [lisasobacca.art](https://www.lisasobacca.art)

Translation: Sarah Fagerström

Contact: **marlene.tamlin@dataspelsbranschen.se**

The report is printed on FSC-labelled paper.

Dataspelsbranschen | Swedish Games Industry
Magnus Ladulåsgatan 65, SE-118 27 Stockholm

swedishgamesindustry.com

The report in brief

- **The carbon footprint of Swedish game companies is low**, both compared with other industries in Sweden and the games industry internationally, and several companies are at the forefront. The greatest consumption of resources occurs when games are played, which is more difficult to measure. Global investments in fossil-free energy and circular economy are important for the industry to reach zero emissions throughout the value chain.
- **The new *Play, Create, Calculate* toolbox helps game studios calculate their emissions.** The most essential actions to reduce emissions from game development are choosing fossil-free energy and reviewing purchases of electronics, server services and travel. Efficiency improvements and eco-modes in games can reduce the resource needs of the player.
- **Technologies, methods and lessons learnt from games are needed in the green transition.** These tools are important for people, society and industry. The role of games as innovation catalysts can be strengthened through research, room for cross-sectoral creative meetings and dissemination of good practices. Games also build relationships and practise skills that are important for sustainability and resilience.
- **Games are digital, creative and intangible rather than physical**, contributing to the dematerialisation of the economy. Playing games is a relatively low-emission activity compared to many alternative interests. There is a need for deeper analysis on how intangible value in general can contribute to a more sustainable economy.
- **The transformative power of (game) culture and art requires artistic freedom and infrastructure** to create more opportunities for creators and new ideas. Art's ability to evoke emotions and dialogue has always played an important role in major societal changes and games are one of the most important cultural expressions today.
- **The reach of games can be an opportunity to raise money, knowledge and engagement** – provided it suits the game's creators, narrative, mechanics and audience. Sharing experiences and contacts can expand these opportunities. The challenge, uniqueness and strength of games is the interactive and changing nature of games where players are co-creators.

Content

Foreword	4
Sustainable development	6
The games industry in sweden	9
Overview – green engagement in the games industry	11
Footprint – reducing negative impacts	15
Emission data and regulatory frameworks	16
Play, Create, Calculate – a toolbox for calculating emissions (U&We)	20
Reducing the environmental impact of playing games (Uppsala University)	22
Handprint – spreading the positive effects	25
Direct benefits of games	26
Climate, digitalisation and intangible value	28
Technical, commercial and financial resources	30
Spreading game innovation (RISE)	32
Voice – contributing to dialogue and engagement	41
Game creators and the art of changing the world	42
Unique creative works	47
Inspiration	51
Information	54
Interaction	59
Analysis and conclusions	64
About the report	66

Foreword

No Games on a Cooked Planet

In June 2019, around 50 leaders from games companies across the Nordic region met on the idyllic Danish island of Bornholm to discuss the future of the industry. The number one issue was to be selected. There was no shortage of suggestions: access to capital, international competition, new markets, consolidation, skills shortage, budget inflation and much more. But it was the climate that 'won'. If we can't solve the climate crisis, there is no point in thinking about the other problems. There are no games on a cooked planet.

This report is about how digital innovative industries can help reduce human climate impact. We choose to use digital games made in Sweden as an example, but we hope that the analysis and suggestions can be applied to other industries and countries.

Should we have to sacrifice our standard of living for the climate? There are many suggestions on how to get out of this conundrum. Digitalisation, servitization and electrification are often mentioned as pathways to green growth. Games encompass all of these: they are of course digital, they have long since moved from being products to being services, and electricity is the energy that powers computers, servers and game devices.

Games are intangible. They have no physical form, they are ephemeral, changeable. But they have great value. The intangible value creation is a suggestion of

how economic development can be sustainable. In 2012, the Swedish games industry had a modest turnover of EUR 427 Million. Ten years later, the industry in Sweden had a turnover of EUR 3.1 Billion. An increase of almost 900% in a decade. The climate emissions caused by the industry increased by only a fraction in the same time-frame. A slight increase in electricity consumption. A bit more travel. Perhaps increased consumption as people make a little more money. Exactly how little emissions caused by games have increased, we cannot know, but in this report we present a way of calculating and will thus be able to follow up.

Not only is production climate-efficient, but so is consumption. When researchers Björn Hedin and Daniel Pargman at KTH Royal Institute of Technology conducted a thought experiment on the most climate-efficient way to consume 50 Euros, they found that buying loot boxes in games has the least impact. Nevertheless, the greatest potential for reducing emissions lies in reviewing the need for energy and resources when games are played, i.e. 'downstream in the value chain' or Scope 3, to speak in mumbo jumbo. The new *Play, Create, Calculate* toolbox also covers these emissions. What is measured can also be improved.

The principle that everyone should be responsible for reducing their emissions is good and necessary. Yet it is easy to feel frustrated. Even if all emissions related to

games were to disappear, it would have little impact on the overall emissions. A bubble in the air rather than a drop in the ocean. Can we do more?

Yes! Technology and design from games can be applied to other industries. If we can help electrify a mine, for example, the consumption of fossil fuels can be significantly reduced. This report contains more suggestions like that. Games are also a social arena. They cannot control people's behaviour, but they can be a place for imagination, reflection, experience and exchange. There are several interesting examples here. Developers can also design games so that players can contribute to immediate climate benefits in the real world, such as funding for conservation projects. To the extent that companies have a cash surplus, it can be invested in climate-friendly innovations and projects. The list goes on.

Games can save the planet. Not on their own, but by doing their part. By contributing to the work of others. By inspiring. And by constantly trying to improve.

We want to create and play, not cook the planet.

Stockholm, October 2024

Per Strömbäck

Managing Director Swedish Games Industry



Sustainable development

The world faces a number of complex challenges that transcend national borders. To address these challenges, global Sustainable Development Goals (SDG) were adopted by UN member states in 2015.

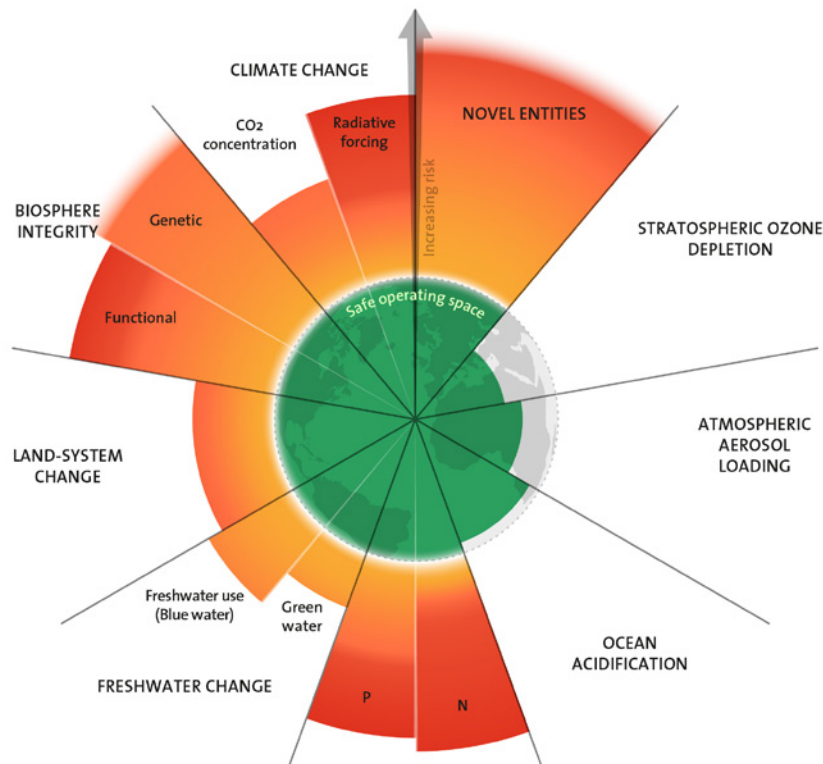
These seventeen goals represent an ambitious and universal agenda that seeks to promote social, economic and environmental sustainability and address the climate crisis. The UN aims to create a more just, sustainable and peaceful world by 2030.

To achieve this, governments, the private sector, civil society and citizens need to work together. The *Swedish Games Industry* is actively working on collaboration and sustainability issues in various forms, and

the *Sustainability in new digital industries* (SUSINDI) project that led to this report is part of that work.

The SDGs are all interlinked and interdependent if the world is to achieve sustainable development. This particular report focuses on how digital games affect the planet's conditions and delves primarily into the climate issue (Goal 13), but also touches on several other areas closely related to climate challenges.





The planetary boundaries 2023.

Credit: Azote for Stockholm Resilience Centre,
based on analysis in *Richardson et al 2023*.

Planetary boundaries and the climate crisis

Planetary boundaries are a scientific model developed under the leadership of Professor Johan Rockström at the Stockholm Resilience Center, an international research centre at Stockholm University. It defines the fundamental processes that together create stable and secure conditions for life on the planet. The model is used to measure and visualise the current state of nine essential planetary processes. Crossing the set planetary boundaries in each area poses a significant risk of creating large-scale, abrupt or irreversible changes to the living environment in the short or long term.

While some processes have been measured since 2009, in 2023 the current status of all nine processes was quantified for the first time by a group of international scientists¹. The results show that the limit of what is

considered safe for humanity has been crossed for six of the nine areas. The fact that several areas are under great pressure at the same time further reduces the planet's resilience and risks causing unpredictable and potentially devastating threshold effects.

The *UN Intergovernmental Panel on Climate Change* (IPCC) 2023 report recognises that climate change is a threat to human well-being and the health of the planet, and is already causing widespread and rapid changes in the atmosphere, oceans, cryosphere and biosphere. Human activities, in particular greenhouse gas emissions, have caused global warming. To avoid the worst impacts, warming must be limited to 1.5°C (2.7 degrees Fahrenheit), which requires urgent and comprehensive emission reduction measures in all sectors.

¹<https://www.science.org/doi/10.1126/sciadv.adh2458>

Minecraft

Minecraft Education: Frozen Planet II Worlds

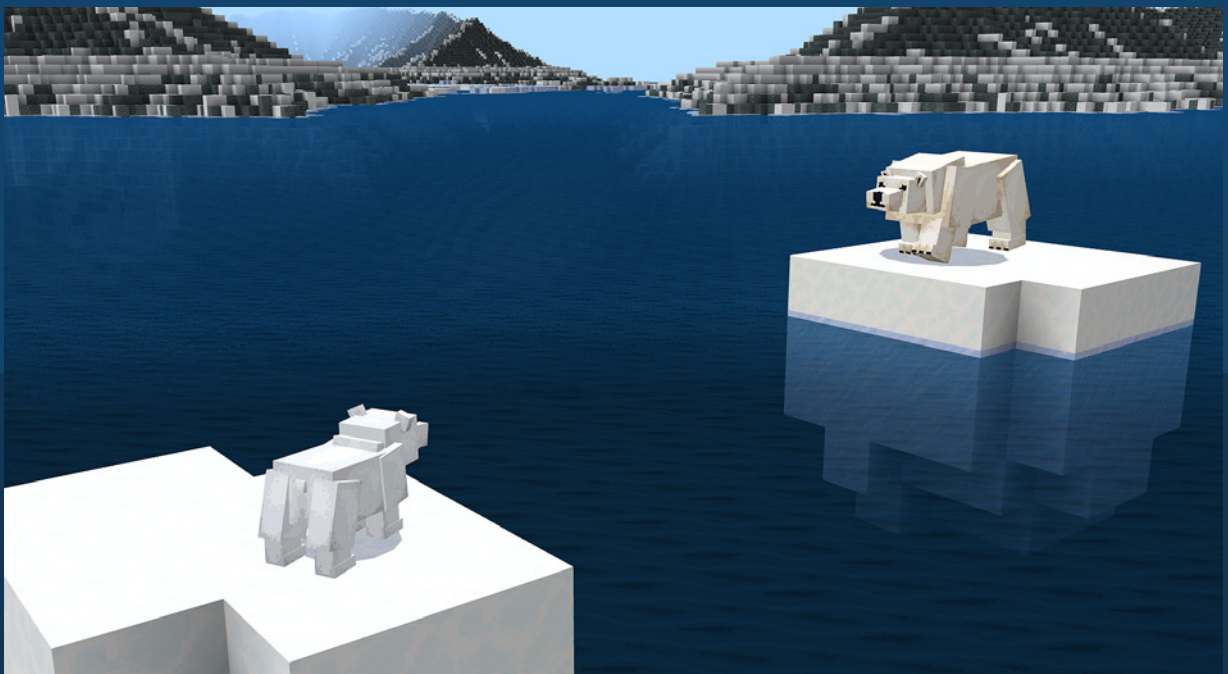
🇸🇪 Mojang Studios (🇺🇸 Microsoft) 2009 (Minecraft) / 2022 (Frozen Planet II Worlds)

ABOUT THE GAME

Minecraft is a popular sandbox game where players can explore and build environments out of blocks in an open world. The game offers both creative mode, where you can build freely, and survival mode, where you have to gather resources and fight monsters, as well as a growing catalog of content, worlds, and new gameplay experiences from various creators around the world. *The Frozen Planet II Worlds* by *Minecraft Education* are a series of five worlds where the player can, for example, hunt as killer whales, protect their polar bear cubs or collect nectar like a bumblebee. These worlds are available in both *Minecraft Education* and *Minecraft Bedrock* on the Marketplace.

ABOUT THE THEME

'Minecraft is used in many different ways in collaborations and projects on environmental and societal challenges, for example in citizen dialogue about urban planning or school hackathons where students can build their own visions of sustainable communities in Minecraft Education. There are also a large number of separate games and worlds to download or buy that in various ways are inspired by or spread knowledge about environmental issues. Minecraft Education's Frozen Planet II Worlds are such examples, created in partnership with BBC Earth and inspired by the tv series Frozen Planet II. Through 5 free Minecraft maps, the player can experience life through the perspective of amazing animals and thus learn about the effects of climate change.'



The games industry in Sweden

The Swedish games industry has developed strongly over the past decade and the country's game developers are characterised by breadth and quality.

Sweden has world-leading development studios in AAA, console, PC, mobile games, VR/AR, digital distribution and specialised subcontractors. Swedish game development is an export industry operating in a largely global market. In 2023 the games industry had a domestic turnover of more than EUR 3 billion and employed more than 9,000 people in the country, 23.7% of whom were women (an increase of 173 women, 9%, compared to 2022).

Over the past decade, the number of Swedish game development companies has doubled and the number of employees has tripled. In 2023, there were a over 1,000 game companies in the country and most of them

are small, with 87.5% of all companies having fewer than ten employees. Games are launched directly on a global market and the supply of skills is also highly international. *The Swedish Games industry* estimates, based on download data from 2022, that at least one in four people in the world has played a game created in Sweden. In total, Swedish-developed games have been downloaded almost seven billion times and major Swedish games regularly top the download and sales charts. All in all, the country's game companies have been internationally successful and, not least, created game experiences for several hundred million players worldwide.



Avatar: Frontiers of Pandora

✚ Massive Entertainment – a Ubisoft studio (2023)

ABOUT THE GAME

A first-person, action-adventure set in the open world of the never-before-seen Western Frontier of Pandora. Abducted by the human militaristic corporation known as the RDA, you, a Na'vi, were trained and moulded to serve their purpose. Fifteen years later, you are free, but find yourself a stranger in your birthplace. Reconnect with your lost heritage, discover what it truly means to be Na'vi, and join other clans to protect Pandora from the RDA.

ABOUT THE THEME

'The development team appreciates the sense of connection with nature and respect for the world that are conveyed by the Avatar films – and has been deeply inspired to carry that ethos into the development of the game.'



Overview – green engagement in the games industry

The desire and commitment to contribute to more sustainable development is widespread in the games industry. There are many different initiatives, projects and organisations around the world that bring companies together for various social or environmental purposes. Listed below are some of the climate-related initiatives that may be relevant for companies and individuals based in Sweden.

For companies

Nordic network PlayCreateGreen spreads knowledge and inspiration

PlayCreateGreen was founded 2020 by several major Nordic games companies including Nordisk Games, Embracer Group, Landfall Games, Massive Entertainment and Advenimus, together with the *Swedish Games Industry*. The initiative is a result of Bornholm Game Days, where the leaders of more than 40 Nordic game companies agreed that climate change is the most important future issue for the industry.

The network is funded entirely by donations and the ambassadors are individuals who give their time, energy and passion to drive the movement forward. It supports the creation and dissemination of knowledge and best practice regarding environmental work in the games industry, which in turn will guide companies that strive to be more sustainable. The initiative has developed a handbook for game companies that provides practical guidance, examples and inspiration for positive climate activities. It has also developed concepts to connect players' environmental engagement with real-life activities. PlayCreateGreen is open to all Nordic companies in the games industry that want to improve the industry's carbon footprint and increase climate awareness.

The UN initiative Playing for the Planet brings together companies worldwide

[Playing for the Planet Alliance](#) (P4P) is a global initiative launched in 2019 by the United Nations Environment

Programme (UNEP) that brings together games companies worldwide with the common goal of improving the world's climate and environment through games. Its members consist of over 40 game companies, industry organisations and other industry stakeholders who joined the Alliance to, among other things, reduce the world's carbon footprint. Members can also create and integrate so-called activations into their games through the Green Game Jam. The aim of the Alliance is to support companies in sharing learning and tracking progress on environmental and sustainability issues.

Playing for the Planet published the 2023 report [*Untangling the Carbon Complexities of the Video Gaming Industry*](#) which is aimed at both game studios and players. P4P members have worked with the Carbon Trust consultancy to shed light on where the biggest sources of emissions are in digital games, who is responsible for them and what new areas could be addressed in the future. The four key messages of the report are: *Measure your emissions*, *Set ambitious 1.5°C targets*, *Call your players to action* and *Learn from others*.

Games Industry supports companies

The *Swedish Games Industry* is the industry association for digital games in Sweden. Through membership, companies can influence and contribute to industry-wide activities including in several sustainability areas. For example, through reports such as this one, various activities, events and networks as well as participation in external projects and working groups.

Sustainable Games Alliance wants to collect data and set standards

[The Sustainable Games Alliance](#) is a cooperative European organisation based in Finland, founded by game entrepreneurs and environmental researchers in 2023, with the aim of making the games industry a leader in sustainability. The organisation aims to support the industry's climate and sustainability work, collect data and develop standards for emission calculations.

Games Forest Club plants forests

[Games Forest Club](#) is a non-profit initiative based in Germany, which wants to support game companies and other creative industries to invest in uptake of CO₂ by planting and protecting forests. All real-life activities will also be showcased in its digital twin, Gamesforest.

For individuals

The Climate Replay developer network wants to engage more people

[Climate Replay](#) is a network of individual game developers aiming to raise awareness of the climate emergency and engage more people in the fight against the climate crisis. The organisation was founded by Cory Scheviak and consists of eleven volunteers who work with Climate Replay in addition to their daily work. The group is mainly based in Sweden but also includes people from the US. Climate Replay organises several events focusing on raising awareness of climate change and donations for charity. All of this is done with a focus on mobilising the gaming world to jointly create a more sustainable future.

IGDA CLIMATE SIG shares tips and advice

[IGDA Climate Special Interest Group](#) is an initiative of the International Game Developers Association (IGDA), and is made up of game developers, climate scientists, researchers and enthusiasts who support grassroots climate action in the games industry worldwide. The network also works to amplify the UN's message on youth engagement, the power of video games and how games can be used to advance climate action. The IGDA CLIMATE SIG has also created a database with tips and advice on how game developers can create effective climate messages in games and reduce production impacts.

SpielFabriques Sustainability Nexus creates meeting places

[Sustainability Nexus](#) is a European initiative launched in 2023 by the French-German Spiel Fabrique in partnership with BSG-Go! and is a network and hybrid conference based in Cologne. The hybrid conference aims to be an international meeting place for the industry, addressing the challenges of environmental impact, social issues, inclusion and diversity. The programme also includes annual sustainability training activities for indie game studios, networking events and activities to support the creation of games with an ecological or social focus.

For the academy

NASG university collaboration promotes sustainability

Nordic Alliance for Sustainability in Gaming (NASG) is a co-operation between universities and colleges in Sweden, Denmark, Iceland, Finland and Estonia. The main goal is to promote environmental and cultural sustainability in game development and game culture. This is for example done through teaching, research and development to address sustainability issues from a variety of viewpoints.

Greening Games focuses on games educations

[Greening Games](#) is an international initiative to raise awareness of climate and environmental issues in European game education. The project, based at the Cologne Game Lab of the Technical University of Cologne, tests and distributes didactic material on the interdisciplinary topic of green digital games.

The Game On research project looks to the future

In 2023, the three-year research project [Game On? Identifying Environmentally Sustainable Trajectories for Video Games](#) was funded by the Swedish Energy Agency. It's run by Uppsala University and the Royal Institute of Technology in collaboration with the *Swedish Games Industry*, among others. The aim of the research project is to identify and promote more sustainable pathways for playing and creating digital games. The project intends to contribute with knowledge and new perspectives on the interaction of energy and climate issues with people and society.



United Nations and Video Games

The UN has been active in the field of games for several years. On its website, there is a category dedicated to the topic and there is also a list of games produced by, or in collaboration with, the UN. The list includes games where the player learns how to take climate action and prevent disasters. On the website, the reader can also find information about ongoing and previous work in the games industry and its environmental impact. For more information visit the UN's [website about games](#).

Footprint, Handprint, and Voice

This report discusses the impact of the games industry on the planet and society from three perspectives: footprint, handprint and voice.



Footprint

Negative impacts to be reduced, such as carbon emissions



Handprint

Positive effects of games, such as community and innovation



Voice

The opportunity to contribute to the public debate, for example by evoking emotions, creating dialogue or capturing engagement

Background

The concept of an *ecological footprint* was launched in the 1990's as a model that provides a measure of the amount of natural resources our lifestyle requires. It serves as an educational conceptual model to show the impact that a person, organisation or country has on ecosystems and planetary boundaries. Humanity's collective footprint needs to stay within what the planet can regenerate to avoid that today's activities destroy opportunities for tomorrow's.

In recent years, the footprint has been complemented by the term handprint, which stands for the positive impact that a person, organisation or activity can have on the world around them, in itself, as a side effect or through specific activities. In this report, the handprint

is used to symbolise both the positive side effects of games themselves and the power of innovation that game development can be at the crossroads of new digital technologies and creativity.

Beyond the more tangible impact symbolised by footprints and handprints, all organisations are also societal actors, participating in public discourse and helping to shape the discussion about the challenges we face. The media and creative and cultural industries have a particularly strong voice, and games are one of today's biggest cultural expressions. Therefore, in this report, *the Swedish Games Industry* introduces the concept of 'voice' to complement the classic footprints and handprints.



Footprint

REDUCING NEGATIVE IMPACTS

All human activity has an impact on the environment and the planet. The climate impact of game development is relatively small, but as the world faces a climate emergency, all sectors need to take responsibility to get to zero emissions as soon as possible.

The term ecological footprint is a conceptual model to visualise how much natural resources something requires. The reality is, of course, more complex and the ecological impact can occur in a number of different areas. In game development, the carbon footprint is mainly about energy, transport and purchases, and finding resource-smart solutions in games.

Emission data and regulatory frameworks

In game development, the main raw material is creativity, the value is intangible and the product is digital, which means that the industry as a whole has a comparatively low carbon footprint. However, it is difficult to obtain precise figures.

Emissions from the games industry range from the development of software to the transport and distribution of hardware, as well as the playing the games. This report focuses on the climate and concerns the development of game content. As such, it does not address related issues like the manufacture and management of hardware – which has other challenges such as chemicals and extraction of raw materials.

The Agency for Digital Government (DIGG) has produced a report on *Climate and environmental impacts of digitalisation* (2023). It estimates that the information technology used to manage and maintain all digital services accounts for 2–3% of global emissions. Efficiency improvements have resulted in only a gradual, slow increase in electricity consumption, despite the multiplication of data traffic. DIGG's report also highlights trends that can be positive, such as economies of scale in larger, more efficient data centres, more energy-efficient displays, and users tending to change equipment less frequently.

The Swedish Agency for Public Procurement has ongoing work to produce data on public organisations' analysis of the environmental impact of purchases, known as environmental spend analysis. They lack a specific and updated data point for digital games, but the latest data for the related area of software programming is 2.02 tCO₂e per MEUR¹. This includes Scope 1, 2 and upstream Scope 3, but not the user phase as the data is designed to support purchasing.

After Climate, run by Dr Benjamin Abraham in Australia, has compiled and estimated the global games industry's climate emissions, based on the 34 largest international companies' reported figures for 2022. They estimate that the global games industry's total footprint is over 14 million tonnes of CO₂. In comparison, this is on a par with Sweden's total industrial emissions according to the Swedish Environmental Protection Agency. They calculate average Scope 1 and 2 emissions of 5.1 tCO₂e per MEUR turnover and believe that when Scope 3 is added, the figure will be

Greenhouse Gas Protocol

Greenhouse Gas Protocol (GHG Protocol) is an international standard used to measure and report greenhouse gas emissions. Emissions are categorised into three scopes, see below.

Scope 1

Direct emissions from own operations, for example from a company car.

Scope 2

Indirect emissions from purchased electricity, heating and cooling, for example the energy consumed by computers in the office.

Scope 3

All other indirect emissions in a company's value chain. This includes both *upstream* emissions such as purchased computers, office supplies or employee travel and *downstream* emissions such as energy consumed by servers, and when games are downloaded and played.

178,6 tCO₂e per MEUR turnover. However, this calculation includes some distorting figures, as many of the international companies included have a range of activities beyond game development.

In a similar calculation of the Swedish industry's emissions, based on the Swedish listed companies' latest reports and their respective business activities, the corresponding comparative figures are between 0.1 and 1 tCO₂e per MEUR turnover for Scope 1 and 2 depending on the activity and accuracy of measurement points, with an average of 0.74 tCO₂e which would mean 2275 tCO₂e from the Swedish games industry in 2022². This corresponds to 0.015% of the emissions from Swedish industry. This can be compared with the fact that games account for almost 0.3% of jobs in the private sector and 1% of Swedish exports.

One thing that makes it difficult to calculate the total impact of the games industry is that a large proportion, estimated at 90–99% of emissions, are in the so-called Scope 3 category under the GHG Protocol, i.e. emissions in a company's value chain that the company does not own itself. This applies both upstream, such as purchased computers, office supplies or employee travel,

and downstream, such as energy consumption for servers, when games are downloaded, and played by consumers. The latter in particular is challenging to obtain concrete data on, not least because the games have a global audience with different conditions in terms of hardware and energy supply.

A few Swedish companies have begun to calculate and report Scope 3, some only upstream while others have also produced data for emissions at the user stage. In these cases, the latter account for between 40–99% of the companies' total reported emissions. The large variation can be explained both by different calculation models, the scope of the calculation and the fact that energy consumption in the user phase varies greatly depending on the type of game, the country in which the player is located and the device on which the game is played. The sample is small, the calculations are made differently and the companies have varying products and activities, which makes it difficult to draw any general conclusions from a calculation of the average. A guess based on the available figures³ is that Swedish companies on average end up with around 99 tCO₂e per MEUR turnover, or 302,250 tCO₂e in total including Scope 1, 2 and 3. If all players had access to fossil-free energy, this footprint would be reduced by up to 90%. Despite the challenges of calculations, some Swedish game development companies are well ahead in developing knowledge and methods to measure and reduce their emissions. Some have set or are working to develop targets in accordance with the Science Based Targets initiative, others have found their own calculation models. Several companies have contributed their experience and figures to the guidance and climate calculator described later in this report. In a global industry, there are great opportunities to create spillover effects from the Swedish companies' commitments and activities, just as the games industry in general can also show the way for other digital industries.

As the EU Corporate Sustainability Reporting Directive (CSRD) is implemented, the demands on the sustainability reports of the largest and listed companies are increasing. By extension, this will also affect small companies, as they are often part of the value chain of other companies in one way or another, or face investors who make demands in line with the legislation. This means that there is a strong focus on analysis and reporting at the moment in many industries, which at best leads to effective next steps and at worst shifts resources from doing to measuring.

Science Based Targets

Science Based Targets initiative (SBTi) is an initiative launched in 2015 in the context of the Paris Agreement. It is a collaborative effort between several major stakeholders, such as CDP, WRI, WWF, We Mean Business and the UN Global Compact. An SBT represents science-based targets that companies can set to reduce their greenhouse gas emissions. These targets are defined based on research on what is needed in each sector and business to ensure that the world collectively achieves the target of a maximum temperature increase of 1.5 degrees. To have their SBTs approved, companies must set targets for all of Scope 1 and 2. If Scope 3 emissions account for 40% or more of total emissions, as is the case for game developers, the business is also required to set a Scope 3 target.

¹ We have used the aggregated annual exchange rate defined by the Riksbank, Sweden's central bank. In 2022, 1 EUR was 10.6317 SEK and 1 USD was 10,1245 SEK

² Calculation based on 2022 data from the following companies: Embracer Group AB, Stillfront Group, Paradox Interactive, Mag Interactive

³ Based on the 2023 sustainability reports from MAG Interactive, Embracer Group and Stillfront Group

Cross-Cutting standards	Topical standards		
	ENVIRONMENT	SOCIAL	GOVERNANCE
ESRS 1 General Principles	ESRS E1 Climate change	ESRS S1 Own workforce	ESRS G1 Business conduct
ESRS 2 General Disclosures	ESRS E2 Pollution	ESRS S2 Workers in the value chain	
	ESRS E3 Water and marine resources	ESRS S3 Affected communities	
	ESRS E4 Biodiversity and ecosystems	ESRS S4 Consumers and end-users	
	ESRS E5 Resource use and circular economy		

CSRD

The Corporate Sustainability Reporting Directive (CSRD) is a new EU directive that sets higher standards for corporate sustainability reporting. The CSRD aims to promote a green and social transition in line with the EU's climate objectives and improve the transparency and reliability of sustainability information reported by companies. The CSRD came into force on January 1st 2024 for large companies in the EU.

CSRD requires companies to report relevant information on environmental, social and governance (ESG) issues in a consistent and comparable manner, enabling both internal and external stakeholders to make informed decisions. A recurring concept is Sustainability Due Diligence, which is an established process to be applied to a company's essential sustainability issues to improve preparedness, understanding and management of risks.

Companies covered by CSRD must report according to the European Sustainability Reporting Standards (ESRS). There are twelve reporting standards that specify what the reporting should contain (which can be seen in the picture).

An important part of CSRD is the dual materiality analysis, which assesses both the company's material impact on the environment and society and the impact of sustainability aspects on the company (financial materiality). The analysis includes the entire value chain and the company's own operations. The aim is to focus the work on the most material challenges for the specific company. CSRD therefore provides company boards with a better basis for managing risks and opportunities, which provides a good basis for integrating sustainability aspects into the company's business model and strategy.



Illustration: lisasobacca.art

*'Climate change is a threat
to human well-being and
planetary health.*

*There is a rapidly closing window
of opportunity to secure a liveable
and sustainable future for all.'*

– IPCC

Play, Create, Calculate

A toolbox for calculating emissions

To help small and medium-sized game developers, sustainability experts from U&We, within the framework of the SUSINDI project, have developed a toolbox, *Play, Create, Calculate*. This chapter summarises the key lessons learned from the work.

More and more companies are interested in understanding and reducing their climate impact, both in their own operations and in the value chain. Under CSRD, it will be mandatory for some companies to report their emissions in Scope 1, 2 and significant parts of Scope 3. Companies will also be required to set climate targets, take action to reduce their climate impact and develop a transition plan.

CSRD mainly applies to large and listed companies. Even for SMEs that are not covered, there is a growing interest and demand to understand, reduce and communicate their climate impact to both internal and external stakeholders such as employees, investors, partners and players.

The toolbox *Play, Create, Calculate* contains an Excel-based climate calculator and a guide for game devel-

opers to calculate their greenhouse gas emissions in Scope 1 and 2, as well as essential parts of Scope 3. The climate calculator and guide are based on the international and established GHG Protocol standard. It also proposes actions to reduce emissions and progressively improve data quality.

It is beneficial to focus on the most essential elements to get started with a climate assessment. The emission categories from the GHG Protocol deemed to have the highest priority and relevance are listed in the table below.

In the *Play, Create, Calculate* toolbox, the guide provides instructions for data collection and use of the calculator for high-priority categories in the table above, and guidance on medium-priority categories. The guide and calculator can be used without external support by

Category	Activities to include in the climate calculation	Where in the value chain do emissions occur?
Assets owned or controlled by the company (Scope 1)	Fuel in company-owned or leased cars	Own operations
Purchased energy (Scope 2)	Electricity and heat consumption	Own operations
Purchased goods and services (3.1)	Hardware (computers, monitors, phones, consoles) Data centres and cloud services, Furniture, Merchandise, Catering and food, Events	Upstream
Business travel (3.6)	Air travel, Train journeys, Hotel nights	Upstream
Use of sold products (3.11)	Energy consumption when playing games sold	Downstream

companies in the industry that are just starting their climate work, but also by companies that have come a long way and want to deepen their commitment.

In a first step, companies can calculate their emissions based on cost or estimates, such as calculating the emissions of electricity based on square metres or emissions from IT products based on spend. In the next step, those who want to expand their work can further calculate their emissions based on real activity data, such as energy consumption in kWh and data from life cycle analyses. In the long term, it is good to assess your climate impact annually, take action and set targets to reduce emissions.

Examples of the difference in data collection and calculation for the different levels are for the purchase of IT hardware:

- **Beginner:** report total cost of IT purchases
- **Intermediate:** report number of purchases per IT category (e.g. phone or laptop)
- **Expert:** report specific emissions data per purchased product through the supplier's own product calculations

By measuring their climate impact, companies gain insight into where their biggest sources of emissions are. The next step is to implement measures to reduce their climate impact. Emissions from game development occur both in the own organization, and upstream and downstream in the value chain. Businesses have different opportunities to influence these emissions, which means different types of measures are needed. If you are a game developer and want to get started measuring and understanding your company's climate impact, the *Play, Create, Calculate* toolbox is available for download from the [Swedish Games Industry website](#).

For game developers who want to dive deeper into the numbers, there are also other tools, such as the French online calculator *lyros*, which allows you to examine the climate impact of your game development at a detailed level.

In 2025, Playing for the Planet, in partnership with the Carbon Trust, will also release a climate calculator based on their joint report [Untangling the Carbon Complexities of the Video Gaming Industry](#).

How game developers reduce their climate impact:

Own operations

- Phase out fossil fuels in any vehicles
- Ensure that the office has renewable electricity

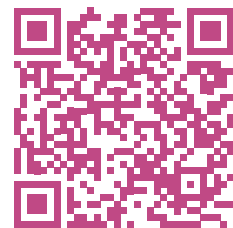
Upstream in the value chain

- Take care of the hardware so that it lasts a long time and if possible buy reconditioned products (and donate or resell after end use to extend the service life)
- Choose suppliers with active climate and sustainability work and set requirements, for example that data centre suppliers should have 100% renewable electricity
- Review any fairs and events so that they are carried out with as low a climate impact as possible
- Travel sensibly and if possible choose train instead of plane
- Encourage employees to choose public transport or cycle to the office

Downstream in the value chain

- Optimise games, for the best possible playing experience while minimising energy consumption
- Ensure that games have a long lifespan and can be played on older consoles and computers
- Industry collaboration, for example to better understand the climate impact of playing games through access to high-quality data and the development of energy-efficient consoles and computers

Download
Play Create
Calculate here



Reducing the environmental impact of playing games

The Game On research project is exploring sustainable pathways for playing and creating digital games. This chapter presents some insights on how game developers can reduce emissions during the user phase.

For any game, the majority of its environmental impact (including energy consumption and emissions) occurs during the time it is being played. This is referred to as the ‘use phase’ and the related emissions are often categorized as ‘Scope 3’. Two factors have made the use phase particularly challenging: (1) the increasing resource intensity of games, which includes higher computing demands due to high fidelity graphics and larger downloads, and (2) the growing amount of time people spend playing games, both at home and on the move. Game developers are in a unique position to address some of the environmental impacts associated with games. By looking at examples from the industry, we can see how sustainability-oriented game design can reduce impact during use phase. Some strategies, like those mentioned below, are displays of low-hanging fruit—changes that can be implemented relatively quickly and cheaply. Others require more complex and thoughtful execution.

As games get increasingly advanced in terms of graphics and mechanics, they may indirectly encourage increased consumption of new and advanced hardware, such as GPUs, CPUs and gaming consoles. Producing high-density silicon, high-fidelity displays, and lithium-ion batteries is resource-intensive and inevitably leads to harmful consequences, such as the extraction of rare earth minerals and labor exploitation. The production phase for most of these components and devices is by far the most harmful in terms of resource use and emissions. Therefore, studios

and publishers need to carefully consider developing and publishing games that can be enjoyed without the need for advanced components and devices and proclaim their mission to decelerate the treadmill of continual hardware upgrades. An encouraging fact is that much of the growth in gaming is occurring in segments like mobile games, which has a relatively low environmental impact, and that many of the most popular games today are older titles that can be enjoyed using previous-generation hardware.

As part of Microsoft’s sustainability program, the *Xbox Sustainability Toolkit* was created to limit energy demand without impacting player experience. Tools include capping framerate and reducing resolution in menus and player lobbies, automatic brightness dimming during prolonged player inactivity and adjustable eco-modes. Case studies indicate impressive results: Fortnite developers achieved savings of 200 MWh per day, depending on the level of throttling. The team at *Call of Duty* realized reductions between 20% and 50% per player with an estimated global decrease of 3%; similar techniques deployed for *Halo Infinite* showed a potential 15% power saving. There are, however, two caveats about the toolkit. First, while all cases suggest minimal impact on player experience, this claim lacks strong empirical support, and further research is needed to assess the true effect on gameplay. Second, the *Call of Duty* study shows a low adoption rate (around 2%) for fully engaged eco-modes. Setting eco-mode as the default, with an opt-out option, could increase adoption



and energy savings. Addressing this by visualizing and communicating the environmental and power savings to users could boost engagement.

A significant portion of the industry's Scope 3 emissions comes from the production and use of gaming devices such as consoles and desktops. An alternative to running games locally is to use thin clients to stream games from cloud gaming services, such as PlayStation Plus Cloud Streaming, Xbox Cloud Gaming, and GeForce Now. Research suggests that cloud gaming can lead to overall energy savings, given that these services largely replace the use of high-end consumer devices like gaming PCs. This transition could theoretically reduce the need for, and environmental impact of, producing hardware and the electricity consumed by frequent downloads and updates. However, many potential rebound effects are associated with this shift. For example, cloud gaming might replace more energy-efficient mobile gaming rather than PC gaming. Additionally, the increased demand for large data centers and the associated impact of building, replacing, and maintaining that infrastructure is another concern. An alternative to cloud gaming that could still reduce the environmental impact of gaming would be to limit download sizes and the frequency of updates and patches.

The use of machine learning and generative AI for video games have received a lot of press recently, mostly for their effects on creative labor and artist attribution. While these techniques can reduce costs, and potentially reduce environmental impact in games production, we would also highlight that their impacts for a particular project should be carefully assessed. This is particularly true where a customized model needs

to be trained for game development, or indeed if the machine learning or generative algorithms are to be run on the client during gameplay (e.g. for game environment generation).

Widely deployed techniques for in-game image enhancement and upscaling or upsampling (e.g. Nvidia's DLSS) require model training for each game but have good potential to reduce consumption during gameplay. However, the typical use case is to increase displayed graphical fidelity and frame rate, with the same energy consumption.

Given a sustainable energy system, the environmental concerns associated with gaming would be less problematic. However, as gaming is a global phenomenon, players from around the world, with vastly different energy mixes, engage with games developed in Sweden or by Swedish companies. While Sweden is well-positioned to transition to a greener energy infrastructure, many other countries are not. This makes it crucial for game developers to continue prioritizing environmental sustainability in the use phase of their games whilst also recognizing that in terms of resource and emissions impact a new hardware purchase will be hundreds or thousands of times worse than the rest of the use phase for that player. Ensuring that games can be enjoyed with minimal negative impact on the environment is an essential step to lower the emissions from the industry, regardless of where or how these games are played.

This chapter was authored by members of the research project Game On? Identifying Environmentally Sustainable Trajectories for Video Games at Uppsala University.

Lightyear Frontier

+ FRAME BREAK | Amplifier Studios (2024)

ABOUT THE GAME

Lightyear Frontier is a peaceful open-world farming adventure set on a planet at the outer edge of the galaxy. Hop into your versatile mech and establish your new home on a distant world where you can cultivate alien crops, build up your farm, and explore the untamed wilderness alongside up to three friends.

ABOUT THE THEME

The game takes place far in the future where humans have exhausted all of Earth's resources and are looking to colonize Mars. Your character realizes that Mars is headed toward the same fate as Earth and chooses

to break free from this destructive cycle by setting sights on distant stars. Early in development, we decided that the player should have a positive impact on the planet. The goal is to live in harmony with nature and nurture the environment around you. The planet you crash-land on has been afflicted by a mysterious pollution that, with the help of your versatile tractor mech, you can clean up. By restoring regions of the planet, the landscape and wildlife can once again flourish. As you explore the planet's history, it becomes clear that the same devastating cycle your character initially escaped has previously been played out by those who lived here before.'





Handprint

SPREADING THE POSITIVE EFFECTS

The handprint represents the positive impact of digital games and game creation on the world around us, both directly and indirectly.

There is still a lot of research to be done, but the studies that exist show that the games industry has great potential to contribute both directly and indirectly to a wide range of the world's sustainability challenges. People feel good about playing, and develop skills and interests that are prerequisites for society's climate transition. In addition, game creation itself drives technological progress and methodological development, intangible value creation and innovation that can contribute to transformative effects in a variety of societal areas.

Direct benefits of games

Games can make people feel better and at the same time develop the skills, relationships and interests that are prerequisites for driving globally sustainable development and meeting the climate challenges and skills needs of the future.

The report *Power of Play* (2023), based on a survey of nearly 13,000 players from 12 countries, shows that people play video games for fun (69%), stress relief (71%), to avoid loneliness (55%) and to cope with everyday challenges (64%). Players also perceive that playing games improves creativity (73%), problem-solving skills (69%) and cognitive skills (69%). The report also identifies benefits such as increased resilience and communication and conflict resolution skills, and shows that playing games can increase interest in scientific subjects.

The latter has been recognised by UNICEF in the project *The Game Changers Coalition* which aims to equip girls around the world with the skills they need and want in science, technology, engineering, arts and maths (STEAM) through game creation to become the developers, designers and leaders of the future.

The report *Responsible Innovation in Technology for Children* (2024) by UNICEF in collaboration with the University of Sheffield, New York University, City University New York and Queensland University of Technology, examines whether and how games can contribute to children's well-being. The study found that well-designed digital games can allow children to feel in control, connected, free to choose and act on new ideas. It also showed that it can promote children's skill and achievement, experiencing and regulating emotions, managing social connections, imagining different possibilities, and

constructing and expressing aspects of themselves and others. These experiences are all important for children's well-being and can support their development.

In its report *Young Digital Leadership* (2023), the Swedish Game Culture Association Sverok mapped skills and competences developed through leadership in, for example, servers, game communities, game events and chats such as: leadership, communication, conflict management, democratic organisation, resilience and inclusion.

The UN report *Education for Sustainable Development Goals* (2017) lists, among other things, skills and competences needed to achieve the global goals, such as: the ability to analyse complex systems, to anticipate consequences and opportunities, to cooperate, communicate and manage conflicts, self-awareness and problem solving. The World Economic Forum also emphasises problem solving, communication, creativity, adaptability, leadership and, not least, STEAM competencies in *Future of Jobs Report*.

The EU project *Cyanotypes*, in which the *Swedish Games Industry* participated, organised a cross-sectoral international workshop in 2023 on 'Driving the green transition'. It recognised that interdisciplinary ways of working, resilient and critical thinking, and creative processes are competences needed in the transition and are present in the cultural and creative industries.

Games also have the ability to connect people across the world, for example across national borders, cultural differences, disabilities, gender, age and beliefs. Games bring people together on equal terms to have fun together. In the same way that physical play such as sport has bridged gaps for a long time, games do the same – but through their digital nature with lower thresholds and greater opportunities for inclusion.

Grow Planet

+ Gro Play (2022)

ABOUT THE GAME

An adventure game for learning in natural sciences, technology, arts, and sustainable development, for ages 6–12. In *Grow Planet*, children are engaged in a motivating context that connects learning to sustainability issues and problem solving in the real world. *Grow Planet* has a unique seamless integration of STEAM education with Sustainability and Citizenship education in an explorative game environment.

ABOUT THE THEME

'In primary school (1–6) teaching STEAM subjects is resource demanding, and not all primary school teachers have the adequate education and expertise.

There is a skill gap in society to deal with the very real and serious problems related to Sustainable Development and Responsible Citizenship. We wanted to address these problems with our unique online game-based learning environment that simplifies STEAM teaching and fosters Sustainability and Citizenship, combined with a powerful LMS (learning management system) to make teacher preparations and assessment cheaper and easier. It also comes as a consumer version, a mobile game available on a global market.'



Climate, digitalisation and intangible value

Creativity and ideas create value beyond the tangible – often referred to as *intangible value*. The main raw material is creativity and the product is digital. This can contribute to the *dematerialisation* of the economy through replacing physical goods and processes.

A classic example of intangible value creation is the ‘Significant objects’ experiment conducted in 2009 by journalist Rob Walker and author Josh Glenn. They spent less than \$130 buying 100 ordinary objects at second-hand stores. They then invited a group of volunteers to write short, fictional stories about each object. After this, the items were put up for sale online, with the fictional stories as descriptions. The items were then sold for a total of over \$3,600, an increase in value of almost 2,800%, without any material refinement.

In digital games, intangible value is at the heart of the matter, which is interesting in the quest for more sustainable economic development. The report of the working group on digitalisation and climate in the Government’s Cooperation Programme (2019–2022) states that *‘Sustainable economic growth is often referred to in terms of digitalisation and services, but intangible value creation can also be added to these. [...] The fact that the three forces of digitalisation, services and intangible value creation can reinforce each other is something that Swedish games are a good example of’*. The programme aimed to join forces to find innovative solutions to common challenges and strengthen Sweden’s competitiveness, and individuals from business, academia, civil society and public actors participated in the programme’s working groups.

While there is still a lack of available concrete research and knowledge on the potential of intangibles to create more sustainable economic development, it is clear that computer games, which are often fully digital and based on intangible value, can contribute to the so-called *dematerialisation* of the economy – when digitalisation replaces physical goods and processes.

Whether there is a net positive effect of this depends on what the time or money spent on games would otherwise be spent on. As many other activities involve the consumption of material goods or physical travel, it can be hypothesised that in many cases games replace consumption with a higher climate impact. In particular, purchases inside games that are already being played, such as new looks for the game character, known as skins, should have negligible additional impact per euro spent. This is something two Swedish researchers from the Royal Institute of Technology (KTH) emphasise in an article from 2017:

‘Could it actually be that increasing trade in digital game artefacts (downloadable content, virtual objects and badges) could be seen as environmentally beneficial, since the money in question is not spent on other activities, products and services with a significantly higher material footprint?’ (From *Useless games for a sustainable world* by Daniel Pargman and Björn Hedin, KTH)

However, this may lead to downstream rebound effects such as increased demand for peripheral products and greater energy consumption, or that downstream growth creates increased purchasing power that may lead to increased consumption of energy-consuming goods and services. (See, for example, the report *The climate and environmental effects of digitalisation* (2023) by the Agency for Digital Government Digg).

In conclusion, as digital services based on intangible value, games can have a positive impact through dematerialisation. This relies on continued transformation in the digital infrastructure and the economy as a whole, and is something that needs to be further explored to understand and utilise the potential.

THOMAS RIESLER THE SWEDISH PATENT AND REGISTRATION OFFICE (PRV)

Senior Advisor



Photo: Knut Capra Pedersen

'The combination of innovation and sustainability positions the games industry as a leading force in environmental efforts'

Hello Thomas! You work as a Senior Advisor at PRV. What does the PRV do?

Most people probably know that we register patents, trademarks and designs. But we also increase knowledge in these areas as well as in copyright and we are the supervisory authority in collective rights management, work against piracy and much more.

How does intangible value creation relate to climate and environment?

Intangible assets can prove to be crucial for climate and green transition. By actively promoting and investing in intangible value creation, businesses and communities can contribute to sustainability. Such efforts can not only reduce their environmental impact but also create long-term economic benefits for all. An example of this is the project carried out by PRV with coffee farmers, where the income from the same coffee farm grew by 500–700% through systematic trade mark work. In the games industry, these issues can be intertwined in many different ways. The combination of innovation and sustainability positions the games industry as a leading force in environmental efforts.

How is the intangible value created in Sweden today measured?

In Sweden, intangible value can be visualised and measured through a variety of methods involving companies, government agencies and academic institutions.

Companies report intangible assets in their annual reports, and PRV contributes by registering patents, trademarks and design protection. Research and development is another important indicator where Statistics Sweden collects data on expenditure. Companies'

revenues from intellectual property rights provide measures of economic value. Market surveys measure brand value; innovation and entrepreneurship are made visible through the number of new companies and new products. Research publications measure knowledge dissemination and intellectual capital. Digital platforms and user data provide insights into the value of digital assets such as software and user-generated content. Sustainability initiatives create intangible value by strengthening brand and customer loyalty through certifications. By measuring different indicators, Sweden can effectively visualise the intangible value in different sectors.

Are there any particular opportunities and challenges?

There are great opportunities. The country's R&D culture can be leveraged to develop new environmental technologies, and certifications can help companies differentiate themselves in the global market. Growing awareness is driving demand for sustainable products and services. International cooperation projects, such as some EU programmes, support the development of environmental technologies, and technology transfers from developed to developing countries can contribute to global sustainability.

But there are also several challenges. In Sweden, extensive and complex regulations and legal requirements can hamper rapid innovation and commercialisation. Small and medium-sized enterprises may have difficulty finding sufficient financing to develop and scale up green innovations. New green products may face resistance in the market if they are more expensive or require a change in the habits of those who will use them – consumers as well as businesses and other organisations.

The protection of intellectual property rights at international level is complex. Variations, but more importantly disagreements, in climate policies between countries create uncertainty for companies investing in green innovations. These challenges need to be overcome through cooperation, supportive policies and strategic investments to promote intellectual property value creation and a sustainable future.

Technical, commercial and financial resources

There are ways to contribute to the green transition outside your own core business. In the games industry, there are many resources that can be made available in various ways to drive a green transition and sustainable development.

Suppliers and partnerships

All market players can use their business relationships with suppliers and partners to drive the transition. By raising questions or demanding action beyond the individual product and business, a company can be part of driving a larger systematic change of the whole market.

This could include, for example, choosing data centres that not only buy fossil-free energy but also work on other measures such as heat recovery, working with manufacturers, licensees, retailers and event venues with their own clear climate work, or having conversations with publishers and platforms about emissions statistics and ways to enable players to contribute. Downstream partnerships can also be interesting. Office furniture, computers and technical equipment can be sold or donated to increase their lifespan and reduce the need for new production.

Marketing, branding and employer branding resources can also provide double benefits with the right direction. This could involve partnering with organisations for fundraising or other activities linked to the games or sponsoring events that raise important issues. Others invest in people, nature or renewable energy, make donations or actively participate in projects and networks that address sustainability in different ways.

Excess liquidity and capital

Excess liquidity means that companies have a surplus of money that is not immediately used for investments or operating costs. If climate benefits are included alongside traditional investment criteria when these funds are invested, they can contribute to the green transition in the meantime, for example through funds investing in climate projects, environmental technologies or green bonds. There are different options on the financial market with different investment horizons and risk profiles.

In addition to companies' excess liquidity, the same logic can be applied to owners' capital investments, for example. To the extent that owners are financial industry players, climate benefits may often already be included as a criterion in investment strategies, but individual owners may benefit from concrete guidance. More knowledge and research is needed.

An ambitious alternative to funds is to invest in climate innovations and climate-smart business ideas at an early stage. By taking more risk as an early-stage investor, you can help simplify and speed up the process of green innovation by showing the way for other investors. In this way, even a small investment can contribute to large climate benefits. One example is

Transition Labs, founded by Icelandic gaming entrepreneur David Helgason, which works to support and disseminate climate projects.

While some financial advisors are interested in this approach, more could get involved to increase knowledge and insights in this area, for example to better characterise risk, expected return and impact, and different forms of investment. By simplifying how early-stage investments in climate innovations can be made, such investments should be able to scale up and accelerate the emergence of future solutions. Of course, this opportunity is not limited to investors from the games industry.

Technology and innovation

Computer game development is one of the industries that has come the furthest in terms of digitalisation of both production and process, as well as of the offer, product and service to its customers and audience. There are greater demands on function, interaction and visualisation in a game that reaches millions of users than there are on specialised software for critical industrial processes. Game development is driving technology development in areas such as visualisation, artificial intelligence, digital business models and digital project management, and Swedish companies are playing in the very top league.

By applying technologies from games, other sectors can achieve efficiency and increased productivity, but

also improved working environments, electrification, reduced need for natural resources, increased safety and skills, and opportunities to test, train and develop new technologies and methods. There are a number of examples of this, several of which are presented in RISE's review of innovation diffusion later in this report.

In many cases, the development of other applications of technology developed for games results in the technology being spun off into a separate company with a different management and business plan, or being acquired by international groups and integrated into their operations, as in the case of the Swedish 3D tools *Simplygon*, which was acquired by Microsoft in 2017, or *Quixel*, which was acquired by Epic in 2019.

So far, traditional industry has only dipped their toes into the potential of these technology transfers, but the forestry and mining industries, in particular, have shown interest in exploring the innovative power of further collaborations with the games industry, and more research is needed. Cross-sectoral meetings and time and space for unconstrained creativity are important for the emergence and development of new ideas and methods – innovations that can be commercial business opportunities, which also incentivise diffusion both internationally and to more industries. All in all, this means that games can contribute to climate benefits far beyond their own regular activities.



Illustration: lisabacca.art

Spreading game innovation

The RISE research institute has explored the potential for knowledge and technology transfer between different sectors of society. The aim is to understand how such innovations can contribute to the climate transition and at the same time strengthen Sweden's global competitiveness. This chapter presents examples of how game development techniques and methods can contribute to sustainable development in a number of different sectors, including construction, urban planning and industrial production.

The climate crisis is a global challenge that requires extensive co-operation and action from all parts of society. It is no longer just traditional industries and the energy sector that are expected to make the most significant changes. Innovation from industries such as games has the potential to make a positive impact by providing technological, creative and organisational solutions. Game technologies and methodologies offer particularly effective tools for visualisation, simulation, training and problem-solving, and these can be transferred to other areas to strengthen sustainability efforts.

Game technology

Game technology is a broad discipline that ranges from the development of game engines and graphics processors to the use of AI and immersive technologies. The technologies used to create games can also be applied to develop and implement climate-smart

solutions in other industries. Here we explore some of these technologies and their applications in the field of sustainability.

Game engines

Game engines, such as *Unity* and *Unreal Engine*, play a central role in game development, but their applications extend far beyond the world of games. These engines allow for the creation of advanced 3D simulations and visualisations, making it possible to test different climate actions and scenarios before implementation. For example, game engines enable simulations of urban planning, traffic flows, different weather conditions and dynamic light, which are invaluable for studying how climate change can affect infrastructure at different times of the day.

During the construction of the *East Link*, the first section of Sweden's new high-speed railway, *Unreal Engine* was used to realistically visualise the engineering design.

This facilitated the consultation process by making it easier for different stakeholders to understand and assess how the project would affect the landscape and neighbouring communities. Similar techniques are also used in other infrastructure projects around the world.

The metals company *Boliden* has started testing advanced digital solutions that include the use of game engines, such as *Unity* and *Unreal Engine*, to improve the automation and remote control of processes in its mines. This has the potential to contribute to their electrification efforts and increase efficiency within their operations. For example, automated systems are used to remotely control machines and optimise mining processes, reducing the need for physical presence in hazardous environments while improving safety.

Game engines such as *Unreal Engine* have proven superior to traditional industrial software by offering more sophisticated visualisations and real-time simulations, facilitating the testing of automated systems in a virtual environment before they are implemented in practice. These solutions help *Boliden* manage processes with greater precision and safety, while supporting the company's electrification, which reduces carbon emissions and improves energy use.

Another example is the visualisation of climate data through game engines. This makes it possible to present future scenarios where users can interact with and experience the effects of climate change in a more intuitive way than static images or texts can offer. For example, by simulating rising sea levels or increasing temperatures in real time, decision-makers can get a more vivid picture of what actions are needed.

GPU – Graphics processing unit

Originally developed to improve graphics rendering in games, the GPU has in recent years become an

essential tool for more advanced calculations. A GPU is a specialised microprocessor optimised for graphics-related calculations and image processing. Unlike a CPU, which is designed for general-purpose computations, a GPU is specifically designed to efficiently handle complex mathematical operations required to render images, videos and 3D graphics.

Nvidia has been a leader in the development of GPUs, which are now used for everything from AI modelling to powering digital twins and self-driving vehicles. A GPU is an extremely powerful processor that can handle parallel computations, making it particularly effective for large amounts of data, as is often the case in climate modelling simulations.

Nvidia Omniverse is a platform where companies and industries can create digital twins of products or entire production lines. This means that companies can simulate their manufacturing processes and test changes in a digital environment before implementing them in the real world. By optimising production processes and reducing waste, this can help reduce carbon emissions and make manufacturing more sustainable.

Another example is how GPUs are being used to power AI models in climate research. *Nvidia*'s powerful H100 processors are used to train large AI models, such as GPT-4, which have the potential to analyse and optimise climate engineering solutions by processing huge amounts of climate data.

Immersive technologies, Extended reality

Immersive technologies, encompassing both Virtual Reality (VR) and Augmented Reality (AR), offer a whole new dimension of experiences and simulations. VR creates a fully digital environment where the user can interact with virtual objects and scenarios, while AR integrates digital objects into the real world. These

Virtual Reality

Virtual Reality – VR creates a fully digital, computer-generated environment that the user experiences through a head-mounted display or VR goggles. This blocks out the physical world and provides a fully simulated visual and sometimes even audio experience.

Augmented Reality

Augmented Reality – AR superimposes digital objects, information or virtual elements on the real physical world that the user sees through a mobile device, glasses or other display. The augmented reality blends with the real environment.

Photo:RISE



VR being used in one of RISE's research projects

technologies are now widely used to create climate-related simulations and educational tools.

For instance, RISE uses VR technology to create experiences where users can see and interact with future scenarios, such as rising sea levels or extreme weather. By experiencing these changes in a visually and emotionally engaging way, VR can help raise awareness and understanding of climate issues. In addition, AR technology has been used to add digital objects to real-world environments to visualise how future buildings or climate action might look and affect the surroundings. This has been used, for example, in urban planning to test how different green infrastructure solutions can be implemented.

Technology consultancy *Sweco* is working with *Around the Corner* to develop a digital tool that promotes democratic and inclusive dialogue in the metaverse. Through a pilot project, which serves as a proof of concept, they are exploring how citizens, municipal representatives and project developers can meet digitally to discuss and understand complex projects in a more accessible and interactive way. In the metaverse, citizens can ask questions, express their opinions and follow projects in real time, while experts can visualise and explain technical solutions in an educational way.

This way of working not only promotes innovation and digital development, but can also contribute to sustainability by reducing the need to travel to physical meetings. Testing and simulating solutions digitally at an early stage allows resources to be used more efficiently

and minimises margins of error. In addition, social sustainability is strengthened as more citizens are empowered to actively participate in the city's development.

Digital twins

A digital twin is a virtual model that represents a physical environment or system. By collecting data from sensors and other sources, the digital twin can reflect, analyse and simulate the performance of its real-world counterpart in real time. This makes it possible to understand and optimise the functioning of the system without having to physically intervene. From urban planning to industrial production, digital twins have made a big impact, contributing to both sustainability gains and financial savings.

Nacka municipality has taken an innovative step towards the future of urban planning by creating a digital twin of the entire municipality. This twin is used to optimise urban development processes by simulating how different decisions and infrastructure projects can affect the sustainability of the city. The aim is to improve the efficiency of the municipality's work and free up time for human interaction, while the technology does the analysis and optimisation where it is most effective.

Digital twins allow Nacka to test different solutions, such as changes in traffic planning or energy management, before implementing them. This contributes to more sustainable development and reduces the risk of costly mistakes. The project, called *Greenovation Twin*, is funded by *Vinnova* and is an example of how digital

technology can support both ecological and social sustainability.

The real estate company *Vasakronan*, together with *Sweco*, has created digital twins of its property portfolio, making it possible to visualise and analyse how their buildings perform from an energy perspective. By collecting data on energy use and indoor climate, for example, it is possible to quickly identify opportunities for improvements and efficiency enhancements. *Vasakronan* can also use these twins to plan maintenance more proactively, leading to reduced costs and more sustainable management.

The digital platform, called *Twinfinity*, makes it possible to monitor the status of buildings in real time and use the information to optimise energy use. This technology is not only a solution for property management, but can also help to reduce carbon emissions by ensuring that energy resources are used in the most efficient way possible.

RISE is leading the work to establish a national hub for digital twins in the civil engineering sector in Sweden. This hub, called *Digital Vision Sweden*, aims to create a framework for how digital twins can be used in a systematic way throughout the country. By coordinating different initiatives and developing common standards, *RISE* wants to facilitate the spread of the technology, while promoting technological, social and ecological sustainability.

Digital twins offer enormous potential for addressing the sustainability challenges of the future. By integrating data from different sources and simulating the effects of different policy and technological decisions, cities and businesses can act faster and more effectively to reduce their climate impact. It is also an approach that fosters collaboration between different actors, as digital twins allow everyone involved to get a clear and up-to-date picture of how different systems work.

Artificial Intelligence (AI)

For example, AI models are currently being used to analyse climate data and make predictions about how different actions might affect future climate conditions. This provides decision-makers with a powerful resource in developing strategies and policies that optimise efforts to reduce climate impact.

Another use is in the energy sector, where AI optimises renewable energy sources by predicting energy demand and optimising the operation of solar and wind farms. For example, AI algorithms can predict weather

patterns and help optimise the production of renewable energy, increasing efficiency and reducing costs.

Game methodology

Game methodology means using the design principles, mechanisms and rules that underpin games in other contexts to improve interaction, engagement and problem solving. In the field of climate change, game methodology is used to create more motivating and effective tools and contexts to address climate-related challenges.

Hackathon

Hackathons are events where developers, engineers and other creators come together to solve specific problems over intense periods of time. *Climate Hack* and *Hack for Sweden* are two examples of hackathons that focus on climate challenges and where participants develop new digital solutions to reduce climate impact.

Climate Hack is a recurring hackathon focused on the climate crisis. The aim is to create information solutions that raise awareness and engagement on climate issues among different target groups. The teams choose a specific target group and develop concepts to reach out with climate information in an effective way.

During *Hack for Sweden 2023*, developers from across the country came together to create solutions to climate-related challenges, such as reducing energy

The word 'hackathon' is a combination of 'hack' and 'marathon', where 'hack' refers to the playful and exploratory programming that takes place during the event. The aim is to work together to develop new ideas, concepts or solutions in a specific area or theme. A hackathon is an event where programmers, developers and others meet for a limited time, usually a day or a weekend, to work together to solve specific problems or challenges through programming and coding.

consumption or creating more sustainable transport systems. The results of these hackathons have led to new innovations that are being integrated into both the business and public sectors.

Epicenter Stockholm held a hackathon in September 2024 focusing on advanced development in extended reality (XR), in response to the growing need for digital solutions to improve everyday life and strengthen the competitiveness of Swedish industry. In particular, there was a need for platforms to stimulate innovation in XR technology in Sweden. Through a collaboration between *Epicenter Stockholm* and *META*, experts came together to explore new solutions in mixed reality, helping to strengthen Sweden's position as a global hub for XR innovation.

In addition to technological advances, this type of hackathon can also have positive climate impacts. For example, by developing digital solutions in XR, remote meetings and virtual collaboration can be promoted, reducing the need for physical travel and thus carbon emissions. Furthermore, XR technologies can be used to simulate and optimise energy use and urban planning, which in turn can contribute to more sustainable communities.

Gamification

Gamification involves applying game mechanics, such as points, levels and challenges, in contexts that are not traditionally games. This has been shown to be particularly effective in raising awareness and engagement around climate change issues, for example.

The aim of gamification is to make activities more enjoyable, motivating and engaging by nudging desirable behaviours. Successful gamification requires a well-thought-out design and good basic operations. Experience shows that players often find shortcuts or 'cheat', just like in entertainment games. Successful examples of gamification therefore rely on participants' own values (intrinsic motivation) and creating a context in which gamification becomes meaningful, for example in the context of involving employees in change management.

Bus transport has started to use gamification and virtual training environments to improve driver training. For example, *OSY Academy*, in collaboration with *MOP-TIL* and *Learning4Teams*, has implemented a VR-based training system specifically for bus drivers. By using VR technology, drivers can be simulated in realistic scenarios such as heavy traffic and dangerous weather con-

ditions, giving them the opportunity to improve their skills without exposing themselves to actual risks. Gamification in this form has proven to be an effective way to increase both safety and efficiency in bus transport through interactive, engaging methods.

Gamification can make it fun to contribute to a better world while socialising and building community locally. *Kawasaki City* in Japan offers an environmental app with the city building game *Green Carbon Farm* where users create buildings in Kawasaki through actual eco-friendly actions. In cities such as *Mannheim* and *Aachen* in Germany, gamified programmes have been implemented to change citizens' behaviours around sustainable consumption and transport choices. These programmes offer rewards to participants when they reduce their carbon emissions by, for example, choosing public transport or cycling over cars. Gamification can make it fun to contribute to a better world while socialising and building community locally.

Players do not always act as developers intended, but often find new and different ways to play. This phenomenon has been observed in various industries, where employees use game elements to achieve better results, sometimes by exploiting the game's design in a way not intended by the developers. This type of behaviour underlines the importance of carefully designing and choosing the right context for gamified systems.

Serious games

Serious games are the type of games developed with a specific 'serious' purpose beyond entertainment and experiences. The aim of these games is often to educate, train or empower the player to develop important skills through interactive and engaging methods. Unlike traditional games, which focus on entertainment, serious games are designed to promote learning and practical problem solving. They harness the ability of games to motivate and visualise complex concepts, making them ideal tools for education and training purposes in a variety of fields, including healthcare, military applications and climate change.

In recent years, serious games have emerged as an innovative approach to addressing global challenges, not least climate change. By engaging players in simulated environments where they can test climate-smart solutions and strategies, these games help raise awareness and understanding of environmental issues. Players take an active role in exploring different scenarios and making decisions that affect the environment,

EcoWeb

🇸🇪 Lutra Interactive (2022)

ABOUT THE GAME

An interactive visualization of an ecosystem where the player can remove and add species, and also see how disturbances such as climate change affect the entire system.

ABOUT THE THEME

'We wanted to engagingly demonstrate that our ecosystems consist of many different species that are interconnected. Specifically, we want to show that events, caused by humans or natural factors, which initially affect one species, actually spread to impact many other species. One of the biggest environmental problems we face today is the loss of biodiversity, meaning the disappearance of species. These species losses are influenced by climate change but also affect how climate change can be managed within ecosystems. With our game, we aim to show that ecology is both important and exciting!'



helping to anchor theoretical knowledge in practical action. The uniqueness of serious games is that the player interprets and acts in the game on their own terms, making the context and guidance around the game crucial to achieving the game's objectives. Creating a supportive learning environment where post-game discussions and reflections take place, and where teachers or facilitators guide players, is central to maximising the impact of these games.

Serious games are used to educate and train individuals and organisations in sustainable and climate-smart practices. For example, games have been developed to simulate how companies can reduce their carbon footprint by testing different business models and strategies in a virtual environment.

A project funded by Vinnova and run by the University of Skövde and RISE, explores the untapped potential of serious games for data collection in the transport sector. The aim is to use games to collect data on user behaviour and how this affects transport systems in practice. By simulating real-life scenarios in game environments, researchers gain a deeper insight into how people interact with different transport solutions. This contributes to shaping more user-friendly transport policies and technology solutions, which are both efficient and sustainable. The project is designed to create a platform where new methods of data collection can be developed. Outcomes are expected to include prototypes of serious games that focus on specific transport challenges, as well as new models for how best to

collect and analyse data from users. These insights can then be used to design the transport systems of the future, which are not only technologically advanced but also take into account important perspectives like sustainability and user-friendliness

Serious games are also used as a tool to involve citizens in climate issues and urban planning. One prominent example is the municipality of Mariestad, which has developed a board game where the goal is to achieve climate neutrality. The Climate Game Mariestad, has been developed within the framework of *Viable Cities* in collaboration with *Sweco* and the *University of Skövde*. Participants play project cards to contribute to the city's goal of becoming climate neutral. Players take on roles as actors in the city and plan to reduce carbon emissions, expand green energy and promote sustainable transport solutions. The game encourages collaboration and critical thinking around real environmental challenges. Through the game, participants gain a deeper understanding of the trade-offs and decisions required to achieve sustainability goals, while being inspired to think creatively about solutions. This initiative shows how game methodology can help make complex societal issues more accessible and engaging to the public.

SMHI has developed the *Climate Adaptation Game*, an online game that aims to increase understanding of how climate change affects societies and the need for adaptation measures. The player is given the responsibility to steer a fictional city through various climate challenges, such as rising sea levels and increased

temperatures, and must take action to make the city more resilient. The game acts as an educational tool, illustrating in a concrete way the challenges and opportunities of climate adaptation. The game's interactive approach makes learning both engaging and informative, making it an effective tool for spreading knowledge about sustainability.

Interdisciplinary, multidisciplinary teams

Computer game development is an industry built on collaboration between different disciplines, and this multidisciplinary approach has proven to be a key to success in solving complex problems such as climate challenges. By combining expertise from different fields, teams can develop innovative and holistic solutions that take into account different aspects of a problem.

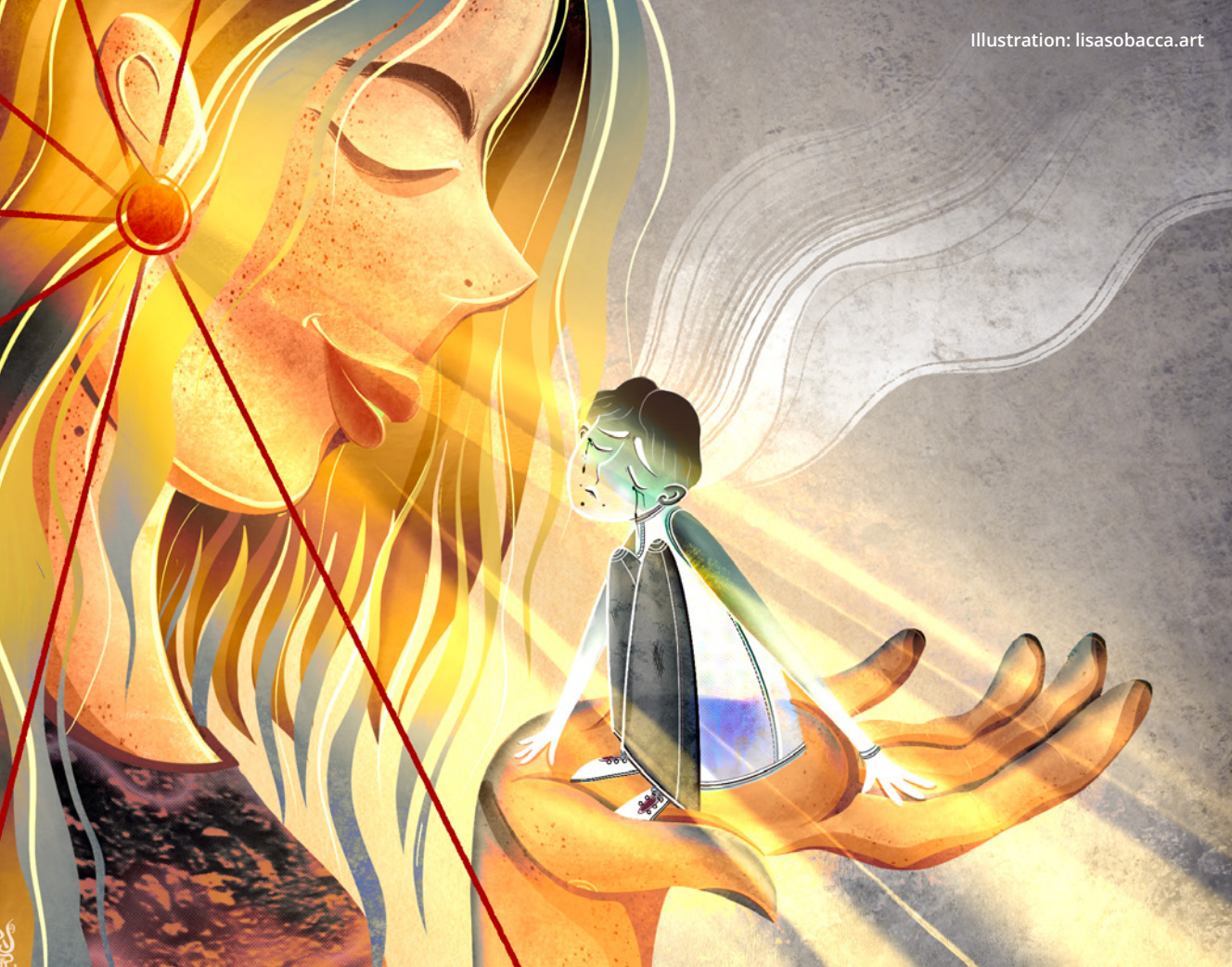
Interdisciplinary work also creates space for cross-fertilisation of ideas, where new insights emerge when different competences meet. Solutions developed through a broad perspective are more likely to be accepted by different stakeholders, as their perspectives have been taken into account from the outset. This type of collaboration is crucial to tackle the complex and intertwined problems posed by the climate crisis.

Cyanotypes is a European project that aims to address knowledge gaps and skills needs in the cultural and creative industries. The project focuses on strengthening the competitiveness of the sector by working across disciplines to address challenges such as COVID-19, the digital transition and the green transition. By bringing together multidisciplinary teams, the project can develop innovative solutions that respond to the needs of the sector and drive progress towards a sustainable future.

Vinnova's work with *mission-driven innovation* aims to address complex societal challenges through systemic change. The work is based on a participatory approach where actors from different sectors and disciplines come together to work towards common goals that are both inspiring and measurable. The aim is to develop solutions that have a broad impact on both society and policy, and that are relevant to large parts of the population. Mission-driven innovation is about creating a clear vision, as in the case of the 1969 moon landing, where multiple actors worked together to achieve a common goal. Similarly, tackling the major challenges facing society today, such as climate change and inequalities, requires a concerted effort. *Vinnova's* approach aims to create prototypes and demonstrators that can show the way towards a sustainable future.



Bild: SMHI



Conclusion

Game technology and game methodology offer unique and powerful tools to address climate challenges in an engaging and interactive way. By using technologies such as game engines, GPUs, immersive technologies, digital twins and AI, we can simulate, visualise and analyse complex climate data and future scenarios in a way that makes them more accessible and understandable to a wider audience. At the same time, game methodologies, such as gamification and serious games, make climate action more motivating and accessible to different audiences, which in turn can help drive the development of more sustainable solutions. However, to maximise the impact of these technologies and methods, further research and cross-sectoral collaboration is needed to ensure that we achieve tangible results in terms of reduced emissions and more sustainable growth.

This chapter was written by Linnea Svenman Wiker and Gabriella Kalteneckar from RISE Research Institutes of Sweden, an independent, state-owned research institute and innovation partner working in international collaboration with business, academia and the public sector.

Polar Panic

+ Apskeppet 2019

ABOUT THE GAME

In *Polar Panic*, the player helps a polar bear survive as long as possible, while various environmental changes make it increasingly difficult. Overfishing, rising sea temperatures, and oil spills are some of the challenges that reduce the chances of survival as the game progresses.

ABOUT THE THEME

'The goal was to create an experience where the player is exposed to different environmental changes in a way that directly affects the gameplay. For example, rising sea temperatures make the ice blocks you jump between smaller, and overfishing reduces the availability of food. The gameplay is inspired by the classic arcade hit Frogger, but the theme and mechanics bring it to a whole new experience.'



Project Shoreline

+ Speldosa Interactive (2024)

ABOUT THE GAME

In *Project Shoreline*, you play as a small Muri tasked with cleaning up a corrupted/polluted beach. As you clean away the corruption with your water gun, the dull gray environment around you is restored to a beautiful, colorful beach!

ABOUT THE THEME

'The game's narrative and connection to climate and the environment are inspired by Studio Ghibli's films Spirited Away and Princess Mononoke, which revolve around nature spirits that have become corrupted for various reasons. We then expanded on that concept, also drawing further inspiration from Ghibli's solarpunk film Nausicaä of the Valley of the Wind.'



Voice

CONTRIBUTING TO DIALOGUE AND ENGAGEMENT

All organisations are social actors that participate in the public conversation and shape the discourse on the challenges we face. In particular, the media and creative and cultural industries have a strong voice, and games are one of the major cultural expressions of today.

All individuals, companies and organisations contribute consciously or unconsciously to shaping social discourse. It is continuously communicated internally and externally, directly and indirectly, sending signals of engagement, or lack of engagement, in societal and environmental challenges. For companies with game development as their core business, membership and participation in, and dissemination of, industry-wide activities can be ways to contribute, as well as in communication internally, with stakeholders and in annual reports. However, the strongest voice is the games themselves and the contact with players.

Game creators and the art of changing the world

‘Culture is much more than a sector – culture is a catalyst and an enabler of change.’

So says the report *Culture & Creative Sectors & Industries driving Green Transition and facing the Energy Crisis* (2023), which emerged from a dialogue between the European Commission and the cultural sector. The dialogue argues that climate and environmental challenges require new forms of support and funding for the creative industries to do what culture does best: break traditions, norms, rules, habits and practices and replace them with new perspectives and forms.

Games are unique and complex cultural – works of art where graphics, music, technology and storytelling come together, and where the player becomes a co-creator of each unique game experience through

play and interactivity. Throughout the millennia, games have been a valued form of entertainment and an integral part of our social and cultural interactions.

For just as long, games have been used as a form of expression to explore real-world challenges. An early example is the *Voting Rights Game (Rösträttsspelet)* from 1910. The dice game begins with the formation of the Association for Women’s Political Voting Rights in 1902 and has its still utopian ending in the long-awaited parliament.

The classic game *Monopoly*, published in the 1930’s, was based on the earlier *The Landlord’s Game*, patented in 1904 by game developer Elizabeth Magie, who created the game with an anti-capitalist agenda, using game mechanics to show how private ownership and rents created monopolies and exclusion.

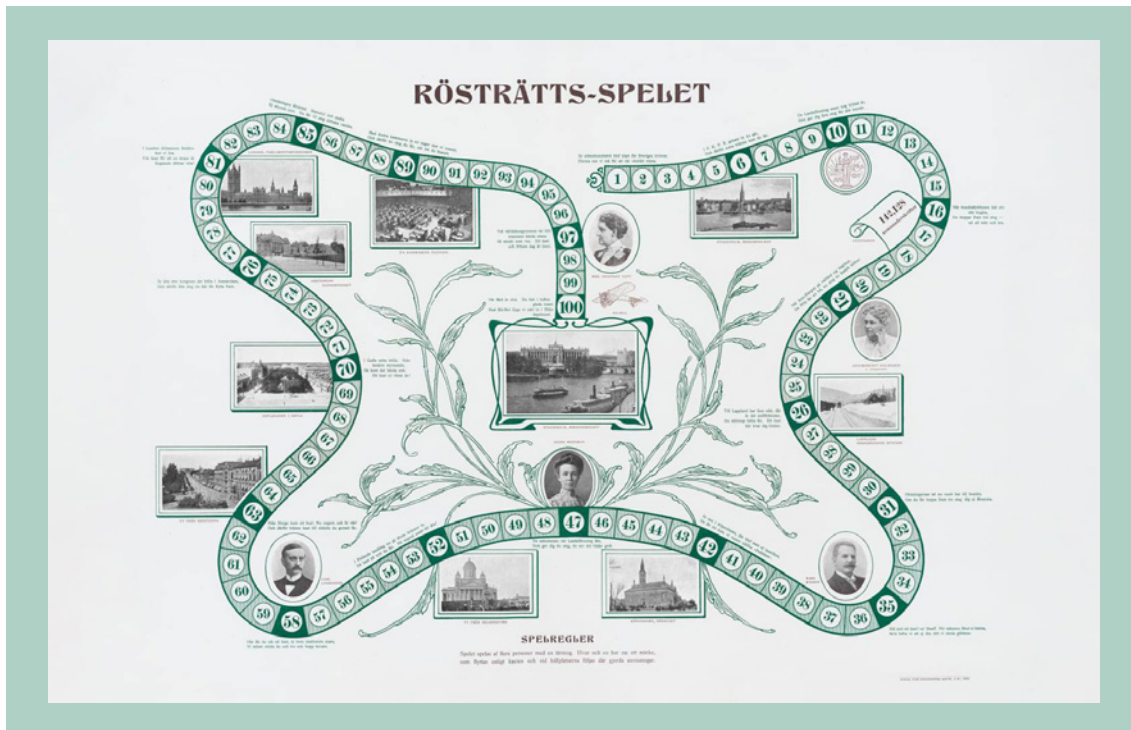
In the 1990’s, Alga’s board game *The Challenge – The Natural Game* taught a generation of families with children about environmental threats and solutions. This was also when the first digital environmental games made their appearance, such as *Lasse & Morgan in Sopköping* inspired by the popular summer holiday programme *Tippen*, Levande böcker’s *The Deep Sea Hunt* and the Educational radio’s *The Wilderness Game*.

Over time, the medium of games has evolved, both in terms of technical possibilities and reach. According to *Video Games Europe’s Key Facts 2022*, 53% of the

Book: Gaming for Good

In the book *Gaming for Good – unlock the power of gaming to create a better world for us all* (2024) authors Jude Ower and Mathias Gredal Nørvig bring together fresh facts and years of experience on combining game creation with commitment to a better world.

ISBN: 978-1-78133-804-9



European population aged 6–64 play video games, 47% of players are women and the average age of players is 32. Swedish video games have been downloaded 7 billion times and at least one in four people worldwide has played People who play games are also slightly more likely to take action on climate change than others, according to a recent study by the Yale Programme on Climate Change Communication. The article *Geeks versus climate change: Understanding video game players' engagement with global warming* (2024) found that people who have more friends and family who play video games, and/or who have consumed global warming content in games, were more likely to have intentions to take collective action on climate.

The in-game *Green Game Jam Player Survey* (2022) explored players' attitudes towards environmental issues and environmental content in games. With nearly 390,000 respondents, the survey found that:

52.9% of players say that environmental issues already affect them now and another 26.4% believe it will affect them at some point in their lifetime.

78.6% of players believe that 'games can help you learn about the environment'

More than **80%** of players would like to see more environmental content in games, provided it fits the game's universe and narrative. Only **13.5%** do not want to see such content.

61.1% of respondents are motivated to pay for environmental content if it improves their experience, supports a good cause or teaches them something new.

35.3% would choose a green-themed game over one without. **14%** would avoid a game because of this.

Beyond their wide reach, games also have another element that many other cultural forms lack: interactivity. Exploring interactivity and allowing the player to be an active co-creator opens up new opportunities to create experiences that can deepen knowledge, understanding and empathy, as well as engage and inspire or upset and question.

Several Swedish developers and publishers have explored ways to integrate environmental issues into games, some of which you can read about in this report. There are also several international initiatives to recognise and create more games and game ideas with sustainability themes.

KATA NYLÉN FOUNDER OF KLIMATPSYKOLOGERNA



'All emotions are allowed to be present. You can feel anger and sadness, but also joy and community'

Hello Kata! What are the main psychological challenges related to the climate transition?

There are many. Here are a few examples of how our brains can mess us up in our climate behaviour:

Availability bias – We think about and act on what is present in our everyday lives. Media reporting, or the lack of it, plays a huge role, and how present the climate issue and the ecological crisis are around us. The climate issue is very abstract and the effects are long-term, which also makes it harder to grasp the threat.

Habituation – At the same time, we get used to ineffective warnings and inadequate policy responses. It becomes background noise, our natural habitat. It becomes natural to carry on as usual in the midst of the crisis.

Loss aversion – We humans hate getting rid of things. Change is difficult and the idea of 'quitting' triggers us more than getting something else – especially if that something else is unclear. We need a shared and clear vision of a sustainable future society.

Social norms – We humans want to be loved and liked by others. Therefore, we are guided by what others do or by what adverts, films, games etc. tell us to do.

Cognitive dissonance – Many of us value a sustainable planet, fair living conditions and a hopeful future for our children, it is close to our hearts. Then, when we can't get our behaviour to fit those values (for example, because of social norms, habituation or loss aversion), it becomes jarring and uncomfortable. It is common for people to push it away, distance themselves from what they really think is important and find excuses. 'What does it matter what I/we do?', 'It's not my responsibility anyway' are some common ways of dealing with cognitive dissonance.

I would like to emphasise that it is a simplistic view that we humans are short-sighted or selfish. Humans can indeed act in the long term and in solidarity if we are given the right support and conditions by society and those in power.

How can culture, arts and media influence people and societies?

Climate change creates emotions. You can feel scared, angry, sad, guilty and ashamed. All these different emotions that we feel in relation to the climate and the ecological crisis, they are not dangerous, they are not wrong. They are telling us to act as a collective, to seek security, comfort, common solutions. To protect planetary boundaries and be more prepared for crises,

we need to be better at acting together. Emotions are functional.

Culture has great potential to engage, to move, to energise, to inspire. To visualise where we are going. Fun, exciting and creative ways to approach difficult issues. Where all emotions are allowed to be present. You can feel anger and sadness, but also joy and community. The climate is a social challenge and a matter of justice. Culture has dealt with all previous major social issues and has contributed to all the rights we have been given.

Can games save the planet? How?

Yes, they can! I think games can be a very important part of transition as well as crisis preparedness. Games are very important as a cultural expression today. A

Psychologist's five tips for committed creators

- Create a connection between the game content and activities that can be done outside the games. This could be building a community where you encourage each other to do joint advocacy work in your local areas.
- Use the games to visualise a more sustainable and just future. We need to know where we are going and feel that we are part of that vision.
- Dare to evoke emotions with the games. Emotions motivate behaviour as long as there is something clear and common to do with the emotions.
- Make sure that any behaviour encouraged in or outside the games is collective. Consumer behaviours, such as sorting waste or buying organic, tend to make people feel alone and ultimately not make much difference.
- Build social norms and role models in the games – let the player try to be part of the collective transition and maybe find idols to aspire to.

Illustration: lisasobacca.art



cultural expression, a forum for meetings and an opportunity to feel emotions and awaken thoughts that have not been possible historically. There is a lot of unexplored potential. Just from all the hours spent playing games, but also in the interactivity, that you are more involved in a game than, for example, watching a film or listening to music.

Games can also train us in the skills we need to manage crises or mobilise for change. Similarly, games can reinforce new social norms by allowing us to try out different ways of being in games.

One important thing to keep in mind is that it is vital from a climate psychology perspective that what you encourage are collective behaviours rather than individual ones. How do you put this into practice, how do we act collectively? Offer context and community. It is important to see yourself as an active citizen, and not just as a small consumer, we need to practise this. We humans will solve this, if we manage to come together and make demands and make the change together. Be brave!

JOSEPHINE BAIRD LECTURER AT THE DEPARTMENT OF GAME DESIGN,
UPPSALA UNIVERSITY



‘Games can provide the opportunity to consider different ways of thinking, being, and acting’

Hello Josephine! What makes games unique?

Games provide an interactive quality that other forms of art and media can't do in quite the same way. This allows for the kind of engagement that can involve and implicate the player in really interesting and unique ways. It provides opportunities to express and tell stories that react to the active input and responses of the players.

Can games inspire, teach or provoke thought in real life?

In my research, I have found that games can very much lead to inspiration, learning, and personal and social transformation. At their best, games provide a safer space to express and explore ideas that might be difficult or impossible to examine in everyday life, or to be yourself in ways you might not have been able to otherwise. Games can provide the opportunity to consider different ways of thinking, being, and acting as well as exploring plans, actions, or even skills that one might want to develop in everyday life. It is important

to realise that games, like any form of art, is both a product and producer of culture and so can also easily reproduce the problems inherent in society. As such, we need to be mindful of that possibility and carefully design our games with that in mind, to maximise their true positive potential.

How can games be part of a change process? For individuals or for society?

Games have already become a massive and integral part of global socio-cultural environments in varied and intersectional ways. As such, they already have a profound influence on individuals and societies. By understanding the impact that games can have, we might harness the positive potential for games to allow people to explore and consider important, challenging, and inspiring subjects and actions. In this way, games can be part of the opportunity to practice and reflect on the transformative potential of the art and the transformative potential of ourselves, and how we might integrate that into our goals to work towards positive changes.

Unique creative works

Games are unique and complex creative works, with unique and complex opportunities to explore contemporary and future challenges.

There is a wide variety of games, and just as many different ways that games can approach an important real-world topic. In interviews and workshops with a wide range of developers, researchers, investors and other stakeholders, three main categories have emerged:

Inspiration – When narrative or game mechanics draw their inspiration from a real-world challenge or vision. This can be dystopian, utopian or focused on problem solving.

Information – When the game increases the player's knowledge of a topic in various ways. For example, it can be both games created for education or games with learning as a more or less conscious side effect.

Interaction – When the game creates interaction between players and a purpose or an organisation. It can be integrated into the game or as a separate event – for example, to raise awareness, solve a specific problem or raise money or information.

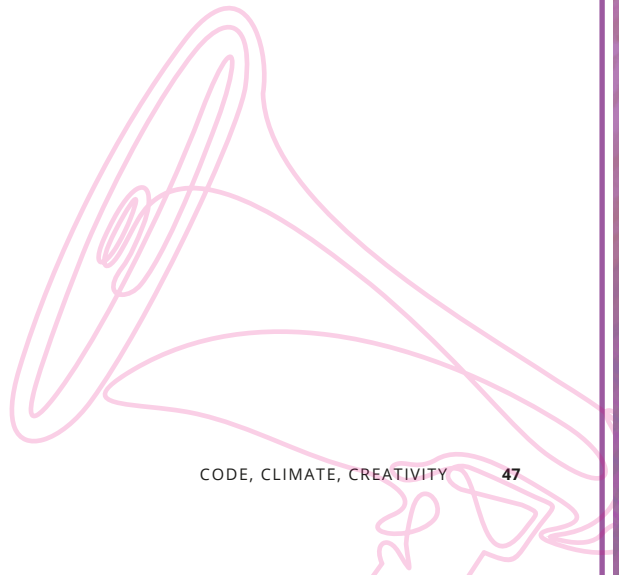
A further dimension within these categories is to look at what part of the game the theme is implemented in. Is it the narrative, the graphics, the game mechanics, out in the main menu or already on the platform where the game is purchased?

Other models of thinking have also been discussed. For example, the scale between serious games, which need a real-life context to come into their own, and pure entertainment games, where players do not always act and react as the developers intended. The difference between optimistic and pessimistic basic attitudes and

whether the player is encouraged to be active or not are other differences that can be used in an analysis.

Regardless of categorisation and scales, it can be concluded that it is not possible to lump games together on the basis that they somehow address the real challenges facing the planet and humanity. The respondents also emphasise that the starting point should be that all games belong to the players more than the game creators. Players determine how they relate to messages and content, they reinterpret and recreate games, comment on games in other channels, create their own content and much more. This is the specificity and strength of games as art and culture.

Each game and each player has its own way of dealing with the challenges of the world. All art and creation is influenced by the world in which the creator and viewer find themselves, and the game medium is a mode of expression with many dimensions and possibilities. However, in order to provide some structure to the text, this report is based on the three main categories of inspiration, information and interaction.



Exoborne

🇺🇸 Sharkmob (Under development)

ABOUT THE GAME

A tactical open-world extraction shooter set in an apocalyptic U.S. being torn apart by extreme forces of nature. The world has been reshaped by torrential rain, floods, fires and storms. As you play you will encounter deadly tornadoes, fierce storms, intense lightning and all kinds of extreme weather. The player explores a dynamic open world full of warring factions and hostile players where you scavenge, craft, and fight to stay alive. In this world you can expect the unexpected.

ABOUT THE THEME

'Exoborne deals with themes like mankind's dual relationship to technology, the strength of community in the face of hardship and the importance of doing the right thing. These topics are explored through both narrative and gameplay. The climate disaster provides a context for talking about these things in a way that hasn't been fully utilized in gaming yet, although it is quite common and popular in Hollywood movies.'



Snufkin: Melody of Moominvalley

🇳🇴 Developed by: **Hyper Games** 🇫🇮 Published by **Raw Fury** (2024)
🇫🇮 Inspired by the works of Tove Jansson

ABOUT THE GAME

A story-rich musical adventure game about Snufkin restoring the valley and helping the characters and critters who call it home, while looking for his best friend Moomintroll. A series of hideous parks have cropped up in Moominvalley, disrupting the landscape and its harmonious nature. As Snufkin you will distract police officers, pull out signs, and knock over misplaced statues as you vigorously try to restore nature and the inhabitants' home while putting an end to the industrious Park Keeper's plans.

ABOUT THE THEME

'Tove Jansson loved nature and spent a great deal of time in the Finnish archipelago, which had a monumental influence on how she wrote about Moominvalley. In Tove's books the Moomin family and their friends confront many extremes of nature: storms, floods, natural disasters, and even comets. Through it all, the Moomins love their precious valley and stay curious about the forests and the sea around it. The game is built around Snufkin's respect for nature, but gives a bigger role to the Park Keeper and the battle between the two. It explores the consequences of interfering with our natural environment, and how important and fragile the balance in all of nature is.'



KreatureKind

+ Valiant Game Studio (Under development)
Co publish Aurora Punks

ABOUT THE GAME

Debate monsters, recruit friends, and start a movement in this deck builder, where the player uses the debate skills in the cards to convince opponents. The world's Mana Well is running dry, and magic is on the verge of disappearing forever. A group of activists set out to try and save magic, by recruiting people and monsters to their cause.

ABOUT THE THEME

'KreatureKind is about saving the world's magic by starting a grassroots movement. It is strongly inspired by the climate movement in our own world, where young people have come together to make their voices heard and bring about change. The game is radically optimistic and offers counterarguments to many claims similar to those used by climate change deniers.'



A Trail of Ooze

+ Insanto Studios (Under development)

ABOUT THE GAME

An adventure game about Majros, a sarcastic cow, who lives on a farm in the Swedish woods. After a leak of genetically modified chemicals, all the animals gain human-like consciousness, and the farmer is missing. Together with the chicken Hilma, Majros embarks on a rescue mission filled with conspiracies, social injustices, and an impending environmental disaster.

ABOUT THE THEME

'Inspired by today's society, how we live and exploit the Earth's resources. But not everything is black and white. Humanity is innovative and we want to highlight both sides with humor. We don't aim to preach, educate, or point fingers. CropCorp is initially portrayed as a company with bad intentions, but later we also see that they are struggling to stay afloat and prevent local unemployment. Some decisions have unforeseen consequences. In the end, it's up to Majros (the player) to either trust in humanity's problem-solving abilities or take the future into her own hooves.'

Inspiration

***'Everything great that happened in the world first happened in someone's imagination.'* /Astrid Lindgren**

The possibilities of drawing inspiration from reality are endless and can result in anything from an action-packed war game in the wake of climate change to a humorous point-and-click game about a cow genetically modified by chemical waste.

The premise can be dystopian, as in the above-mentioned case, or visionarily positive, like the possibility of starting over and doing it right on a distant planet. The theme can be an immovable fact, as in the case of the polar bear desperately jumping between smaller and smaller ice floes, or part of the game mechanics where the player can influence the outcome by cleaning up or building a resistance movement.

The issue of inspiring the player in the next step is more complex. The overall state of research over several years on whether violent games lead to violent behaviour does not show such a link. Similarly, it can be assumed that environmentally positive behaviours or messages in a game do not automatically lead to the same behaviours being repeated in real life.

However, the very choice of narrative or game mechanics can trigger thoughts, questions, conversations

and emotions – just as art and culture have always done. This can in turn influence the democratic dialogue and contribute to both individual and societal perspectives and development. For this very reason, the liberal arts are a cornerstone of democracy – and the first thing that movements with fascist aspirations try to silence. The interactive nature of games also allows the player to be a co-creator, which can further enhance the intensity of the experience, and thus the possibility for thoughts and feelings to linger for longer.

One of the challenges of creating games inspired by environmental challenges, highlighted in interviews with game creators, is the balance between people's need for escapism and play and the connection to real-world challenges and concerns. If the game is not fun or engaging to play, neither reach nor possibly desired impact is achieved. The game simply needs to be firmly grounded in a game idea to avoid being perceived as an interactive touchstone.

Funding is another challenge raised by most respondents. This is a major problem, especially for smaller, start-up companies with great commitment and few



resources. Private investors are often concerned that games with serious themes or connections will not be commercially viable. At the same time, public funding is conspicuous by its absence. For games created for specific serious uses in, for example, schools and education, known as serious games, there may sometimes be opportunities for cooperation with public actors. However, this is not the case for games that aim for entertainment value and commercial success combined with world-saving ambitions. In other words, there is a risk of getting stuck in the grey area between commercial games and serious games. Where even the latter generally lack support for acceleration after initial project funding.

One issue that has been discussed in the project's workshops with reference groups is whether games as a form of expression linked to the environment and society should be given more space in games programmes, to give students both inspiration for working life and the opportunity to explore game ideas during their funded studies. The discussion concluded that it is positive that more people are aware of sustainability challenges, but participants also emphasised that it is important not to let good ambitions turn into an instrumental view of games as a medium. Cultural policy could be a solution: recognising games as a unique cultural expression in public policy documents could

both ensure clarity around the requirements for artistic freedom and what is known as the policy's 'arm's length' from the content – and possibly in the long run be a way to open up more opportunities for support and funding for new types of game projects.

Un-Jam

NASG Un-Jam is a workshop run by the academic collaboration Nordic Alliance for Sustainability in Gaming for students from universities in the Nordic countries. In a short period of time, game prototypes are created with a focus on environmental and cultural sustainability. For a few days, students are given inspirational lectures and then work in small groups to develop a prototype for a game, digital or analogue, that addresses a sustainability issue. After the first Un-Jam in Tallinn in 2022, a research publication entitled *'From "doomsday talks" to "excitement at last": A case study of incorporating sustainability perspectives into formal game education'* by several researchers from Nordic universities. In 2024, the workshop was held at the University of Skövde in June. The game ideas that emerged addressed a wide range of issues, such as fast fashion, the influence of oligarchs on policy development, co-operation to achieve the UN's global goals and sustainable agriculture.

From Un-Jam 2024



Keep up with the rapidly changing fashion in this game prototype by Nikolaus Freskos, Karoliina Jansson, Edvin Skogsholm Sanne, Rakel Ýr Gunnlaugsdóttir and Markus Elvig



Sonic Soil – an audio game about the composition of the soil by Mykhailo Stavrovskiy, Daniel Karlberg, Ásta Olga Magnúsdóttir, Botond Orutay and Kasper Westin



The graphics evolve into a game that combines café management with sustainable farming solutions by Smbat Voskanyan, Kristofer Vaske, Katariina Moilanen and George Boyle

'The creative process helps students deal with difficult issues'

Hi Victor, what is Un-Jam and how does it work?

Un-Jam is a game jam, mixed with seminars and workshops, where issues of sustainability in and around the games industry are tackled. The reason for the name 'un' as in negating prefix, is that the jam breaks with conventions associated with traditional game jams, such as creative competition and crunch culture, as we aim for a more sustainable approach. Students and teachers from all six participating universities will come together to both learn about and express themselves on sustainability issues through the medium of games over five days. After introductory lectures, students are divided into groups according to their background/

expertise and then work on game prototypes that highlight a sustainability issue (environmental, social or cultural) or raise a vision of progress in relation to the topic.

How is the project funded?

We have been granted funding from Nordplus Higher Education for the three years (2022–2024) that we have been organising this event. Now the project is over and we have not yet finalised how to work forward.

How have students reacted, what do they take away?

The big win we identified is that the creative process helps students deal with difficult issues that might normally give them climate anxiety or feelings of hopelessness. It also triggers them to start imagining and discussing the path to a more environmentally and human-friendly games industry.



Students and teachers at NASG Un-jam 2024 in Skövde, Victor Bankler front right

Photo: Dennis Mbuthia

Information

'The world needs a new story.' /Johan Rockström

Play provides space to explore one's environment and oneself and fosters creativity, problem-solving skills and social interaction. As children, play is a person's primary tool for learning, but even adults often learn best through enjoyable interactivity.

Games therefore have unique potential as tools for spreading knowledge and lessons learnt. These can be games where the learning is in the game mechanics, such as games for children that can support school work on specific subjects, or classic strategy games for adults that are based on real-life situations and challenges, with a focus on exploring different solutions. These can be games where knowledge is at the centre of the game idea, for example games based on research or a specific theme to delve into, or games where knowledge is a more or less unintended by-product of the game theme.

The challenges raised by game creators in this category, as in the inspiration category, are to keep the game fun and engaging, but also transparent. Regardless of age, players do not want to feel manipulated. On the other hand, few people mind learning things if they can choose to do so themselves.

In a reference group, the risk of customised games was also raised – when games are something to be added to an already completed idea. Too much control from a client with no expertise in games can result in dull products that miss the target. The core must be a good game idea.

When it comes to games for schoolchildren about climate and the environment, respondents say that it is important neither to minimise the challenges nor to present them as unsolvable. Interaction with teachers is emphasised as a prerequisite, so that the games are part of an educational whole and not a substitute for teaching. By making the player an active party with the ability to change the situation, children are also given tools to see themselves not as victims, but as part of the solution.

More collaborations between academia and research, schools and education, and game developers could accelerate the supply and quality of knowledge in games of all kinds.

Games for Change

Founded in 2004, Games for Change is a non-profit organisation based in New York. The organisation works to use games to help people learn, improve their communities and make the world a better place. Games for Change organises several events throughout the year, including a festival themed *The 2030 Marker: A Catalyst for Global Change* in June 2024, which brought together global voices to inspire civic engagement and drive social change, and show how games can break down barriers to bring people together across generations and around the world. In addition to the festival, XR for Change, Raising Good Gamers, G4C Learn, workshops and Game Jams are organised among many others.

JENNY BRUSK ATTENDED GAMES FOR CHANGE

PhD, innovation leader and business coach at Science Park Skövde



'It was useful for me to participate and the contacts I made will be valuable for a long time to come'

Hi Jenny! You were at Game for Change 2023 in New York, how was it?

It felt useful to be there and talk about games in other ways than growth and market. It was a good meeting place with various people in different disciplines, which provided an opportunity to make valuable contacts, and for Sweden to be visible and collaborate internationally.

What was on the agenda?

In addition to a review of the sustainability work that has been done and what initiatives exist in the industry, it was about how the major players want to work with the games industry. For example, the UN agency UNDP asked for co-operation on the climate crisis. There was talk about trends in sustainability-themed games – for

example, implementing game mechanics or themes that raise awareness and encourage positive behaviour change as an integral part of game design.

What are your takeaways?

It was useful for me to participate and the contacts I made will be valuable for a long time to come. I would recommend others to go there if sustainability is an issue they are working on. It is a great opportunity for knowledge exchange, to build a more international network and to be inspired for future work. It would be interesting to have a sustainability conference in Sweden or the Nordic countries as well, where industry voices and actors come together to answer questions like; What are we doing here? What initiatives exist? What opportunities?



PLANET IN PLAY

KliMATSpelet

 IUS Innovation (2024)

ABOUT THE GAME

Fix Sweden's food system, save biodiversity and the climate – test various issues and goal conflicts. *The Climate Game* (KliMATSpelet) is primarily aimed at high school and upper secondary school students and their teachers, and is adapted to the curriculum.

ABOUT THE THEME

'The idea of the game was born at SLU and started as a wish to communicate research results to school youth about an important ecosystem service – food production. The project is a collaboration between several committed organizations.'

theHunter: Call of the Wild

+ Avalanche Studios Group,
Expansive Worlds (2017)

ABOUT THE GAME

An atmospheric hunting game that offers a realistic open world, constantly expanding and evolving in collaboration with its large community. Dive deep into the campaign or share the experience with a group of friends in a hunting party.

ABOUT THE THEME

'We are developing the game in dialogue with our community and portray hunting in a respectful and sustainable way. This promotes broader awareness of the importance of preserving biodiversity. The game's environments are diverse and realistically depicted, aiming to spark or nurture a genuine interest in animals and nature. For example, we see ongoing discussions about sustainable wildlife management and the effects of climate change.'



Bumi: Next stop, Earth!

+ Blamorama Games (2024)

ABOUT THE GAME

Here, you get help from your alien Bumi friends to save the planet. With your new space buddies, you'll sort trash, replant forests, surf around in a spaceship to take care of marine life – and protect your city from an alien villain. Green activities like planting, caring, collecting, and creating are the focus – and Sweden's recycling deposit system is the game's currency. The game combines puzzles, mini-games, and city-building for children aged 6 and up. There's also an AR photo mode in the game where you can share fun pictures with family and friends.

ABOUT THE THEME

'Our vision is to create fun experiences that make a difference, that we believe in and can be proud of. We want to create games that address social and environmental issues, with diversity and inclusion at the core. We've chosen to focus on mobile games because they allow many people to access them. Games are a great way to learn and an opportunity to make an impact. Bumi: Next stop, Earth! is at the intersection of gaming, education, and sustainability. The goal is to create and raise awareness among children and young people about the impact their choices have on the environment, while also fostering positive behavioral changes for a greener future.'



The Gunk

✚ Image & Form now Thunderful Games (2021)

ABOUT THE GAME

An action-adventure game that stars Rani, part of our duo space haulers, struggling to make a buck as they chance upon an untouched planet brimming with life. They came in search of valuable resources, and it looks like they've hit the jackpot... As they uncover the dormant secrets of a shattered civilization, they must battle a toxic gunk parasite, all while getting caught in a spiral of festering mistrust.

ABOUT THE THEME

'The main theme is humanity's – or rather civilizations'– impact on the climate and the individual's ability to make a difference. The protagonist, Rani, arrives on a new planet to which she initially has no connection. Over time, Rani changes her perspective and realizes the importance of doing her part to save the flora and fauna on the new planet. The inspiration comes from our own thoughts on the environment and climate.'

Among Ripples

✚ Eat Create Sleep (2014)

ABOUT THE GAME

Control a pond's ecosystem; experiment and see what happens. Among Ripples is a meditative ecosystem management simulator; you add different creatures to the pond and see how they interact.

ABOUT THE THEME

'A small experimental game where players, in a purely audiovisual way without text, restore a dead lake. It was part of a student project, which became ECS's debut project when polished and released as a free indie game. The simplistic graphics were inspired by artist Lotte Reiniger's stop-motion films with paper silhouettes.'



Cities: Skylines II

🇫🇮 Developed by: **Colossal Order** 🇸🇪 Published by: **Paradox Interactive** (2023)

ABOUT THE GAME

Build a city from the ground up and turn it into a thriving metropolis in the most realistic city-building game ever. Use your creativity and build on an entirely new scale. Experience limitless world-building with deep simulation and a vibrant economy.

ABOUT THE THEME

'Cities: Skylines II provides players with a realistic simulation of the challenges and rewards of managing a city's development, including environmental and climate

choices. For example, the decisions players make regarding energy sources can significantly impact pollution levels in both land and air. Cities can experience soil, air, and water pollution, affecting citizens' health and the city's aesthetics. Dynamic weather influences various aspects of city management. The game's advanced traffic AI and transport systems also play a role in environmental management. Efficient public transportation systems reduce traffic congestion and emissions. Players can design extensive public transport networks to encourage citizens to leave their cars at home.'



Interaction

'When we start to act hope is everywhere' / Greta Thunberg

According to the book *Gaming for good* (Ower & Gredal Nørvig, 2023), three billion people play games for an average of just over an hour a day, and the industry in Sweden alone has a turnover of over EUR 3 billion, making it bigger than music and film combined.

There are several examples of games companies collaborating with various charities around the world. In Sweden, for example, Raw Fury ran a campaign during the COVID-19 pandemic in 2021 where all money raised was donated to the Go Give One campaign created by the WHO Foundation to help low-income countries with vaccines. King partnered with Battersea and ran a four-week campaign to help animals through its game *Pet Rescue Saga*. Mojang has done several collaborations around the world through the game *Minecraft* aimed at children and young people. Here in Sweden, for example, there have been several school hackathons in *Minecraft* where classes have competed with each other in building innovative solutions for sustainable communities. Other examples include donating a percentage of the proceeds to a specific cause, organizing joint events or fundraising streams. Another way is to integrate information about an issue or an organization into a game – for example, the collaboration with the organization Friends in the *Scrabble Games* by Gro Play.

One challenge identified in background research for the report, in the form of interviews and workshops, is that many game developers are small companies with limited time and resources to build collaborations from scratch, while the organizations often lack knowledge about games. Generic solutions can also be difficult, as tailored approaches are required to suit the particular game's theme, mechanics and target audience. Another challenge that has emerged from conversations with companies and organizations is that the player base is global, which is not always the case, organization or economic legislation. It is also important that the causes

and organizations raised are vetted and effective – skills that not every single game studio possesses.

At the other end of the scale lies a very large potential. Players are numerous and a majority of them want to see responsibility and initiatives for a better world from game creators. There are many good examples where relatively small efforts have generated big results. If the organizations and ecosystem around the games companies can find ways to meet the will and commitment in a concrete way, it can create both happy players and great direct benefit for the planet and humanity.

Another way of using the reach of games that has started to be explored is knowledge collection. This can be a request to players to answer a survey, it can be research on behaviors inside games or integrated minigames where players themselves can contribute directly to research. In this way, computer games have contributed to both the IPCC climate reports and the fight against the coronavirus. More on this in a separate section below.

Green Game Jam (GGJ)

The annual *Green Game Jam* (GGJ) event supported by the United Nations Environment Programme is an initiative of the *Playing for the Planet Alliance*. The aim of the GGJ is to challenge game studios to implement 'green activations' in their games. These are so-called packages of content both in and around the games, based on an annual theme. It can be anything from a time-limited event, characters or stories to a marketing campaign highlighting an environmental theme. Over the past four years, more than 120 games have participated in the Green Game Jam, including campaigns to protect oceans, forests and wildlife. Over 2.5 million trees have also been planted with the support of players worldwide.

SARA HEDENCRONA PROJECT MANAGER FOR GGJ AT MAG INTERACTIVE



'It's an effective way to use their channels to both provide gamers with new, original content while raising important issues in a fun and innovative way.'

Hi Sara! You are a project manager at MAG Interactive. You have been involved in Green Game Jam for several years. How does it work?

Every year, the Playing 4 the Planet team presents an overarching theme that the Green Game Jam project will focus on. This could be about protecting a particular habitat, endangered animal or raising issues around recycling, food or air pollution. In the years MAG has participated in the GGJ, we have supported projects aimed at planting trees in the Amazon, as well as raising awareness of the impact of climate change on our coral reefs and its consequences.

MAG always wants to reach out to as many players as possible with interesting content, hence the focus on the game teams' activations. Our marketing team has an important role in spreading our message and content in an informative and creative way. Playing 4 the Planet always provides basic information on this year's theme to make it easier for all participating studios, and then it's up to us at MAG to find a good angle on the topic we want to highlight.

What have you done and what results have you achieved?

In 2023, the theme was 'wild life'. Each game studio was given the opportunity to choose between three different endangered habitats to inform their players

about, as well as collect donations for an animal to represent each area. MAG chose to focus on the Himalayas and the conservation of the snow leopard this year.

Planning work with MAG began in January 2023 and activations were launched in June of that year. The team can be large, as both the Games team and the marketing department work together. Therefore, good structure, planning and clear communication are essential for a successful project.

In addition to our marketing department, four of our games participated: *QuizDuel*, *Ruzzle*, *Wordbrain* and *WordDomination*. During the process, new graphic material was developed and used in our games and for external communication in our social media. The game activations were a mix of various temporary events and special quizzes. We also offered a time-limited package in one of the games that players could buy, of which a certain percentage was donated to support the conservation of the snow leopard and its environment. The aim was to raise awareness of the snow leopard's plight while providing players with a fun and interesting experience.

What has been the most fun and rewarding?

In 2023, GGJ was a relatively big project for us. All the teams involved were very committed to the process



and worked hard for the final delivery. The outcome and feedback from our players was very positive, which felt like a great reward.

MAG has participated in the GGJ since 2020 and our goal is to help raise important topics regarding climate and sustainability using our platforms. It will also be different and exciting content for the players to keep them engaged. P4P is a project that I think many at MAG feel very proud to have contributed to and it creates a lot of drive internally.

What has been most challenging?

GGJ is a project where everyone involved feels very committed to each theme and always wants to contribute their best. During the period when we are working

on GGJ, other work is of course going on in parallel. This requires that all teams are well informed about deadlines and that everyone takes responsibility for communicating about any delays and final deliveries during the project.

Would you recommend other companies to do something similar?

We would definitely recommend other game studios to participate in the Green Game Jam. It's an effective way to use their channels to both provide gamers with new, original content while raising important issues in a fun and innovative way. The goal doesn't have to be to create large-scale projects, but that even smaller engagements can contribute a lot.

Knowledge acquisition and research through games

In recent years, there have been several projects that have used the reach of games for knowledge gathering. This is an area that has so far only scratched the surface of its potential and requires more research and development. However, the projects that have been undertaken have produced quick and positive results, below are some examples identified by the project team.

The Peoples' Climate Vote

The *Peoples' Climate Vote* is a global opinion poll and an arm of the *Mission 1.5* campaign launched in 2020 by the United Nations Development Programme (UNDP) together with the University of Oxford, and a number of non-governmental organisations (NGOs). The aim of the survey was to give people the tools to help improve the climate and environment and ask them what actions they think governments should take.

To collect data for the 2021 survey, the United Nations Development Programme (UNDP), together with its partners, developed a new method to reach the desired audience – mobile game advertising. The advert was designed to be inviting, fun and playful, which would attract players to respond to the poll that was then collected. Around 4,000 mobile games of a wide variety of popularity worldwide were randomly integrated with the advert and it was only shown at one point in the game. With over 30 million invitations, the survey yielded 1.4 million responses, which in turn yielded a response rate of 4.6%. With over one million respond-

ents from a total of 50 countries, the survey covers 56% of the world's population. This makes the *Peoples' Climate Vote* the largest climate change opinion poll ever conducted.

The survey informed the *Mission 1.5* campaign created by the United Nations Development Programme (UNDP) together with Playmo. The campaign, which was a mobile game, educates people about climate policy and provides a platform for players to vote on the solutions they want to see to the climate crisis. The votes were compiled and analysed by the University of Oxford before being handed over to government leaders and climate policy makers. This is an example of when games are not only used for broad data collection, but can also help people take action and influence climate policy.

MMOS

Massive Multiplayer Online Science (MMOS) is the name of an initiative aimed precisely at integrating scientific research projects into Massively Multiplayer Online Games (MMOs). By utilising the large player base and their collective efforts, scientific tasks are integrated into the mechanics of the game, meaning that players perform real research tasks while playing. This can include data analysis, pattern recognition or solving complex problems relevant to scientific studies. MMOS utilises the strength of the global gaming community to promote scientific research and education.

MMOS coordinated the GAPARS (Gamification of participatory science for training and education purposes) project funded by the EU's Horizon 2020 research and innovation programme. The project lasted three



Illustration: lisasobacca.art

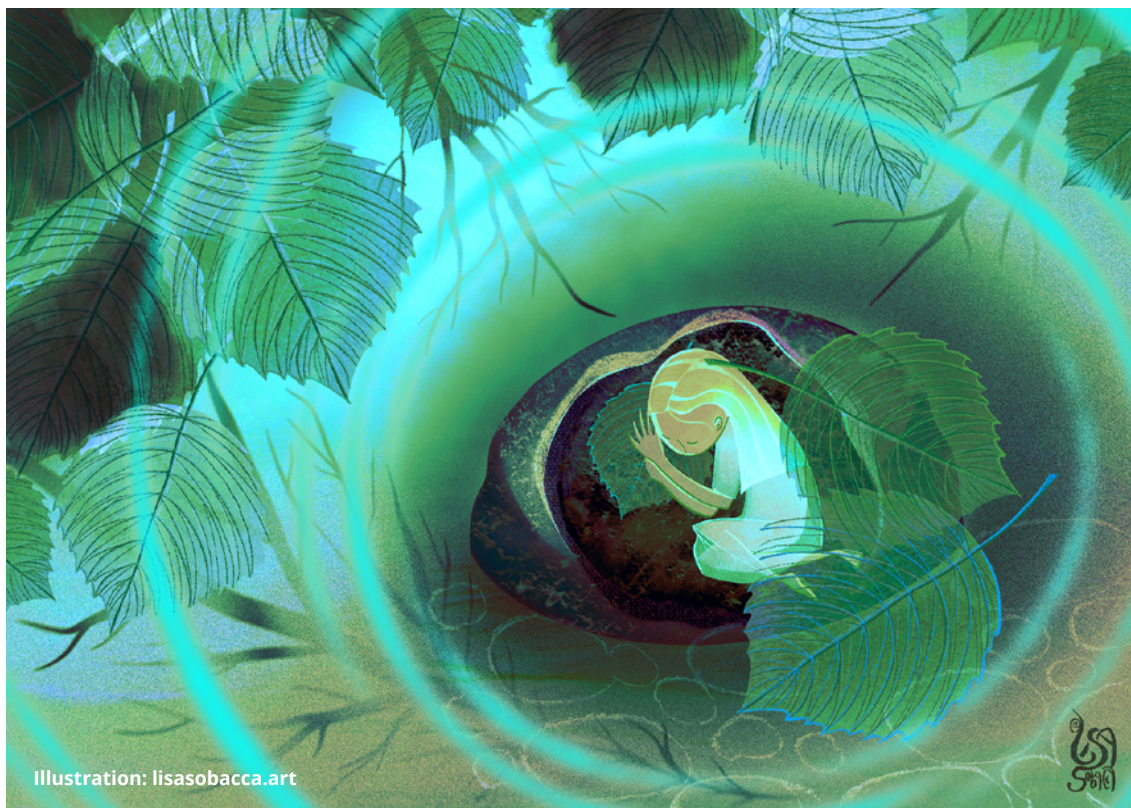


Illustration: lisasobacca.art

years and the research team consisted of researchers, professors and experts including Emma Lundberg, Professor of Cellular and Clinical Proteomics at the Royal Institute of Technology (KTH). GAPARS became the most successful Citizen Science project in terms of data collected, as it was able to reach more than 1.5 million EU citizens using MMO games.

Human Protein Atlas

The Swedish *Human Protein Atlas* project has found an innovative way to engage the public in mapping human proteins. By developing a game that combines multiplex immunohistochemistry and crowdsourcing, the project has been able to generate over 10 million images showing protein expression patterns at the single cell level. The game 'Protein Mappers' invites players from all over the world to help analyse and annotate the huge amounts of microscope images produced by the *Human Protein Atlas*. By harnessing the human brain's ability to detect patterns and details, players can contribute valuable information about protein localisation and expression levels in different tissues

and cell types. In the game, players are presented with microscope images of tissue sections where different proteins have been stained with fluorescent antibodies. Their task is to identify and label cells expressing specific proteins and assess the level of expression. By having many players analysing the same image, the project can collect robust and reliable data.

TRIBE 2020

The project *TRIBE 2020* was a collaboration between RISE, Södertälje municipality, Telge Återvinning and Umeå University. The aim was to develop IoT-based concepts for utilising machine-generated data as a strategic resource for internal efficiency and democratisation in Södertälje. The focus was on developing data-driven working methods for resource and cost efficiency in resource and waste management, in order to achieve the municipality's sustainability goals by 2030. The project resulted in increased knowledge about the environmental impact of digital solutions, knowledge dissemination within the municipality and citizen collaboration on sustainable and connected communities.

Analysis and conclusions

Game development is an industry with low emissions, high ambitions, positive impacts and great potential. With the right conditions, support and co-operation, the games industry in general and Swedish companies in particular can be leading actors in the green transition.



The games industry in Sweden is estimated to account for as little as 0.015% of industrial emissions, but closer to 0.3% of private sector jobs and 1% of exports. The industry in Sweden also performs well in an international perspective according to available data. Several Swedish companies are at the forefront of calculating their climate emissions and have set ambitious targets for emission reductions. The Swedish games industry is well placed to be a leading player in the green transition.

The *Play, Create, Calculate* guide can help small and medium-sized game developers and other digital service companies gain insight and knowledge about their own emissions. The most important measures for reducing emissions from game development are choosing fossil-free energy and reviewing purchases of electronics, furniture and travel.

However, the major consumption of resources does not take place during development, but when the games are played. Many factors, such as the player's choice of electricity supplier or how the hardware is produced, are outside the direct control of the developer. The most important issue for the industry to reach zero emissions all the way is global investment in fossil-free

energy and circular processes. This requires international co-operation and public action in the form of support and legislation.

There are measures game developers can take to reduce emissions in the user phase. For the individual, a new hardware purchase often causes more environmental impact than all the use of the same hardware. As a game developer, working to ensure that games can be played on existing hardware wherever possible can therefore be an important contribution. Cloud-based gameplay can also reduce the need for new hardware and also lead to energy savings, but there are potential rebound effects associated with this technology shift that need to be explored.

It is possible to reduce energy and performance requirements without significantly affecting the experience. For example, by lowering the resolution of menus, introducing eco-mode and limiting the size of downloads. More concrete data is needed to fully analyse the potential, but small measures can have a big impact – not least in games with many active players. Developing standards or labelling and informing consumers about the potential savings could drive future developments.

Better access to statistics and energy data is a prerequisite for accurate and comparable Scope 3 figures for games. Transparent and standardised reports from platforms could help. Industry-wide efforts to develop and disseminate methods and best practice, as well as further development and updating of calculation models, lay the foundation for companies' future climate work.



Games can contribute positively to the well-being of people and the planet by providing experiences, building relationships, spreading joy and reducing stress. Games also enhance skills such as creativity, collaboration and problem-solving, as well as interest in so-called STEAM subjects (science, technology, engineering, arts and maths). There is much to experience and learn through games. An unbalanced debate on screen time, for example, risks creating both greater cultural divisions in society and a skills gap resulting in missed opportunities. A balanced and curious approach to games and digital creativity in society and in organisations close to children and young people can broaden perspectives and open doors to new opportunities.

Creativity and intangible value creation contribute to the dematerialisation of the economy and thus potentially to more sustainable economic development. There are currently no concrete overall figures on intangible value in Sweden and there is a need for a deeper analysis of how this value can contribute to future prosperity without increasing the burden on the planet.

The industry also has the opportunity to contribute to the green transition outside its core business, for example through cooperation and participation in joint sustainability projects or by setting requirements for suppliers and business partners. If climate benefits are included alongside traditional investment criteria, excess liquidity and capital can be used to invest in climate innovations and green funds. Simplification and concrete guidance would open up the opportunity to more people, and these opportunities are not limited to the games industry.

Game technologies and methodologies can be powerful tools to tackle the climate challenge in new ways, and the games industry's knowledge of digitalisation across the value chain can support processes in the rest of society. There are several promising examples in visualisation, digital twins, gamification, games for learning, hackathons and multiplayer science. Furthermore, the games industry has a long track record of working creatively in multidisciplinary teams, a skill needed to solve complex challenges such as the climate crisis. The role of games as an innovation catalyst for society and traditional industries can be strengthened through research, space for cross-sectoral creative meetings and dissemination of good practices.



Computer games, like other art forms, can be used as a form of expression to explore social issues, evoke emotions, create dialogue or capture engagement. The interactive nature of games means that players themselves determine how they relate to messages and content, they interpret and re-create the games, comment and create their own content. This is the specificity and strength of game culture.

There are many different ways of raising important issues through games, but what they all have in common is that the game idea needs to be of high quality, otherwise there will be no players. The creator's vision must be at the core, and like all art, it thrives best without instrumental or political control. There is often a lack of infrastructure and resources to experiment with ideas that are not overtly commercial or strictly driven by a specific purpose. Formalising the inclusion of games in cultural policy could clarify the need for artistic freedom and also open up more opportunities for creators and new ideas.

Utilising the reach and interaction with players through collaborations to raise money, data or knowledge, or otherwise capture engagement on a specific issue has been shown to yield good results – done right. It is also something that the vast majority of players view favourably, provided it is done in a way that suits the specific game. Exchanging experiences, contacts and forms of cooperation between games companies and relevant organisations can create more opportunities for companies to meet their players' commitment and willingness to contribute in this way.

Finally, there is one recommendation that is worth repeating. In the 2023 edition of the *Game Developer Index*, KTH researcher Björn Hedin answered the question:

What do you think the games industry could do more for the climate?

The answer?

'Get more people to play!'

About the report

This is the final report of the project *Sustainability in new digital industries* (SUSINDI), which aims to strengthen the industry's unity around sustainability issues. SUSINDI has been implemented in 2023-2024 in collaboration between the *Swedish Games Industry*, RISE and Game Habitat, with funding from Vinnova through the call 'Circular and Bio-based Economy', call for proposals 'Policy and instruments for a sustainable industry.' Additional expert support has also been obtained through sustainability consultants from U&We.

The report is limited to focusing on climate issues with some perspectives on other environmental issues, and concerns the development of game content and software. It thus does not deal with the manufacture and management of hardware and touches on other sustainability issues only superficially, if at all.

The project has gathered existing knowledge within the project organisations and externally by reading reports, annual reports, statistics, surveys, research studies, books and knowledge material from relevant organisations. In addition, some forty interviews and meetings with individuals or organisations have been conducted, supplemented by a number of discussions and workshops with reference groups within and outside the games industry.

During the project, the *Swedish Games Industry* has been responsible for the operational project management, while RISE has taken responsibility for project administration and collected and analysed examples of how the games industry has contributed to innovation and research in other industries. In collaboration with the *Swedish Games Industry*, U&We has investigated the opportunities and needs of companies linked to climate data and accounting to develop the *Play, Create,*

Calculate toolbox. The Game On research project has contributed insights in a separate chapter. The rest of the research, text and editorial work was carried out by the *Swedish Games Industry*. Game Habitat has supported with input and contacts and coordinated the project's external communication.

A large number of companies and organisations have participated in various ways, including engaging in discussions, meetings, and workshops, providing interviews, sharing data, background material, and reflections, or contributing in other ways to the work that led to this report. Many thanks to all who contributed, including representatives of:

Apskeppet, Arctic game, Avalanche Studios Group, BioSquare, Blamorama, Climate Replay, Dag Hammarskjöld Foundation / IPYP, Dataspelscentrum, DSB Sustainability network, East Sweden game, Eat Create Sleep, Embracer games archive, Embracer group, Frame Break, Game On, Gamescom Congress, Green Leap Games, Gro Play, GSS For Devs, Hyper Games, Insanto Studios, IUS Innovation, King, Klimatpsykologerna, KTH Royal Institute of Technology, Lutra Interactive, MAG interactive, Massive Entertainment, Mojang / Microsoft, Swedish Society for Nature Conservation, Nordic Game Policy Summit, Paradox Interactive, The Swedish Intellectual Property Office PRV, Play Create Green, Playing 4 the Planet, Power Up, Raw Fury, Really Interactive, Resolution Games, University of Skövde, Skövde Science Park, Speldosa Interactive, Sting Incubate, Sustainable Games Alliance, Sustainability Nexus, Thunderful Games, Trancenders Media, The National Agency for Public Procurement, Uppsala University, Valiant Game Studio and WWF



DATASPELSBRANSCHEN
Swedish Games Industry

The Swedish Games Industry is the trade organisation for video games in Sweden. The organisation represents the industry as a whole through the industry associations Spelplan-ASGD (game developers, producers, education, academia and support members) and ANGI (publishers and distributors).



RISE Research Institutes of Sweden is Sweden's research institute and innovation partner. Through international collaboration with industry, academia and the public sector, the state-owned company contributes to business competitiveness and a sustainable society.



Game Habitat is a regional association for the games industry of southern Sweden.



U&We ABC is a sustainability agency that helps companies understand, draw power from, and navigate sustainability issues with the aim of creating sustainable and profitable business.

With funding from:





THE GLOBAL GOALS



DATASPELSBRANSCHEN
Swedish Games Industry

www.swedishgamesindustry.com